tagpdf – A package to experiment with pdf tagging*

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Contents

*This file describes v0.99e, last revised 2024-09-11.

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`\tag_stop:`
`\tag_start:`
`\tagstop`
`\tagstart`

We need commands to stop tagging in some places. They switches three local booleans and also stop the counting of paragraphs. If they are nested an inner `\tag_start:` will not restart tagging.

`\tag_stop:n` `\tag_stop:n{`⟨*label*⟩`}`
`\tag_start:n` `\tag_start:n{`⟨*label*⟩`}`

The commands with argument allow to give a label. This is only used in debugging messages to allow to follow the nesting.

`activate/spaces␣(setup-key)`

`activate/spaces` activates the additional parsing needed for interword spaces. It replaces the deprecated key `interwordspace`.

`activate/mc␣(setup-key)`
`activate/tree␣(setup-key)`
`activate/struct␣(setup-key)`
`activate/all␣(setup-key)`
`activate-mc␣(deprecated)`
`activate-tree␣(deprecated)`
`activate-struct␣(deprecated)`
`activate-all␣(deprecated)`

Keys to activate the various tagging steps.

`activate/struct-dest␣(setup-key)`
`no-struct-dest␣(deprecated)`

The key allows to suppress the creation of structure destinations

`debug/log␣(setup-key)`

The `debug/log` key takes currently the values `none`, `v`, `vv`, `vvv`, `all`. More details are in `tagpdf-checks`.

`activate/tagunmarked␣(setup-key)`
`tagunmarked␣(deprecated)`

This key allows to set if (in luamode) unmarked text should be marked up as artifact. The initial value is true.

`activate/softhyphen␣(setup-key)`

This key allows to activates automatic handling of hyphens inserted by hyphenation. It only is used in luamode and replaces hyphens by U+00AD if the font supports this.

`page/tabsorder␣(setup-key)`
`tabsorder␣(deprecated)`

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.

tagstruct
tagstructobj
tagabspage
tagmcabs
tagmcid

These are attributes used by the label/ref system.

1 Initialization and test if pdfmanagement is active.

```
⟨@@=tag⟩
⟨*package⟩
\ProvidesExplPackage {tagpdf} {2024-09-11} {0.99e}
  { LaTeX kernel code for PDF tagging }

\bool_if:nF
  {
    \bool_lazy_and_p:nn
      {\cs_if_exist_p:N \pdfmanagement_if_active_p:}
      { \pdfmanagement_if_active_p: }
  }
  {  %error for now, perhaps warning later.
    \PackageError{tagpdf}
     {
       PDF~resource~management~is~no~active!\MessageBreak
       tagpdf~will~no~work.
     }
     {
       Activate~it~with \MessageBreak
       \string\RequirePackage{pdfmanagement-testphase}\MessageBreak
       \string\DocumentMetadata{<options>}\MessageBreak
       before~\string\documentclass
     }
  }
⟨/package⟩
```

<*debug>

```
\ProvidesExplPackage {tagpdf-debug} {2024-09-11} {0.99e}
  { debug code for tagpdf }
\@ifpackageloaded{tagpdf}{}{\PackageWarning{tagpdf-debug}{tagpdf~not~loaded,~quitting}\endinp
```

</debug> We map the internal module name “tag” to “tagpdf” in messages.

```
⟨*package⟩
\prop_gput:Nnn \g_msg_module_name_prop { tag }{ tagpdf }
⟨/package⟩
```

Debug mode has its special mapping:

```
⟨*debug⟩
\prop_gput:Nnn \g_msg_module_type_prop { tag / debug} {}
\prop_gput:Nnn \g_msg_module_name_prop { tag / debug }{tagpdf~DEBUG}
⟨/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

```
⟨*base⟩
\ProvidesExplPackage {tagpdf-base} {2024-09-11} {0.99e}
  {part of tagpdf - provide base, no-op versions of the user commands }
⟨/base⟩
```

3 Package options

There are only two documented options to switch for luatex between generic and luamode, TODO try to get rid of them. The option `disabledelayedshipout` is only temporary to be able to debug problem with the new shipout keyword if needed.

```
⟨*package⟩
\bool_new:N\g__tag_mode_lua_bool
\bool_new:N\g__tag_delayed_shipout_bool
\bool_lazy_and:nnT
  { \bool_if_exist_p:N \l__pdfmanagement_delayed_shipout_bool }
  { \l__pdfmanagement_delayed_shipout_bool }
  {
    \bool_gset_true:N\g__tag_delayed_shipout_bool
  }
\DeclareOption {luamode}  { \sys_if_engine_luatex:T { \bool_gset_true:N \g__tag_mode_lua_bool
\DeclareOption {genericmode}{ \bool_gset_false:N\g__tag_mode_lua_bool }
\DeclareOption {disabledelayedshipout}{ \bool_gset_false:N\g__tag_delayed_shipout_bool }
\ExecuteOptions{luamode}
\ProcessOptions
```

4 Packages

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

```
\RequirePackage{tagpdf-base}
⟨/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:

```
⟨*base⟩
\cs_new_protected:Npn \__tag_whatsits: {}
\AddToHook{begindocument}
 {
  \str_case:VnF \c_sys_backend_str
   {
    { luatex  } { \cs_set_protected:Npn \__tag_whatsits: {} }
    { dvisvgm } { \cs_set_protected:Npn \__tag_whatsits: {} }
   }
   {
     \cs_set_protected:Npn \__tag_whatsits: {\tex_special:D {} }
   }
 }
⟨/base⟩
```

4.1 Patches related to Ref improvement

2024-09-09: Temporary code. Can be removed when the latex-lab-footnote and latex-lab-toc code have been adapted to the better Ref handling.

```
⟨*package⟩
\AddToHook{package/latex-lab-testphase-new-or-2/after}
  {
    \cs_set_protected:Npn \__fnote_gput_ref:nn #1 #2 %#1 the structure number receiving the r
      {
        \tag_struct_gput:nnn {#1}{ref_num}{#2}
      }
  }
\AddToHook{package/latex-lab-testphase-toc/after}
  {
    \cs_set_protected:Npn \g__tag_struct_ref_by_dest:
      {
        \prop_map_inline:Nn\g__tag_struct_ref_by_dest_prop
          {
            \tag_struct_gput:nnn {##1}{ref_dest}{##2}
          }
      }
  }
⟨/package⟩
```

4.2 a LastPage label

See also issue #2 in Accessible-xref

__tag_lastpagelabel:

```
⟨*package⟩
\cs_new_protected:Npn \__tag_lastpagelabel:
  {
    \legacy_if:nT { @filesw }
      {
        \exp_args:NNne \exp_args:NNe\iow_now:Nn \@auxout
           {
             \token_to_str:N \new@label@record
               {@tag@LastPage}
               {
                 {abspage} { \int_use:N \g_shipout_readonly_int}
                 {tagmcabs}{ \int_use:N \c@g__tag_MCID_abs_int }
                 {tagstruct}{\int_use:N \c@g__tag_struct_abs_int }
               }
           }
      }
  }

 \AddToHook{enddocument/afterlastpage}
  {\__tag_lastpagelabel:}
```

(*End of definition for* `\__tag_lastpagelabel:`.)

5 Variables

\l__tag_tmpa_tl
\l__tag_tmpb_tl
\l__tag_Ref_tmpa_tl
\l__tag_get_tmpc_tl
\l__tag_get_parent_tmpa_tl
\l__tag_get_parent_tmpb_tl
\l__tag_tmpa_str
\l__tag_tmpa_prop
\l__tag_tmpa_seq
\l__tag_tmpb_seq
\l__tag_tmpa_clist
\l__tag_tmpa_int
\l__tag_tmpa_box
\l__tag_tmpb_box

A few temporary variables

```
\tl_new:N    \l__tag_tmpa_tl
\tl_new:N    \l__tag_tmpb_tl
\tl_new:N    \l__tag_Ref_tmpa_tl
\tl_new:N    \l__tag_get_tmpc_tl
\tl_new:N    \l__tag_get_parent_tmpa_tl
\tl_new:N    \l__tag_get_parent_tmpb_tl
\str_new:N   \l__tag_tmpa_str
\prop_new:N  \l__tag_tmpa_prop
\seq_new:N   \l__tag_tmpa_seq
\seq_new:N   \l__tag_tmpb_seq
\clist_new:N \l__tag_tmpa_clist
\int_new:N   \l__tag_tmpa_int
\box_new:N   \l__tag_tmpa_box
\box_new:N   \l__tag_tmpb_box
```

(*End of definition for* `\l__tag_tmpa_tl` *and others.*)

Attribute lists for the label command. We have a list for mc-related labels, and one for structures.

\c__tag_property_mc_clist
\c__tag_property_struct_clist

```
\clist_const:Nn \c__tag_property_mc_clist     {tagabspage,tagmcabs,tagmcid}
\clist_const:Nn \c__tag_property_struct_clist {tagstruct,tagstructobj}
```

(*End of definition for* `\c__tag_property_mc_clist` *and* `\c__tag_property_struct_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.

```
\int_new:N  \l__tag_loglevel_int
```

(*End of definition for* `\l__tag_loglevel_int`.)

\g__tag_active_space_bool
\g__tag_active_mc_bool
\g__tag_active_tree_bool
\g__tag_active_struct_bool
\g__tag_active_struct_dest_bool

These booleans should help to control the global behaviour of tagpdf. Ideally it should more or less do nothing if all are false. The space-boolean controls the interword space code, the mc-boolean activates `\tag_mc_begin:n`, the tree-boolean activates writing the finish code and the pdfmanagement related commands, the struct-boolean activates the 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, 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.

```
\bool_new:N \g__tag_active_space_bool
\bool_new:N \g__tag_active_mc_bool
\bool_new:N \g__tag_active_tree_bool
\bool_new:N \g__tag_active_struct_bool
\bool_new:N \g__tag_active_struct_dest_bool
\bool_gset_true:N \g__tag_active_struct_dest_bool
```

(*End of definition for* `\g__tag_active_space_bool` *and others.*)

\l__tag_active_mc_bool
\l__tag_active_struct_bool
\l__tag_active_socket_bool

These booleans should help to control the *local* behaviour of tagpdf. In some cases it 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.

```
\bool_new:N \l__tag_active_mc_bool
\bool_set_true:N \l__tag_active_mc_bool
\bool_new:N \l__tag_active_struct_bool
\bool_set_true:N \l__tag_active_struct_bool
\bool_new:N \l__tag_active_socket_bool
```

(*End of definition for* `\l__tag_active_mc_bool`, `\l__tag_active_struct_bool`, *and* `\l__tag_active_socket_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.

```
\bool_new:N \g__tag_tagunmarked_bool
```

(*End of definition for* `\g__tag_tagunmarked_bool`.)

\g__tag_softhyphen_bool

This boolean controls if the code should try to automatically handle hyphens from hyphenation. It is currently only used in luamode.

```
\bool_new:N \g__tag_softhyphen_bool
```

(*End of definition for* `\g__tag_softhyphen_bool`.)

6 Variants of l3 commands

```
\prg_generate_conditional_variant:Nnn \pdf_object_if_exist:n {e}{T,F,TF}
\cs_generate_variant:Nn \pdf_object_ref:n {e}
\cs_generate_variant:Nn \pdfannot_dict_put:nnn {nne}
\cs_generate_variant:Nn \pdffile_embed_stream:nnn {nee,oee}
\cs_generate_variant:Nn \prop_gput:Nnn {Nee,Nen} %** unneeded
\cs_generate_variant:Nn \prop_put:Nnn  {Nee}     %** unneeded
\cs_generate_variant:Nn \prop_item:Nn {No,Ne}    %**  unneeded
\cs_generate_variant:Nn \seq_set_split:Nnn{Nne}  %**  unneeded
\cs_generate_variant:Nn \str_set_convert:Nnnn {Nonn, Noon, Nnon }
\cs_generate_variant:Nn \clist_map_inline:nn {on}
```

7 Label and Reference commands

The code uses mostly the kernel properties but need a few local variants.

__tag_property_record:nn

The command to record a property while preserving the spaces similar to the standard `\label`.

```
    \cs_new_protected:Npn \__tag_property_record:nn #1#2
      {
        \@bsphack
        \property_record:nn{#1}{#2}
        \@esphack
      }

```

And a few variants

```
\cs_generate_variant:Nn \property_ref:nnn {enn}
\cs_generate_variant:Nn \property_ref:nn  {en}
\cs_generate_variant:Nn \__tag_property_record:nn {en,eV}
```

(*End of definition for* `\__tag_property_record:nn`.)

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

```
\cs_new:Npn \__tag_property_ref_lastpage:nn #1 #2
  {
    \property_ref:nnn {@tag@LastPage}{#1}{#2}
  }
```

(*End of definition for* `\__tag_property_ref_lastpage:nn`.)

8 Setup label attributes

`tagstruct` `tagstructobj` `tagabspage` `tagmcabs` `tagmcid` 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`.

```
\property_new:nnnn
  { tagstruct } { now }
  {1} { \int_use:N \c@g__tag_struct_abs_int }
\property_new:nnnn  { tagstructobj } { now }  {}
  {
     \pdf_object_ref_indexed:nn { __tag/struct } { \c@g__tag_struct_abs_int }
  }
\property_new:nnnn
  { tagabspage } { shipout }
  {0} { \int_use:N \g_shipout_readonly_int }
\property_new:nnnn  { tagmcabs } { now }
  {0} { \int_use:N \c@g__tag_MCID_abs_int }

\flag_new:n { __tag/mcid }
\property_new:nnnn  {tagmcid } { shipout }
   {0} { \flag_height:n { __tag/mcid } }

```

(*End of definition for* `tagstruct` *and others. These functions are documented on page 7.*)

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_prop_new_linked: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
```

```
\cs_set_eq:NN \__tag_prop_new:N        \prop_new:N
\cs_set_eq:NN \__tag_prop_new_linked:N \prop_new_linked:N
\cs_set_eq:NN \__tag_seq_new:N         \seq_new:N
\cs_set_eq:NN \__tag_prop_gput:Nnn     \prop_gput:Nnn
\cs_set_eq:NN \__tag_seq_gput_right:Nn \seq_gput_right:Nn
\cs_set_eq:NN \__tag_seq_item:cn       \seq_item:cn
\cs_set_eq:NN \__tag_prop_item:cn      \prop_item:cn
\cs_set_eq:NN \__tag_seq_show:N        \seq_show:N
\cs_set_eq:NN \__tag_prop_show:N       \prop_show:N
% cnx temporary needed for latex-lab-graphic code
\cs_generate_variant:Nn \__tag_prop_gput:Nnn      { Nen , Nee, Nne , cnn, cen, cne, cno, cnx}
\cs_generate_variant:Nn \__tag_seq_gput_right:Nn  { Ne  , No, cn, ce }
\cs_generate_variant:Nn \__tag_prop_new:N   { c }
\cs_generate_variant:Nn \__tag_seq_new:N    { c }
\cs_generate_variant:Nn \__tag_seq_show:N   { c }
\cs_generate_variant:Nn \__tag_prop_show:N  { c }
⟨/package⟩
```

(*End of definition for* `\__tag_prop_new:N` *and others.*)

10 General tagging commands

```
\tag_stop:
\tag_start:
\tag_stop:n
\tag_start:n
```

We need commands to stop tagging in some places. They switch local booleans and also stop the counting of paragraphs. The commands keep track of the nesting with a local counter. Tagging only is only restarted at the outer level, if the current level is 1. The commands with argument allow to give a label. This is only used in debugging messages to allow to follow the nesting.

When stop/start pairs are nested we do not want the inner start command to restart tagging. To control this we use a local int: The stop command will increase it. The starting will decrease it and only restart tagging, if it is zero. This will replace the label version.

```
\l__tag_tag_stop_int
```

```
⟨*package | debug⟩
⟨package⟩\int_new:N \l__tag_tag_stop_int

\cs_set_protected:Npn \tag_stop:
  {
⟨debug⟩     \msg_note:nne {tag / debug }{tag-stop}{ \int_use:N \l__tag_tag_stop_int }
    \int_incr:N \l__tag_tag_stop_int
    \bool_set_false:N \l__tag_active_struct_bool
    \bool_set_false:N \l__tag_active_mc_bool
    \bool_set_false:N \l__tag_active_socket_bool
    \__tag_stop_para_ints:
  }
\cs_set_protected:Npn \tag_start:
  {
    \int_if_zero:nF { \l__tag_tag_stop_int } { \int_decr:N \l__tag_tag_stop_int }
    \int_if_zero:nT { \l__tag_tag_stop_int }
      {
        \bool_set_true:N \l__tag_active_struct_bool
        \bool_set_true:N \l__tag_active_mc_bool
        \bool_set_true:N \l__tag_active_socket_bool
```

```
        \__tag_start_para_ints:
      }
⟨debug⟩    \msg_note:nne {tag / debug }{tag-start}{ \int_use:N \l__tag_tag_stop_int }
  }
\cs_set_eq:NN\tagstop\tag_stop:
\cs_set_eq:NN\tagstart\tag_start:
\cs_set_protected:Npn \tag_stop:n #1
  {
⟨debug⟩    \msg_note:nnee {tag / debug }{tag-stop}
⟨debug⟩       { \int_use:N \l__tag_tag_stop_int }{\exp_not:n{#1}}
    \int_incr:N \l__tag_tag_stop_int
    \bool_set_false:N \l__tag_active_struct_bool
    \bool_set_false:N \l__tag_active_mc_bool
    \bool_set_false:N \l__tag_active_socket_bool
    \__tag_stop_para_ints:
  }
\cs_set_protected:Npn \tag_start:n #1
  {
    \int_if_zero:nF { \l__tag_tag_stop_int } { \int_decr:N \l__tag_tag_stop_int }
    \int_if_zero:nT { \l__tag_tag_stop_int }
      {
        \bool_set_true:N \l__tag_active_struct_bool
        \bool_set_true:N \l__tag_active_mc_bool
        \bool_set_true:N \l__tag_active_socket_bool
        \__tag_start_para_ints:
      }
⟨debug⟩    \msg_note:nnee {tag / debug }{tag-start}
⟨debug⟩       { \int_use:N \l__tag_tag_stop_int }{\exp_not:n{#1}}
  }
⟨/package | debug⟩
⟨*base⟩
\cs_new_protected:Npn \tag_stop:{}
\cs_new_protected:Npn \tag_start:{}
\cs_new_protected:Npn \tagstop{}
\cs_new_protected:Npn \tagstart{}
\cs_new_protected:Npn \tag_stop:n  #1 {}
\cs_new_protected:Npn \tag_start:n #1 {}
⟨/base⟩
```

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

11 Keys for tagpdfsetup

TODO: the log-levels must be sorted

`activate/mc␣(setup-key)`
`activate/tree␣(setup-key)`
`activate/struct␣(setup-key)`
`activate/all␣(setup-key)`
`activate/struct-dest␣(setup-key)`

Keys to (globally) activate tagging. `activate/spaces` activates the additional parsing needed for interword spaces. It is defined in tagpdf-space. `activate/struct-dest` allows to activate or suppress structure destinations.

```
⟨*package⟩
\keys_define:nn { __tag / setup }
  {
    activate/mc      .bool_gset:N = \g__tag_active_mc_bool,
    activate/tree    .bool_gset:N = \g__tag_active_tree_bool,
```

```
    activate/struct .bool_gset:N = \g__tag_active_struct_bool,
    activate/all    .meta:n =
      {activate/mc={#1},activate/tree={#1},activate/struct={#1}},
    activate/all  .default:n = true,
    activate/struct-dest .bool_gset:N = \g__tag_active_struct_dest_bool,
```

old, deprecated names

```
    activate-mc     .bool_gset:N = \g__tag_active_mc_bool,
    activate-tree   .bool_gset:N = \g__tag_active_tree_bool,
    activate-struct .bool_gset:N = \g__tag_active_struct_bool,
    activate-all    .meta:n =
      {activate/mc={#1},activate/tree={#1},activate/struct={#1}},
    activate-all  .default:n = true,
    no-struct-dest .bool_gset_inverse:N = \g__tag_active_struct_dest_bool,
```

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

`debug/show␣(setup-key)` Subkeys/values are defined in various other places.

```
    debug/show            .choice:,
```

(*End of definition for* `debug/show (setup-key)`*. This function is documented on page* ??.)

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

```
    debug/log             .choice:,
    debug/log / none      .code:n = {\int_set:Nn \l__tag_loglevel_int { 0 }},
    debug/log / v         .code:n =
      {
        \int_set:Nn \l__tag_loglevel_int { 1 }
        \cs_set_protected:Nn \__tag_check_typeout_v:n { \iow_term:e {##1} }
      },
    debug/log / vv        .code:n = {\int_set:Nn \l__tag_loglevel_int { 2 }},
    debug/log / vvv       .code:n = {\int_set:Nn \l__tag_loglevel_int { 3 }},
    debug/log / all       .code:n = {\int_set:Nn \l__tag_loglevel_int { 10 }},
    debug/uncompress .code:n = { \pdf_uncompress:  },
```

deprecated but still needed as the documentmetadata key argument uses it.

```
    log             .meta:n = {debug/log={#1}},
    uncompress      .code:n = { \pdf_uncompress:  },
```

(*End of definition for* `debug/log (setup-key)` *and others. These functions are documented on page* 6.)

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

```
    activate/tagunmarked     .bool_gset:N = \g__tag_tagunmarked_bool,
    activate/tagunmarked     .initial:n  = true,
```

deprecated name

```
    tagunmarked .bool_gset:N = \g__tag_tagunmarked_bool,
```

(*End of definition for* `activate/tagunmarked (setup-key)` *and* `tagunmarked (deprecated)`*. These functions are documented on page* 6.)

`activate/softhyphen␣(setup-key)` This key activates (in luamode) the handling of soft hyphens.

```
    activate/softhyphen     .bool_gset:N = \g__tag_softhyphen_bool,
    activate/softhyphen     .initial:n  = true,
```

(*End of definition for* `activate/softhyphen (setup-key)`. *This function is documented on page 6.*)

`page/tabsorder␣(setup-key)`
`tabsorder␣(deprecated)`

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.

```
    page/tabsorder       .choice:,
    page/tabsorder / row       .code:n =
      \pdfmanagement_add:nnn { Page } {Tabs}{/R},
    page/tabsorder / column    .code:n =
      \pdfmanagement_add:nnn { Page } {Tabs}{/C},
    page/tabsorder / structure .code:n =
      \pdfmanagement_add:nnn { Page } {Tabs}{/S},
    page/tabsorder / none      .code:n =
      \pdfmanagement_remove:nn {Page} {Tabs},
    page/tabsorder       .initial:n = structure,
```

deprecated name

```
    tabsorder .meta:n = {page/tabsorder={#1}},
  }
```

(*End of definition for* `page/tabsorder (setup-key)` *and* `tabsorder (deprecated)`. *These functions are documented on page 6.*)

12 loading of engine/more dependent code

```
\sys_if_engine_luatex:T
  {
    \file_input:n {tagpdf-luatex.def}
  }
⟨/package⟩
⟨*mcloading⟩
\bool_if:NTF \g__tag_mode_lua_bool
  {
   \RequirePackage {tagpdf-mc-code-lua}
  }
  {
   \RequirePackage {tagpdf-mc-code-generic} %
  }
⟨/mcloading⟩
⟨*debug⟩
\bool_if:NTF \g__tag_mode_lua_bool
  {
   \RequirePackage {tagpdf-debug-lua}
  }
  {
   \RequirePackage {tagpdf-debug-generic} %
  }
⟨/debug⟩
```

Part I
The tagpdf-checks module Messages and check code Part of the tagpdf package

1 Commands

`\tag_if_active_p:` ⋆
`\tag_if_active:TF` ⋆

This command tests if tagging is active. It only gives true if all tagging has been activated, *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`.

`\tag_if_box_tagged_p:N` ⋆ `\tag_if_box_tagged:N{`⟨*box*⟩`}`
`\tag_if_box_tagged:NTF` ⋆

This tests if a box contains tagging commands. It relies currently on that the code, that saved the box, correctly sets the command `\l_tag_box_\int_use:N #1_tl` to a positive value. The LaTeX commands will do that automatically at some time but it is in the responsibility of the user to ensure that when using low-level code. If the internal command doesn't exist the box is assumed to be untagged.

2 Description of log messages

2.1 `\ShowTagging` command

Argument	type	note
`\ShowTagging`mc-data = num	log+term	lua-only
`\ShowTagging`mc-current	log+term	
`\ShowTagging`struck-stack= [log|show]	log or term+stop	
`\ShowTagging`debug/structures = num	log+termn	debug mode only

2.2 Messages in checks and commands

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

message	log-level	remark
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	
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-unknown`
`struct-no-objnum`
`struct-orphan`
`struct-faulty-nesting`
`struct-missing-tag`
`struct-used-twice`
`struct-label-unknown`
`struct-show-closing`
	Various messages related to structure. Check the definition in the code for their meaning and the arguments they take.

`tree-struct-still-open`	Message issued at the end of the compilation if there are (beside Root) other open structures on the stack.
`tree-statistic`	Message issued at the end of the compilation showing the number of objects to write
`show-struct` `show-kids`	These two messages are used in debug mode to show the current structures in the log and terminal.
`attr-unknown`	Message if an attribute i sunknown.

`role-missing`
`role-unknown`
`role-unknown-tag`
`role-unknown-NS`
`role-tag`
`new-tag`
`role-parent-child`
`role-remapping`
	Messages related to role mapping.

`tree-mcid-index-wrong`	Used in the tree code, typically indicates the document must be rerun.
`sys-no-interwordspace`	Message if an engine doesn't support inter word spaces
`para-hook-count-wrong`	Message if the number of begin paragraph and end paragraph differ. This normally means faulty structure.

```
⟨@@=tag⟩
⟨*header⟩
\ProvidesExplPackage {tagpdf-checks-code} {2024-09-11} {0.99e}
 {part of tagpdf - code related to checks, conditionals, debugging and messages}
⟨/header⟩
```

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.

```
⟨*package⟩
\msg_new:nnn { tag } {mc-nested} { nested~marked~content~found~--~mcid~#1 }
```

(*End of definition for* `mc-nested`. *This function is documented on page* 19.)

mc-tag-missing

If the tag is missing

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

(*End of definition for* `mc-tag-missing`. *This function is documented on page* 19.)

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.

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

(*End of definition for* `mc-label-unknown`. *This function is documented on page* 19.)

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.

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

(*End of definition for* `mc-used-twice`. *This function is documented on page* 19.)

mc-not-open

This is issued if a `\tag_mc_end:` is issued wrongly, wrong coding.

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

(*End of definition for* `mc-not-open`. *This function is documented on page* 19.)

mc-pushed
mc-popped

Informational messages about mc-pushing.

```
\msg_new:nnn { tag } {mc-pushed} { #1~has~been~pushed~to~the~mc~stack}
\msg_new:nnn { tag } {mc-popped} { #1~has~been~removed~from~the~mc~stack }
```

(*End of definition for* `mc-pushed` *and* `mc-popped`. *These functions are documented on page* 19.)

mc-current

Informational messages about current mc state.

```
\msg_new:nnn { tag } {mc-current}
  { current~MC:~
    \bool_if:NTF\g__tag_in_mc_bool
      {abscnt=\__tag_get_mc_abs_cnt:,~tag=\g__tag_mc_key_tag_tl}
      {no~MC~open,~current~abscnt=\__tag_get_mc_abs_cnt:"}
  }
```

(*End of definition for* `mc-current`. *This function is documented on page* 19.)

3.2 Messages related to structures

`struct-unknown` if for example a parent key value points to structure that doesn't exist (yet)

```
\msg_new:nnn { tag } {struct-unknown}
  { structure~with~number~#1~doesn't~exist\\ #2 }
```

(*End of definition for* `struct-unknown`. *This function is documented on page 20.*)

`struct-no-objnum` Should not happen ...

```
\msg_new:nnn { tag } {struct-no-objnum} { objnum~missing~for~structure~#1 }
```

(*End of definition for* `struct-no-objnum`. *This function is documented on page 20.*)

`struct-orphan` This indicates that there is a structure which has kids but no parent. This can happen if a structure is stashed but then not used.

```
\msg_new:nnn { tag } {struct-orphan}
  {
    Structure~#1~has~#2~kids~but~no~parent.\\
    It~is~turned~into~an~artifact.\\
    Did~you~stashed~a~structure~and~then~didn't~use~it?
  }

```

(*End of definition for* `struct-orphan`. *This function is documented on page 20.*)

`struct-faulty-nesting` This indicates that there is somewhere one `\tag_struct_end:` too much. This should be normally an error.

```
\msg_new:nnn { tag }
  {struct-faulty-nesting}
  { there~is~no~open~structure~on~the~stack }
```

(*End of definition for* `struct-faulty-nesting`. *This function is documented on page 20.*)

`struct-missing-tag` A structure must have a tag.

```
\msg_new:nnn { tag } {struct-missing-tag} { a~structure~must~have~a~tag! }
```

(*End of definition for* `struct-missing-tag`. *This function is documented on page 20.*)

`struct-used-twice`

```
\msg_new:nnn { tag } {struct-used-twice}
  { structure~with~label~#1~has~already~been~used}
```

(*End of definition for* `struct-used-twice`. *This function is documented on page 20.*)

`struct-label-unknown` label is unknown, typically needs a rerun.

```
\msg_new:nnn { tag } {struct-label-unknown}
  { structure~with~label~#1~is~unknown~rerun}
```

(*End of definition for* `struct-label-unknown`. *This function is documented on page 20.*)

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

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

(*End of definition for* `struct-show-closing`. *This function is documented on page 20.*)

struct-Ref-unknown This message is issued at the end, when the Ref keys are updated. TODO: in debug mode it should report more info about the structure.

```
\msg_new:nnn { tag } {struct-Ref-unknown}
 {
     #1~has~no~related~structure.\\
    /Ref~not~updated.
 }
```

(*End of definition for* `struct-Ref-unknown`. *This function is documented on page* **??**.)

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

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

(*End of definition for* `tree-struct-still-open`. *This function is documented on page 20.*)

tree-statistic Message issued at the end showing the estimated number of structures and MC-childs

```
\msg_new:nnn { tag } {tree-statistic}
  {
    Finalizing~the~tagging~structure:\\
    Writing~out~\c_tilde_str
    \int_use:N\c@g__tag_struct_abs_int\c_space_tl~structure~objects\\
    with~\c_tilde_str
    \int_use:N\c@g__tag_MCID_abs_int\c_space_tl'MC'~leaf~nodes.\\
    Be~patient~if~there~are~lots~of~objects!
  }
⟨/package⟩
```

(*End of definition for* `tree-statistic`. *This function is documented on page 20.*)

The following messages are only needed in debug mode.

show-struct
show-kids This two messages are used to show the current structures in the log and terminal.

```
⟨*debug⟩
\msg_new:nnn { tag/debug } { show-struct }
  {
    =========================\\
    The~structure~#1~
    \tl_if_empty:nTF {#2}
      { is~empty \\>~ . }
      { contains: #2  }
    \\
  }
\msg_new:nnn { tag/debug } { show-kids }
  {
    The~structure~has~the~following~kids:
    \tl_if_empty:nTF {#2}
      { \\>~ NONE }
      { #2  }
    \\
```

```
    ========================
  }
⟨/debug⟩
```

(*End of definition for* `show-struct` *and* `show-kids`*. These functions are documented on page 20.*)

3.3 Attributes

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

attr-unknown

```
⟨*package⟩
\msg_new:nnn { tag } {attr-unknown}  { attribute~#1~is~unknown}
```

(*End of definition for* `attr-unknown`*. This function is documented on page 20.*)

3.4 Roles

role-missing
role-unknown
role-unknown-tag
role-unknown-NS

Warning message if either the tag or the role is missing

```
\msg_new:nnn { tag } {role-missing}     { tag~#1~has~no~role~assigned  }
\msg_new:nnn { tag } {role-unknown}     { role~#1~is~not~known  }
\msg_new:nnn { tag } {role-unknown-tag} { tag~#1~is~not~known  }
\msg_new:nnn { tag } {role-unknown-NS}  { \tl_if_empty:nTF{#1}{Empty~NS}{NS~#1~is~not~known}
```

(*End of definition for* `role-missing` *and others. These functions are documented on page 20.*)

role-parent-child

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

```
\msg_new:nnn { tag } {role-parent-child}
  { Parent-Child~'#1'~-->~'#2'.\\Relation~is~#3~\msg_line_context:}
```

(*End of definition for* `role-parent-child`*. This function is documented on page 20.*)

role-remapping

This is info and warning message about role-remapping

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

(*End of definition for* `role-remapping`*. This function is documented on page 20.*)

role-tag
new-tag

Info messages.

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

(*End of definition for* `role-tag` *and* `new-tag`*. These functions are documented on page 20.*)

3.5 Miscellaneous

tree-mcid-index-wrong

Used in the tree code, typically indicates the document must be rerun.

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

(*End of definition for* `tree-mcid-index-wrong`. *This function is documented on page* 20.)

sys-no-interwordspace

Currently only pdflatex and lualatex have some support for real spaces.

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

(*End of definition for* `sys-no-interwordspace`. *This function is documented on page* 20.)

__tag_check_typeout_v:n

A simple logging function. By default is gobbles its argument, but the log-keys sets it to typeout.

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

(*End of 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 and breaks the structure.

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

(*End of definition for* `para-hook-count-wrong`. *This function is documented on page* 20.)

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`.

```
⟨base⟩\cs_new:Npn \tag_get:n #1   { \use:c {__tag_get_data_#1: } }
```

(*End of definition for* `\tag_get:n`. *This function is documented on page* 17.)

5 User conditionals

\tag_if_active_p:
\tag_if_active:*TF*

This tests 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.

```
⟨*base⟩
\prg_new_conditional:Npnn \tag_if_active: { p , T , TF, F }
  { \prg_return_false: }
⟨/base⟩
⟨*package⟩
\prg_set_conditional:Npnn \tag_if_active: { p , T , TF, F }
  {
     \bool_lazy_all:nTF
       {
         {\g__tag_active_struct_bool}
         {\g__tag_active_mc_bool}
```

```
          {\g__tag_active_tree_bool}
          {\l__tag_active_struct_bool}
          {\l__tag_active_mc_bool}
        }
        {
          \prg_return_true:
        }
        {
          \prg_return_false:
        }
  }
⟨/package⟩
```

(*End of definition for* `\tag_if_active:TF`. *This function is documented on page 17.*)

`\tag_if_box_tagged_p:N`
`\tag_if_box_tagged:NTF`

This tests if a box contains tagging commands. It relies on that the code that saved the box correctly set `\l_tag_box_<box number>_tl` to a positive value. The LaTeX commands will do that automatically at some time but it is in the responsibility of the user to ensure that when using low-level code. If the internal command doesn't exist the box is assumed to be untagged.

```
⟨*base⟩
\prg_new_conditional:Npnn \tag_if_box_tagged:N #1 {p,T,F,TF}
    {
      \tl_if_exist:cTF {l_tag_box_\int_use:N #1_tl}
       {
         \int_compare:nNnTF {0\tl_use:c{l_tag_box_\int_use:N #1_tl}}>{0}
          { \prg_return_true:  }
          { \prg_return_false: }
       }
       {
         \prg_return_false:
         % warning??
       }
    }
⟨/base⟩
```

(*End of definition for* `\tag_if_box_tagged:NTF`. *This function is documented on page 17.*)

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`
`\__tag_check_if_active_struct:TF`

This checks if mc are active.

```
⟨*package⟩
\prg_new_conditional:Npnn \__tag_check_if_active_mc: {T,F,TF}
  {
    \bool_lazy_and:nnTF { \g__tag_active_mc_bool } { \l__tag_active_mc_bool }
      {
        \prg_return_true:
      }
      {
```

```
          \prg_return_false:
      }
  }
\prg_new_conditional:Npnn \__tag_check_if_active_struct: {T,F,TF}
  {
    \bool_lazy_and:nnTF { \g__tag_active_struct_bool } { \l__tag_active_struct_bool }
      {
         \prg_return_true:
      }
      {
         \prg_return_false:
      }
  }
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_check_structure_has_tag:n #1 %#1 struct num
  {
    \prop_if_in:cnF { g__tag_struct_#1_prop }
      {S}
      {
        \msg_error:nn { tag } {struct-missing-tag}
      }
  }
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_check_structure_tag:N #1
  {
    \prop_if_in:NoF \g__tag_role_tags_NS_prop {#1}
      {
        \msg_warning:nne { tag } {role-unknown-tag} {#1}
      }
  }
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_check_info_closing_struct:n #1 %#1 struct num
  {
    \int_compare:nNnT {\l__tag_loglevel_int} > { 0 }
      {
        \msg_info:nnn { tag } {struct-show-closing} {#1}
      }
  }

\cs_generate_variant:Nn \__tag_check_info_closing_struct:n {o,e}
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_check_no_open_struct:
  {
    \msg_error:nn { tag } {struct-faulty-nesting}
  }
```

(*End of definition for* `\__tag_check_no_open_struct:`.)

`\__tag_check_struct_used:n` This checks if a stashed structure has already been used.

```
\cs_new_protected:Npn \__tag_check_struct_used:n #1 %#1 label
  {
    \prop_get:cnNT
      {g__tag_struct_\property_ref:enn{tagpdfstruct-#1}{tagstruct}{unknown}_prop}
      {P}
      \l__tag_tmpa_tl
      {
        \msg_warning:nnn { tag } {struct-used-twice} {#1}
      }
  }
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_check_add_tag_role:nn #1 #2 %#1 tag, #2 role
  {
    \tl_if_empty:nTF {#2}
      {
        \msg_error:nnn { tag } {role-missing} {#1}
      }
      {
        \prop_get:NnNTF \g__tag_role_tags_NS_prop {#2} \l_tmpa_tl
          {
            \int_compare:nNnT {\l__tag_loglevel_int} > { 0 }
              {
                \msg_info:nnnn { tag } {role-tag} {#1} {#2}
              }
          }
          {
            \msg_error:nnn { tag } {role-unknown} {#2}
          }
      }
  }
```

Similar with a namespace

```
\cs_new_protected:Npn \__tag_check_add_tag_role:nnn #1 #2 #3 %#1 tag/NS, #2 role #3 namespace
  {
    \tl_if_empty:nTF {#2}
      {
        \msg_error:nnn { tag } {role-missing} {#1}
```

```
      }
      {
        \prop_get:cnNTF { g__tag_role_NS_#3_prop } {#2} \l_tmpa_tl
          {
            \int_compare:nNnT {\l__tag_loglevel_int} > { 0 }
              {
                \msg_info:nnnn { tag } {role-tag} {#1} {#2/#3}
              }
          }
          {
            \msg_error:nnn { tag } {role-unknown} {#2/#3}
          }
      }
  }
```

(*End of definition for* `\__tag_check_add_tag_role:nn`.)

6.4 Check related to mc-chunks

`\__tag_check_mc_if_nested:`
`\__tag_check_mc_if_open:`

Two tests if a mc is currently open. One for the true (for begin code), one for the false part (for end code).

```
\cs_new_protected:Npn \__tag_check_mc_if_nested:
  {
    \__tag_mc_if_in:T
      {
        \msg_warning:nne { tag } {mc-nested} { \__tag_get_mc_abs_cnt: }
      }
  }

\cs_new_protected:Npn \__tag_check_mc_if_open:
  {
    \__tag_mc_if_in:F
      {
        \msg_warning:nne { tag } {mc-not-open} { \__tag_get_mc_abs_cnt: }
      }
  }
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_check_mc_pushed_popped:nn #1 #2
  {
    \int_compare:nNnT
      { \l__tag_loglevel_int } ={ 2 }
      { \msg_info:nne {tag}{mc-#1}{#2} }
    \int_compare:nNnT
      { \l__tag_loglevel_int } > { 2 }
      {
        \msg_info:nne {tag}{mc-#1}{#2}
        \seq_log:N \g__tag_mc_stack_seq
      }
  }
```

(*End of definition for* `\__tag_check_mc_pushed_popped:nn`.)

`\__tag_check_mc_tag:N` This checks if the mc has a (known) tag.

```
\cs_new_protected:Npn \__tag_check_mc_tag:N #1  %#1 is var with a tag name in it
  {
    \tl_if_empty:NT #1
      {
        \msg_error:nne { tag } {mc-tag-missing} { \__tag_get_mc_abs_cnt: }
      }
   \prop_if_in:NoF \g__tag_role_tags_NS_prop {#1}
     {
       \msg_warning:nne { tag } {role-unknown-tag} {#1}
     }
  }
```

(*End of 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??

```
\cs_new_protected:Npn \__tag_check_init_mc_used:
  {
    \intarray_new:Nn \g__tag_check_mc_used_intarray { 65536 }
    \cs_gset_eq:NN \__tag_check_init_mc_used: \prg_do_nothing:
  }
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_check_mc_used:n #1 %#1 mcid abscnt
  {
    \int_compare:nNnT {\l__tag_loglevel_int} > { 2 }
      {
        \__tag_check_init_mc_used:
        \intarray_gset:Nnn \g__tag_check_mc_used_intarray
          {#1}
          { \intarray_item:Nn \g__tag_check_mc_used_intarray {#1} + 1 }
        \int_compare:nNnT
          {
            \intarray_item:Nn \g__tag_check_mc_used_intarray {#1}
          }
          >
          { 1 }
          {
            \msg_warning:nnn { tag } {mc-used-twice} {#1}
          }
      }
  }
```

(*End of definition for* `\__tag_check_mc_used:n`.)

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

```
\cs_new_protected:Npn \__tag_check_show_MCID_by_page:
  {
    \tl_set:Ne \l__tag_tmpa_tl
      {
        \__tag_property_ref_lastpage:nn
          {abspage}
          {-1}
      }
    \int_step_inline:nnnn {1}{1}
      {
        \l__tag_tmpa_tl
      }
      {
        \seq_clear:N \l_tmpa_seq
        \int_step_inline:nnnn
          {1}
          {1}
          {
            \__tag_property_ref_lastpage:nn
              {tagmcabs}
              {-1}
          }
          {
            \int_compare:nT
              {
                \property_ref:enn
                  {mcid-####1}
                  {tagabspage}
                  {-1}
                =
                ##1
             }
             {
               \seq_gput_right:Ne \l_tmpa_seq
                 {
                   Page##1-####1-
                   \property_ref:enn
                     {mcid-####1}
                     {tagmcid}
                     {-1}
                 }
             }
          }
          \seq_show:N \l_tmpa_seq
      }
  }
```

(*End of 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:
__tag_check_mc_in_galley:TF

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 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.

```
\prg_new_conditional:Npnn \__tag_check_if_mc_in_galley: { T,F,TF }
 {
   \tl_if_eq:NNTF \l__tag_mc_firstmarks_seq \l__tag_mc_botmarks_seq
    { \prg_return_false: }
    { \prg_return_true: }
 }
```

(*End of definition for* `\__tag_check_mc_in_galley:TF`.)

__tag_check_if_mc_tmb_missing_p:
__tag_check_if_mc_tmb_missing:TF

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

```
\prg_new_conditional:Npnn \__tag_check_if_mc_tmb_missing: { T,F,TF }
 {
  \bool_if:nTF
    {
      \str_if_eq_p:ee {\seq_item:Nn \l__tag_mc_firstmarks_seq {1}}{e-}
      ||
      \str_if_eq_p:ee {\seq_item:Nn \l__tag_mc_firstmarks_seq {1}}{b+}
    }
    { \prg_return_true: }
    { \prg_return_false: }
 }
```

(*End of definition for* `\__tag_check_if_mc_tmb_missing:TF`.)

__tag_check_if_mc_tme_missing_p:
__tag_check_if_mc_tme_missing:TF

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

```
\prg_new_conditional:Npnn \__tag_check_if_mc_tme_missing: { T,F,TF }
 {
   \str_if_eq:eeTF {\seq_item:Nn \l__tag_mc_botmarks_seq {1}}{b+}
    { \prg_return_true: }
    { \prg_return_false: }
 }
```

(*End of definition for* `\__tag_check_if_mc_tme_missing:TF`.)

```
⟨/package⟩
⟨*debug⟩
```

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

```
\msg_new:nnn { tag / debug } {mc-begin} { MC~begin~#1~with~options:~\tl_to_str:n{#2}~[\msg_li
\msg_new:nnn { tag / debug } {mc-end}   { MC~end~#1~[\msg_line_context:] }

\cs_new_protected:Npn \__tag_debug_mc_begin_insert:n #1
 {
   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
     {
        \msg_note:nnnn { tag / debug } {mc-begin} {inserted} { #1 }
     }
 }
\cs_new_protected:Npn \__tag_debug_mc_begin_ignore:n #1
 {
   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
     {
        \msg_note:nnnn { tag / debug } {mc-begin } {ignored} { #1 }
     }
 }
\cs_new_protected:Npn \__tag_debug_mc_end_insert:
 {
   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
     {
        \msg_note:nnn { tag / debug } {mc-end} {inserted}
     }
 }
\cs_new_protected:Npn \__tag_debug_mc_end_ignore:
 {
   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
     {
        \msg_note:nnn { tag / debug } {mc-end } {ignored}
     }
 }
```

And now something for the structures

```
\msg_new:nnn { tag / debug } {struct-begin}
  {
    Struct~\tag_get:n{struct_num}~begin~#1~with~options:~\tl_to_str:n{#2}~\\[\msg_line_contex
  }
\msg_new:nnn { tag / debug } {struct-end}
  {
    Struct~end~#1~[\msg_line_context:]
  }
\msg_new:nnn { tag / debug } {struct-end-wrong}
  {
    Struct~end~'#1'~doesn't~fit~start~'#2'~[\msg_line_context:]
  }

\cs_new_protected:Npn \__tag_debug_struct_begin_insert:n #1
 {
   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
     {
        \msg_note:nnnn { tag / debug } {struct-begin} {inserted} { #1 }
        \seq_log:N \g__tag_struct_tag_stack_seq
```

```
    }
 }
\cs_new_protected:Npn \__tag_debug_struct_begin_ignore:n #1
 {
   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
     {
        \msg_note:nnnn { tag / debug } {struct-begin } {ignored} { #1 }
     }
 }
\cs_new_protected:Npn \__tag_debug_struct_end_insert:
 {
   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
     {
        \msg_note:nnn { tag / debug } {struct-end} {inserted}
        \seq_log:N \g__tag_struct_tag_stack_seq
     }
 }
\cs_new_protected:Npn \__tag_debug_struct_end_ignore:
 {
   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
     {
        \msg_note:nnn { tag / debug } {struct-end } {ignored}
     }
 }
\cs_new_protected:Npn \__tag_debug_struct_end_check:n #1
 {
   \int_compare:nNnT { \l__tag_loglevel_int } > {0}
    {
      \seq_get:NNT \g__tag_struct_tag_stack_seq \l__tag_tmpa_tl
        {
          \str_if_eq:eeF
           {#1}
           {\exp_last_unbraced:NV\use_i:nn \l__tag_tmpa_tl}
           {
             \msg_warning:nnee { tag/debug }{ struct-end-wrong }
              {#1}
              {\exp_last_unbraced:NV\use_i:nn \l__tag_tmpa_tl}
           }
        }
     }
 }
```

This tracks tag stop and start. The tag-stop message should go before the int is increased. The tag-start message after the int is decreased.

```
\msg_new:nnn { tag / debug } {tag-stop}
  {
    \int_if_zero:nTF
      {#1}
      {Tagging~stopped}
      {Tagging~(not)~stopped~(already~inactive)}\\
    level:~#1~==>~\int_eval:n{#1+1}\tl_if_empty:nF{#2}{,~label:~#2}~[\msg_line_context:]
  }
\msg_new:nnn { tag / debug } {tag-start}
  {
```

```
    \int_if_zero:nTF
      {#1}
      {Tagging~restarted}
      {Tagging~(not)~restarted}\\
    level:~\int_eval:n{#1+1}~==>~#1\tl_if_empty:nF{#2}{,~label:~#2}~[\msg_line_context:]
  }
```

⟨/debug⟩

6.6 Benchmarks

It doesn't make much sense to do benchmarks in debug mode or in combination with a log-level as this would slow down the compilation. So we add simple commands that can be activated if l3benchmark has been loaded. TODO: is a warning needed?

⟨*package⟩

```
\cs_new_protected:Npn \__tag_check_benchmark_tic:{}
\cs_new_protected:Npn \__tag_check_benchmark_toc:{}
\cs_new_protected:Npn \tag_check_benchmark_on:
  {
    \cs_if_exist:NT \benchmark_tic:
     {
       \cs_set_eq:NN \__tag_check_benchmark_tic: \benchmark_tic:
       \cs_set_eq:NN \__tag_check_benchmark_toc: \benchmark_toc:
     }
  }
```

⟨/package⟩

Part II
The tagpdf-user module
Code related to LaTeX2e user commands and document commands
Part of the tagpdf package

1 Setup commands

\tagpdfsetup `\tagpdfsetup{⟨key val list⟩}`

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).

activate␣(setup-key) And additional setup key which combine the other activate keys `activate/mc`, `activate/tree`, `activate/struct` and additionally adds a document structure.

\tag_tool:n `\tag_tool:n{⟨key val⟩}`
\tagtool

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

\tagmcbegin `\tagmcbegin {⟨key-val⟩}`
\tagmcend `\tagmcend`
\tagmcuse `\tagmcuse{⟨label⟩}`

These are wrappers around `\tag_mc_begin:n`, `\tag_mc_end:` and `\tag_mc_use:n`. The commands and their argument are documentated 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`.

\tagmcifinTF `\tagmcifin {⟨true code⟩}{⟨false 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

\tagstructbegin `\tagstructbegin {⟨key-val⟩}`
\tagstructend `\tagstructend`
\tagstructuse `\tagstructuse{⟨label⟩}`

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

\ShowTagging `\ShowTagging {⟨key-val⟩}`

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

mc-data␣(show-key) `mc-data = ⟨number⟩`

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.

mc-current␣(show-key) `mc-current`

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.

mc-marks␣(show-key) `mc-marks = show|use`

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

struct-stack␣(show-key) `struct-stack = log|show`

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`.

debug/structures␣(show-key) `debug/structures = ⟨structure number⟩`

This key is available only if the tagpdf-debug package is loaded and shows all structures starting with the one with the number given by the key.

5 Extension commands

The following commands and code parts are not core commands 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 Tagging of paragraphs

This makes use of the paragraph hooks in 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.

para/tagging␣(setup-key)	para/tagging = true|false
paratagging-show␣(deprecated)	debug/show=para
paratagging␣(deprecated)	debug/show=paraOff

The `para/tagging` key can be used in `\tagpdfsetup` and enable/disables tagging of paragraphics. `debug/show=para` puts small colored 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.

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

`\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}%
```

5.3 Header and footer

Header and footer are automatically tagged as artifact: They are surrounded by an artifact-mc and inside tagging is stopped. If some real content is in the header and footer, tagging must be restarted there explicitly. The behaviour can be changed with the following key. The key accepts the values `true` (the default), `false` which disables the header tagging code. This can be useful if the page style is empty (it then avoids empty mc-chunks) or if the head and foot should be tagged in some special way. The last value, `pagination`, is like `true` but additionally adds an artifact structure with an pagination attribute.

`page/exclude-header-footer␣(setup-key)` `page/exclude-header-footer = true|false|pagination`

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 Socket support

`\tag_socket_use:n` `\tag_socket_use:n {⟨socket name⟩}`
`\tag_socket_use:nn` `\tag_socket_use:nn {⟨socket name⟩} {⟨socket argument⟩}`
`\UseTaggingSocket` `\UseTaggingSocket {⟨socket name⟩}`
`\UseTaggingSocket {⟨socket name⟩} {⟨socket argument⟩}`

The next LaTeX (2024-06-01) will use special sockets for the tagging.

These sockets will use names starting with `tagsupport/`. Usually, these sockets have exactly two plugs defined: `noop` (when no tagging is requested or tagging is not wanted for some reason) and a second plug that enables the tagging. There may be more, e.g., tagging with special debugging, etc., but right now it is usually just on or off.

Given that we sometimes have to suspend tagging, it would be fairly inefficient to put different plugs into these sockets whenever that happens. We therefore offer `\UseTaggingSocket` which is like `\UseSocket` except that the socket name is specified without `tagsupport/`, i.e.,

`\UseTaggingSocket{foo}` → `\UseSocket{tagsupport/foo}`

Beside being slightly shorter, the big advantage is that this way we can change `\UseTaggingSocket` to do nothing by switching a boolean instead of changing the plugs of the tagging support sockets back and forth.

It is possible to use the tagging support sockets with `\UseSocket` directly, but in this case the socket remains active if e.g. `\SuspendTagging` is in force. There may be reasons for doing that but in general we expect to always use `\UseTaggingSocket`.

The L3 programming layer versions `\tag_socket_use:n` and `\tag_socket_use:nn` are slightly more efficient than `\UseTaggingSocket` because they do not have to determine how many arguments the socket takes when disabling it.

7 User commands and extensions of document commands

```
⟨@@=tag⟩
⟨*header⟩
\ProvidesExplPackage {tagpdf-user} {2024-09-11} {0.99e}
  {tagpdf - user commands}
⟨/header⟩
```

8 Setup and preamble commands

\tagpdfsetup

```
⟨base⟩\NewDocumentCommand \tagpdfsetup { m }{}
⟨*package⟩
\RenewDocumentCommand \tagpdfsetup { m }
  {
    \keys_set:nn { __tag / setup } { #1 }
  }
⟨/package⟩
```

(*End of definition for* `\tagpdfsetup`. *This function is documented on page 36.*)

\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.

```
⟨base⟩\cs_new_protected:Npn\tag_tool:n #1 {}
⟨base⟩\cs_set_eq:NN\tagtool\tag_tool:n
⟨*package⟩
\cs_set_protected:Npn\tag_tool:n #1
  {
    \tag_if_active:T { \keys_set:nn {tag / tool}{#1} }
  }
\cs_set_eq:NN\tagtool\tag_tool:n
⟨/package⟩
```

(*End of definition for* `\tag_tool:n` *and* `\tagtool`. *These functions are documented on page 36.*)

9 Commands for the mc-chunks

\tagmcbegin
\tagmcend
\tagmcuse

```
⟨*base⟩
\NewDocumentCommand \tagmcbegin { m }
  {
    \tag_mc_begin:n {#1}
  }
```

```
\NewDocumentCommand \tagmcend {  }
  {
    \tag_mc_end:
  }

\NewDocumentCommand \tagmcuse { m }
  {
    \tag_mc_use:n {#1}
  }
⟨/base⟩
```

(*End of definition for* `\tagmcbegin`, `\tagmcend`, *and* `\tagmcuse`. *These functions are documented on page 36.*)

`\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 pdflatex as lualatex doesn't mind much if a mc tag is not correctly closed. Unlike the expl3 command it is not expandable.

```
⟨*package⟩
\NewDocumentCommand \tagmcifinTF { m m }
  {
    \tag_mc_if_in:TF { #1 } { #2 }
  }
⟨/package⟩
```

(*End of definition for* `\tagmcifinTF`. *This function is documented on page 36.*)

10 Commands for the structure

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

```
⟨*base⟩
\NewDocumentCommand \tagstructbegin { m }
  {
    \tag_struct_begin:n {#1}
  }

\NewDocumentCommand \tagstructend {  }
  {
   \tag_struct_end:
  }

\NewDocumentCommand \tagstructuse { m }
  {
    \tag_struct_use:n {#1}
  }
⟨/base⟩
```

(*End of definition for* `\tagstructbegin`, `\tagstructend`, *and* `\tagstructuse`. *These functions are documented on page 37.*)

11 Socket support

Until we can be sure that the kernel defines the commands we provide them before redefining them:

```
⟨*base⟩
\providecommand\tag_socket_use:n[1]{}
\providecommand\tag_socket_use:nn[2]{}
\providecommand\UseTaggingSocket[1]{}
⟨/base⟩
```

\tag_socket_use:n
\tag_socket_use:nn
\UseTaggingSocket

```
⟨*package⟩
\cs_set_protected:Npn \tag_socket_use:n #1
  {
    \bool_if:NT \l__tag_active_socket_bool
      { \UseSocket {tagsupport/#1} }
  }
\cs_set_protected:Npn \tag_socket_use:nn #1#2
  {
    \bool_if:NT \l__tag_active_socket_bool
       { \UseSocket {tagsupport/#1} {#2} }
  }
\cs_set_protected:Npn \UseTaggingSocket #1
  {
    \bool_if:NTF \l__tag_active_socket_bool
      { \UseSocket{tagsupport/#1} }
      {
        \int_case:nnF
            { \int_use:c { c__socket_tagsupport/#1_args_int } }
            {
              0 \prg_do_nothing:
              1 \use_none:n
              2 \use_none:nn
            }
            {
              \ERROR usetaggingsocket
      }
  }
⟨/package⟩
```

We do not expect tagging sockets with more than one or two arguments, so for now we only provide those.

(*End of definition for* `\tag_socket_use:n`, `\tag_socket_use:nn`, *and* `\UseTaggingSocket`. *These functions are documented on page 39.*)

12 Debugging

\ShowTagging

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

```
⟨*package⟩
\NewDocumentCommand\ShowTagging { m }
  {
```

```
    \keys_set:nn { __tag / show }{ #1}

  }
```

(*End of definition for* `\ShowTagging`. *This function is documented on page 37.*)

`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.

```
\keys_define:nn { __tag / show }
  {
    mc-data .code:n =
      {
        \sys_if_engine_luatex:T
          {
            \lua_now:e{ltx.__tag.trace.show_all_mc_data(#1,\__tag_get_mc_abs_cnt:,0)}
          }
      }
    ,mc-data .default:n = 1
  }

```

(*End of definition for* `mc-data (show-key)`. *This function is documented on page 37.*)

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

```
\keys_define:nn { __tag / show }
  { mc-current .code:n =
     {
       \bool_if:NTF \g__tag_mode_lua_bool
         {
           \sys_if_engine_luatex:T
             {
               \int_compare:nNnTF
                 { -2147483647 }
                  =
                 {
                   \lua_now:e
                     {
                        tex.print
                         (tex.getattribute
                           (luatexbase.attributes.g__tag_mc_cnt_attr))
                     }
                 }
                 {
                   \lua_now:e
                     {
                       ltx.__tag.trace.log
                        (
                          "mc-current:~no~MC~open,~current~abscnt
                           =\__tag_get_mc_abs_cnt:"
                          ,0
                        )
                       texio.write_nl("")
                     }
```

```
                }
                {
                  \lua_now:e
                    {
                      ltx.__tag.trace.log
                       (
                         "mc-current:~abscnt=\__tag_get_mc_abs_cnt:=="
                          ..
                          tex.getattribute(luatexbase.attributes.g__tag_mc_cnt_attr)
                          ..
                          "~=>tag="
                          ..
                          tostring
                            (ltx.__tag.func.get_tag_from
                              (tex.getattribute
                                (luatexbase.attributes.g__tag_mc_type_attr)))
                          ..
                          "="
                          ..
                          tex.getattribute
                           (luatexbase.attributes.g__tag_mc_type_attr)
                          ,0
                       )
                      texio.write_nl("")
                    }
                }
            }
        }
        {
         \msg_note:nn{ tag }{ mc-current }
        }
    }
}
```

(*End of definition for* `mc-current (show-key)`. *This function is documented on page 37.*)

`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).

```
\keys_define:nn { __tag / show }
  {
    mc-marks .choice: ,
    mc-marks / show .code:n =
      {
        \__tag_mc_get_marks:
        \__tag_check_if_mc_in_galley:TF
         {
          \iow_term:n {Marks~from~this~page:~}
         }
         {
           \iow_term:n {Marks~from~a~previous~page:~}
         }
        \seq_show:N \l__tag_mc_firstmarks_seq
        \seq_show:N \l__tag_mc_botmarks_seq
        \__tag_check_if_mc_tmb_missing:T
```

```
        {
          \iow_term:n {BDC~missing~on~this~page!}
        }
      \__tag_check_if_mc_tme_missing:T
        {
          \iow_term:n {EMC~missing~on~this~page!}
        }
    },
  mc-marks / use .code:n =
    {
      \__tag_mc_get_marks:
      \__tag_check_if_mc_in_galley:TF
       { Marks~from~this~page:~}
       { Marks~from~a~previous~page:~}
      \seq_use:Nn \l__tag_mc_firstmarks_seq {,~}\quad
      \seq_use:Nn \l__tag_mc_botmarks_seq {,~}\quad
      \__tag_check_if_mc_tmb_missing:T
       {
         BDC~missing~
       }
      \__tag_check_if_mc_tme_missing:T
       {
         EMC~missing
       }
    },
  mc-marks .default:n = show
}
```

(*End of definition for* `mc-marks (show-key)`. *This function is documented on page 37.*)

`struct-stack␣(show-key)`

```
\keys_define:nn { __tag / show }
  {
     struct-stack .choice:
    ,struct-stack / log .code:n = \seq_log:N \g__tag_struct_tag_stack_seq
    ,struct-stack / show .code:n = \seq_show:N \g__tag_struct_tag_stack_seq
    ,struct-stack .default:n = show
  }
⟨/package⟩
```

(*End of definition for* `struct-stack (show-key)`. *This function is documented on page 37.*)

`debug/structures␣(show-key)` The following key is available only if the tagpdf-debug package is loaded and shows all structures starting with the one with the number given by the key.

```
⟨*debug⟩
\keys_define:nn { __tag / show }
  {
    ,debug/structures .code:n =
      {
        \int_step_inline:nnn{#1}{\c@g__tag_struct_abs_int}
           {
            \msg_term:nneeee
                   { tag/debug } { show-struct }
                   { ##1 }
```

```
                    {
                      \prop_map_function:cN
                        {g__tag_struct_debug_##1_prop}
                        \msg_show_item_unbraced:nn
                    }
                    { } { }
            \msg_term:nneeee
                    { tag/debug } { show-kids }
                    {  ##1 }
                    {
                      \seq_map_function:cN
                        {g__tag_struct_debug_kids_##1_seq}
                        \msg_show_item_unbraced:n
                    }
                    { } { }
          }
      }
    ,debug/structures .default:n = 1
  }
⟨/debug⟩
```

(*End of definition for* `debug/structures (show-key)`*. This function is documented on page 37.*)

13 Commands to extend document commands

The following commands and code parts are not core commands 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.

```
⟨*package⟩
```

13.1 Document structure

`\g__tag_root_default_tl`
`activate␣(setup-key)`
`activate/socket␣(setup-key)`

```
\tl_new:N\g__tag_root_default_tl
\tl_gset:Nn\g__tag_root_default_tl {Document}

\hook_gput_code:nnn{begindocument}{tagpdf}{\tagstructbegin{tag=\g__tag_root_default_tl}}
\hook_gput_code:nnn{tagpdf/finish/before}{tagpdf}{\tagstructend}

\keys_define:nn { __tag / setup}
 {
   activate/socket .bool_set:N  = \l__tag_active_socket_bool,
   activate  .code:n =
    {
      \keys_set:nn { __tag / setup }
        { activate/mc,activate/tree,activate/struct,activate/socket }
      \tl_gset:Nn\g__tag_root_default_tl {#1}
    },
   activate .default:n = Document
 }

```

(*End of definition for* `\g__tag_root_default_tl`, `activate (setup-key)`, *and* `activate/socket (setup-key)`. *These functions are documented on page 36.*)

13.2 Structure destinations

Since TeXlive 2022 pdftex and luatex offer support for structure destinations and the pdfmanagement has backend support for. We activate them if structures are actually created. Structure destinations are actually PDF 2.0 only but they don't harm in older PDF and can improve html export.

```
\AddToHook{begindocument/before}
  {
    \bool_lazy_and:nnT
      { \g__tag_active_struct_dest_bool }
      { \g__tag_active_struct_bool }
      {
        \tl_set:Nn \l_pdf_current_structure_destination_tl
           { {__tag/struct}{\g__tag_struct_stack_current_tl }}
        \pdf_activate_indexed_structure_destination:
      }
   }
```

13.3 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

```
\sys_if_engine_luatex:T
  {
    \NewDocumentCommand\pdffakespace { }
     {
       \__tag_fakespace:
     }
  }
\providecommand\pdffakespace{}
```

(*End of definition for* `\pdffakespace`. *This function is documented on page 38.*)

13.4 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`
`\g__tag_para_main_struct_tl`
`\l__tag_para_tag_default_tl`
`\l__tag_para_tag_tl`
`\l__tag_para_main_tag_tl`
`\l__tag_para_attr_class_tl`
`\l__tag_para_main_attr_class_tl`

At first some variables.

```
⟨/package⟩
⟨base⟩\bool_new:N \l__tag_para_flattened_bool
⟨base⟩\bool_new:N \l__tag_para_bool
⟨*package⟩
\int_new:N  \g__tag_para_begin_int
\int_new:N  \g__tag_para_end_int
\int_new:N  \g__tag_para_main_begin_int
\int_new:N  \g__tag_para_main_end_int
```

this will hold the structure number of the current text-unit.

```
\tl_new:N   \g__tag_para_main_struct_tl
\tl_gset:Nn  \g__tag_para_main_struct_tl {1}
\tl_new:N   \l__tag_para_tag_default_tl
\tl_set:Nn  \l__tag_para_tag_default_tl { text }
\tl_new:N   \l__tag_para_tag_tl
\tl_set:Nn  \l__tag_para_tag_tl { \l__tag_para_tag_default_tl }
\tl_new:N   \l__tag_para_main_tag_tl
\tl_set:Nn  \l__tag_para_main_tag_tl {text-unit}
```

this is perhaps already defined by the block code

```
\tl_if_exist:NF \l__tag_para_attr_class_tl
 {\tl_new:N \l__tag_para_attr_class_tl }
\tl_new:N \l__tag_para_main_attr_class_tl
```

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

`\__tag_gincr_para_main_begin_int:`
`\__tag_gincr_para_main_end_int:`
`\__tag_gincr_para_begin_int:`
`\__tag_gincr_para_end_int:`

The global para counter should be set through commands so that `\tag_stop:` can stop them.

```
\cs_new_protected:Npn \__tag_gincr_para_main_begin_int:
 {
   \int_gincr:N \g__tag_para_main_begin_int
 }
\cs_new_protected:Npn \__tag_gincr_para_begin_int:
 {
   \int_gincr:N \g__tag_para_begin_int
 }
\cs_new_protected:Npn \__tag_gincr_para_main_end_int:
 {
   \int_gincr:N \g__tag_para_main_end_int
 }
\cs_new_protected:Npn \__tag_gincr_para_end_int:
 {
   \int_gincr:N \g__tag_para_end_int
 }
```

(*End of definition for* `\__tag_gincr_para_main_begin_int:` *and others.*)

`\__tag_start_para_ints:`
`\__tag_stop_para_ints:`

```
\cs_new_protected:Npn \__tag_start_para_ints:
 {
   \cs_set_protected:Npn \__tag_gincr_para_main_begin_int:
     {
       \int_gincr:N \g__tag_para_main_begin_int
     }
   \cs_set_protected:Npn \__tag_gincr_para_begin_int:
    {
      \int_gincr:N \g__tag_para_begin_int
    }
   \cs_set_protected:Npn \__tag_gincr_para_main_end_int:
    {
      \int_gincr:N \g__tag_para_main_end_int
    }
   \cs_set_protected:Npn \__tag_gincr_para_end_int:
```

```
    {
      \int_gincr:N \g__tag_para_end_int
    }
  }
\cs_new_protected:Npn \__tag_stop_para_ints:
  {
    \cs_set_eq:NN \__tag_gincr_para_main_begin_int:\prg_do_nothing:
    \cs_set_eq:NN \__tag_gincr_para_begin_int: \prg_do_nothing:
    \cs_set_eq:NN \__tag_gincr_para_main_end_int: \prg_do_nothing:
    \cs_set_eq:NN \__tag_gincr_para_end_int: \prg_do_nothing:
  }
```

(*End of definition for* `\__tag_start_para_ints:` *and* `\__tag_stop_para_ints:`.)

We want to be able to inspect the current para main structure, so we need a command to store its structure number

`\__tag_para_main_store_struct:`

```
\cs_new:Npn \__tag_para_main_store_struct:
  {
    \tl_gset:Ne \g__tag_para_main_struct_tl {\int_use:N \c@g__tag_struct_abs_int }
  }
```

(*End of definition for* `\__tag_para_main_store_struct:`.)

TEMPORARY FIX (2023-11-17). Until latex-lab is updated we must adapt a sec command:

```
\AddToHook{package/latex-lab-testphase-sec/after}
 {
   \cs_set_protected:Npn \@kernel@tag@hangfrom #1
    {
     \tagstructbegin{tag=\l__tag_para_tag_tl}
     \__tag_gincr_para_begin_int:
     \tagstructbegin{tag=Lbl}
     \setbox\@tempboxa
       \hbox
         {
           \bool_lazy_and:nnT
            {\tag_if_active_p:}
            {\g__tag_mode_lua_bool}
            {\tagmcbegin{tag=Lbl}}
           {#1}
         }
   \tag_stop:n{hangfrom}
   \hangindent \wd\@tempboxa\noindent
   \tag_start:n{hangfrom}
   \tagmcbegin{}\box\@tempboxa\tagmcend\tagstructend\tagmcbegin{}
   }
 }
```

and one temporary adaptions for the block module:

```
\AddToHook{package/latex-lab-testphase-block/after}
 {
   \tl_if_exist:NT \l_tag_para_attr_class_tl
    {
      \tl_set:Nn \l__tag_para_attr_class_tl { \l_tag_para_attr_class_tl }
    }
```

```
}
```

para/tagging␣(setup-key)
para/tag␣(setup-key)
para/maintag␣(setup-key)
para/tagging␣(tool-key)
para/tag␣(tool-key)
para/maintag␣(tool-key)
para/flattened␣(tool-key)
unittag␣(deprecated)
para-flattened␣(deprecated)
paratagging␣(deprecated)
paratagging-show␣(deprecated)
paratag␣(deprecated)

These keys enable/disable locally paratagging. Paragraphs are typically tagged with two structure: A main structure around the whole paragraph, and inner structures around the various chunks. Debugging can be activated locally with `debug/show=para`, this can affect the typesetting as the small numbers are boxes and they have a (small) height. Debugging can be deactivated with `debug/show=paraOff` The `para/tag` key sets the tag used by the inner structure, `para/maintag` the tag of the outer structure, both can also be changed with `\tag_tool:n`

```
\keys_define:nn { __tag / setup }
  {
    para/tagging      .bool_set:N = \l__tag_para_bool,
    debug/show/para   .code:n = {\bool_set_true:N \l__tag_para_show_bool},
    debug/show/paraOff  .code:n = {\bool_set_false:N \l__tag_para_show_bool},
    para/tag          .tl_set:N   = \l__tag_para_tag_tl,
    para/maintag      .tl_set:N   = \l__tag_para_main_tag_tl,
    para/flattened    .bool_set:N = \l__tag_para_flattened_bool
  }
\keys_define:nn { tag / tool}
  {
    para/tagging   .bool_set:N = \l__tag_para_bool,
    para/tag       .tl_set:N = \l__tag_para_tag_tl,
    para/maintag   .tl_set:N = \l__tag_para_main_tag_tl,
    para/flattened .bool_set:N = \l__tag_para_flattened_bool
  }
```

the deprecated names

```
\keys_define:nn { __tag / setup }
  {
    paratagging      .bool_set:N = \l__tag_para_bool,
    paratagging-show .bool_set:N = \l__tag_para_show_bool,
    paratag          .tl_set:N   = \l__tag_para_tag_tl
  }
\keys_define:nn { tag / tool}
  {
    para    .bool_set:N = \l__tag_para_bool,
    paratag .tl_set:N = \l__tag_para_tag_tl,
    unittag .tl_set:N = \l__tag_para_main_tag_tl,
    para-flattened .bool_set:N = \l__tag_para_flattened_bool
  }
```

(*End of definition for* `para/tagging (setup-key)` *and others. These functions are documented on page* *38*.)

Helper command for debugging:

```
\cs_new_protected:Npn \__tag_check_para_begin_show:nn #1 #2
 %#1 color, #2 prefix
  {
    \bool_if:NT \l__tag_para_show_bool
      {
        \tag_mc_begin:n{artifact}
        \llap{\color_select:n{#1}\tiny#2\int_use:N\g__tag_para_begin_int\ }
        \tag_mc_end:
      }
```

```
 }

\cs_new_protected:Npn \__tag_check_para_end_show:nn #1 #2
 %#1  color, #2 prefix
 {
   \bool_if:NT \l__tag_para_show_bool
     {
       \tag_mc_begin:n{artifact}
       \rlap{\color_select:n{#1}\tiny\ #2\int_use:N\g__tag_para_end_int}
       \tag_mc_end:
     }
 }
```

The para/begin and para/end code. We have two variants here: a simpler one, which must be used if the block code is not used (and so probably will disappear at some time) and a more sophisticated one that must be used if the block code is used. It is possible that we will need more variants, so we setup a socket so that the code can be easily switched.

```
\socket_new:nn      {tagsupport/para/begin}{0}
\socket_new:nn      {tagsupport/para/end}{0}

\socket_new_plug:nnn{tagsupport/para/begin}{plain}
 {
   \bool_if:NT \l__tag_para_bool
     {
       \bool_if:NF \l__tag_para_flattened_bool
          {
            \__tag_gincr_para_main_begin_int:
            \tag_struct_begin:n
              {
                tag=\l__tag_para_main_tag_tl,
              }
            \__tag_para_main_store_struct:
          }
       \__tag_gincr_para_begin_int:
       \tag_struct_begin:n {tag=\l__tag_para_tag_tl}
       \__tag_check_para_begin_show:nn {green}{}
       \tag_mc_begin:n {}
     }
 }
\socket_new_plug:nnn{tagsupport/para/begin}{block}
 {
   \bool_if:NT \l__tag_para_bool
     {
       \legacy_if:nF { @inlabel }
         {
           \__tag_check_typeout_v:n
             {==>~ @endpe = \legacy_if:nTF { @endpe }{true}{false} \on@line }
           \legacy_if:nF { @endpe }
            {
              \bool_if:NF \l__tag_para_flattened_bool
                 {
                   \__tag_gincr_para_main_begin_int:
                   \tag_struct_begin:n
```

```
                    {
                     tag=\l__tag_para_main_tag_tl,
                     attribute-class=\l__tag_para_main_attr_class_tl,
                    }
                   \__tag_para_main_store_struct:
                 }
             }
            \__tag_gincr_para_begin_int:
            \__tag_check_typeout_v:n {==>~increment~ P \on@line }
            \tag_struct_begin:n
              {
                tag=\l__tag_para_tag_tl
                ,attribute-class=\l__tag_para_attr_class_tl
              }
            \__tag_check_para_begin_show:nn {green}{\PARALABEL}
            \tag_mc_begin:n {}
      }
    }
}
```

there was no real difference between the original and in the block variant, only a debug message. We therefore define only a plain variant.

```
\socket_new_plug:nnn{tagsupport/para/end}{plain}
  {
    \bool_if:NT \l__tag_para_bool
      {
        \__tag_gincr_para_end_int:
        \__tag_check_typeout_v:n {==>~increment~ /P \on@line }
        \tag_mc_end:
        \__tag_check_para_end_show:nn {red}{}
        \tag_struct_end:
        \bool_if:NF \l__tag_para_flattened_bool
         {
           \__tag_gincr_para_main_end_int:
           \tag_struct_end:
         }
      }
  }
```

By default we assign the plain plug:

```
\socket_assign_plug:nn { tagsupport/para/begin}{plain}
\socket_assign_plug:nn { tagsupport/para/end}{plain}
```

And use the sockets in the hooks. Once tagging sockets exist, this can be adapted.

```
\AddToHook{para/begin}{ \socket_use:n { tagsupport/para/begin }
  }
\AddToHook{para/end} { \socket_use:n { tagsupport/para/end } }
```

If the block code is loaded we must ensure that it doesn't overwrite the hook again. And we must reassign the para/begin plug. This can go once the block code no longer tries to adapt the hooks.

```
\AddToHook{package/latex-lab-testphase-block/after}
 {
   \RemoveFromHook{para/begin}[tagpdf]
   \RemoveFromHook{para/end}[latex-lab-testphase-block]
```

```
  \AddToHook{para/begin}[tagpdf]
   {
     \socket_use:n { tagsupport/para/begin }
   }
  \AddToHook{para/end}[tagpdf]
   {
     \socket_use:n { tagsupport/para/end }
   }
  \socket_assign_plug:nn { tagsupport/para/begin}{block}
}

```

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.

```
\AddToHook{enddocument/info}
 {
   \tag_if_active:F
     {
       \msg_redirect_name:nnn { tag } { para-hook-count-wrong } { warning }
     }
   \int_compare:nNnF {\g__tag_para_main_begin_int}={\g__tag_para_main_end_int}
        {
          \msg_error:nneee
            {tag}
            {para-hook-count-wrong}
            {\int_use:N\g__tag_para_main_begin_int}
            {\int_use:N\g__tag_para_main_end_int}
            {text-unit}
        }
   \int_compare:nNnF {\g__tag_para_begin_int}={\g__tag_para_end_int}
        {
          \msg_error:nneee
            {tag}
            {para-hook-count-wrong}
            {\int_use:N\g__tag_para_begin_int}
            {\int_use:N\g__tag_para_end_int}
            {text}
        }
 }
```

We need at least the new-or-1 code. In generic mode we also must insert the code to finish the MC-chunks

```
\@ifpackageloaded{footmisc}
  {\PackageWarning{tagpdf}{tagpdf~has~been~loaded~too~late!}} %
  {\RequirePackage{latex-lab-testphase-new-or-1}}

\AddToHook{begindocument/before}
 {
   \providecommand\@kernel@tagsupport@@makecol{}
   \providecommand\@kernel@before@cclv{}
   \bool_if:NF \g__tag_mode_lua_bool
     {
        \cs_if_exist:NT \@kernel@before@footins
         {
```

```
            \tl_put_right:Nn \@kernel@before@footins
              { \__tag_add_missing_mcs_to_stream:Nn \footins {footnote} }
            \tl_put_right:Nn \@kernel@before@cclv
              {
                \__tag_check_typeout_v:n {====>~In~\token_to_str:N \@makecol\c_space_tl\the\c@
                \__tag_add_missing_mcs_to_stream:Nn \@cclv {main}
              }
            \tl_put_right:Nn \@kernel@tagsupport@@makecol
              {
                \__tag_check_typeout_v:n {====>~In~\token_to_str:N \@makecol\c_space_tl\the\c@
                \__tag_add_missing_mcs_to_stream:Nn \@outputbox {main}
              }
            \tl_put_right:Nn \@mult@ptagging@hook
              {
                \__tag_check_typeout_v:n {====>~In~\string\page@sofar}
                \process@cols\mult@firstbox
                 {
                   \__tag_add_missing_mcs_to_stream:Nn \count@ {multicol}
                 }
                \__tag_add_missing_mcs_to_stream:Nn \mult@rightbox {multicol}
              }
          }
      }
  }
⟨/package⟩
```

\tagpdfparaOn
\tagpdfparaOff

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}

```
⟨base⟩\newcommand\tagpdfparaOn {}
⟨base⟩\newcommand\tagpdfparaOff{}
⟨*package⟩
\renewcommand\tagpdfparaOn {\bool_set_true:N \l__tag_para_bool}
\renewcommand\tagpdfparaOff{\bool_set_false:N \l__tag_para_bool}
```

(*End of definition for* \tagpdfparaOn *and* \tagpdfparaOff*. These functions are documented on page* 38.)

\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}%
```

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

(*End of definition for* \tagpdfsuppressmarks*. This function is documented on page* 38.)

13.5 Language support

With the following key the lang variable is set. All structures in the current group will then set this lang variable.

test/lang␣(setup-key)

```
\keys_define:nn { __tag / setup }
  {
    text / lang .tl_set:N = \l__tag_struct_lang_tl
  }
```

(*End of definition for* `test/lang (setup-key)`. *This function is documented on page* ??.)

13.6 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 there at the end. TODO check if Pagination should be changeable.

```
\cs_new_protected:Npn\__tag_hook_kernel_before_head:{}
\cs_new_protected:Npn\__tag_hook_kernel_after_head:{}
\cs_new_protected:Npn\__tag_hook_kernel_before_foot:{}
\cs_new_protected:Npn\__tag_hook_kernel_after_foot:{}

\AddToHook{begindocument}
 {
  \cs_if_exist:NT \@kernel@before@head
   {
     \tl_put_right:Nn \@kernel@before@head {\__tag_hook_kernel_before_head:}
     \tl_put_left:Nn  \@kernel@after@head  {\__tag_hook_kernel_after_head:}
     \tl_put_right:Nn \@kernel@before@foot {\__tag_hook_kernel_before_foot:}
     \tl_put_left:Nn  \@kernel@after@foot  {\__tag_hook_kernel_after_foot:}
   }
 }

\bool_new:N \g__tag_saved_in_mc_bool
\cs_new_protected:Npn \__tag_exclude_headfoot_begin:
 {
    \bool_set_false:N  \l__tag_para_bool
    \bool_if:NTF \g__tag_mode_lua_bool
     {
      \tag_mc_end_push:
     }
     {
       \bool_gset_eq:NN   \g__tag_saved_in_mc_bool \g__tag_in_mc_bool
       \bool_gset_false:N \g__tag_in_mc_bool
     }
    \tag_mc_begin:n {artifact}
    \tag_stop:n{headfoot}
 }
\cs_new_protected:Npn \__tag_exclude_headfoot_end:
 {
    \tag_start:n{headfoot}
    \tag_mc_end:
    \bool_if:NTF \g__tag_mode_lua_bool
```

```
      {
       \tag_mc_begin_pop:n{}
      }
      {
        \bool_gset_eq:NN \g__tag_in_mc_bool\g__tag_saved_in_mc_bool
      }
 }
```

This version allows to use an Artifact structure

```
\__tag_attr_new_entry:nn {__tag/attr/pagination}{/O/Artifact/Type/Pagination}
\cs_new_protected:Npn \__tag_exclude_struct_headfoot_begin:n #1
 {
    \bool_set_false:N  \l__tag_para_bool
    \bool_if:NTF \g__tag_mode_lua_bool
     {
      \tag_mc_end_push:
     }
     {
       \bool_gset_eq:NN   \g__tag_saved_in_mc_bool \g__tag_in_mc_bool
       \bool_gset_false:N \g__tag_in_mc_bool
     }
    \tag_struct_begin:n{tag=Artifact,attribute-class=__tag/attr/#1}
    \tag_mc_begin:n {artifact=#1}
    \tag_stop:n{headfoot}
 }

\cs_new_protected:Npn \__tag_exclude_struct_headfoot_end:
 {
    \tag_start:n{headfoot}
    \tag_mc_end:
    \tag_struct_end:
    \bool_if:NTF \g__tag_mode_lua_bool
     {
      \tag_mc_begin_pop:n{}
     }
     {
       \bool_gset_eq:NN \g__tag_in_mc_bool\g__tag_saved_in_mc_bool
     }
 }
```

And now the keys

page/exclude-header-footer␣(setup-key)
exclude-header-footer␣(deprecated)

```
\keys_define:nn { __tag / setup }
  {
    page/exclude-header-footer .choice:,
    page/exclude-header-footer / true .code:n =
     {
       \cs_set_eq:NN \__tag_hook_kernel_before_head: \__tag_exclude_headfoot_begin:
       \cs_set_eq:NN \__tag_hook_kernel_before_foot: \__tag_exclude_headfoot_begin:
       \cs_set_eq:NN \__tag_hook_kernel_after_head:  \__tag_exclude_headfoot_end:
       \cs_set_eq:NN \__tag_hook_kernel_after_foot:  \__tag_exclude_headfoot_end:
     },
    page/exclude-header-footer / pagination .code:n =
     {
```

```
      \cs_set:Nn \__tag_hook_kernel_before_head: { \__tag_exclude_struct_headfoot_begin:n {p
      \cs_set:Nn \__tag_hook_kernel_before_foot: { \__tag_exclude_struct_headfoot_begin:n {p
      \cs_set_eq:NN \__tag_hook_kernel_after_head:  \__tag_exclude_struct_headfoot_end:
      \cs_set_eq:NN \__tag_hook_kernel_after_foot:  \__tag_exclude_struct_headfoot_end:
    },
   page/exclude-header-footer / false .code:n =
    {
      \cs_set_eq:NN \__tag_hook_kernel_before_head: \prg_do_nothing:
      \cs_set_eq:NN \__tag_hook_kernel_before_foot: \prg_do_nothing:
      \cs_set_eq:NN \__tag_hook_kernel_after_head:  \prg_do_nothing:
      \cs_set_eq:NN \__tag_hook_kernel_after_foot:  \prg_do_nothing:
    },
  page/exclude-header-footer .default:n = true,
  page/exclude-header-footer .initial:n = true,
```

deprecated name

```
   exclude-header-footer .meta:n = { page/exclude-header-footer = {#1} }
  }
```

(*End of definition for* `page/exclude-header-footer (setup-key)` *and* `exclude-header-footer (deprecated)`. *These functions are documented on page* 39.)

13.7 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.

```
\hook_gput_code:nnn
  {pdfannot/link/URI/before}
  {tagpdf}
  {
    \tag_mc_end_push:
    \tag_struct_begin:n { tag=Link }
    \tag_mc_begin:n { tag=Link }
    \pdfannot_dict_put:nne
      { link/URI }
      { StructParent }
      { \tag_struct_parent_int: }
  }

\hook_gput_code:nnn
  {pdfannot/link/URI/after}
  {tagpdf}
  {
     \tag_struct_insert_annot:ee {\pdfannot_link_ref_last:}{\tag_struct_parent_int:}
     \tag_mc_end:
     \tag_struct_end:
     \tag_mc_begin_pop:n{}
  }

\hook_gput_code:nnn
  {pdfannot/link/GoTo/before}
  {tagpdf}
  {
```

```
729       \tag_mc_end_push:
730       \tag_struct_begin:n{tag=Link}
731       \tag_mc_begin:n{tag=Link}
732       \pdfannot_dict_put:nne
733         { link/GoTo }
734         { StructParent }
735         { \tag_struct_parent_int: }
736   }
737
738 \hook_gput_code:nnn
739   {pdfannot/link/GoTo/after}
740   {tagpdf}
741   {
742     \tag_struct_insert_annot:ee {\pdfannot_link_ref_last:}{\tag_struct_parent_int:}
743     \tag_mc_end:
744     \tag_struct_end:
745     \tag_mc_begin_pop:n{}
746
747   }
748
749 % "alternative descriptions " for PAX3. How to get better text here??
750 \pdfannot_dict_put:nnn
751  { link/URI }
752  { Contents }
753  { (url) }
754
755 \pdfannot_dict_put:nnn
756  { link/GoTo }
757  { Contents }
758  { (ref) }
759
```

</package>

Part III
The tagpdf-tree module Commands trees and main dictionaries Part of the tagpdf package

```
⟨@@=tag⟩
⟨*header⟩
\ProvidesExplPackage {tagpdf-tree-code} {2024-09-11} {0.99e}
 {part of tagpdf - code related to writing trees and dictionaries to the pdf}
⟨/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.

```
⟨*package⟩
\hook_gput_code:nnn{begindocument}{tagpdf}
  {
    \bool_if:NT \g__tag_active_tree_bool
      {
        \sys_if_output_pdf:TF
          {
            \AddToHook{enddocument/end} { \__tag_finish_structure: }
          }
          {
            \AddToHook{shipout/lastpage} { \__tag_finish_structure: }
          }
      }
  }
```

1.1 Check structure

__tag_tree_final_checks:

```
\cs_new_protected:Npn \__tag_tree_final_checks:
 {
   \int_compare:nNnF {\seq_count:N\g__tag_struct_stack_seq}={1}
    {
      \msg_warning:nn {tag}{tree-struct-still-open}
      \int_step_inline:nnn{2}{\seq_count:N\g__tag_struct_stack_seq}
       {\tag_struct_end:}
    }
   \msg_note:nn {tag}{tree-statistic}
 }
```

(*End of definition for* __tag_tree_final_checks:.)

1.2 Catalog: MarkInfo and StructTreeRoot and OpenAction

The StructTreeRoot and the MarkInfo entry must be added to the catalog. If there is an OpenAction entry we must update it, so that it contains also a structure destination. We do it late so that we can win, but before the pdfmanagement hook.

__tag/struct/1 This is the object for the root object, the StructTreeRoot

```
\pdf_object_new_indexed:nn { __tag/struct }{ 1 }
```

(*End of definition for* __tag/struct/1.)

\g__tag_tree_openaction_struct_tl We need a variable that indicates which structure is wanted in the OpenAction. By default we use 2 (the Document structure).

```
\tl_new:N   \g__tag_tree_openaction_struct_tl
\tl_gset:Nn \g__tag_tree_openaction_struct_tl { 2 }
```

(*End of definition for* \g__tag_tree_openaction_struct_tl.)

viewer/startstructure␣(setup-key) We also need an option to setup the start structure. So we setup a key which sets the variable to the current structure. This still requires hyperref to do most of the job, this should perhaps be changed.

```
\keys_define:nn { __tag / setup }
 {
   viewer/startstructure .code:n =
    {
       \tl_gset:Ne \g__tag_tree_openaction_struct_tl {#1}
    }
  ,viewer/startstructure .default:n =  { \int_use:N \c@g__tag_struct_abs_int }
 }
```

(*End of definition for* viewer/startstructure (setup-key)*. This function is documented on page* **??**.)

The OpenAction should only be updated if it is there. So we inspect the Catalog-prop:

```
\cs_new_protected:Npn \__tag_tree_update_openaction:
  {
    \prop_get:cnNT
     { \__kernel_pdfdict_name:n { g__pdf_Core/Catalog } }
     {OpenAction}
     \l__tag_tmpa_tl
     {
```

we only do something if the OpenAction is an array (as set by hyperref) in other cases we hope that the author knows what they did.

```
       \tl_if_head_eq_charcode:eNT { \tl_trim_spaces:V\l__tag_tmpa_tl } [ %]
         {
           \seq_set_split:NnV\l__tag_tmpa_seq{/}\l__tag_tmpa_tl
           \pdfmanagement_add:nne {Catalog} { OpenAction }
             {
               <<
                 /S/GoTo \c_space_tl
                 /D~\l__tag_tmpa_tl\c_space_tl
                 /SD~[\pdf_object_ref_indexed:nn{__tag/struct}{\g__tag_tree_openaction_struct
```

there should be always a /Fit etc in the array but better play safe here ...

```
                        \int_compare:nNnTF{ \seq_count:N \l__tag_tmpa_seq } > {1}
                         { /\seq_item:Nn\l__tag_tmpa_seq{2} }
                         { ] }
                >>
              }
           }
      }
  }
\hook_gput_code:nnn{shipout/lastpage}{tagpdf}
  {
    \bool_if:NT \g__tag_active_tree_bool
      {
        \pdfmanagement_add:nnn { Catalog / MarkInfo } { Marked } { true }
        \pdfmanagement_add:nne
          { Catalog }
          { StructTreeRoot }
          { \pdf_object_ref_indexed:nn { __tag/struct } { 1 } }
        \__tag_tree_update_openaction:
      }
  }
```

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

```
\int_new:N\g__tag_tree_id_pad_int
```

(*End of definition for* \g__tag_tree_id_pad_int.)

Now we get the needed padding

```
\cs_generate_variant:Nn \tl_count:n {e}
\hook_gput_code:nnn{begindocument}{tagpdf}
 {
   \int_gset:Nn\g__tag_tree_id_pad_int
    {\tl_count:e { \__tag_property_ref_lastpage:nn{tagstruct}{1000}}+1}
 }

```

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.

```
\cs_new_protected:Npn \__tag_tree_write_idtree:
  {
    \tl_clear:N \l__tag_tmpa_tl
    \tl_clear:N \l__tag_tmpb_tl
    \int_zero:N \l__tag_tmpa_int
    \int_step_inline:nnn {2} {\c@g__tag_struct_abs_int}
      {
        \int_incr:N\l__tag_tmpa_int
        \tl_put_right:Ne \l__tag_tmpa_tl
```

```
          {
            \__tag_struct_get_id:n{##1}~\pdf_object_ref_indexed:nn {__tag/struct}{##1}~
          }
        \int_compare:nNnF {\l__tag_tmpa_int}<{50} %
          {
            \pdf_object_unnamed_write:ne {dict}
              { /Limits~[\__tag_struct_get_id:n{##1-\l__tag_tmpa_int+1}~\__tag_struct_get_id:
                /Names~[\l__tag_tmpa_tl]
              }
            \tl_put_right:Ne\l__tag_tmpb_tl {\pdf_object_ref_last:\c_space_tl}
            \int_zero:N \l__tag_tmpa_int
            \tl_clear:N \l__tag_tmpa_tl
          }
      }
     \tl_if_empty:NF \l__tag_tmpa_tl
      {
        \pdf_object_unnamed_write:ne {dict}
          {
           /Limits~
             [\__tag_struct_get_id:n{\c@g__tag_struct_abs_int-\l__tag_tmpa_int+1}~
              \__tag_struct_get_id:n{\c@g__tag_struct_abs_int}]
           /Names~[\l__tag_tmpa_tl]
          }
        \tl_put_right:Ne\l__tag_tmpb_tl {\pdf_object_ref_last:}
      }
      \pdf_object_unnamed_write:ne {dict}{/Kids~[\l__tag_tmpb_tl]}
      \__tag_prop_gput:cne
          { g__tag_struct_1_prop }
          { IDTree }
          { \pdf_object_ref_last: }
  }
```

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.

```
\cs_new_protected:Npn \__tag_tree_write_structtreeroot:
  {
     \__tag_prop_gput:cne
       { g__tag_struct_1_prop }
       { ParentTree }
       { \pdf_object_ref:n { __tag/tree/parenttree } }
     \__tag_prop_gput:cne
       { g__tag_struct_1_prop }
       { RoleMap }
       { \pdf_object_ref:n { __tag/tree/rolemap } }
     \__tag_struct_fill_kid_key:n { 1 }
     \prop_gremove:cn { g__tag_struct_1_prop } {S}
     \__tag_struct_get_dict_content:nN { 1 } \l__tag_tmpa_tl
     \pdf_object_write_indexed:nnne
         { __tag/struct } { 1 }
         {dict}
         {
```

```
142           \l__tag_tmpa_tl
143         }
```

Better put S back, see https://github.com/latex3/tagging-project/issues/86

```
144       \prop_gput:cnn { g__tag_struct_1_prop } {S}{ /StructTreeRoot }
145   }
```

(*End of definition for* `\__tag_tree_write_structtreeroot:`.)

`\__tag_tree_write_structelements:` This writes out the other struct elems, the absolute number is in the counter.

```
146 \cs_new_protected:Npn \__tag_tree_write_structelements:
147   {
148     \int_step_inline:nnnn {2}{1}{\c@g__tag_struct_abs_int}
149       {
150         \__tag_struct_write_obj:n { ##1 }
151       }
152   }
```

(*End of definition for* `\__tag_tree_write_structelements:`.)

1.5 ParentTree

`__tag/tree/parenttree` The object which will hold the parenttree

```
153 \pdf_object_new:n { __tag/tree/parenttree }
```

(*End of 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 dictinct 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.

```
154 \newcounter  { g__tag_parenttree_obj_int }
155 \hook_gput_code:nnn{begindocument}{tagpdf}
156   {
157     \int_gset:Nn
158       \c@g__tag_parenttree_obj_int
159       { \__tag_property_ref_lastpage:nn{abspage}{100}  }
160   }
```

(*End of 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`

```
161 \tl_new:N \g__tag_parenttree_objr_tl
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_parenttree_add_objr:nn #1 #2 %#1 StructParent number, #2 objref
  {
    \tl_gput_right:Ne \g__tag_parenttree_objr_tl
      {
        #1 \c_space_tl #2 ^^J
      }
  }
```

(*End of definition for* `\__tag_parenttree_add_objr:nn`.)

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

```
\tl_new:N \l__tag_parenttree_content_tl
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_tree_parenttree_rerun_msg: {}
\cs_new_protected:Npn \__tag_tree_fill_parenttree:
  {
    \int_step_inline:nnnn{1}{1}{\__tag_property_ref_lastpage:nn{abspage}{-1}} %not quite clea
      { %page ##1
        \prop_clear:N \l__tag_tmpa_prop
        \int_step_inline:nnnn{1}{1}{\__tag_property_ref_lastpage:nn{tagmcabs}{-
1}}
          {
            %mcid####1
            \int_compare:nT
              {\property_ref:enn{mcid-####1}{tagabspage}{-1}=##1} %mcid is on current page
              {% yes
                \prop_put:Nee
                  \l__tag_tmpa_prop
                  {\property_ref:enn{mcid-####1}{tagmcid}{-1}}
                  {\prop_item:Nn \g__tag_mc_parenttree_prop {####1}}
              }
          }
        \tl_put_right:Ne\l__tag_parenttree_content_tl
          {
            \int_eval:n {##1-1}\c_space_tl
            [\c_space_tl %]
          }
        \int_step_inline:nnnn %####1
          {0}
          {1}
          { \prop_count:N \l__tag_tmpa_prop -1 }
          {
            \prop_get:NnNTF \l__tag_tmpa_prop {####1} \l__tag_tmpa_tl
              {% page#1:mcid##1:\l__tag_tmpa_tl :content
                \tl_put_right:Ne \l__tag_parenttree_content_tl
                  {
                    \prop_if_exist:cTF  { g__tag_struct_ \l__tag_tmpa_tl _prop  }
                      {
```

```
                        \pdf_object_ref_indexed:nn { __tag/struct }{ \l__tag_tmpa_tl }
                      }
                      {
                        null
                      }
                    \c_space_tl
                  }
              }
              {
                \cs_set_protected:Npn \__tag_tree_parenttree_rerun_msg:
                  {
                    \msg_warning:nn { tag } {tree-mcid-index-wrong}
                  }
              }
          }
        \tl_put_right:Nn
          \l__tag_parenttree_content_tl
          {%[
            ]^^J
          }
      }
  }
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_tree_lua_fill_parenttree:
  {
    \tl_set:Nn \l__tag_parenttree_content_tl
      {
        \lua_now:e
          {
            ltx.__tag.func.output_parenttree
              (
                \int_use:N\g_shipout_readonly_int
              )
          }
      }
  }
```

(*End of 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?

```
\cs_new_protected:Npn \__tag_tree_write_parenttree:
  {
    \bool_if:NTF \g__tag_mode_lua_bool
      {
        \__tag_tree_lua_fill_parenttree:
      }
      {
        \__tag_tree_fill_parenttree:
      }
    \__tag_tree_parenttree_rerun_msg:
```

```
    \tl_put_right:NV \l__tag_parenttree_content_tl\g__tag_parenttree_objr_tl
    \pdf_object_write:nne  { __tag/tree/parenttree }{dict}
      {
        /Nums\c_space_tl [\l__tag_parenttree_content_tl]
      }
  }
```

(*End of 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. Rolemap is also used in PDF 2.0 as a fallback.

```
\pdf_object_new:n { __tag/tree/rolemap }
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_tree_write_rolemap:
 {
   \bool_if:NT \g__tag_role_add_mathml_bool
     {
       \prop_map_inline:Nn \g__tag_role_NS_mathml_prop
        {
          \prop_gput:Nnn \g__tag_role_rolemap_prop {##1}{Span}
        }
     }
   \prop_map_inline:Nn\g__tag_role_rolemap_prop
     {
       \tl_if_eq:nnF {##1}{##2}
        {
          \pdfdict_gput:nne {g__tag_role/RoleMap_dict}
           {##1}
           {\pdf_name_from_unicode_e:n{##2}}
        }
     }
   \pdf_object_write:nne  { __tag/tree/rolemap }{dict}
    {
     \pdfdict_use:n{g__tag_role/RoleMap_dict}
    }
 }
```

(*End of 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:

```
\cs_new_protected:Npn \__tag_tree_write_classmap:
  {
    \tl_clear:N \l__tag_tmpa_tl
```

We process the older sec for compatibility with the table code. TODO: check if still needed

```
    \seq_map_inline:Nn \g__tag_attr_class_used_seq
     {
       \prop_gput:Nnn \g__tag_attr_class_used_prop {##1}{}
     }
    \prop_map_inline:Nn \g__tag_attr_class_used_prop
     {
       \tl_put_right:Ne \l__tag_tmpa_tl
        {
          ##1\c_space_tl
          <<
           \prop_item:Nn
            \g__tag_attr_entries_prop
            {##1}
          >>
         \iow_newline:
        }
     }
    \tl_if_empty:NF
      \l__tag_tmpa_tl
      {
        \pdf_object_new:n { __tag/tree/classmap }
        \pdf_object_write:nne
          { __tag/tree/classmap }
          {dict}
          { \l__tag_tmpa_tl }
        \__tag_prop_gput:cne
          { g__tag_struct_1_prop }
          { ClassMap }
          { \pdf_object_ref:n { __tag/tree/classmap }  }
      }
  }
```

(*End of 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

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

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

__tag_tree_write_namespaces:

```
\cs_new_protected:Npn \__tag_tree_write_namespaces:
  {
   \pdf_version_compare:NnF < {2.0}
```

```
    {
      \prop_map_inline:Nn \g__tag_role_NS_prop
        {
          \pdfdict_if_empty:nF {g__tag_role/RoleMapNS_##1_dict}
            {
              \pdf_object_write:nne {__tag/RoleMapNS/##1}{dict}
                {
                  \pdfdict_use:n {g__tag_role/RoleMapNS_##1_dict}
                }
              \pdfdict_gput:nne{g__tag_role/Namespace_##1_dict}
                {RoleMapNS}{\pdf_object_ref:n {__tag/RoleMapNS/##1}}
            }
          \pdf_object_write:nne{tag/NS/##1}{dict}
            {
               \pdfdict_use:n {g__tag_role/Namespace_##1_dict}
            }
        }
      \pdf_object_write:nne {__tag/tree/namespaces}{array}
        {
          \prop_map_tokens:Nn \g__tag_role_NS_prop{\use_ii:nn}
        }
    }
  }
```

(*End of 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:`

```
\hook_new:n {tagpdf/finish/before}
\cs_new_protected:Npn \__tag_finish_structure:
  {
    \bool_if:NT\g__tag_active_tree_bool
      {
        \hook_use:n {tagpdf/finish/before}
        \__tag_tree_final_checks:
        \iow_term:n{Package~tagpdf~Info:~writing~ParentTree}
        \__tag_check_benchmark_tic:
        \__tag_tree_write_parenttree:
        \__tag_check_benchmark_toc:
        \iow_term:n{Package~tagpdf~Info:~writing~IDTree}
        \__tag_check_benchmark_tic:
        \__tag_tree_write_idtree:
        \__tag_check_benchmark_toc:
        \iow_term:n{Package~tagpdf~Info:~writing~RoleMap}
        \__tag_check_benchmark_tic:
        \__tag_tree_write_rolemap:
        \__tag_check_benchmark_toc:
        \iow_term:n{Package~tagpdf~Info:~writing~ClassMap}
        \__tag_check_benchmark_tic:
        \__tag_tree_write_classmap:
```

```
        \__tag_check_benchmark_toc:
        \iow_term:n{Package~tagpdf~Info:~writing~NameSpaces}
        \__tag_check_benchmark_tic:
        \__tag_tree_write_namespaces:
        \__tag_check_benchmark_toc:
        \iow_term:n{Package~tagpdf~Info:~writing~StructElems}
        \__tag_check_benchmark_tic:
        \__tag_tree_write_structelements: %this is rather slow!!
        \__tag_check_benchmark_toc:
        \iow_term:n{Package~tagpdf~Info:~writing~Root}
        \__tag_check_benchmark_tic:
        \__tag_tree_write_structtreeroot:
        \__tag_check_benchmark_toc:
      }
  }
⟨/package⟩
```

(*End of 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.

```
⟨*package⟩
\hook_gput_code:nnn{begindocument}{tagpdf}
  {
    \bool_if:NT\g__tag_active_tree_bool
      {
       \hook_gput_code:nnn{shipout/before} { tagpdf/structparents }
         {
           \pdfmanagement_add:nne
             { Page }
             { StructParents }
             { \int_eval:n { \g_shipout_readonly_int} }
         }
      }
  }
⟨/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

\tag_mc_begin:n `\tag_mc_begin:n{`⟨*key-values*⟩`}`
\tag_mc_end: `\tag_mc_end:`

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.

\tag_mc_use:n `\tag_mc_use:n{`⟨*label*⟩`}`

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.

\tag_mc_artifact_group_begin:n `\tag_mc_artifact_group_begin:n {`⟨*name*⟩`}`
\tag_mc_artifact_group_end: `\tag_mc_artifact_group_end:`

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

\tag_mc_end_push: `\tag_mc_end_push:`
\tag_mc_begin_pop:n `\tag_mc_begin_pop:n{`⟨*key-values*⟩`}`

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 looses info like the alt text for now.

\tag_mc_if_in_p: ⋆ `\tag_mc_if_in:TF {`⟨*true code*⟩`} {`⟨*false code*⟩`}`
\tag_mc_if_in:TF ⋆

Determines if a mc-chunk is open.

\tag_mc_reset_box:N ⋆ \tag_mc_reset_box:N {⟨box⟩}

New: 2023-06-11 This resets in lua mode the mc attributes to the one currently in use. It does nothing in generic mode.

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

3 Marked content code – shared

```
⟨@@=tag⟩
⟨*header⟩
\ProvidesExplPackage {tagpdf-mc-code-shared} {2024-09-11} {0.99e}
  {part of tagpdf - code related to marking chunks -
   code shared by generic and luamode }
⟨/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_abs_int` and `\tl_put_right:Nn\cl@@ckpt{\@elt{g_@@_MCID_abs_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`

```
⟨*base⟩
\newcounter { g__tag_MCID_abs_int }
```

(*End of definition for* `g__tag_MCID_abs_int`.)

`\__tag_get_data_mc_counter:` This command allows `\tag_get:n` to get the current state of the mc counter with the keyword `mc_counter`. By comparing the numbers it can be used to check the number of structure commands in a piece of code.

```
\cs_new:Npn \__tag_get_data_mc_counter:
  {
    \int_use:N \c@g__tag_MCID_abs_int
  }
⟨/base⟩
```

(*End of definition for* `\__tag_get_data_mc_counter:`.)

`\__tag_get_mc_abs_cnt:` A (expandable) function to get the current value of the cnt. TODO: duplicate of the previous one, this should be cleaned up.

```
⟨*shared⟩
\cs_new:Npn \__tag_get_mc_abs_cnt: { \int_use:N \c@g__tag_MCID_abs_int }
```

(*End of definition for* `\__tag_get_mc_abs_cnt:`.)

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

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

(*End of 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

```
\__tag_prop_new_linked:N \g__tag_mc_parenttree_prop
```

(*End of 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:

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

(*End of 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.

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

(*End of definition for* `\l__tag_mc_artifact_type_tl`.)

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

```
\bool_new:N \l__tag_mc_key_stash_bool
\bool_new:N \l__tag_mc_artifact_bool
```

(*End of definition for* `\l__tag_mc_key_stash_bool` *and* `\l__tag_mc_artifact_bool`.)

\l__tag_mc_key_tag_tl
\g__tag_mc_key_tag_tl
\l__tag_mc_key_label_tl
\l__tag_mc_key_properties_tl Variables used by the keys. `\l_@@_mc_key_properties_tl` will collect a number of values. TODO: should this be a pdfdict now?

```
\tl_new:N \l__tag_mc_key_tag_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 of definition for* `\l__tag_mc_key_tag_tl` *and others.*)

3.2 Functions

__tag_mc_handle_mc_label:e 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
`tagabspage`: the absolute page, `\g_shipout_readonly_int`,
`tagmcabs`: the absolute mc-counter `\c@g_@@_MCID_abs_int`. The reference command is based on l3ref.

```
\cs_new:Npn \__tag_mc_handle_mc_label:e #1
  {
    \__tag_property_record:en{tagpdf-#1}{tagabspage,tagmcabs}
  }
```

(*End of definition for* `\__tag_mc_handle_mc_label:e`.)

__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 of 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:Ne  \l__tag_tmpa_tl { \property_ref:nnn{tagpdf-#1}{tagmcabs}{} }
        \tl_if_empty:NTF\l__tag_tmpa_tl
          {
            \msg_warning:nnn {tag} {mc-label-unknown} {#1}
          }
          {
            \cs_if_free:cTF { g__tag_mc_label_\tl_to_str:n{#1}_used_tl }
              {
                \__tag_mc_handle_stash:e { \l__tag_tmpa_tl }
                \__tag_mc_set_label_used:n {#1}
              }
              {
                 \msg_warning:nnn {tag}{mc-used-twice}{#1}
              }
          }
      }
  }
⟨/shared⟩
```

(*End of definition for* `\tag_mc_use:n`. *This function is documented on page 70.*)

\tag_mc_artifact_group_begin:n
\tag_mc_artifact_group_end:

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.

```
⟨base⟩\cs_new_protected:Npn \tag_mc_artifact_group_begin:n #1 {}
⟨base⟩\cs_new_protected:Npn \tag_mc_artifact_group_end:{}
⟨*shared⟩
\cs_set_protected:Npn \tag_mc_artifact_group_begin:n #1
 {
  \tag_mc_end_push:
  \tag_mc_begin:n {artifact=#1}
  \group_begin:
  \tag_stop:n{artifact-group}
 }

\cs_set_protected:Npn \tag_mc_artifact_group_end:
 {
  \tag_start:n{artifact-group}
  \group_end:
  \tag_mc_end:
  \tag_mc_begin_pop:n{}
 }
⟨/shared⟩
```

(*End of definition for* `\tag_mc_artifact_group_begin:n` *and* `\tag_mc_artifact_group_end:`. *These functions are documented on page 70.*)

`\tag_mc_reset_box:N` This allows to reset the mc-attributes in box. On base and generic mode it should do nothing.

```
⟨base⟩\cs_new_protected:Npn \tag_mc_reset_box:N #1 {}
```

(*End of definition for* `\tag_mc_reset_box:N`. *This function is documented on page 71.*)

`\tag_mc_end_push:`
`\tag_mc_begin_pop:n`

```
⟨base⟩\cs_new_protected:Npn \tag_mc_end_push: {}
⟨base⟩\cs_new_protected:Npn \tag_mc_begin_pop:n #1 {}
⟨*shared⟩
\cs_set_protected:Npn \tag_mc_end_push:
  {
    \__tag_check_if_active_mc:T
      {
        \__tag_mc_if_in:TF
          {
            \seq_gpush:Ne \g__tag_mc_stack_seq { \tag_get:n {mc_tag} }
            \__tag_check_mc_pushed_popped:nn
              { pushed }
              { \tag_get:n {mc_tag} }
            \tag_mc_end:
          }
          {
            \seq_gpush:Nn \g__tag_mc_stack_seq {-1}
            \__tag_check_mc_pushed_popped:nn { pushed }{-1}
          }
      }
  }

\cs_set_protected:Npn \tag_mc_begin_pop:n #1
  {
    \__tag_check_if_active_mc:T
      {
        \seq_gpop:NNTF \g__tag_mc_stack_seq \l__tag_tmpa_tl
          {
            \tl_if_eq:NnTF \l__tag_tmpa_tl {-1}
              {
                \__tag_check_mc_pushed_popped:nn {popped}{-1}
              }
              {
                \__tag_check_mc_pushed_popped:nn {popped}{\l__tag_tmpa_tl}
                \tag_mc_begin:n {tag=\l__tag_tmpa_tl,#1}
              }
          }
          {
            \__tag_check_mc_pushed_popped:nn {popped}{empty~stack,~nothing}
          }
      }
  }
```

(*End of definition for* `\tag_mc_end_push:` *and* `\tag_mc_begin_pop:n`. *These functions are documented on page 70.*)

3.3 Keys

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

stash␣(mc-key)
__artifact-bool
__artifact-type

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.

```
\keys_define:nn { __tag / mc }
  {
    stash                    .bool_set:N    = \l__tag_mc_key_stash_bool,
    __artifact-bool          .bool_set:N    = \l__tag_mc_artifact_bool,
    __artifact-type          .choice:,
    __artifact-type / pagination .code:n    =
      {
        \tl_set:Nn \l__tag_mc_artifact_type_tl { Pagination }
      },
    __artifact-type / pagination/header .code:n    =
      {
        \tl_set:Nn \l__tag_mc_artifact_type_tl { Pagination/Subtype/Header }
      },
    __artifact-type / pagination/footer .code:n    =
      {
        \tl_set:Nn \l__tag_mc_artifact_type_tl { Pagination/Subtype/Footer }
      },
    __artifact-type / layout     .code:n    =
      {
        \tl_set:Nn \l__tag_mc_artifact_type_tl { Layout }
      },
    __artifact-type / page       .code:n    =
      {
        \tl_set:Nn \l__tag_mc_artifact_type_tl { Page }
      },
    __artifact-type / background .code:n    =
      {
        \tl_set:Nn \l__tag_mc_artifact_type_tl { Background }
      },
    __artifact-type / notype     .code:n    =
      {
        \tl_set:Nn \l__tag_mc_artifact_type_tl {}
      },
    __artifact-type /      .code:n    =
      {
        \tl_set:Nn \l__tag_mc_artifact_type_tl {}
      },
  }
```

(*End of definition for* `stash (mc-key)`, `__artifact-bool`, *and* `__artifact-type`. *This function is documented on page 71.*)

⟨/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

```
⟨@@=tag⟩
⟨*generic⟩
\ProvidesExplPackage {tagpdf-mc-code-generic} {2024-09-11} {0.99e}
 {part of tagpdf - code related to marking chunks - generic mode}
⟨/generic⟩
⟨*debug⟩
\ProvidesExplPackage {tagpdf-debug-generic} {2024-09-11} {0.99e}
 {part of tagpdf - debugging code related to marking chunks - generic mode}
⟨/debug⟩
```

1.1 Variables

```
⟨*generic⟩
```

\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.

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

(*End of definition for* `\l__tag_mc_ref_abspage_tl`.)

\l__tag_mc_tmpa_tl

temporary variable

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

(*End of 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.

```
\newmarks  \g__tag_mc_marks
```

(*End of definition for* `\g__tag_mc_marks`.)

\g__tag_mc_main_marks_seq
\g__tag_mc_footnote_marks_seq
\g__tag_mc_multicol_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. TODO: perhaps an interface for more streams will be needed.

```
\seq_new:N \g__tag_mc_main_marks_seq
\seq_new:N \g__tag_mc_footnote_marks_seq
\seq_new:N \g__tag_mc_multicol_marks_seq
```

(*End of 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
\l__tag_mc_botmarks_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.

```
\seq_new:N  \l__tag_mc_firstmarks_seq
\seq_new:N  \l__tag_mc_botmarks_seq
```

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

1.2 Functions

__tag_mc_begin_marks:nn
__tag_mc_artifact_begin_marks:n
__tag_mc_end_marks:

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).

```
\cs_new_protected:Npn \__tag_mc_begin_marks:nn #1 #2 %#1 tag, #2 label
  {
    \tex_marks:D \g__tag_mc_marks
      {
        b-, %first of begin pair
        \int_use:N\c@g__tag_MCID_abs_int, %mc-num
        \g__tag_struct_stack_current_tl,  %structure num
        #1, %tag
        \bool_if:NT \l__tag_mc_key_stash_bool{stash}, % stash info
        #2, %label
      }
    \tex_marks:D \g__tag_mc_marks
      {
        b+, % second of begin pair
        \int_use:N\c@g__tag_MCID_abs_int, %mc-num
        \g__tag_struct_stack_current_tl,  %structure num
        #1, %tag
        \bool_if:NT \l__tag_mc_key_stash_bool{stash}, % stash info
        #2, %label
      }
  }
\cs_generate_variant:Nn \__tag_mc_begin_marks:nn {oo}
\cs_new_protected:Npn \__tag_mc_artifact_begin_marks:n #1 %#1 type
  {
    \tex_marks:D \g__tag_mc_marks
      {
        b-, %first of begin pair
        \int_use:N\c@g__tag_MCID_abs_int, %mc-num
        -1, %structure num
        #1 %type
      }
    \tex_marks:D \g__tag_mc_marks
      {
        b+, %first of begin pair
        \int_use:N\c@g__tag_MCID_abs_int, %mc-num
        -1,  %structure num
        #1  %Type
      }
  }
```

```
58
59 \cs_new_protected:Npn \__tag_mc_end_marks:
60   {
61     \tex_marks:D \g__tag_mc_marks
62       {
63         e-, %first of end pair
64         \int_use:N\c@g__tag_MCID_abs_int, %mc-num
65         \g__tag_struct_stack_current_tl,  %structure num
66       }
67     \tex_marks:D \g__tag_mc_marks
68       {
69         e+, %second of end pair
70         \int_use:N\c@g__tag_MCID_abs_int, %mc-num
71         \g__tag_struct_stack_current_tl,  %structure num
72       }
73   }
```

(*End of 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.

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

(*End of 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.

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

(*End of definition for* `\__tag_mc_get_marks:`.)

`\__tag_mc_store:nnn` This inserts the mc-chunk ⟨*mc-num*⟩ into the structure struct-num after the ⟨*mc-prev*⟩. 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.

```
89 \cs_new_protected:Npn \__tag_mc_store:nnn #1 #2 #3 %#1 mc-prev, #2 mc-num #3 structure-
   num
90   {
91     %\prop_show:N \g__tag_struct_cont_mc_prop
92     \prop_get:NnNTF \g__tag_struct_cont_mc_prop {#1} \l__tag_tmpa_tl
93       {
```

```
        \prop_gput:Nne \g__tag_struct_cont_mc_prop {#1}{ \l__tag_tmpa_tl \__tag_struct_mcid_d
      }
      {
        \prop_gput:Nne \g__tag_struct_cont_mc_prop {#1}{ \__tag_struct_mcid_dict:n {#2}}
      }
    \prop_gput:Nee \g__tag_mc_parenttree_prop
      {#2}
      {#3}
  }
\cs_generate_variant:Nn \__tag_mc_store:nnn {eee}
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_mc_insert_extra_tmb:n #1 % #1 stream: e.g. main or footnote
  {
    \__tag_check_typeout_v:n {=>~ first~ \seq_use:Nn \l__tag_mc_firstmarks_seq {,~}}
    \__tag_check_typeout_v:n {=>~ bot~ \seq_use:Nn \l__tag_mc_botmarks_seq {,~}}
    \__tag_check_if_mc_tmb_missing:TF
      {
        \__tag_check_typeout_v:n {=>~ TMB~ ~ missing~ ---~ inserted}
        %test if artifact
        \int_compare:nNnTF { \seq_item:cn { g__tag_mc_#1_marks_seq } {3} } = {-
1}
          {
            \tl_set:Ne \l__tag_tmpa_tl { \seq_item:cn { g__tag_mc_#1_marks_seq } {4} }
            \__tag_mc_handle_artifact:N \l__tag_tmpa_tl
          }
          {
            \exp_args:Ne
            \__tag_mc_bdc_mcid:n
              {
                \seq_item:cn { g__tag_mc_#1_marks_seq } {4}
              }
            \str_if_eq:eeTF
              {
                \seq_item:cn { g__tag_mc_#1_marks_seq } {5}
              }
              {}
              {
                %store
                \__tag_mc_store:eee
                  {
                    \seq_item:cn { g__tag_mc_#1_marks_seq } {2}
                  }
                  { \int_eval:n{\c@g__tag_MCID_abs_int} }
                  {
```

```
                    \seq_item:cn { g__tag_mc_#1_marks_seq } {3}
                  }
              }
              {
                 %stashed -> warning!!
              }
          }
      }
      {
        \__tag_check_typeout_v:n {=>~ TMB~ not~ missing}
      }
  }

\cs_new_protected:Npn \__tag_mc_insert_extra_tme:n #1 % #1 stream, eg. main or footnote
 {
   \__tag_check_if_mc_tme_missing:TF
     {
       \__tag_check_typeout_v:n {=>~ TME~ ~ missing~ ---~ inserted}
       \__tag_mc_emc:
       \seq_gset_eq:cN
         {  g__tag_mc_#1_marks_seq }
         \l__tag_mc_botmarks_seq
     }
     {
       \__tag_check_typeout_v:n {=>~ TME~ not~ missing}
     }
 }
```

(*End of 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 und is currently either `main` for the main galley, `footnote` for footnote note text, or `multicol` for boxes produced for columns in that environment. Other streams may follow over time.

```
\cs_new_protected:Npn\__tag_add_missing_mcs:Nn #1 #2 {
  \vbadness \@M
  \vfuzz    \c_max_dim
  \vbox_set_to_ht:Nnn #1 { \box_ht:N #1 } {
    \hbox_set:Nn \l__tag_tmpa_box { \__tag_mc_insert_extra_tmb:n {#2} }
    \hbox_set:Nn \l__tag_tmpb_box { \__tag_mc_insert_extra_tme:n {#2} }
    \int_compare:nNnT {\l__tag_loglevel_int} > { 0 }
         {
```

```
171             \seq_log:c { g__tag_mc_#2_marks_seq}
172           }
```

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

```
173     \box_set_ht:Nn \l__tag_tmpa_box \c_zero_dim
174     \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.

```
175     \box_set_ht:Nn \l__tag_tmpb_box \c_zero_dim
176     \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.

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

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

```
180     \tex_kern:D -\box_dp:N \l__tag_tmpb_box
```

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

```
181     \nointerlineskip
182     \box_use_drop:N \l__tag_tmpb_box
183   }
184 }
```

(*End of 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 therefore 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.

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

First set up a temp box for trial splitting.

```
188     \vbadness\maxdimen
189     \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).

```
190     \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`

```
191     \exp_args:NNe
192     \seq_set_from_clist:Nn \l__tag_mc_firstmarks_seq
193         { \tex_splitfirstmarks:D \g__tag_mc_marks }
```

Some debugging info:

```
%    \iow_term:n { First~ mark~ from~ this~ box: }
%    \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!

```
    \seq_if_empty:NTF \l__tag_mc_firstmarks_seq
        {
          \__tag_check_typeout_v:n
            {
              No~ marks~ so~ use~ saved~ bot~ mark:~
              \seq_use:cn {g__tag_mc_#2_marks_seq} {,~} \iow_newline:
            }
           \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).

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

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.

```
        {
          \__tag_check_typeout_v:n
            {
              Pick~ up~ new~ bot~ mark!
            }
          \exp_args:NNe
          \seq_set_from_clist:Nn \l__tag_mc_botmarks_seq
              { \tex_splitbotmarks:D   \g__tag_mc_marks }
        }
```

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

```
    \__tag_add_missing_mcs:Nn #1 {#2}
%%
    \seq_gset_eq:cN  {g__tag_mc_#2_marks_seq} \l__tag_mc_botmarks_seq
%%
  }
}
```

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

`\__tag_mc_if_in_p:`
`\__tag_mc_if_in:TF`
`\tag_mc_if_in_p:`
`\tag_mc_if_in:TF`

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.

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.

```
\prg_new_conditional:Nnn \__tag_mc_if_in: {p,T,F,TF}
  {
    \bool_if:NTF \g__tag_in_mc_bool
      { \prg_return_true:  }
      { \prg_return_false: }
  }

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

(*End of definition for* `\__tag_mc_if_in:TF` *and* `\tag_mc_if_in:TF`*. This function is documented on page* 70.)

`\__tag_mc_bmc:n` `\__tag_mc_emc:` `\__tag_mc_bdc:nn`

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. 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. change 2023-08-18: we are delaying the writing to the shipout.

```
% #1 tag, #2 properties
\cs_set_eq:NN \__tag_mc_bmc:n  \pdf_bmc:n
\cs_set_eq:NN \__tag_mc_emc:   \pdf_emc:
\cs_set_eq:NN \__tag_mc_bdc:nn \pdf_bdc:nn
\cs_set_eq:NN \__tag_mc_bdc_shipout:ee \pdf_bdc_shipout:ee
```

(*End of definition for* `\__tag_mc_bmc:n`*,* `\__tag_mc_emc:`*, and* `\__tag_mc_bdc:nn`*.*)

`\__tag_mc_bdc_mcid:nn` `\__tag_mc_bdc_mcid:n` `\__tag_mc_handle_mcid:nn` `\__tag_mc_handle_mcid:VV`

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. Starting with texlive 2023 this is much simpler and faster as we can use delay the numbering to the shipout. We also define a wrapper around the low-level command as luamode will need something different.

```
\bool_if:NTF\g__tag_delayed_shipout_bool
  {
    \hook_gput_code:nnn {shipout/before}{tagpdf}{ \flag_clear:n { __tag/mcid } }
    \cs_set_protected:Npn \__tag_mc_bdc_mcid:nn #1 #2
      {
        \int_gincr:N \c@g__tag_MCID_abs_int
        \__tag_property_record:eV
         {
           mcid-\int_use:N \c@g__tag_MCID_abs_int
         }
         \c__tag_property_mc_clist
        \__tag_mc_bdc_shipout:ee
          {#1}
          {
            /MCID~\flag_height:n { __tag/mcid }
            \flag_raise:n { __tag/mcid }~  #2
          }
      }
  }
```

if the engine is too old, we have to revert to earlier method.

```
{
  \msg_new:nnn { tagpdf } { old-engine }
```

```
    {
      The~engine~or~the~PDF management~is~too~old~or\\
      delayed~shipout~has~been~disabled.\\
      Fast~numbering~of~MC-chunks~not~available.\\
      More~compilations~will~be~needed~in~generic~mode.
    }
  \msg_warning:nn { tagpdf} { old-engine }
  \__tag_prop_new:N \g__tag_MCID_byabspage_prop
  \int_new:N \g__tag_MCID_tmp_bypage_int
  \cs_generate_variant:Nn \__tag_mc_bdc:nn {ne}
```

revert the attribute:

```
  \property_gset:nnnn {tagmcid } { now }
      {0}  { \int_use:N \g__tag_MCID_tmp_bypage_int }
  \cs_new_protected:Npn \__tag_mc_bdc_mcid:nn #1 #2
    {
      \int_gincr:N \c@g__tag_MCID_abs_int
      \tl_set:Ne \l__tag_mc_ref_abspage_tl
        {
          \property_ref:enn %3 args
            {
              mcid-\int_use:N \c@g__tag_MCID_abs_int
            }
            { tagabspage }
            {-1}
        }
      \prop_get:NoNTF
        \g__tag_MCID_byabspage_prop
        {
          \l__tag_mc_ref_abspage_tl
        }
        \l__tag_mc_tmpa_tl
        {
          %key already present, use value for MCID and add 1 for the next
          \int_gset:Nn \g__tag_MCID_tmp_bypage_int { \l__tag_mc_tmpa_tl }
          \__tag_prop_gput:Nee
            \g__tag_MCID_byabspage_prop
            { \l__tag_mc_ref_abspage_tl }
            { \int_eval:n {\l__tag_mc_tmpa_tl +1} }
        }
        {
          %key not present, set MCID to 0 and insert 1
          \int_gzero:N \g__tag_MCID_tmp_bypage_int
          \__tag_prop_gput:Nee
            \g__tag_MCID_byabspage_prop
            { \l__tag_mc_ref_abspage_tl }
            {1}
        }
      \__tag_property_record:eV
        {
          mcid-\int_use:N \c@g__tag_MCID_abs_int
        }
        \c__tag_property_mc_clist
       \__tag_mc_bdc:ne
         {#1}
```

```
          { /MCID~\int_eval:n { \g__tag_MCID_tmp_bypage_int }~ \exp_not:n { #2 } }
      }
 }
 \cs_new_protected:Npn \__tag_mc_bdc_mcid:n #1
  {
    \__tag_mc_bdc_mcid:nn {#1} {}
  }

\cs_new_protected:Npn \__tag_mc_handle_mcid:nn #1 #2 %#1 tag, #2 properties
  {
    \__tag_mc_bdc_mcid:nn {#1} {#2}
  }

\cs_generate_variant:Nn \__tag_mc_handle_mcid:nn {VV}
```

(*End of definition for* `\__tag_mc_bdc_mcid:nn`, `\__tag_mc_bdc_mcid:n`, *and* `\__tag_mc_handle_mcid:nn`.)

`\__tag_mc_handle_stash:n`
`\__tag_mc_handle_stash:e`

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?

```
\cs_new_protected:Npn \__tag_mc_handle_stash:n #1 %1 mcidnum
  {
    \__tag_check_mc_used:n {#1}
    \__tag_struct_kid_mc_gput_right:nn
      { \g__tag_struct_stack_current_tl }
      {#1}
   \prop_gput:Nee \g__tag_mc_parenttree_prop
     {#1}
     { \g__tag_struct_stack_current_tl }
  }
\cs_generate_variant:Nn \__tag_mc_handle_stash:n { e }
```

(*End of definition for* `\__tag_mc_handle_stash:n`.)

`\__tag_mc_bmc_artifact:`
`\__tag_mc_bmc_artifact:n`
`\__tag_mc_handle_artifact:N`

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

```
\cs_new_protected:Npn  \__tag_mc_bmc_artifact:
  {
    \__tag_mc_bmc:n {Artifact}
  }
\cs_new_protected:Npn \__tag_mc_bmc_artifact:n #1
  {
    \__tag_mc_bdc:nn {Artifact}{/Type/#1}
  }
\cs_new_protected:Npn \__tag_mc_handle_artifact:N #1
   % #1 is a var containing the artifact type
  {
    \int_gincr:N \c@g__tag_MCID_abs_int
    \tl_if_empty:NTF #1
      { \__tag_mc_bmc_artifact: }
      { \exp_args:NV\__tag_mc_bmc_artifact:n #1 }
  }
```

(*End of 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.

```
\cs_new:Nn \__tag_get_data_mc_tag: { \g__tag_mc_key_tag_tl }
⟨/generic⟩
```

(*End of definition for* `\__tag_get_data_mc_tag:`.)

`\tag_mc_begin:n` `\tag_mc_end:` 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.

```
⟨base⟩\cs_new_protected:Npn \tag_mc_begin:n #1 { \__tag_whatsits: \int_gincr:N \c@g__tag_MCID_
⟨base⟩\cs_new_protected:Nn \tag_mc_end:{ \__tag_whatsits: }
⟨*generic | debug⟩
⟨*generic⟩
\cs_set_protected:Npn \tag_mc_begin:n #1 %#1 keyval
  {
    \__tag_check_if_active_mc:T
      {
⟨/generic⟩
⟨*debug⟩
\cs_set_protected:Npn \tag_mc_begin:n #1 %#1 keyval
  {
    \__tag_check_if_active_mc:TF
      {
        \__tag_debug_mc_begin_insert:n { #1 }
⟨/debug⟩
        \group_begin: %hm
        \__tag_check_mc_if_nested:
        \bool_gset_true:N \g__tag_in_mc_bool
```

set default MC tags to structure:

```
        \tl_set_eq:NN \l__tag_mc_key_tag_tl \g__tag_struct_tag_tl
        \tl_gset_eq:NN\g__tag_mc_key_tag_tl \g__tag_struct_tag_tl
        \keys_set:nn { __tag / mc } {#1}
        \bool_if:NTF \l__tag_mc_artifact_bool
          { %handle artifact
            \__tag_mc_handle_artifact:N \l__tag_mc_artifact_type_tl
            \exp_args:NV
            \__tag_mc_artifact_begin_marks:n \l__tag_mc_artifact_type_tl
          }
          { %handle mcid type
            \__tag_check_mc_tag:N  \l__tag_mc_key_tag_tl
            \__tag_mc_handle_mcid:VV
               \l__tag_mc_key_tag_tl
               \l__tag_mc_key_properties_tl
            \__tag_mc_begin_marks:oo{\l__tag_mc_key_tag_tl}{\l__tag_mc_key_label_tl}
            \tl_if_empty:NF {\l__tag_mc_key_label_tl}
              {
                \exp_args:NV
                \__tag_mc_handle_mc_label:e \l__tag_mc_key_label_tl
              }
```

```
              \bool_if:NF \l__tag_mc_key_stash_bool
                {
                  \exp_args:NV\__tag_struct_get_parentrole:nNN
                      \g__tag_struct_stack_current_tl
                      \l__tag_get_parent_tmpa_tl
                      \l__tag_get_parent_tmpb_tl
                   \__tag_check_parent_child:VVnnN
                     \l__tag_get_parent_tmpa_tl
                     \l__tag_get_parent_tmpb_tl
                     {MC}{}
                     \l__tag_parent_child_check_tl
                  \int_compare:nNnT {\l__tag_parent_child_check_tl}<{0}
                   {
                      \prop_get:cnN
                       { g__tag_struct_ \g__tag_struct_stack_current_tl _prop}
                       {S}
                       \l__tag_tmpa_tl
                      \msg_warning:nneee
                       { tag }
                       {role-parent-child}
                       { \l__tag_get_parent_tmpa_tl/\l__tag_get_parent_tmpb_tl  }
                       { MC~(real content) }
                       { not~allowed~
                         (struct~\g__tag_struct_stack_current_tl,~\l__tag_tmpa_tl)
                       }
                   }
                  \__tag_mc_handle_stash:e { \int_use:N \c@g__tag_MCID_abs_int }
                }
            }
          \group_end:
        }
⟨*debug⟩
        {
          \__tag_debug_mc_begin_ignore:n { #1 }
        }
⟨/debug⟩
    }
⟨*generic⟩
\cs_set_protected:Nn \tag_mc_end:
  {
    \__tag_check_if_active_mc:T
      {
⟨/generic⟩
⟨*debug⟩
\cs_set_protected:Nn \tag_mc_end:
  {
    \__tag_check_if_active_mc:TF
      {
        \__tag_debug_mc_end_insert:
⟨/debug⟩
        \__tag_check_mc_if_open:
        \bool_gset_false:N \g__tag_in_mc_bool
        \tl_gset:Nn  \g__tag_mc_key_tag_tl { }
        \__tag_mc_emc:
```

```
          \__tag_mc_end_marks:
        }
⟨*debug⟩
        {
          \__tag_debug_mc_end_ignore:
        }
⟨/debug⟩
    }
⟨/generic | debug⟩
```

(*End of definition for* `\tag_mc_begin:n` *and* `\tag_mc_end:`*. These functions are documented on page 70.*)

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)
alt␣(mc-key)
actualtext␣(mc-key)
label␣(mc-key)
artifact␣(mc-key)

```
⟨*generic⟩
\keys_define:nn { __tag / mc }
  {
    tag .code:n = % the name (H,P,Span) etc
      {
        \tl_set:Ne   \l__tag_mc_key_tag_tl { #1 }
        \tl_gset:Ne  \g__tag_mc_key_tag_tl { #1 }
      },
    raw  .code:n =
      {
        \tl_put_right:Ne \l__tag_mc_key_properties_tl { #1 }
      },
    alt .code:n      = % Alt property
      {
        \str_set_convert:Noon
          \l__tag_tmpa_str
          { #1 }
          { default }
          { utf16/hex }
        \tl_put_right:Nn \l__tag_mc_key_properties_tl { /Alt~< }
        \tl_put_right:No \l__tag_mc_key_properties_tl { \l__tag_tmpa_str>~ }
      },
    alttext .meta:n = {alt=#1},
    actualtext .code:n      = % ActualText property
      {
        \tl_if_empty:oF{#1}
         {
           \str_set_convert:Noon
             \l__tag_tmpa_str
             { #1 }
             { default }
             { utf16/hex }
           \tl_put_right:Nn \l__tag_mc_key_properties_tl { /ActualText~< }
           \tl_put_right:No \l__tag_mc_key_properties_tl { \l__tag_tmpa_str>~ }
         }
```

```
      },
    label .tl_set:N        = \l__tag_mc_key_label_tl,
    artifact .code:n       =
      {
        \exp_args:Nne
          \keys_set:nn
            { __tag / mc }
            { __artifact-bool, __artifact-type=#1 }
      },
    artifact .default:n    = {notype}
  }
```
⟨/generic⟩

(*End of definition for* `tag (mc-key)` *and others. These functions are documented on page 71.*)

Part VI
The tagpdf-mc-luacode module Code related to Marked Content (mc-chunks), luamode-specific Part of the tagpdf package

The code is split 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 ship out. 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.

```
⟨@@=tag⟩
⟨*luamode⟩
\ProvidesExplPackage {tagpdf-mc-code-lua} {2024-09-11} {0.99e}
  {tagpdf - mc code only for the luamode }
⟨/luamode⟩
⟨*debug⟩
\ProvidesExplPackage {tagpdf-debug-lua} {2024-09-11} {0.99e}
 {part of tagpdf - debugging code related to marking chunks - lua mode}
⟨/debug⟩
```

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

```
⟨*luamode⟩
\hook_gput_code:nnn{begindocument}{tagpdf/mc}
 {
   \bool_if:NT\g__tag_active_space_bool
     {
       \lua_now:e
         {
           if~luatexbase.callbacktypes.pre_shipout_filter~then~
             luatexbase.add_to_callback("pre_shipout_filter", function(TAGBOX)~
             ltx.__tag.func.space_chars_shipout(TAGBOX)~return~true~
             end, "tagpdf")~
             if~luatexbase.declare_callback_rule~then~
               luatexbase.declare_callback_rule("pre_shipout_filter", "luaotfload.dvi", "aft
             end~
           end
         }
      \lua_now:e
        {
          if~luatexbase.callbacktypes.pre_shipout_filter~then~
          token.get_next()~
          end
        }\@secondoftwo\@gobble
          {
            \hook_gput_code:nnn{shipout/before}{tagpdf/lua}
              {
               \lua_now:e
                  { ltx.__tag.func.space_chars_shipout (tex.box["ShipoutBox"]) }
              }
          }
     }
   \bool_if:NT\g__tag_active_mc_bool
     {
       \lua_now:e
         {
           if~luatexbase.callbacktypes.pre_shipout_filter~then~
             luatexbase.add_to_callback("pre_shipout_filter", function(TAGBOX)~
             ltx.__tag.func.mark_shipout(TAGBOX)~return~true~
             end, "tagpdf")~
           end
         }
      \lua_now:e
        {
          if~luatexbase.callbacktypes.pre_shipout_filter~then~
          token.get_next()~
          end
        }\@secondoftwo\@gobble
          {
            \hook_gput_code:nnn{shipout/before}{tagpdf/lua}
              {
                \lua_now:e
                  { ltx.__tag.func.mark_shipout (tex.box["ShipoutBox"]) }
              }
```

```
        }
    }
}
```

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.

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

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

__tag_mc_if_in_p:
__tag_mc_if_in:TF
\tag_mc_if_in_p:
\tag_mc_if_in:TF

This tests, if we are in an mc, for attributes this means to check against a number.

```
\prg_new_conditional:Nnn \__tag_mc_if_in: {p,T,F,TF}
  {
    \int_compare:nNnTF
      { -2147483647 }
      =
      {\lua_now:e
         {
           tex.print(\int_use:N \c_document_cctab,tex.getattribute(luatexbase.attributes.g__t
         }
      }
      { \prg_return_false:  }
      { \prg_return_true: }
  }

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

(*End of definition for* `\__tag_mc_if_in:TF` *and* `\tag_mc_if_in:TF`. *This function is documented on page* 70.)

__tag_mc_lua_set_mc_type_attr:n
__tag_mc_lua_set_mc_type_attr:o
__tag_mc_lua_unset_mc_type_attr:

This takes a tag name, and sets the attributes globally to the related number.

```
\cs_new:Nn \__tag_mc_lua_set_mc_type_attr:n % #1 is a tag name
  {
    %TODO ltx.__tag.func.get_num_from("#1") seems not to return a suitable number??
    \tl_set:Ne\l__tag_tmpa_tl{\lua_now:e{ltx.__tag.func.output_num_from ("#1")} }
    \lua_now:e
      {
        tex.setattribute
         (
          "global",
          luatexbase.attributes.g__tag_mc_type_attr,
          \l__tag_tmpa_tl
         )
      }
    \lua_now:e
      {
        tex.setattribute
         (
           "global",
           luatexbase.attributes.g__tag_mc_cnt_attr,
           \__tag_get_mc_abs_cnt:
         )
```

```
      }
  }

\cs_generate_variant:Nn\__tag_mc_lua_set_mc_type_attr:n { o }

\cs_new:Nn \__tag_mc_lua_unset_mc_type_attr:
  {
    \lua_now:e
      {
        tex.setattribute
          (
            "global",
            luatexbase.attributes.g__tag_mc_type_attr,
            -2147483647
          )
      }
     \lua_now:e
      {
        tex.setattribute
          (
            "global",
            luatexbase.attributes.g__tag_mc_cnt_attr,
            -2147483647
          )
      }
  }

```

(*End of definition for* `\__tag_mc_lua_set_mc_type_attr:n` *and* `\__tag_mc_lua_unset_mc_type_attr:`.)

`\__tag_mc_insert_mcid_kids:n`
`\__tag_mc_insert_mcid_single_kids:n`

These commands will in the finish code replace the dummy for a mc by the real mcid kids we need a variant for the case that it is the only kid, to get the array right

```
\cs_new:Nn \__tag_mc_insert_mcid_kids:n
  {
    \lua_now:e { ltx.__tag.func.mc_insert_kids (#1,0) }
  }

\cs_new:Nn \__tag_mc_insert_mcid_single_kids:n
  {
    \lua_now:e {ltx.__tag.func.mc_insert_kids (#1,1) }
  }
```

(*End of definition for* `\__tag_mc_insert_mcid_kids:n` *and* `\__tag_mc_insert_mcid_single_kids:n`.)

`\__tag_mc_handle_stash:n`
`\__tag_mc_handle_stash:e`

This is the lua variant for the command to put an mcid absolute number in the current structure.

```
⟨/luamode⟩
⟨*luamode | debug⟩
⟨luamode⟩\cs_new_protected:Npn \__tag_mc_handle_stash:n #1 %1 mcidnum
⟨debug⟩\cs_set_protected:Npn \__tag_mc_handle_stash:n #1 %1 mcidnum
  {
    \__tag_check_mc_used:n { #1 }
    \seq_gput_right:cn % Don't fill a lua table due to the command in the item,
                       % so use the kernel command
```

```
      { g__tag_struct_kids_\g__tag_struct_stack_current_tl _seq }
      {
        \__tag_mc_insert_mcid_kids:n {#1}%
      }
⟨debug⟩    \seq_gput_right:cn % Don't fill a lua table due to the command in the item,
⟨debug⟩                       % so use the kernel command
⟨debug⟩      { g__tag_struct_debug_kids_\g__tag_struct_stack_current_tl _seq }
⟨debug⟩      {
⟨debug⟩        MC~#1%
⟨debug⟩      }
    \lua_now:e
      {
        ltx.__tag.func.store_struct_mcabs
          (
            \g__tag_struct_stack_current_tl,#1
          )
      }
    \prop_gput:Nee
      \g__tag_mc_parenttree_prop
      { #1 }
      { \g__tag_struct_stack_current_tl }
  }
⟨/luamode | debug⟩
⟨*luamode⟩
\cs_generate_variant:Nn \__tag_mc_handle_stash:n { e }
```

(*End of 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.

```
\cs_set_protected:Nn \tag_mc_begin:n
  {
    \__tag_check_if_active_mc:T
      {
        \group_begin:
        %\__tag_check_mc_if_nested:
        \bool_gset_true:N \g__tag_in_mc_bool
        \bool_set_false:N\l__tag_mc_artifact_bool
        \tl_clear:N \l__tag_mc_key_properties_tl
        \int_gincr:N \c@g__tag_MCID_abs_int
```

set the default tag to the structure:

```
        \tl_set_eq:NN \l__tag_mc_key_tag_tl \g__tag_struct_tag_tl
        \tl_gset_eq:NN\g__tag_mc_key_tag_tl \g__tag_struct_tag_tl
        \lua_now:e
          {
            ltx.__tag.func.store_mc_data(\__tag_get_mc_abs_cnt:,"tag","\g__tag_struct_tag_tl'
          }
        \keys_set:nn { __tag / mc }{ label={}, #1 }
        %check that a tag or artifact has been used
        \__tag_check_mc_tag:N \l__tag_mc_key_tag_tl
        %set the attributes:
        \__tag_mc_lua_set_mc_type_attr:o  { \l__tag_mc_key_tag_tl }
        \bool_if:NF \l__tag_mc_artifact_bool
          { % store the absolute num name in a label:
```

```
            \tl_if_empty:NF {\l__tag_mc_key_label_tl}
              {
                \exp_args:NV
                 \__tag_mc_handle_mc_label:e  \l__tag_mc_key_label_tl
              }
            % if not stashed record the absolute number
             \bool_if:NF \l__tag_mc_key_stash_bool
              {
                \exp_args:NV\__tag_struct_get_parentrole:nNN
                  \g__tag_struct_stack_current_tl
                  \l__tag_get_parent_tmpa_tl
                  \l__tag_get_parent_tmpb_tl
                \__tag_check_parent_child:VVnnN
                  \l__tag_get_parent_tmpa_tl
                  \l__tag_get_parent_tmpb_tl
                  {MC}{}
                  \l__tag_parent_child_check_tl
                \int_compare:nNnT {\l__tag_parent_child_check_tl}<{0}
                 {
                   \prop_get:cnN
                    { g__tag_struct_ \g__tag_struct_stack_current_tl _prop}
                    {S}
                    \l__tag_tmpa_tl
                   \msg_warning:nneee
                     { tag }
                     {role-parent-child}
                     { \l__tag_get_parent_tmpa_tl/\l__tag_get_parent_tmpb_tl  }
                     { MC~(real content) }
                     {
                       not~allowed~
                       (struct~\g__tag_struct_stack_current_tl,~\l__tag_tmpa_tl)
                     }
                 }
                \__tag_mc_handle_stash:e { \__tag_get_mc_abs_cnt: }
              }
          }
        \group_end:
    }
}
```

(*End of definition for* `\tag_mc_begin:n`. *This function is documented on page* 70.)

`\tag_mc_end:` TODO: check how the use command must be guarded.

```
\cs_set_protected:Nn \tag_mc_end:
  {
    \__tag_check_if_active_mc:T
      {
        %\__tag_check_mc_if_open:
        \bool_gset_false:N \g__tag_in_mc_bool
        \bool_set_false:N\l__tag_mc_artifact_bool
        \__tag_mc_lua_unset_mc_type_attr:
        \tl_set:Nn  \l__tag_mc_key_tag_tl { }
        \tl_gset:Nn \g__tag_mc_key_tag_tl { }
      }
  }
```

(*End of definition for* `\tag_mc_end:`. *This function is documented on page 70.*)

`\tag_mc_reset_box:N` This allows to reset the mc-attributes in box. On base and generic mode it should do nothing.

```
\cs_set_protected:Npn \tag_mc_reset_box:N #1
  {
    \lua_now:e
     {
       local~type=tex.getattribute(luatexbase.attributes.g__tag_mc_type_attr)
       local~mc=tex.getattribute(luatexbase.attributes.g__tag_mc_cnt_attr)
       ltx.__tag.func.update_mc_attributes(tex.getbox(\int_use:N #1),mc,type)
     }
  }
```

(*End of definition for* `\tag_mc_reset_box:N`. *This function is documented on page 71.*)

`\__tag_get_data_mc_tag:` The command to retrieve the current mc tag. TODO: Perhaps this should use the attribute instead.

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

(*End of 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)`
`alt␣(mc-key)`
`actualtext␣(mc-key)`
`label␣(mc-key)`
`artifact␣(mc-key)`

```
\keys_define:nn { __tag / mc }
  {
    tag .code:n = %
      {
        \tl_set:Ne   \l__tag_mc_key_tag_tl { #1 }
        \tl_gset:Ne  \g__tag_mc_key_tag_tl { #1 }
        \lua_now:e
          {
            ltx.__tag.func.store_mc_data(\__tag_get_mc_abs_cnt:,"tag","#1")
          }
      },
    raw .code:n =
      {
        \tl_put_right:Ne \l__tag_mc_key_properties_tl { #1 }
        \lua_now:e
          {
            ltx.__tag.func.store_mc_data(\__tag_get_mc_abs_cnt:,"raw","#1")
          }
      },
    alt .code:n      = % Alt property
      {
        \tl_if_empty:oF{#1}
          {
            \str_set_convert:Noon
              \l__tag_tmpa_str
              { #1 }
              { default }
              { utf16/hex }
            \tl_put_right:Nn \l__tag_mc_key_properties_tl { /Alt~< }
```

```
          \tl_put_right:No \l__tag_mc_key_properties_tl { \l__tag_tmpa_str>~ }
          \lua_now:e
            {
              ltx.__tag.func.store_mc_data
                (
                  \__tag_get_mc_abs_cnt:,"alt","/Alt~<\str_use:N \l__tag_tmpa_str>"
                )
            }
        }
    },
  alttext .meta:n = {alt=#1},
  actualtext .code:n      = % Alt property
    {
      \tl_if_empty:oF{#1}
        {
          \str_set_convert:Noon
            \l__tag_tmpa_str
            { #1 }
            { default }
            { utf16/hex }
          \tl_put_right:Nn \l__tag_mc_key_properties_tl { /Alt~< }
          \tl_put_right:No \l__tag_mc_key_properties_tl { \l__tag_tmpa_str>~ }
          \lua_now:e
            {
              ltx.__tag.func.store_mc_data
                (
                  \__tag_get_mc_abs_cnt:,
                  "actualtext",
                  "/ActualText~<\str_use:N \l__tag_tmpa_str>"
                )
            }
        }
    },
  label .code:n =
    {
      \tl_set:Nn\l__tag_mc_key_label_tl { #1 }
      \lua_now:e
        {
          ltx.__tag.func.store_mc_data
            (
              \__tag_get_mc_abs_cnt:,"label","#1"
            )
        }
    },
  __artifact-store .code:n =
    {
      \lua_now:e
        {
          ltx.__tag.func.store_mc_data
            (
              \__tag_get_mc_abs_cnt:,"artifact","#1"
            )
        }
    },
```

```
    artifact .code:n       =
      {
        \exp_args:Nne
          \keys_set:nn
            { __tag / mc}
            { __artifact-bool, __artifact-type=#1, tag=Artifact }
        \exp_args:Nne
          \keys_set:nn
            { __tag / mc }
            { __artifact-store=\l__tag_mc_artifact_type_tl }
      },
    artifact .default:n    = { notype }
  }

⟨/luamode⟩
```

(*End of definition for* `tag (mc-key)` *and others. These functions are documented on page 71.*)

Part VII
The tagpdf-struct module
Commands to create the structure
Part of the tagpdf package

1 Public Commands

\tag_struct_begin:n `\tag_struct_begin:n{⟨key-values⟩}`
\tag_struct_end: `\tag_struct_end:`
\tag_struct_end:n `\tag_struct_end:n{⟨tag⟩}`

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!

\tag_struct_use:n `\tag_struct_use:n{⟨label⟩}`
\tag_struct_use_num:n `\tag_struct_use_num:n{⟨structure number⟩}`

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.

\tag_struct_object_ref:n `\tag_struct_object_ref:n{⟨struct number⟩}`
\tag_struct_object_ref:e

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{⟨struct_num⟩}`. 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.

\tag_struct_insert_annot:nn `\tag_struct_insert_annot:nn{⟨object reference⟩}{⟨struct parent number⟩}`

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:`.

\tag_struct_parent_int: `\tag_struct_parent_int:`

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

\tag_struct_gput:nnn `\tag_struct_gput:nnn{⟨structure number⟩}{⟨keyword⟩}{⟨value⟩}`

This is a command that allows to update the data of a structure. This often can't done simply by replacing the value, as we have to preserve and extend existing content. We use therefore dedicated functions adjusted to the key in question. 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` which updates the Ref key (an array)

\tag_struct_gput_ref:nnn `\tag_struct_gput_ref:nnn{⟨structure number⟩}{⟨keyword⟩}{⟨value⟩}`

This is an user interface to add a Ref key to an existing structure. The target structure doesn't have to exist yet but can be addressed by label, destname or even num. ⟨*keyword*⟩ is currently either `label`, `dest` or `num`. The value is then either a label name, the name of a destination or a structure number.

2 Public keys

2.1 Keys for the structure commands

tag␣(struct-key) 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 `type/NS`, where `NS` is the shorthand of a declared name space. Currently the names spaces `pdf`, `pdf2`, `mathml` and `user` 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.

stash␣(struct-key) 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.

label␣(struct-key) This key sets a label by which one can refer to the structure. It is e.g. used by `\tag_struct_use:n` (where a real label is actually not needed as you can only use structures already defined), and by the `ref` key (which can refer to future structures). Internally the label name will start with `tagpdfstruct-` and it stores the two attributes `tagstruct` (the structure number) and `tagstructobj` (the object reference).

parent␣(struct-key) 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 `\tag_get:n`, but one can also use a label on the parent structure and then use `\property_ref:nn{tagpdfstruct-label}{tagstruct}` to retrieve it.

title␣(struct-key)
title-o␣(struct-key) This keys allows to set the dictionary entry `/Title` in the structure object. The value is handled as verbatim string and hex encoded. Commands are not expanded. `title-o` will expand the value once.

`alt␣(struct-key)` This key inserts an `/Alt` 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.

`actualtext␣(struct-key)` This key inserts an `/ActualText` 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.

`lang␣(struct-key)` This key allows to set the language for a structure element. The value should be a bcp-identifier, e.g. `de-De`.

`ref␣(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␣(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 sticked to E).

`AF␣(struct-key)`
`AFref␣(struct-key)`
`AFinline␣(struct-key)`
`AFinline-o␣(struct-key)`
`texsource`
`mathml`

`AF` = ⟨*object name*⟩
`AFref` = ⟨*object reference*⟩
`AF-inline` = ⟨*text content*⟩

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.

`texsource` is a special variant of `AF-inline-o` which embeds the file as `.tex` source with the `/AFrelationship` key set to `/Source`. It also sets the `/Desc` key to a (currently) fix text.

`mathml` is a special variant of `AF-inline-o` which embeds the file as `.xml` file with the `/AFrelationship` key set to `/Supplement`. It also sets the `/Desc` key to a (currently) fix text.

The argument of `AF` is an object name referring an embedded file as declared for example with `\pdf_object_new:n` or with the l3pdffile module. `AF` expands its argument (this allows e.g. to use some variable for automatic numbering) and can be used more than once, to associate more than one file.

The argument of `AFref` is an object reference to an embedded file or a variable expanding to such a object reference in the format as you would get e.g. from `\pdf_object_ref_last:` or `\pdf_object_ref:n` (and which is different for the various engines!). The key allows to make use of anonymous objects. Like `AF` the `AFref` key expands its argument and can be used more than once, to associate more than one file. *It does not check if the reference is valid!*

The inline keys can be used only once per structure. Additional calls are ignored.

attribute␣(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␣(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

role/new-attribute␣(setup-key) role/new-attribute = {⟨*name*⟩}{⟨*Content*⟩}
newattribute␣(deprecated)

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
 {
  role/new-attribute =
   {TH-col}{/O /Table /Scope /Column},
  role/new-attribute =
   {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.

```
⟨@@=tag⟩
⟨*header⟩
\ProvidesExplPackage {tagpdf-struct-code} {2024-09-11} {0.99e}
 {part of tagpdf - code related to storing structure}
⟨/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.

```
⟨base⟩\newcounter  { g__tag_struct_abs_int }
⟨base⟩\int_gset:Nn \c@g__tag_struct_abs_int { 1 }
```

(*End of 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.

```
⟨*package⟩
\__tag_seq_new:N  \g__tag_struct_objR_seq
```

(*End of definition for* `\g__tag_struct_objR_seq`.)

`\c__tag_struct_null_tl` In lua mode we have to test if the kids a null

```
\tl_const:Nn\c__tag_struct_null_tl {null}
```

(*End of definition for* `\c__tag_struct_null_tl`.)

`\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 absolute mc num, the value the pdf directory.

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

(*End of 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.

```
\seq_new:N    \g__tag_struct_stack_seq
\seq_gpush:Nn \g__tag_struct_stack_seq {1}
```

(*End of 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.

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

(*End of definition for* `\g__tag_struct_tag_stack_seq`.)

`\g__tag_struct_stack_current_tl`
`\l__tag_struct_stack_parent_tmpa_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.

```
⟨/package⟩
⟨base⟩\tl_new:N  \g__tag_struct_stack_current_tl
⟨base⟩\tl_gset:Nn \g__tag_struct_stack_current_tl {\int_use:N\c@g__tag_struct_abs_int}
⟨*package⟩
\tl_new:N     \l__tag_struct_stack_parent_tmpa_tl
```

(*End of 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_1_prop` for the root and `\g_@@_struct_N_prop`, $N \geq= 2$ 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,lange,alt,E,actualtext)

\c__tag_struct_StructTreeRoot_entries_seq
\c__tag_struct_StructElem_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.

```
\seq_const_from_clist:Nn \c__tag_struct_StructTreeRoot_entries_seq
  {%p. 857/858
    Type,              % always /StructTreeRoot
    K,                 % kid, dictionary or array of dictionaries
    IDTree,            % currently unused
    ParentTree,        % required,obj ref to the parent tree
    ParentTreeNextKey, % optional
    RoleMap,
    ClassMap,
    Namespaces,
    AF                 %pdf 2.0
  }

\seq_const_from_clist:Nn \c__tag_struct_StructElem_entries_seq
  {%p 858 f
    Type,              %always /StructElem
    S,                 %tag/type
    P,                 %parent
    ID,                %optional
    Ref,               %optional, pdf 2.0 Use?
    Pg,                %obj num of starting page, optional
    K,                 %kids
    A,                 %attributes, probably unused
    C,                 %class ""
    %R,                %attribute revision number, irrelevant for us as we
                       % don't update/change existing PDF and (probably)
                       % deprecated in PDF 2.0
    T,                 %title, value in () or <>
    Lang,              %language
    Alt,               % value in () or <>
    E,                 % abbreviation
    ActualText,
    AF,                 %pdf 2.0, array of dict, associated files
    NS,                 %pdf 2.0, dict, namespace
    PhoneticAlphabet,   %pdf 2.0
    Phoneme             %pdf 2.0
  }
```

(*End of definition for* `\c__tag_struct_StructTreeRoot_entries_seq` *and* `\c__tag_struct_StructElem_entries_seq`.)

3.1 Variables used by the keys

\g__tag_struct_tag_tl
\g__tag_struct_tag_NS_tl
\l__tag_struct_roletag_tl
\g__tag_struct_roletag_NS_tl

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

```
\tl_new:N \g__tag_struct_tag_tl
\tl_new:N \g__tag_struct_tag_NS_tl
\tl_new:N \l__tag_struct_roletag_tl
\tl_new:N \l__tag_struct_roletag_NS_tl
```

(*End of definition for* `\g__tag_struct_tag_tl` *and others.*)

`\g__tag_struct_label_num_prop` This will hold for every structure label the associated structure number. The prop will allow to fill the /Ref key directly at the first compilation if the ref key is used.

```
\prop_new_linked:N \g__tag_struct_label_num_prop
```

(*End of definition for* `\g__tag_struct_label_num_prop`.)

`\l__tag_struct_elem_stash_bool` This will keep track of the stash status

```
\bool_new:N \l__tag_struct_elem_stash_bool
```

(*End of definition for* `\l__tag_struct_elem_stash_bool`.)

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.

```
⟨/package⟩
⟨base⟩\prop_new_linked:N \g__tag_struct_dest_num_prop
⟨*package⟩
```

(*End of 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.

```
\prop_new_linked:N \g__tag_struct_ref_by_dest_prop
```

(*End of 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`

```
\cs_new:Npn \__tag_struct_output_prop_aux:nn #1 #2 %#1 num, #2 key
  {
    \prop_if_in:cnT
      { g__tag_struct_#1_prop }
      { #2 }
      {
        \c_space_tl/#2~ \prop_item:cn{ g__tag_struct_#1_prop } { #2 }
```

```
      }
  }

\cs_new_protected:Npn \__tag_new_output_prop_handler:n #1
  {
    \cs_new:cn { __tag_struct_output_prop_#1:n }
      {
        \__tag_struct_output_prop_aux:nn {#1}{##1}
      }
  }
⟨/package⟩
```

(*End of definition for* `\__tag_struct_output_prop_aux:nn` *and* `\__tag_new_output_prop_handler:n`.)

`\__tag_struct_prop_gput:nnn`

The structure props must be filled in various places. For this we use a common command which also takes care of the debug package:

```
⟨*package | debug⟩
⟨package⟩\cs_new_protected:Npn \__tag_struct_prop_gput:nnn #1 #2 #3
⟨debug⟩\cs_set_protected:Npn \__tag_struct_prop_gput:nnn #1 #2 #3
 {
   \__tag_prop_gput:cnn
        { g__tag_struct_#1_prop }{#2}{#3}
⟨debug⟩\prop_gput:cnn { g__tag_struct_debug_#1_prop } {#2} {#3}
 }
\cs_generate_variant:Nn \__tag_struct_prop_gput:nnn {onn,nne,nee,nno}
⟨/package | debug⟩
```

(*End of definition for* `\__tag_struct_prop_gput:nnn`.)

4.1 Initialization of the StructTreeRoot

The first structure element, the StructTreeRoot is special, so created manually. The underlying object is `@@/struct/1` 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.

```
⟨*package⟩
\tl_gset:Nn \g__tag_struct_stack_current_tl {1}
```

`\__tag_pdf_name_e:n`

```
\cs_new:Npn \__tag_pdf_name_e:n #1{\pdf_name_from_unicode_e:n{#1}}
⟨/package⟩
```

(*End of definition for* `\__tag_pdf_name_e:n`.)

`g__tag_struct_1_prop`
`g__tag_struct_kids_1_seq`

```
⟨*package⟩
\__tag_prop_new:c { g__tag_struct_1_prop }
\__tag_new_output_prop_handler:n {1}
\__tag_seq_new:c  { g__tag_struct_kids_1_seq }

\__tag_struct_prop_gput:nne
  { 1 }
  { Type }
```

```
  { \pdf_name_from_unicode_e:n {StructTreeRoot} }

\__tag_struct_prop_gput:nne
  { 1 }
  { S }
  { \pdf_name_from_unicode_e:n {StructTreeRoot} }

\__tag_struct_prop_gput:nne
  { 1 }
  { rolemap }
  { {StructTreeRoot}{pdf} }

\__tag_struct_prop_gput:nne
  { 1 }
  { parentrole }
  { {StructTreeRoot}{pdf} }
```

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

```
\pdf_version_compare:NnF < {2.0}
 {
   \__tag_struct_prop_gput:nne
    { 1 }
    { Namespaces }
    { \pdf_object_ref:n { __tag/tree/namespaces } }
 }
```

⟨/package⟩

In debug mode we have to copy the root manually as it is already setup:

```
⟨debug⟩\prop_new:c { g__tag_struct_debug_1_prop }
⟨debug⟩\seq_new:c  { g__tag_struct_debug_kids_1_seq }
⟨debug⟩\prop_gset_eq:cc { g__tag_struct_debug_1_prop }{ g__tag_struct_1_prop }
⟨debug⟩\prop_gremove:cn { g__tag_struct_debug_1_prop }{Namespaces}
```

(*End of definition for* `g__tag_struct_1_prop` *and* `g__tag_struct_kids_1_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`

```
⟨*package⟩
\cs_new:Npn \__tag_struct_get_id:n #1 %#1=struct num
  {
    (
     ID.
     \prg_replicate:nn
      { \int_abs:n{\g__tag_tree_id_pad_int - \tl_count:e { \int_to_arabic:n { #1 } }} }
      { 0 }
     \int_to_arabic:n { #1 }
    )
  }
```

(*End of definition for* `\__tag_struct_get_id:n`.)

4.3 Filling in the tag info

__tag_struct_set_tag_info:nnn

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

```
\pdf_version_compare:NnTF < {2.0}
 {
   \cs_new_protected:Npn \__tag_struct_set_tag_info:nnn #1 #2 #3
     %#1 structure number, #2 tag, #3 NS
     {
       \__tag_struct_prop_gput:nne
         { #1 }
         { S }
         { \pdf_name_from_unicode_e:n {#2}  } %
     }
 }
 {
   \cs_new_protected:Npn \__tag_struct_set_tag_info:nnn #1 #2 #3
     {
       \__tag_struct_prop_gput:nne
         { #1 }
         { S }
         { \pdf_name_from_unicode_e:n {#2} } %
       \prop_get:NnNT \g__tag_role_NS_prop {#3} \l__tag_get_tmpc_tl
         {
           \__tag_struct_prop_gput:nne
             { #1 }
             { NS }
             { \l__tag_get_tmpc_tl } %
         }
     }
 }
\cs_generate_variant:Nn \__tag_struct_set_tag_info:nnn {eVV}
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_struct_get_parentrole:nNN #1 #2 #3
   %#1 struct num, #2 tlvar for tag , #3 tlvar for NS
    {
       \prop_get:cnNTF
         { g__tag_struct_#1_prop }
         { parentrole }
         \l__tag_get_tmpc_tl
         {
           \tl_set:Ne #2{\exp_last_unbraced:NV\use_i:nn  \l__tag_get_tmpc_tl}
           \tl_set:Ne #3{\exp_last_unbraced:NV\use_ii:nn \l__tag_get_tmpc_tl}
         }
         {
           \tl_clear:N#2
           \tl_clear:N#3
         }
    }
\cs_generate_variant:Nn\__tag_struct_get_parentrole:nNN {eNN}
```

(*End of 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:ne`

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 to 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!

```
\cs_new:Npn \__tag_struct_mcid_dict:n #1 %#1 MCID absnum
  {
     <<
      /Type \c_space_tl /MCR \c_space_tl
      /Pg
        \c_space_tl
      \pdf_pageobject_ref:n { \property_ref:enn{mcid-#1}{tagabspage}{1} }
       /MCID \c_space_tl \property_ref:enn{mcid-#1}{tagmcid}{1}
     >>
  }
⟨/package⟩
⟨*package | debug⟩
⟨package⟩\cs_new_protected:Npn \__tag_struct_kid_mc_gput_right:nn #1 #2 %#1 structure num, #2
⟨debug⟩\cs_set_protected:Npn \__tag_struct_kid_mc_gput_right:nn #1 #2 %#1 structure num, #2 M
  {
    \__tag_seq_gput_right:ce
      { g__tag_struct_kids_#1_seq }
      {
        \__tag_struct_mcid_dict:n {#2}
      }
⟨debug⟩    \seq_gput_right:cn
⟨debug⟩      { g__tag_struct_debug_kids_#1_seq }
⟨debug⟩      {
⟨debug⟩        MC~#2
⟨debug⟩      }
    \__tag_seq_gput_right:cn
      { g__tag_struct_kids_#1_seq }
      {
        \prop_item:Nn \g__tag_struct_cont_mc_prop {#2}
      }
  }
⟨package⟩\cs_generate_variant:Nn \__tag_struct_kid_mc_gput_right:nn {ne}
```

(*End of definition for* `\__tag_struct_kid_mc_gput_right:nn`.)

`\__tag_struct_kid_struct_gput_right:nn`
`\__tag_struct_kid_struct_gput_right:ee`

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

```
⟨package⟩\cs_new_protected:Npn\__tag_struct_kid_struct_gput_right:nn #1 #2 %#1 num of parent s
```

```
⟨debug⟩\cs_set_protected:Npn\__tag_struct_kid_struct_gput_right:nn #1 #2 %#1 num of parent st
  {
    \__tag_seq_gput_right:ce
      { g__tag_struct_kids_#1_seq }
      {
        \pdf_object_ref_indexed:nn { __tag/struct }{ #2 }
      }
⟨debug⟩    \seq_gput_right:cn
⟨debug⟩      { g__tag_struct_debug_kids_#1_seq }
⟨debug⟩      {
⟨debug⟩        Struct~#2
⟨debug⟩      }
  }

⟨package⟩\cs_generate_variant:Nn \__tag_struct_kid_struct_gput_right:nn {ee}
```

(*End of definition for* `\__tag_struct_kid_struct_gput_right:nn`.)

`\__tag_struct_kid_OBJR_gput_right:nnn`
`\__tag_struct_kid_OBJR_gput_right:eee`

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

```
⟨package⟩\cs_new_protected:Npn\__tag_struct_kid_OBJR_gput_right:nnn #1 #2 #3 %#1 num of parent
⟨package⟩                                                          %#2 obj reference
⟨package⟩                                                          %#3 page object referenc
⟨debug⟩\cs_set_protected:Npn\__tag_struct_kid_OBJR_gput_right:nnn #1 #2 #3
  {
    \pdf_object_unnamed_write:nn
      { dict }
      {
        /Type/OBJR/Obj~#2/Pg~#3
      }
    \__tag_seq_gput_right:ce
      { g__tag_struct_kids_#1_seq }
      {
        \pdf_object_ref_last:
      }
⟨debug⟩    \seq_gput_right:ce
⟨debug⟩      { g__tag_struct_debug_kids_#1_seq }
⟨debug⟩      {
⟨debug⟩        OBJR~reference
⟨debug⟩      }
  }
⟨/package | debug⟩
⟨*package⟩
\cs_generate_variant:Nn\__tag_struct_kid_OBJR_gput_right:nnn { eee }
```

(*End of 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. Change 2024-03-19: don't use a regex - that is slow.

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

```
    \seq_gpop_left:NN #1 \l__tag_tmpa_tl
    \tl_replace_once:Nnn \l__tag_tmpa_tl
     {\__tag_mc_insert_mcid_kids:n}
     {\__tag_mc_insert_mcid_single_kids:n}
    \seq_gput_left:NV #1 \l__tag_tmpa_tl
  }

\cs_generate_variant:Nn\__tag_struct_exchange_kid_command:N { c }
```

(*End of 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.

```
\cs_new_protected:Npn \__tag_struct_fill_kid_key:n #1 %#1 is the struct num
  {
    \bool_if:NF\g__tag_mode_lua_bool
     {
        \seq_clear:N \l__tag_tmpa_seq
        \seq_map_inline:cn { g__tag_struct_kids_#1_seq }
         { \seq_put_right:Ne \l__tag_tmpa_seq { ##1 } }
        %\seq_show:c { g__tag_struct_kids_#1_seq }
        %\seq_show:N \l__tag_tmpa_seq
        \seq_remove_all:Nn \l__tag_tmpa_seq {}
        %\seq_show:N \l__tag_tmpa_seq
        \seq_gset_eq:cN { g__tag_struct_kids_#1_seq } \l__tag_tmpa_seq
     }

    \int_case:nnF
      {
        \seq_count:c
          {
            g__tag_struct_kids_#1_seq
          }
       }
       {
         { 0 }
          { } %no kids, do nothing
         { 1 } % 1 kid, insert
          {
            % in this case we need a special command in
            % luamode to get the array right. See issue #13
            \bool_if:NTF\g__tag_mode_lua_bool
              {
                \__tag_struct_exchange_kid_command:c
                 {g__tag_struct_kids_#1_seq}
```

check if we get null

```
                \tl_set:Ne\l__tag_tmpa_tl
                  {\use:e{\seq_item:cn {g__tag_struct_kids_#1_seq} {1}}}
                \tl_if_eq:NNF\l__tag_tmpa_tl \c__tag_struct_null_tl
                  {
                    \__tag_struct_prop_gput:nne
                      {#1}
                      {K}
```

```
                    {
                      \seq_item:cn
                        {
                          g__tag_struct_kids_#1_seq
                        }
                        {1}
                    }
                }
            }
            {
              \__tag_struct_prop_gput:nne
                {#1}
                {K}
                {
                  \seq_item:cn
                    {
                      g__tag_struct_kids_#1_seq
                    }
                    {1}
                }
            }
        } %
    }
    { %many kids, use an array
      \__tag_struct_prop_gput:nne
        {#1}
        {K}
        {
          [
            \seq_use:cn
              {
                g__tag_struct_kids_#1_seq
              }
              {
                \c_space_tl
              }
          ]
        }
    }
}

```

(*End of 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. This is used a lot so should be rather fast.

```
\cs_new_protected:Npn \__tag_struct_get_dict_content:nN #1 #2 %#1: structure num
  {
    \tl_clear:N #2
    \prop_map_inline:cn { g__tag_struct_#1_prop }
      {
```

Some keys needs the option to format the value, e.g. add brackets for an array, we also need the option to ignore some entries in the properties.

```
        \cs_if_exist_use:cTF {__tag_struct_format_##1:nnN}
          {
            {##1}{##2}#2
          }
          {
            \tl_put_right:Ne #2 { \c_space_tl/##1~##2 }
          }
      }
  }
```

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

`\__tag_struct_format_rolemap:nnN` `\__tag_struct_format_parentrole:nnN`

This two entries should not end in the PDF.

```
\cs_new:Nn\__tag_struct_format_rolemap:nnN{}
\cs_new:Nn\__tag_struct_format_parentrole:nnN{}
```

(*End of definition for* `\__tag_struct_format_rolemap:nnN` *and* `\__tag_struct_format_parentrole:nnN`.)

`\__tag_struct_format_Ref:nnN`

Ref is an array, we store values as a clist of commands that must be executed here, the formatting has to add also brackets.

```
\cs_new_protected:Nn\__tag_struct_format_Ref:nnN
  {
    \tl_put_right:Nn #3 { ~/#1~[ } %]
    \clist_map_inline:nn{ #2 }
     {
       ##1 #3
     }
    \tl_put_right:Nn #3
     { %[
      \c_space_tl]
     }
  }
```

(*End of definition for* `\__tag_struct_format_Ref:nnN`.)

`\__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.

```
\cs_new_protected:Npn \__tag_struct_write_obj:n #1 % #1 is the struct num
  {
    \prop_if_exist:cTF { g__tag_struct_#1_prop }
      {
```

It can happen that a structure is not used and so has not parent. Simply ignoring it is problematic as it is also recorded in the IDTree, so we make an artifact out of it.

```
        \prop_get:cnNF { g__tag_struct_#1_prop } {P}\l__tag_tmpb_tl
          {
            \prop_gput:cne { g__tag_struct_#1_prop } {P}{\pdf_object_ref_indexed:nn { __tag/s
            \prop_gput:cne { g__tag_struct_#1_prop } {S}{/Artifact}
            \seq_if_empty:cF {g__tag_struct_kids_#1_seq}
              {
                \msg_warning:nnee
                  {tag}
```

```
                    {struct-orphan}
                    { #1 }
                    {\seq_count:c{g__tag_struct_kids_#1_seq}}
                }
            }
          \__tag_struct_fill_kid_key:n { #1 }
          \__tag_struct_get_dict_content:nN { #1 } \l__tag_tmpa_tl
          \pdf_object_write_indexed:nnne
             { __tag/struct }{ #1 }
             {dict}
             {
               \l__tag_tmpa_tl\c_space_tl
               /ID~\__tag_struct_get_id:n{#1}
             }

        }
        {
          \msg_error:nnn { tag } { struct-no-objnum } { #1}
        }
    }
```

(*End of 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

```
        \tag_struct_begin:n { tag=Link }
        \tag_mc_begin:n { tag=Link }
(1)     \pdfannot_dict_put:nne
          { 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:
```

```
\cs_new_protected:Npn \__tag_struct_insert_annot:nn #1 #2 %#1 object reference to the annotat
                                                        %#2 structparent number
  {
    \bool_if:NT \g__tag_active_struct_bool
      {
        %get the number of the parent structure:
        \seq_get:NNF
          \g__tag_struct_stack_seq
          \l__tag_struct_stack_parent_tmpa_tl
```

```
424           {
425             \msg_error:nn { tag } { struct-faulty-nesting }
426           }
427         %put the obj number of the annot in the kid entry, this also creates
428         %the OBJR object
429         \__tag_property_record:nn {@tag@objr@page@#2 }{ tagabspage }
430         \__tag_struct_kid_OBJR_gput_right:eee
431           {
432             \l__tag_struct_stack_parent_tmpa_tl
433           }
434           {
435             #1 %
436           }
437           {
438             \pdf_pageobject_ref:n { \property_ref:nnn {@tag@objr@page@#2 }{ tagabspage }{1} }
439           }
440         % add the parent obj number to the parent tree:
441         \exp_args:Nne
442         \__tag_parenttree_add_objr:nn
443           {
444             #2
445           }
446           {
447             \pdf_object_ref_indexed:nn { __tag/struct }{ \l__tag_struct_stack_parent_tmpa_tl
448           }
449         % increase the int:
450         \int_gincr:N \c@g__tag_parenttree_obj_int
451       }
452   }
```

(*End of 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`.

```
453 \cs_new:Npn \__tag_get_data_struct_tag:
454   {
455     \exp_args:Ne
456     \tl_tail:n
457      {
458        \prop_item:cn {g__tag_struct_\g__tag_struct_stack_current_tl _prop}{S}
459      }
460   }
```

(*End of 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`.

```
461 \cs_new:Npn \__tag_get_data_struct_id:
462   {
463     \__tag_struct_get_id:n {\g__tag_struct_stack_current_tl}
464   }
465 ⟨/package⟩
```

(*End of 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

```
⟨*base⟩
\cs_new:Npn \__tag_get_data_struct_num:
  {
    \g__tag_struct_stack_current_tl
  }
⟨/base⟩
```

(*End of definition for* __tag_get_data_struct_num:.)

__tag_get_data_struct_counter: this command allows \tag_get:n to get the current state of the structure counter with the keyword struct_counter. By comparing the numbers it can be used to check the number of structure commands in a piece of code.

```
⟨*base⟩
\cs_new:Npn \__tag_get_data_struct_counter:
  {
    \int_use:N \c@g__tag_struct_abs_int
  }
⟨/base⟩
```

(*End of definition for* __tag_get_data_struct_counter:.)

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.

This socket is used by the tag key. It allows to switch between the latex-tabs and the standard tags.

```
⟨*package⟩
\socket_new:nn { tag/struct/tag }{1}
\socket_new_plug:nnn { tag/struct/tag }{ latex-tags }
 {
   \seq_set_split:Nne \l__tag_tmpa_seq { / } {#1/\prop_item:Ne\g__tag_role_tags_NS_prop{#1}}
   \tl_gset:Ne \g__tag_struct_tag_tl   { \seq_item:Nn\l__tag_tmpa_seq {1} }
   \tl_gset:Ne \g__tag_struct_tag_NS_tl{ \seq_item:Nn\l__tag_tmpa_seq {2} }
   \__tag_check_structure_tag:N \g__tag_struct_tag_tl
 }

\socket_new_plug:nnn { tag/struct/tag }{ pdf-tags }
 {
   \seq_set_split:Nne \l__tag_tmpa_seq { / } {#1/\prop_item:Ne\g__tag_role_tags_NS_prop{#1}}
   \tl_gset:Ne \g__tag_struct_tag_tl   { \seq_item:Nn\l__tag_tmpa_seq {1} }
   \tl_gset:Ne \g__tag_struct_tag_NS_tl{ \seq_item:Nn\l__tag_tmpa_seq {2} }
   \__tag_role_get:VVNN \g__tag_struct_tag_tl\g__tag_struct_tag_NS_tl\l__tag_tmpa_tl\l__tag_t
   \tl_gset:Ne \g__tag_struct_tag_tl {\l__tag_tmpa_tl}
   \tl_gset:Ne \g__tag_struct_tag_NS_tl{\l__tag_tmpb_tl}
   \__tag_check_structure_tag:N \g__tag_struct_tag_tl
 }
\socket_assign_plug:nn { tag/struct/tag } {latex-tags}
```

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)

```
\keys_define:nn { __tag / struct }
  {
    label .code:n        =
      {
        \prop_gput:Nee\g__tag_struct_label_num_prop
          {#1}{\int_use:N \c@g__tag_struct_abs_int}
        \__tag_property_record:eV
          {tagpdfstruct-#1}
          \c__tag_property_struct_clist
      },
    stash .bool_set:N    = \l__tag_struct_elem_stash_bool,
    parent .code:n       =
      {
        \bool_lazy_and:nnTF
          {
            \prop_if_exist_p:c { g__tag_struct_\int_eval:n {#1}_prop }
          }
          {
            \int_compare_p:nNn {#1}<{\c@g__tag_struct_abs_int}
          }
          { \tl_set:Ne \l__tag_struct_stack_parent_tmpa_tl { \int_eval:n {#1} } }
          {
            \msg_warning:nnee { tag } { struct-unknown }
              { \int_eval:n {#1} }
              { parent~key~ignored }
          }
      },
    parent .default:n    = {-1},
    tag    .code:n       = % S property
      {
        \socket_use:nn { tag/struct/tag }{#1}
      },
    title .code:n        = % T property
      {
        \str_set_convert:Nnnn
          \l__tag_tmpa_str
          { #1 }
          { default }
          { utf16/hex }
        \__tag_struct_prop_gput:nne
          { \int_use:N \c@g__tag_struct_abs_int }
          { T }
          { <\l__tag_tmpa_str> }
      },
    title-o .code:n        = % T property
      {
        \str_set_convert:Nonn
          \l__tag_tmpa_str
          { #1 }
          { default }
          { utf16/hex }
        \__tag_struct_prop_gput:nne
          { \int_use:N \c@g__tag_struct_abs_int }
```

```
          { T }
          { <\l__tag_tmpa_str> }
      },
    alt .code:n      = % Alt property
      {
       \tl_if_empty:oF{#1}
         {
          \str_set_convert:Noon
            \l__tag_tmpa_str
            { #1 }
            { default }
            { utf16/hex }
          \__tag_struct_prop_gput:nne
            { \int_use:N \c@g__tag_struct_abs_int }
            { Alt }
            { <\l__tag_tmpa_str> }
         }
      },
    alttext .meta:n = {alt=#1},
    actualtext .code:n  = % ActualText property
      {
        \tl_if_empty:oF{#1}
          {
           \str_set_convert:Noon
             \l__tag_tmpa_str
             { #1 }
             { default }
             { utf16/hex }
           \__tag_struct_prop_gput:nne
             { \int_use:N \c@g__tag_struct_abs_int }
             { ActualText }
             { <\l__tag_tmpa_str>}
          }
      },
    lang .code:n        = % Lang property
      {
        \__tag_struct_prop_gput:nne
          { \int_use:N \c@g__tag_struct_abs_int }
          { Lang }
          { (#1) }
      },
    }
```

Ref is rather special as it values are often known only at the end of the document. It therefore stores it values as clist of commands which are executed at the end of the document, when the structure elements are written.

this commands are helper commands that are stored as clist in the Ref key of a structure. They are executed when the structure elements are written in `\__tag_struct_write_obj`. They are used in `\__tag_struct_format_Ref`. They allow to add a Ref by object reference, label, destname and structure number

```
\cs_new_protected:Npn \__tag_struct_Ref_obj:nN #1 #2 %#1 a object reference
  {
    \tl_put_right:Ne#2
```


__tag_struct_Ref_obj:nN
__tag_struct_Ref_label:nN
__tag_struct_Ref_dest:nN
__tag_struct_Ref_num:nN

```
      {
        \c_space_tl#1
      }
  }

\cs_new_protected:Npn \__tag_struct_Ref_label:nN #1 #2 %#1 a label
  {
    \prop_get:NnNTF \g__tag_struct_label_num_prop {#1} \l__tag_tmpb_tl
      {
        \tl_put_right:Ne#2
          {
            \c_space_tl\tag_struct_object_ref:e{ \l__tag_tmpb_tl }
          }
      }
      {
        \msg_warning:nnn {tag}{struct-Ref-unknown}{Label~'#1'}
      }
  }
\cs_new_protected:Npn \__tag_struct_Ref_dest:nN #1 #2 %#1 a dest name
  {
    \prop_get:NnNTF \g__tag_struct_dest_num_prop {#1} \l__tag_tmpb_tl
      {
        \tl_put_right:Ne#2
          {
            \c_space_tl\tag_struct_object_ref:e{ \l__tag_tmpb_tl }
          }
      }
      {
        \msg_warning:nnn {tag}{struct-Ref-unknown}{Destination~'#1'}
      }
  }
\cs_new_protected:Npn \__tag_struct_Ref_num:nN #1 #2 %#1 a structure number
  {
    \tl_put_right:Ne#2
      {
        \c_space_tl\tag_struct_object_ref:e{ #1 }
      }
  }


\keys_define:nn { __tag / struct }
  {
    ref .code:n        = % ref property
      {
        \clist_map_inline:on {#1}
          {
            \tag_struct_gput:nne
              {\int_use:N \c@g__tag_struct_abs_int}{ref_label}{ ##1 }
          }
      },
    E .code:n        = % E property
      {
        \str_set_convert:Nnon
          \l__tag_tmpa_str
          { #1 }
```

```
          { default }
          { utf16/hex }
        \__tag_struct_prop_gput:nne
          { \int_use:N \c@g__tag_struct_abs_int }
          { E }
          { <\l__tag_tmpa_str> }
      },
  }
```

(*End of definition for* `label (struct-key)` *and others. These functions are documented on page 101.*)

`AF␣(struct-key)`
`AFref␣(struct-key)`
`AFinline␣(struct-key)`
`AFinline-o␣(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/AFref 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

```
\int_new:N\g__tag_struct_AFobj_int
```

`\g__tag_struct_AFobj_int`

```
\cs_generate_variant:Nn \pdffile_embed_stream:nnN {neN}
\cs_new_protected:Npn \__tag_struct_add_inline_AF:nn #1 #2
% #1 content, #2 extension
 {
   \tl_if_empty:nF{#1}
     {
      \group_begin:
      \int_gincr:N \g__tag_struct_AFobj_int
      \pdffile_embed_stream:neN
        {#1}
        {tag-AFfile\int_use:N\g__tag_struct_AFobj_int.#2}
        \l__tag_tmpa_tl
        \__tag_struct_add_AF:ee
          { \int_use:N \c@g__tag_struct_abs_int }
          { \l__tag_tmpa_tl }
        \__tag_struct_prop_gput:nne
          { \int_use:N \c@g__tag_struct_abs_int }
          { AF }
          {
            [
              \tl_use:c
               { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_AF_tl }
            ]
          }
      \group_end:
     }
 }

\cs_generate_variant:Nn \__tag_struct_add_inline_AF:nn {on}
\cs_new_protected:Npn \__tag_struct_add_AF:nn #1 #2 % #1 struct num #2 object reference
  {
     \tl_if_exist:cTF
       {
```

```
          g__tag_struct_#1_AF_tl
        }
        {
          \tl_gput_right:ce
            { g__tag_struct_#1_AF_tl }
            {  \c_space_tl #2 }
        }
        {
           \tl_new:c
             { g__tag_struct_#1_AF_tl }
           \tl_gset:ce
             { g__tag_struct_#1_AF_tl }
             { #2 }
        }
  }
\cs_generate_variant:Nn \__tag_struct_add_AF:nn {en,ee}
\keys_define:nn { __tag / struct }
 {
    AF .code:n        = % AF property
      {
        \pdf_object_if_exist:eTF {#1}
          {
            \__tag_struct_add_AF:ee { \int_use:N \c@g__tag_struct_abs_int }{\pdf_object_ref:e
            \__tag_struct_prop_gput:nne
             { \int_use:N \c@g__tag_struct_abs_int }
             { AF }
             {
               [
                 \tl_use:c
                   { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_AF_tl }
               ]
             }
          }
          {
             % message?
          }
      },
    AFref .code:n        = % AF property
      {
        \tl_if_empty:eF {#1}
         {
           \__tag_struct_add_AF:ee { \int_use:N \c@g__tag_struct_abs_int }{#1}
           \__tag_struct_prop_gput:nne
             { \int_use:N \c@g__tag_struct_abs_int }
             { AF }
             {
               [
                 \tl_use:c
                 { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_AF_tl }
               ]
             }
         }
      },
   ,AFinline .code:n =
```

```
    {
      \__tag_struct_add_inline_AF:nn {#1}{txt}
    }
  ,AFinline-o .code:n =
    {
      \__tag_struct_add_inline_AF:on {#1}{txt}
    }
  ,texsource .code:n =
   {
     \group_begin:
     \pdfdict_put:nnn { l_pdffile/Filespec } {Desc}{(TeX~source)}
     \pdfdict_put:nnn { l_pdffile/Filespec }{AFRelationship} { /Source }
     \__tag_struct_add_inline_AF:on {#1}{tex}
     \group_end:
   }
  ,mathml .code:n =
    {
     \group_begin:
     \pdfdict_put:nnn { l_pdffile/Filespec } {Desc}{(mathml~representation)}
     \pdfdict_put:nnn { l_pdffile/Filespec }{AFRelationship} { /Supplement }
     \__tag_struct_add_inline_AF:on {#1}{xml}
     \group_end:
    }
}
```

(*End of definition for* `AF (struct-key)` *and others. These functions are documented on page 102.*)

`root-AF␣(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!

```
\keys_define:nn { __tag / setup }
  {
    root-AF .code:n =
     {
        \pdf_object_if_exist:nTF {#1}
          {
            \__tag_struct_add_AF:ee { 1 }{\pdf_object_ref:n {#1}}
            \__tag_struct_prop_gput:nne
             { 1 }
             { AF }
             {
               [
                 \tl_use:c
                   { g__tag_struct_1_AF_tl }
               ]
             }
          }
          {

          }
      },
  }
```

(*End of definition for* `root-AF (setup-key)`*. This function is documented on page 103.*)

6 User commands

We allow to set a language by default

\l__tag_struct_lang_tl

```
\tl_new:N \l__tag_struct_lang_tl
⟨/package⟩
```

(*End of definition for* \l__tag_struct_lang_tl.)

\tag_struct_begin:n
\tag_struct_end:

```
⟨base⟩\cs_new_protected:Npn \tag_struct_begin:n #1 {\int_gincr:N \c@g__tag_struct_abs_int}
⟨base⟩\cs_new_protected:Npn \tag_struct_end:{}
⟨base⟩\cs_new_protected:Npn \tag_struct_end:n{}
⟨*package | debug⟩
⟨package⟩\cs_set_protected:Npn \tag_struct_begin:n #1 %#1 key-val
⟨debug⟩\cs_set_protected:Npn \tag_struct_begin:n #1 %#1 key-val
  {
⟨package⟩\__tag_check_if_active_struct:T
⟨debug⟩\__tag_check_if_active_struct:TF
      {
        \group_begin:
        \int_gincr:N \c@g__tag_struct_abs_int
        \__tag_prop_new:c  { g__tag_struct_\int_eval:n { \c@g__tag_struct_abs_int }_prop }
⟨debug⟩         \prop_new:c { g__tag_struct_debug_\int_eval:n {\c@g__tag_struct_abs_int}_prop
        \__tag_new_output_prop_handler:n {\int_eval:n { \c@g__tag_struct_abs_int }}
        \__tag_seq_new:c  { g__tag_struct_kids_\int_eval:n { \c@g__tag_struct_abs_int }_seq}
⟨debug⟩         \seq_new:c { g__tag_struct_debug_kids_\int_eval:n {\c@g__tag_struct_abs_int}_
          \pdf_object_new_indexed:nn { __tag/struct }
            { \c@g__tag_struct_abs_int }
          \__tag_struct_prop_gput:nnn
            { \int_use:N \c@g__tag_struct_abs_int }
            { Type }
            { /StructElem }
          \tl_if_empty:NF \l__tag_struct_lang_tl
            {
              \__tag_struct_prop_gput:nne
               { \int_use:N \c@g__tag_struct_abs_int }
               { Lang }
               { (\l__tag_struct_lang_tl) }
            }
          \__tag_struct_prop_gput:nnn
            { \int_use:N \c@g__tag_struct_abs_int }
            { Type }
            { /StructElem }

        \tl_set:Nn \l__tag_struct_stack_parent_tmpa_tl {-1}
        \keys_set:nn { __tag / struct} { #1 }
        \__tag_struct_set_tag_info:eVV
          { \int_use:N \c@g__tag_struct_abs_int }
           \g__tag_struct_tag_tl
           \g__tag_struct_tag_NS_tl
        \__tag_check_structure_has_tag:n { \int_use:N \c@g__tag_struct_abs_int }
```

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

```
\int_compare:nNnT { \l__tag_struct_stack_parent_tmpa_tl } = { -1 }
  {
    \seq_get:NNF
      \g__tag_struct_stack_seq
      \l__tag_struct_stack_parent_tmpa_tl
      {
        \msg_error:nn { tag } { struct-faulty-nesting }
      }
  }
\seq_gpush:NV \g__tag_struct_stack_seq        \c@g__tag_struct_abs_int
\__tag_role_get:VVNN
  \g__tag_struct_tag_tl
  \g__tag_struct_tag_NS_tl
  \l__tag_struct_roletag_tl
  \l__tag_struct_roletag_NS_tl
```

to target role and role NS

```
 \__tag_struct_prop_gput:nne
   { \int_use:N \c@g__tag_struct_abs_int }
   { rolemap }
   {
     {\l__tag_struct_roletag_tl}{\l__tag_struct_roletag_NS_tl}
   }
```

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!

```
\str_case:VnTF \l__tag_struct_roletag_tl
 {
   {Part} {}
   {Div}  {}
   {NonStruct} {}
 }
 {
   \prop_get:cnNT
    { g__tag_struct_ \l__tag_struct_stack_parent_tmpa_tl _prop }
    { parentrole }
    \l__tag_get_tmpc_tl
    {
      \__tag_struct_prop_gput:nno
        { \int_use:N \c@g__tag_struct_abs_int }
        { parentrole }
        {
          \l__tag_get_tmpc_tl
        }
    }
 }
 {
    \__tag_struct_prop_gput:nne
      { \int_use:N \c@g__tag_struct_abs_int }
      { parentrole }
      {
```

```
883                 {\l__tag_struct_roletag_tl}{\l__tag_struct_roletag_NS_tl}
884               }
885           }
886         \seq_gpush:Ne \g__tag_struct_tag_stack_seq
887           {{\g__tag_struct_tag_tl}{\l__tag_struct_roletag_tl}}
888         \tl_gset:NV   \g__tag_struct_stack_current_tl \c@g__tag_struct_abs_int
889         %\seq_show:N   \g__tag_struct_stack_seq
890         \bool_if:NF
891           \l__tag_struct_elem_stash_bool
892           {
```

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!

```
893             \__tag_struct_get_parentrole:eNN
894               {\l__tag_struct_stack_parent_tmpa_tl}
895               \l__tag_get_parent_tmpa_tl
896               \l__tag_get_parent_tmpb_tl
897             \__tag_check_parent_child:VVVVN
898               \l__tag_get_parent_tmpa_tl
899               \l__tag_get_parent_tmpb_tl
900               \g__tag_struct_tag_tl
901               \g__tag_struct_tag_NS_tl
902               \l__tag_parent_child_check_tl
903             \int_compare:nNnT {\l__tag_parent_child_check_tl}<0
904               {
905                 \prop_get:cnN
906                   { g__tag_struct_ \l__tag_struct_stack_parent_tmpa_tl _prop}
907                   {S}
908                   \l__tag_tmpa_tl
909                 \quark_if_no_value:NT\l__tag_tmpa_tl{\tl_set:Nn \l__tag_tmpa_tl{UNKNOWN}}
910                 \msg_warning:nneee
911                  { tag }
912                  {role-parent-child}
913                  { \l__tag_get_parent_tmpa_tl/\l__tag_get_parent_tmpb_tl }
914                  { \g__tag_struct_tag_tl/\g__tag_struct_tag_NS_tl  }
915                  { not~allowed~
916                    (struct~\l__tag_struct_stack_parent_tmpa_tl,~\l__tag_tmpa_tl
917                     \c_space_tl-->~struct~\int_eval:n {\c@g__tag_struct_abs_int})
918                  }
919                 \cs_set_eq:NN \l__tag_role_remap_tag_tl \g__tag_struct_tag_tl
920                 \cs_set_eq:NN \l__tag_role_remap_NS_tl \g__tag_struct_tag_NS_tl
921                 \__tag_role_remap:
922                 \cs_gset_eq:NN \g__tag_struct_tag_tl \l__tag_role_remap_tag_tl
923                 \cs_gset_eq:NN  \g__tag_struct_tag_NS_tl \l__tag_role_remap_NS_tl
924                 \__tag_struct_set_tag_info:eVV
925                   { \int_use:N \c@g__tag_struct_abs_int }
926                     \g__tag_struct_tag_tl
927                     \g__tag_struct_tag_NS_tl
928               }
```

Set the Parent.

```
929              \__tag_struct_prop_gput:nne
930               { \int_use:N \c@g__tag_struct_abs_int }
```

```
              { P }
              {
                \pdf_object_ref_indexed:nn { __tag/struct} { \l__tag_struct_stack_parent_tmpa
              }
            %record this structure as kid:
            %\tl_show:N \g__tag_struct_stack_current_tl
            %\tl_show:N \l__tag_struct_stack_parent_tmpa_tl
            \__tag_struct_kid_struct_gput_right:ee
               { \l__tag_struct_stack_parent_tmpa_tl }
               { \g__tag_struct_stack_current_tl }
            %\prop_show:c { g__tag_struct_\g__tag_struct_stack_current_tl _prop }
            %\seq_show:c {g__tag_struct_kids_\l__tag_struct_stack_parent_tmpa_tl _seq}
          }
```

the debug mode stores in second prop and replaces value with more suitable ones. (If the structure is updated later this gets perhaps lost, but well ...) This must be done outside of the stash boolean.

```
⟨debug⟩            \prop_gset_eq:cc
⟨debug⟩              { g__tag_struct_debug_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
⟨debug⟩              { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
⟨debug⟩            \prop_gput:cne
⟨debug⟩              { g__tag_struct_debug_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
⟨debug⟩              { P }
⟨debug⟩              {
⟨debug⟩                \bool_if:NTF \l__tag_struct_elem_stash_bool
⟨debug⟩                  {no~parent:~stashed}
⟨debug⟩                  {
⟨debug⟩                    parent~structure:~\l__tag_struct_stack_parent_tmpa_tl\c_space_tl =~
⟨debug⟩                     \prop_item:cn{ g__tag_struct_\l__tag_struct_stack_parent_tmpa_tl _p
⟨debug⟩                  }
⟨debug⟩              }
⟨debug⟩            \prop_gput:cne
⟨debug⟩              { g__tag_struct_debug_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
⟨debug⟩              { NS }
⟨debug⟩              { \g__tag_struct_tag_NS_tl }
          %\prop_show:c { g__tag_struct_\g__tag_struct_stack_current_tl _prop }
          %\seq_show:c {g__tag_struct_kids_\l__tag_struct_stack_parent_tmpa_tl _seq}
⟨debug⟩   \__tag_debug_struct_begin_insert:n { #1 }
          \group_end:
      }
⟨debug⟩{ \__tag_debug_struct_begin_ignore:n { #1 }}
  }
⟨package⟩\cs_set_protected:Nn \tag_struct_end:
⟨debug⟩\cs_set_protected:Nn \tag_struct_end:
  { %take the current structure num from the stack:
    %the objects are written later, lua mode hasn't all needed info yet
    %\seq_show:N \g__tag_struct_stack_seq
⟨package⟩\__tag_check_if_active_struct:T
⟨debug⟩\__tag_check_if_active_struct:TF
      {
        \seq_gpop:NN   \g__tag_struct_tag_stack_seq \l__tag_tmpa_tl
        \seq_gpop:NNTF \g__tag_struct_stack_seq \l__tag_tmpa_tl
          {
```

```
            \__tag_check_info_closing_struct:o { \g__tag_struct_stack_current_tl }
          }
          { \__tag_check_no_open_struct: }
        % get the previous one, shouldn't be empty as the root should be there
        \seq_get:NNTF \g__tag_struct_stack_seq \l__tag_tmpa_tl
          {
            \tl_gset:NV   \g__tag_struct_stack_current_tl \l__tag_tmpa_tl
          }
          {
            \__tag_check_no_open_struct:
          }
       \seq_get:NNT \g__tag_struct_tag_stack_seq \l__tag_tmpa_tl
          {
            \tl_gset:Ne \g__tag_struct_tag_tl
              { \exp_last_unbraced:NV\use_i:nn \l__tag_tmpa_tl }
            \prop_get:NVNT\g__tag_role_tags_NS_prop \g__tag_struct_tag_tl\l__tag_tmpa_tl
             {
               \tl_gset:Ne \g__tag_struct_tag_NS_tl { \l__tag_tmpa_tl }
             }
          }
⟨debug⟩\__tag_debug_struct_end_insert:
      }
⟨debug⟩{\__tag_debug_struct_end_ignore:}
  }

\cs_set_protected:Npn \tag_struct_end:n #1
 {
⟨debug⟩    \__tag_check_if_active_struct:T{\__tag_debug_struct_end_check:n{#1}}
   \tag_struct_end:
 }
⟨/package | debug⟩
```

(*End of definition for* `\tag_struct_begin:n` *and* `\tag_struct_end:`*. These functions are documented on page 100.*)

`\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.

```
⟨base⟩\cs_new_protected:Npn \tag_struct_use:n #1 {}
⟨*package | debug⟩
\cs_set_protected:Npn \tag_struct_use:n #1 %#1 is the label
  {
    \__tag_check_if_active_struct:T
      {
        \prop_if_exist:cTF
          { g__tag_struct_\property_ref:enn{tagpdfstruct-#1}{tagstruct}{unknown}_prop } %
          {
            \__tag_check_struct_used:n {#1}
            %add the label structure as kid to the current structure (can be the root)
            \__tag_struct_kid_struct_gput_right:ee
              { \g__tag_struct_stack_current_tl }
              { \property_ref:enn{tagpdfstruct-#1}{tagstruct}{1} }
            %add the current structure to the labeled one as parents
            \__tag_prop_gput:cne
              { g__tag_struct_\property_ref:enn{tagpdfstruct-#1}{tagstruct}{1}_prop }
```

```
                { P }
                {
                  \pdf_object_ref_indexed:nn { __tag/struct } { \g__tag_struct_stack_current_tl
                }
```

debug code

```
⟨debug⟩           \prop_gput:cne
⟨debug⟩             { g__tag_struct_debug_\property_ref:enn{tagpdfstruct-#1}{tagstruct}{1}_pr
⟨debug⟩             { P }
⟨debug⟩             {
⟨debug⟩               parent~structure:~\g__tag_struct_stack_current_tl\c_space_tl=~
⟨debug⟩               \g__tag_struct_tag_tl
⟨debug⟩             }
```

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:

```
              \__tag_struct_get_parentrole:eNN
               {\property_ref:enn{tagpdfstruct-#1}{tagstruct}{1}}
               \l__tag_tmpa_tl
               \l__tag_tmpb_tl
             \__tag_check_parent_child:VVVVN
               \g__tag_struct_tag_tl
               \g__tag_struct_tag_NS_tl
               \l__tag_tmpa_tl
               \l__tag_tmpb_tl
               \l__tag_parent_child_check_tl
             \int_compare:nNnT {\l__tag_parent_child_check_tl}<0
               {
                 \cs_set_eq:NN \l__tag_role_remap_tag_tl \g__tag_struct_tag_tl
                 \cs_set_eq:NN \l__tag_role_remap_NS_tl \g__tag_struct_tag_NS_tl
                 \__tag_role_remap:
                 \cs_gset_eq:NN \g__tag_struct_tag_tl \l__tag_role_remap_tag_tl
                 \cs_gset_eq:NN  \g__tag_struct_tag_NS_tl \l__tag_role_remap_NS_tl
                 \__tag_struct_set_tag_info:eVV
                   { \int_use:N \c@g__tag_struct_abs_int }
                     \g__tag_struct_tag_tl
                     \g__tag_struct_tag_NS_tl
               }
           }
           {
             \msg_warning:nnn{ tag }{struct-label-unknown}{#1}
           }
      }
  }
⟨/package | debug⟩
```

(*End of definition for* `\tag_struct_use:n`. *This function is documented on page* 100.)

`\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.

```
⟨base⟩\cs_new_protected:Npn \tag_struct_use_num:n #1 {}
⟨*package | debug⟩
\cs_set_protected:Npn \tag_struct_use_num:n #1 %#1 is structure number
  {
```

```
    \__tag_check_if_active_struct:T
      {
        \prop_if_exist:cTF
          { g__tag_struct_#1_prop } %
          {
            \prop_get:cnNT
              {g__tag_struct_#1_prop}
              {P}
              \l__tag_tmpa_tl
              {
                \msg_warning:nnn { tag } {struct-used-twice} {#1}
              }
            %add the \#1 structure as kid to the current structure (can be the root)
            \__tag_struct_kid_struct_gput_right:ee
              { \g__tag_struct_stack_current_tl }
              { #1 }
            %add the current structure to \#1 as parent
             \__tag_struct_prop_gput:nne
              { #1 }
              { P }
              {
                \pdf_object_ref_indexed:nn { __tag/struct }{ \g__tag_struct_stack_current_tl
              }
⟨debug⟩           \prop_gput:cne
⟨debug⟩             { g__tag_struct_debug_#1_prop }
⟨debug⟩             { P }
⟨debug⟩             {
⟨debug⟩               parent~structure:~\g__tag_struct_stack_current_tl\c_space_tl=~
⟨debug⟩               \g__tag_struct_tag_tl
⟨debug⟩             }
```

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:

```
             \__tag_struct_get_parentrole:eNN
              {#1}
              \l__tag_tmpa_tl
              \l__tag_tmpb_tl
            \__tag_check_parent_child:VVVVN
              \g__tag_struct_tag_tl
              \g__tag_struct_tag_NS_tl
              \l__tag_tmpa_tl
              \l__tag_tmpb_tl
              \l__tag_parent_child_check_tl
            \int_compare:nNnT {\l__tag_parent_child_check_tl}<0
              {
                \cs_set_eq:NN \l__tag_role_remap_tag_tl \g__tag_struct_tag_tl
                \cs_set_eq:NN \l__tag_role_remap_NS_tl \g__tag_struct_tag_NS_tl
                \__tag_role_remap:
                \cs_gset_eq:NN \g__tag_struct_tag_tl \l__tag_role_remap_tag_tl
                \cs_gset_eq:NN  \g__tag_struct_tag_NS_tl \l__tag_role_remap_NS_tl
                \__tag_struct_set_tag_info:eVV
                  { \int_use:N \c@g__tag_struct_abs_int }
                    \g__tag_struct_tag_tl
                    \g__tag_struct_tag_NS_tl
```

```
            }
          }
          {
            \msg_warning:nnn{ tag }{struct-label-unknown}{#1}
          }
      }
  }
⟨/package | debug⟩
```

(*End of definition for* `\tag_struct_use_num:n`. *This function is documented on page* 100.)

`\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.

```
⟨*package⟩
\cs_new:Npn \tag_struct_object_ref:n #1
 {
   \pdf_object_ref_indexed:nn {__tag/struct}{ #1 }
 }
\cs_generate_variant:Nn \tag_struct_object_ref:n {e}
⟨/package⟩
```

(*End of definition for* `\tag_struct_object_ref:n`. *This function is documented on page* 100.)

`\tag_struct_gput:nnn` This is a command that allows to update the data of a structure. This often can't done simply by replacing the value, as we have to preserve and extend existing content. We use therefore dedicated functions adjusted to the key in question. The first argument is the number of the structure, the second a keyword referring to a function, the third the value. Currently the existing keywords are all related to the `Ref` key (an array). The keyword `ref` takes as value an explicit object reference to a structure. The keyword `ref_label` expects as value a label name (from a label set in a `\tagstructbegin` command). The keyword `ref_dest` expects a destination name set with `\MakeLinkTarget`. It then will refer to the structure in which this `\MakeLinkTarget` was used. At last the keyword `ref_num` expects a structure number.

```
⟨base⟩\cs_new_protected:Npn \tag_struct_gput:nnn #1 #2 #3{}
⟨*package⟩
\cs_set_protected:Npn \tag_struct_gput:nnn #1 #2 #3
 {
   \cs_if_exist_use:cF {__tag_struct_gput_data_#2:nn}
    { %warning??
      \use_none:nn
    }
    {#1}{#3}
 }
\cs_generate_variant:Nn \tag_struct_gput:nnn {ene,nne}
⟨/package⟩
```

(*End of definition for* `\tag_struct_gput:nnn`. *This function is documented on page* 101.)

`\__tag_struct_gput_data_ref_aux:nnn`

```
⟨*package⟩
\cs_new_protected:Npn \__tag_struct_gput_data_ref_aux:nnn #1 #2 #3
  % #1 receiving struct num, #2 key word #3 value
   {
```

```
      \prop_get:cnNTF
        { g__tag_struct_#1_prop }
        {Ref}
        \l__tag_get_tmpc_tl
        {
          \tl_put_right:No \l__tag_get_tmpc_tl
            {\cs:w __tag_struct_Ref_#2:nN \cs_end: {#3},}
        }
        {
          \tl_set:No \l__tag_get_tmpc_tl
            {\cs:w __tag_struct_Ref_#2:nN \cs_end: {#3},}
        }
        \__tag_struct_prop_gput:nno
          { #1 }
          { Ref }
          { \l__tag_get_tmpc_tl }
    }
\cs_new_protected:Npn \__tag_struct_gput_data_ref:nn #1 #2
  {
    \__tag_struct_gput_data_ref_aux:nnn {#1}{obj}{#2}
  }
\cs_new_protected:Npn \__tag_struct_gput_data_ref_label:nn #1 #2
  {
    \__tag_struct_gput_data_ref_aux:nnn {#1}{label}{#2}
  }
\cs_new_protected:Npn \__tag_struct_gput_data_ref_dest:nn #1 #2
  {
    \__tag_struct_gput_data_ref_aux:nnn {#1}{dest}{#2}
  }
\cs_new_protected:Npn \__tag_struct_gput_data_ref_num:nn #1 #2
  {
    \__tag_struct_gput_data_ref_aux:nnn {#1}{num}{#2}
  }

\cs_generate_variant:Nn \__tag_struct_gput_data_ref:nn {ee,no}
```

(*End of definition for* `\__tag_struct_gput_data_ref_aux:nnn`.)

`\tag_struct_insert_annot:nn`
`\tag_struct_insert_annot:ee`
`\tag_struct_insert_annot:ee`
`\tag_struct_parent_int:`

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:`.

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.

```
\cs_new_protected:Npn \tag_struct_insert_annot:nn #1 #2 %#1 should be an object reference
                                                        %#2 struct parent num
  {
    \__tag_check_if_active_struct:T
      {
        \__tag_struct_insert_annot:nn {#1}{#2}
      }
  }

\cs_generate_variant:Nn \tag_struct_insert_annot:nn {xx,ee}
\cs_new:Npn \tag_struct_parent_int: {\int_use:c { c@g__tag_parenttree_obj_int }}
```

```
⟨/package⟩
```

(*End of definition for* `\tag_struct_insert_annot:nn` *and* `\tag_struct_parent_int:`. *These functions are documented on page 100.*)

7 Attributes and attribute classes

```
⟨*header⟩
\ProvidesExplPackage {tagpdf-attr-code} {2024-09-11} {0.99e}
  {part of tagpdf - code related to attributes and attribute classes}
⟨/header⟩
```

7.1 Variables

`\g__tag_attr_entries_prop`
`\g__tag_attr_class_used_prop`
`\g__tag_attr_objref_prop`
`\l__tag_attr_value_tl`

`\g_@@_attr_entries_prop` will store attribute names and their dictionary content. `\g_@@_attr_class_used_prop` will hold the attributes which have been used as class name. `\l_@@_attr_value_tl` is used to build the attribute array or key. Every time 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`

```
⟨*package⟩
\prop_new:N \g__tag_attr_entries_prop
\prop_new_linked:N \g__tag_attr_class_used_prop
\tl_new:N   \l__tag_attr_value_tl
\prop_new:N \g__tag_attr_objref_prop %will contain obj num of used attributes
```

This seq is currently kept for compatibility with the table code.

```
\seq_new:N\g__tag_attr_class_used_seq
```

(*End of definition for* `\g__tag_attr_entries_prop` *and others.*)

7.2 Commands and keys

`\__tag_attr_new_entry:nn`
`role/new-attribute␣(setup-key)`
`newattribute␣(deprecated)`

This allows to define attributes. Defined attributes are stored in a global property. `role/new-attribute` expects two brace group, the name and the content. The content typically needs an `/O` key for the owner. An example look like this.

TODO: consider to put them directly in the ClassMap, that is perhaps more effective.

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

```
\cs_new_protected:Npn \__tag_attr_new_entry:nn #1 #2 %#1:name, #2: content
  {
    \prop_gput:Nen \g__tag_attr_entries_prop
      {\pdf_name_from_unicode_e:n{#1}}{#2}
  }

\cs_generate_variant:Nn \__tag_attr_new_entry:nn {ee}
```

```
\keys_define:nn { __tag / setup }
  {
    role/new-attribute .code:n =
      {
        \__tag_attr_new_entry:nn #1
      }
```

deprecated name

```
   ,newattribute .code:n =
      {
        \__tag_attr_new_entry:nn #1
      },
  }
```

(*End of definition for* `\__tag_attr_new_entry:nn`, `role/new-attribute (setup-key)`, *and* `newattribute (deprecated)`. *These functions are documented on page 103.*)

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

```
\keys_define:nn { __tag / struct }
  {
    attribute-class .code:n =
     {
       \clist_set:Ne \l__tag_tmpa_clist { #1 }
       \seq_set_from_clist:NN \l__tag_tmpb_seq \l__tag_tmpa_clist
```

we convert the names into pdf names with slash

```
       \seq_set_map_e:NNn \l__tag_tmpa_seq \l__tag_tmpb_seq
         {
           \pdf_name_from_unicode_e:n {##1}
         }
       \seq_map_inline:Nn \l__tag_tmpa_seq
         {
           \prop_if_in:NnF \g__tag_attr_entries_prop {##1}
             {
               \msg_error:nnn { tag } { attr-unknown } { ##1 }
             }
           \prop_gput:Nnn\g__tag_attr_class_used_prop { ##1} {}
         }
       \tl_set:Ne \l__tag_tmpa_tl
         {
           \int_compare:nT { \seq_count:N \l__tag_tmpa_seq > 1 }{[}
           \seq_use:Nn \l__tag_tmpa_seq  { \c_space_tl  }
           \int_compare:nT { \seq_count:N \l__tag_tmpa_seq > 1 }{]}
         }
       \int_compare:nT { \seq_count:N \l__tag_tmpa_seq > 0 }
         {
           \__tag_struct_prop_gput:nne
             { \int_use:N \c@g__tag_struct_abs_int }
             { C }
             { \l__tag_tmpa_tl }
            %\prop_show:c  { g__tag_struct_\int_eval:n {\c@g__tag_struct_abs_int}_prop }
         }
     }
  }
```

(*End of definition for* `attribute-class (struct-key)`. *This function is documented on page 103.*)

`attribute␣(struct-key)`

```
\keys_define:nn { __tag / struct }
  {
    attribute .code:n  = % A property (attribute, value currently a dictionary)
      {
        \clist_set:Ne          \l__tag_tmpa_clist { #1 }
        \clist_if_empty:NF \l__tag_tmpa_clist
         {
            \seq_set_from_clist:NN \l__tag_tmpb_seq \l__tag_tmpa_clist
```

we convert the names into pdf names with slash

```
           \seq_set_map_e:NNn \l__tag_tmpa_seq \l__tag_tmpb_seq
             {
               \pdf_name_from_unicode_e:n {##1}
             }
           \tl_set:Ne \l__tag_attr_value_tl
             {
               \int_compare:nT { \seq_count:N \l__tag_tmpa_seq > 1 }{[]%]
             }
           \seq_map_inline:Nn \l__tag_tmpa_seq
             {
               \prop_if_in:NnF \g__tag_attr_entries_prop {##1}
                 {
                   \msg_error:nnn { tag } { attr-unknown } { ##1 }
                 }
               \prop_if_in:NnF \g__tag_attr_objref_prop {##1}
                 {%\prop_show:N \g__tag_attr_entries_prop
                   \pdf_object_unnamed_write:ne
                     { dict }
                     {
                       \prop_item:Nn\g__tag_attr_entries_prop {##1}
                     }
                   \prop_gput:Nne \g__tag_attr_objref_prop {##1} {\pdf_object_ref_last:}
                 }
               \tl_put_right:Ne \l__tag_attr_value_tl
                 {
                   \c_space_tl
                   \prop_item:Nn \g__tag_attr_objref_prop {##1}
                 }
    %      \tl_show:N \l__tag_attr_value_tl
             }
           \tl_put_right:Ne \l__tag_attr_value_tl
             { %[
               \int_compare:nT { \seq_count:N \l__tag_tmpa_seq > 1 }{]}%
             }
    %      \tl_show:N \l__tag_attr_value_tl
           \__tag_struct_prop_gput:nne
             { \int_use:N \c@g__tag_struct_abs_int }
             { A }
             { \l__tag_attr_value_tl }
         }
    },
```

```
1314     }
1315 ⟨/package⟩
```

(*End of definition for* `attribute (struct-key)`. *This function is documented on page 103.*)

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

```
⟨@@=tag⟩
⟨*luatex⟩
\ProvidesExplFile {tagpdf-luatex.def} {2024-09-11} {0.99e}
  {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.

```
{
  \fontencoding{TU}\fontfamily{lmr}\fontseries{m}\fontshape{n}\fontsize{10pt}{10pt}\selectfon
}
\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
```

```
\cs_set_protected:Npn \__tag_prop_new:N #1
  {
    \prop_new:N #1
    \lua_now:e { ltx.__tag.tables.\cs_to_str:N#1 = {} }
  }

\cs_set_protected:Npn \__tag_prop_new_linked:N #1
  {
    \prop_new_linked:N #1
    \lua_now:e { ltx.__tag.tables.\cs_to_str:N#1 = {} }
  }


\cs_set_protected:Npn \__tag_seq_new:N #1
  {
    \seq_new:N #1
    \lua_now:e { ltx.__tag.tables.\cs_to_str:N#1 = {} }
  }


\cs_set_protected:Npn \__tag_prop_gput:Nnn #1 #2 #3
```

```
  {
    \prop_gput:Nnn #1 { #2 } { #3 }
    \lua_now:e { ltx.__tag.tables.\cs_to_str:N#1 ["#2"] = "\lua_escape:n{#3}" }
  }


\cs_set_protected:Npn \__tag_seq_gput_right:Nn #1 #2
  {
    \seq_gput_right:Nn #1 { #2 }
    \lua_now:e { table.insert(ltx.__tag.tables.\cs_to_str:N#1, "#2") }
  }

%Hm not quite sure about the naming

\cs_set:Npn \__tag_seq_item:cn #1 #2
  {
    \lua_now:e { tex.print(ltx.__tag.tables.#1[#2]) }
  }

\cs_set:Npn \__tag_prop_item:cn #1 #2
  {
    \lua_now:e { tex.print(ltx.__tag.tables.#1["#2"]) }
  }

%for debugging commands that show both the seq/prop and the lua tables
\cs_set_protected:Npn \__tag_seq_show:N #1
  {
    \seq_show:N #1
    \lua_now:e { ltx.__tag.trace.log ("lua~sequence~array~\cs_to_str:N#1",1) }
    \lua_now:e { ltx.__tag.trace.show_seq (ltx.__tag.tables.\cs_to_str:N#1) }
  }

\cs_set_protected:Npn \__tag_prop_show:N #1
  {
    \prop_show:N #1
    \lua_now:e {ltx.__tag.trace.log  ("lua~property~table~\cs_to_str:N#1",1) }
    \lua_now:e {ltx.__tag.trace.show_prop (ltx.__tag.tables.\cs_to_str:N#1) }
 }
```

(*End of definition for* `\__tag_prop_new:N` *and others.*)

⟨/luatex⟩

The module declaration

⟨*lua⟩

```
-- tagpdf.lua
-- Ulrike Fischer

local ProvidesLuaModule = {
    name          = "tagpdf",
    version       = "0.99e",       --TAGVERSION
    date          = "2024-09-11", --TAGDATE
    description   = "tagpdf lua code",
    license       = "The LATEX Project Public License 1.3c"
}
```

```
80
81 if luatexbase and luatexbase.provides_module then
82   luatexbase.provides_module (ProvidesLuaModule)
83 end
84
85 --[[
86 The code has quite probably a number of problems
87  - more variables should be local instead of global
88  - the naming is not always consistent due to the development of the code
89  - the traversing of the shipout box must be tested with more complicated setups
90  - it should probably handle more node types
91  -
92 --]]
93
```

Some comments about the lua structure.

```
94 --[[
95 the main table is named ltx.__tag. It contains the functions and also the data
96 collected during the compilation.
97
98 ltx.__tag.mc     will contain mc connected data.
99 ltx.__tag.struct will contain structure related data.
100 ltx.__tag.page   will contain page data
101 ltx.__tag.tables contains also data from mc and struct (from older code). This needs cleaning
102              There are certainly dublettes, but I don't dare yet ...
103 ltx.__tag.func   will contain (public) functions.
104 ltx.__tag.trace  will contain tracing/logging functions.
105 local functions starts with __
106 functions meant for users will be in ltx.tag
107
108 functions
109  ltx.__tag.func.get_num_from (tag):    takes a tag (string) and returns the id number
110  ltx.__tag.func.output_num_from (tag): takes a tag (string) and prints (to tex) the id number
111  ltx.__tag.func.get_tag_from (num):    takes a num and returns the tag
112  ltx.__tag.func.output_tag_from (num): takes a num and prints (to tex) the tag
113  ltx.__tag.func.store_mc_data (num,key,data): stores key=data in ltx.__tag.mc[num]
114  ltx.__tag.func.store_mc_label (label,num): stores label=num in ltx.__tag.mc.labels
115  ltx.__tag.func.store_mc_kid (mcnum,kid,page): stores the mc-kids of mcnum on page page
116  ltx.__tag.func.store_mc_in_page(mcnum,mcpagecnt,page): stores in the page table the number o
117  ltx.__tag.func.store_struct_mcabs (structnum,mcnum): stores relations structnum<->mcnum (abs
118  ltx.__tag.func.mc_insert_kids (mcnum): inserts the /K entries for mcnum by wandering through
119  ltx.__tag.func.mark_page_elements(box,mcpagecnt,mccntprev,mcopen,name,mctypeprev) : the main
120  ltx.__tag.func.mark_shipout (): a wrapper around the core function which inserts the last EM
121  ltx.__tag.func.fill_parent_tree_line (page): outputs the entries of the parenttree for this
122  ltx.__tag.func.output_parenttree(): outputs the content of the parenttree
123  ltx.__tag.func.pdf_object_ref(name,index): outputs the object reference for the object name
124  ltx.__tag.func.markspaceon(), ltx.__tag.func.markspaceoff(): (de)activates the marking of po
125  ltx.__tag.trace.show_mc_data (num,loglevel): shows ltx.__tag.mc[num] is the current log leve
126  ltx.__tag.trace.show_all_mc_data (max,loglevel): shows a maximum about mc's if the current l
127  ltx.__tag.trace.show_seq: shows a sequence (array)
128  ltx.__tag.trace.show_struct_data (num): shows data of structure num
129  ltx.__tag.trace.show_prop: shows a prop
130  ltx.__tag.trace.log
131  ltx.__tag.trace.showspaces : boolean
132 --]]
```

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. The interwordspaceOff attr allows to locally suppress the insertion of real space chars, e.g. when they are inserted by other means (e.g. with `\char`).

```
local mctypeattributeid  = luatexbase.new_attribute ("g__tag_mc_type_attr")
local mccntattributeid   = luatexbase.new_attribute ("g__tag_mc_cnt_attr")
local iwspaceOffattributeid = luatexbase.new_attribute ("g__tag_interwordspaceOff_attr")
local iwspaceattributeid = luatexbase.new_attribute ("g__tag_interwordspace_attr")
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

```
local tagunmarkedbool= token.create("g__tag_tagunmarked_bool")
local truebool       = token.create("c_true_bool")
```

with this token we can query the state of the softhyphen boolean and so detect if hyphens from hyphenation should be replaced by soft-hyphens.

```
local softhyphenbool = token.create("g__tag_softhyphen_bool")
```

Now a number of local versions from global tables. Not all is perhaps needed, most node variants were copied from lua-debug.

```
local catlatex       = luatexbase.registernumber("catcodetable@latex")
local tableinsert    = table.insert
local nodeid           = node.id
local nodecopy         = node.copy
local nodegetattribute = node.get_attribute
local nodesetattribute = node.set_attribute
local nodehasattribute = node.has_attribute
local nodenew          = node.new
local nodetail         = node.tail
local nodeslide        = node.slide
local noderemove       = node.remove
local nodetraverseid   = node.traverse_id
local nodetraverse     = node.traverse
local nodeinsertafter  = node.insert_after
local nodeinsertbefore = node.insert_before
local pdfpageref       = pdf.pageref

local fonthashes      = fonts.hashes
local identifiers     = fonthashes.identifiers
local fontid          = font.id

local HLIST          = node.id("hlist")
local VLIST          = node.id("vlist")
local RULE           = node.id("rule")
local DISC           = node.id("disc")
local GLUE           = node.id("glue")
local GLYPH          = node.id("glyph")
local KERN           = node.id("kern")
```

```
local PENALTY        = node.id("penalty")
local LOCAL_PAR      = node.id("local_par")
local MATH           = node.id("math")

local explicit_disc = 1
local regular_disc = 3
```

Now we setup the main table structure. ltx is used by other latex code too!

```
ltx             = ltx        or { }
ltx.__tag          = ltx.__tag        or { }
ltx.__tag.mc       = ltx.__tag.mc     or  { } -- mc data
ltx.__tag.struct   = ltx.__tag.struct or  { } -- struct data
ltx.__tag.tables   = ltx.__tag.tables or  { } -- tables created with new prop and new seq.
                                          -- wasn't a so great idea ...
                                          -- g__tag_role_tags_seq used by tag<-> is in this tab
                                          -- used for pure lua tables too now!
ltx.__tag.page     = ltx.__tag.page   or  { } -- page data, currently only i->{0->mcnum,1->mc
ltx.__tag.trace    = ltx.__tag.trace  or  { } -- show commands
ltx.__tag.func     = ltx.__tag.func   or  { } -- functions
ltx.__tag.conf     = ltx.__tag.conf   or  { } -- configuration variables
```

2 Logging functions

__tag_log
ltx.__tag.trace.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.

```
local __tag_log =
 function (message,loglevel)
  if (loglevel or 3) <= tex.count["l__tag_loglevel_int"] then
   texio.write_nl("tagpdf: ".. message)
  end
 end

ltx.__tag.trace.log = __tag_log
```

(*End of 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.

```
function ltx.__tag.trace.show_seq (seq)
 if (type(seq) == "table") then
  for i,v in ipairs(seq) do
   __tag_log ("[" .. i .. "] => " .. tostring(v),1)
  end
  else
   __tag_log ("sequence " .. tostring(seq) .. " not found",1)
  end
end
```

(*End of definition for* `ltx.__tag.trace.show_seq`.)

__tag_pairs_prop
ltx.__tag.trace.show_prop

This shows the content of a prop as stored in the tables table. It is used by the \@@_prop_show:N function.

```
local __tag_pairs_prop =
 function  (prop)
      local a = {}
      for n in pairs(prop) do tableinsert(a, n) end
      table.sort(a)
      local i = 0                -- iterator variable
      local iter = function ()   -- iterator function
        i = i + 1
        if a[i] == nil then return nil
        else return a[i], prop[a[i]]
        end
      end
      return iter
  end


function ltx.__tag.trace.show_prop (prop)
 if (type(prop) == "table") then
  for i,v in __tag_pairs_prop (prop) do
    __tag_log ("[" .. i .. "] => " .. tostring(v),1)
  end
 else
   __tag_log ("prop " .. tostring(prop) .. " not found or not a table",1)
 end
 end
```

(*End of 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

```
function ltx.__tag.trace.show_mc_data (num,loglevel)
 if ltx.__tag and ltx.__tag.mc and ltx.__tag.mc[num] then
  for k,v in pairs(ltx.__tag.mc[num]) do
   __tag_log  ("mc"..num..": "..tostring(k).."=>"..tostring(v),loglevel)
  end
  if ltx.__tag.mc[num]["kids"] then
  __tag_log ("mc" .. num .. " has " .. #ltx.__tag.mc[num]["kids"] .. " kids",loglevel)
   for k,v in ipairs(ltx.__tag.mc[num]["kids"]) do
    __tag_log ("mc ".. num .. " kid "..k.." =>" .. v.kid.." on page " ..v.page,loglevel)
   end
  end
 else
  __tag_log  ("mc"..num.." not found",loglevel)
 end
end
```

(*End of 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.

```
function ltx.__tag.trace.show_all_mc_data (min,max,loglevel)
 for i = min, max do
```

```
  ltx.__tag.trace.show_mc_data (i,loglevel)
 end
 texio.write_nl("")
end
```

(*End of 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.

```
function ltx.__tag.trace.show_struct_data (num)
 if ltx.__tag and ltx.__tag.struct and ltx.__tag.struct[num] then
  for k,v in ipairs(ltx.__tag.struct[num]) do
   __tag_log  ("struct "..num..": "..tostring(k).."=>"..tostring(v),1)
  end
 else
  __tag_log   ("struct "..num.." not found ",1)
 end
end
```

(*End of 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.

```
local __tag_get_mc_cnt_type_tag = function (n)
  local mccnt      =  nodegetattribute(n,mccntattributeid)  or -1
  local mctype     =  nodegetattribute(n,mctypeattributeid)  or -1
  local tag        =  ltx.__tag.func.get_tag_from(mctype)
  return mccnt,mctype,tag
end
```

(*End of 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.

```
local function __tag_get_mathsubtype  (mathnode)
 if mathnode.subtype == 0 then
  subtype = "beginmath"
 else
  subtype = "endmath"
 end
 return subtype
end
```

(*End of 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.

```
ltx.__tag.tables.role_tag_attribute = {}
ltx.__tag.tables.role_attribute_tag = {}
```

(*End of definition for* `ltx.__tag.tables.role_tag_attribute`.)

ltx.__tag.func.alloctag

```
local __tag_alloctag =
 function (tag)
   if not ltx.__tag.tables.role_tag_attribute[tag] then
    table.insert(ltx.__tag.tables.role_attribute_tag,tag)
    ltx.__tag.tables.role_tag_attribute[tag]=#ltx.__tag.tables.role_attribute_tag
    __tag_log  ("Add "..tag.." "..ltx.__tag.tables.role_tag_attribute[tag],3)
   end
 end
ltx.__tag.func.alloctag = __tag_alloctag
```

(*End of definition for* `ltx.__tag.func.alloctag`.)

__tag_get_num_from
ltx.__tag.func.get_num_from
ltx.__tag.func.output_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.

```
local __tag_get_num_from =
 function (tag)
  if ltx.__tag.tables.role_tag_attribute[tag] then
    a= ltx.__tag.tables.role_tag_attribute[tag]
  else
    a= -1
  end
  return a
 end

ltx.__tag.func.get_num_from = __tag_get_num_from

function ltx.__tag.func.output_num_from (tag)
  local num = __tag_get_num_from (tag)
  tex.sprint(catlatex,num)
  if num == -1 then
   __tag_log ("Unknown tag "..tag.." used")
  end
end
```

(*End of definition for* `__tag_get_num_from`, `ltx.__tag.func.get_num_from`, *and* `ltx.__tag.func.output_num_from`.)

__tag_get_tag_from
ltx.__tag.func.get_tag_from
ltx.__tag.func.output_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.

```
local __tag_get_tag_from =
 function  (num)
  if ltx.__tag.tables.role_attribute_tag[num] then
   a = ltx.__tag.tables.role_attribute_tag[num]
  else
   a= "UNKNOWN"
  end
 return a
end

ltx.__tag.func.get_tag_from = __tag_get_tag_from

```

```
function ltx.__tag.func.output_tag_from (num)
  tex.sprint(catlatex,__tag_get_tag_from (num))
end
```

(*End of 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.

```
function ltx.__tag.func.store_mc_data (num,key,data)
 ltx.__tag.mc[num] = ltx.__tag.mc[num] or { }
 ltx.__tag.mc[num][key] = data
 __tag_log  ("INFO TEX-STORE-MC-DATA: "..num.." => "..tostring(key).." => "..tostring(data),3
end
```

(*End of 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.

```
function ltx.__tag.func.store_mc_label (label,num)
 ltx.__tag.mc["labels"] = ltx.__tag.mc["labels"] or { }
 ltx.__tag.mc.labels[label] = num
end
```

(*End of 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.

```
function ltx.__tag.func.store_mc_kid (mcnum,kid,page)
 ltx.__tag.trace.log("INFO TAG-STORE-MC-KID: "..mcnum.." => " .. kid.." on page " .. page,3)
 ltx.__tag.mc[mcnum]["kids"] = ltx.__tag.mc[mcnum]["kids"] or { }
 local kidtable = {kid=kid,page=page}
 tableinsert(ltx.__tag.mc[mcnum]["kids"], kidtable )
end
```

(*End of 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.

```
function ltx.__tag.func.mc_num_of_kids (mcnum)
 local num = 0
 if ltx.__tag.mc[mcnum] and ltx.__tag.mc[mcnum]["kids"] then
   num = #ltx.__tag.mc[mcnum]["kids"]
 end
 ltx.__tag.trace.log ("INFO MC-KID-NUMBERS: " .. mcnum .. "has " .. num .. "KIDS",4)
 return num
end
```

(*End of definition for* `ltx.__tag.func.mc_num_of_kids`.)

3.2 Functions to insert the pdf literals

__tag_backend_create_emc_node
__tag_insert_emc_node

This insert the emc node. We support also dvips and dvipdfmx backend

```
local __tag_backend_create_emc_node
if tex.outputmode == 0 then
 if token.get_macro("c_sys_backend_str") == "dvipdfmx" then
  function __tag_backend_create_emc_node ()
    local emcnode = nodenew("whatsit","special")
      emcnode.data = "pdf:code EMC"
    return emcnode
  end
 else -- assume a dvips variant
  function __tag_backend_create_emc_node ()
    local emcnode = nodenew("whatsit","special")
      emcnode.data = "ps:SDict begin mark /EMC pdfmark end"
    return emcnode
  end
 end
else -- pdf mode
  function __tag_backend_create_emc_node ()
    local emcnode = nodenew("whatsit","pdf_literal")
      emcnode.data = "EMC"
      emcnode.mode=1
    return emcnode
  end
end

local function __tag_insert_emc_node (head,current)
  local emcnode= __tag_backend_create_emc_node()
  head = node.insert_before(head,current,emcnode)
  return head
end
```

(*End of definition for* `__tag_backend_create_emc_node` *and* `__tag_insert_emc_node`.)

__tag_backend_create_bmc_node
__tag_insert_bmc_node

This inserts a simple bmc node

```
local __tag_backend_create_bmc_node
if tex.outputmode == 0 then
 if token.get_macro("c_sys_backend_str") == "dvipdfmx" then
  function __tag_backend_create_bmc_node (tag)
    local bmcnode = nodenew("whatsit","special")
    bmcnode.data = "pdf:code /"..tag.." BMC"
    return bmcnode
  end
 else -- assume a dvips variant
  function __tag_backend_create_bmc_node (tag)
    local bmcnode = nodenew("whatsit","special")
    bmcnode.data = "ps:SDict begin mark/"..tag.." /BMC pdfmark end"
    return bmcnode
  end
 end
else -- pdf mode
  function __tag_backend_create_bmc_node (tag)
    local bmcnode = nodenew("whatsit","pdf_literal")
```

```
    bmcnode.data = "/"..tag.." BMC"
    bmcnode.mode=1
    return bmcnode
  end
end

local function __tag_insert_bmc_node (head,current,tag)
 local bmcnode = __tag_backend_create_bmc_node (tag)
 head = node.insert_before(head,current,bmcnode)
 return head
end
```

(*End of definition for* `__tag_backend_create_bmc_node` *and* `__tag_insert_bmc_node`.)

`__tag_backend_create_bdc_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.

```
local __tag_backend_create_bdc_node

if tex.outputmode == 0 then
 if token.get_macro("c_sys_backend_str") == "dvipdfmx" then
  function __tag_backend_create_bdc_node (tag,dict)
    local bdcnode = nodenew("whatsit","special")
    bdcnode.data = "pdf:code /"..tag.."<<"..dict..">> BDC"
    return bdcnode
  end
 else -- assume a dvips variant
  function __tag_backend_create_bdc_node (tag,dict)
    local bdcnode = nodenew("whatsit","special")
    bdcnode.data = "ps:SDict begin mark/"..tag.."<<"..dict..">> /BDC pdfmark end"
    return bdcnode
  end
 end
else -- pdf mode
  function __tag_backend_create_bdc_node (tag,dict)
    local bdcnode = nodenew("whatsit","pdf_literal")
    bdcnode.data = "/"..tag.."<<"..dict..">> BDC"
    bdcnode.mode=1
    return bdcnode
  end
end

local function __tag_insert_bdc_node (head,current,tag,dict)
 bdcnode= __tag_backend_create_bdc_node (tag,dict)
 head = node.insert_before(head,current,bdcnode)
 return head
end
```

(*End of definition for* `__tag_backend_create_bdc_node` *and* `__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.

```
local function __tag_pdf_object_ref (name,index)
   local object
   if ltx.pdf.object_id then
```

```
    object = ltx.pdf.object_id (name,index) ..' 0 R'
  else
    local tokenname = 'c__pdf_object_'..name..'/'..index..'_int'
    object = token.create(tokenname).mode ..' 0 R'
  end
  return object
end
ltx.__tag.func.pdf_object_ref = __tag_pdf_object_ref
```

(*End of definition for* `__tag_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.

```
local function __tag_show_spacemark (head,current,color,height)
 local markcolor = color or "1 0 0"
 local markheight = height or 10
 local pdfstring
 if tex.outputmode == 0 then
  -- ignore dvi mode for now
 else
  pdfstring = node.new("whatsit","pdf_literal")
       pdfstring.data =
       string.format("q "..markcolor.." RG "..markcolor.." rg 0.4 w 0 %g m 0 %g l S Q",-3,markheight)
       head = node.insert_after(head,current,pdfstring)
  return head
 end
end
```

(*End of definition for* `__tag_show_spacemark`.)

`__tag_fakespace` This is used to define a lua version of `\pdffakespace`

`ltx.__tag.func.fakespace`

```
local function __tag_fakespace()
   tex.setattribute(iwspaceattributeid,1)
   tex.setattribute(iwfontattributeid,font.current())
end
ltx.__tag.func.fakespace = __tag_fakespace
```

(*End of 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.

```
--[[ a function to mark up places where real space chars should be inserted
     it only sets an attribute.
--]]

local function __tag_mark_spaces (head)
  local inside_math = false
  for n in nodetraverse(head) do
    local id = n.id
```

```
    if id == GLYPH then
      local glyph = n
      default_currfontid = glyph.font
      if glyph.next and (glyph.next.id == GLUE)
        and not inside_math  and (glyph.next.width >0)
      then
        nodesetattribute(glyph.next,iwspaceattributeid,1)
        nodesetattribute(glyph.next,iwfontattributeid,glyph.font)
      -- for debugging
       if ltx.__tag.trace.showspaces then
        __tag_show_spacemark (head,glyph)
       end
      elseif glyph.next and (glyph.next.id==KERN) and not inside_math then
       local kern = glyph.next
       if kern.next and (kern.next.id== GLUE)  and (kern.next.width >0)
       then
        nodesetattribute(kern.next,iwspaceattributeid,1)
        nodesetattribute(kern.next,iwfontattributeid,glyph.font)
       end
      end
     --  look also back
     if glyph.prev and (glyph.prev.id == GLUE)
        and not inside_math
        and (glyph.prev.width >0)
        and not nodehasattribute(glyph.prev,iwspaceattributeid)
      then
        nodesetattribute(glyph.prev,iwspaceattributeid,1)
        nodesetattribute(glyph.prev,iwfontattributeid,glyph.font)
      -- for debugging
       if ltx.__tag.trace.showspaces then
        __tag_show_spacemark (head,glyph)
       end
      end
    elseif id == PENALTY then
      local glyph = n
      -- ltx.__tag.trace.log ("PENALTY ".. n.subtype.."VALUE"..n.penalty,3)
      if glyph.next and (glyph.next.id == GLUE)
        and not inside_math  and (glyph.next.width >0) and n.subtype==0
      then
        nodesetattribute(glyph.next,iwspaceattributeid,1)
        --  changed 2024-01-18, issue #72
        nodesetattribute(glyph.next,iwfontattributeid,default_currfontid)
      -- for debugging
       if ltx.__tag.trace.showspaces then
        __tag_show_spacemark (head,glyph)
       end
      end
    elseif id == MATH then
      inside_math = (n.subtype == 0)
    end
  end
  return head
end
```

(*End of definition for* `__tag_mark_spaces`.)

__tag_activate_mark_space
ltx.__tag.func.markspaceon
ltx.__tag.func.markspaceoff

These functions add/remove the function which marks the spaces to the callbacks `pre_linebreak_filter` and `hpack_filter`

```
local function __tag_activate_mark_space ()
 if not luatexbase.in_callback ("pre_linebreak_filter","markspaces") then
  luatexbase.add_to_callback("pre_linebreak_filter",__tag_mark_spaces,"markspaces")
  luatexbase.add_to_callback("hpack_filter",__tag_mark_spaces,"markspaces")
 end
end

ltx.__tag.func.markspaceon=__tag_activate_mark_space

local function __tag_deactivate_mark_space ()
 if luatexbase.in_callback ("pre_linebreak_filter","markspaces") then
 luatexbase.remove_from_callback("pre_linebreak_filter","markspaces")
 luatexbase.remove_from_callback("hpack_filter","markspaces")
 end
end

ltx.__tag.func.markspaceoff=__tag_deactivate_mark_space
```

(*End of 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.

```
local default_space_char = nodenew(GLYPH)
local default_fontid     = fontid("TU/lmr/m/n/10")
local default_currfontid = fontid("TU/lmr/m/n/10")
default_space_char.char  = 32
default_space_char.font  = default_fontid
```

And a function to check as best as possible if a font has a space:

```
local function __tag_font_has_space (fontid)
 t= fonts.hashes.identifiers[fontid]
 if luaotfload.aux.slot_of_name(fontid,"space")
    or t.characters and t.characters[32] and t.characters[32]["unicode"]==32
 then
    return true
 else
    return false
 end
end
```

__tag_space_chars_shipout
ltx.__tag.func.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.

```
local function __tag_space_chars_shipout (box)
 local head = box.head
  if head then
    for n in node.traverse(head) do
      local spaceattr = -1
      if not nodehasattribute(n,iwspaceOffattributeid) then
        spaceattr = nodegetattribute(n,iwspaceattributeid)  or -1
      end
      if n.id == HLIST  then -- enter the hlist
         __tag_space_chars_shipout (n)
      elseif n.id == VLIST then -- enter the vlist
```

```
          __tag_space_chars_shipout (n)
      elseif n.id == GLUE then
        if ltx.__tag.trace.showspaces and spaceattr==1  then
          __tag_show_spacemark (head,n,"0 1 0")
        end
        if spaceattr==1  then
          local space
          local space_char = node.copy(default_space_char)
          local curfont    = nodegetattribute(n,iwfontattributeid)
          ltx.__tag.trace.log ("INFO SPACE-FUNCTION-FONT: ".. tostring(curfont),3)
          if curfont and
            -- luaotfload.aux.slot_of_name(curfont,"space")
            __tag_font_has_space (curfont)
          then
            space_char.font=curfont
          end
          head, space = node.insert_before(head, n, space_char) --
          n.width     = n.width - space.width
          space.attr  = n.attr
        end
      end
    end
    box.head = head
  end
end

function ltx.__tag.func.space_chars_shipout (box)
  __tag_space_chars_shipout (box)
end
```

(*End of 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.

```
function ltx.__tag.func.mc_insert_kids (mcnum,single)
  if ltx.__tag.mc[mcnum] then
  ltx.__tag.trace.log("INFO TEX-MC-INSERT-KID-TEST: " .. mcnum,4)
   if ltx.__tag.mc[mcnum]["kids"] then
    if #ltx.__tag.mc[mcnum]["kids"] > 1 and single==1 then
     tex.sprint("[")
    end
    for i,kidstable in ipairs( ltx.__tag.mc[mcnum]["kids"] ) do
     local kidnum  = kidstable["kid"]
     local kidpage = kidstable["page"]
     local kidpageobjnum = pdfpageref(kidpage)
     ltx.__tag.trace.log("INFO TEX-MC-INSERT-KID: " .. mcnum ..
                         " insert KID " ..i..
                         " with num " .. kidnum ..
                         " on page " .. kidpage.."/"..kidpageobjnum,3)
```

```
      tex.sprint(catlatex,"<</Type /MCR /Pg "..kidpageobjnum .. " 0 R /MCID "..kidnum.. ">> "
    end
    if #ltx.__tag.mc[mcnum]["kids"] > 1 and single==1 then
     tex.sprint("]")
    end
   else
    -- this is typically not a problem, e.g. empty hbox in footer/header can
    -- trigger this warning.
    ltx.__tag.trace.log("WARN TEX-MC-INSERT-NO-KIDS: "..mcnum.." has no kids",2)
    if single==1 then
      tex.sprint("null")
    end
   end
  else
   ltx.__tag.trace.log("WARN TEX-MC-INSERT-MISSING: "..mcnum.." doesn't exist",0)
  end
end
```

(*End of 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.

```
function ltx.__tag.func.store_struct_mcabs (structnum,mcnum)
 ltx.__tag.struct[structnum]=ltx.__tag.struct[structnum] or { }
 ltx.__tag.struct[structnum]["mc"]=ltx.__tag.struct[structnum]["mc"] or { }
 -- a structure can contain more than on mc chunk, the content should be ordered
 tableinsert(ltx.__tag.struct[structnum]["mc"],mcnum)
 ltx.__tag.trace.log("INFO TEX-MC-INTO-STRUCT: "..
                   mcnum.." inserted in struct "..structnum,3)
 -- but every mc can only be in one structure
 ltx.__tag.mc[mcnum]= ltx.__tag.mc[mcnum] or { }
 ltx.__tag.mc[mcnum]["parent"] = structnum
end

```

(*End of 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.

```
-- pay attention: lua counts arrays from 1, tex pages from one
-- mcid and arrays in pdf count from 0.
function ltx.__tag.func.store_mc_in_page (mcnum,mcpagecnt,page)
 ltx.__tag.page[page] = ltx.__tag.page[page] or {}
 ltx.__tag.page[page][mcpagecnt] = mcnum
 ltx.__tag.trace.log("INFO TAG-MC-INTO-PAGE: page " .. page ..
                   ": inserting MCID " .. mcpagecnt .. " => " .. mcnum,3)
end
```

(*End of definition for* `ltx.__tag.func.store_mc_in_page`.)

`ltx.__tag.func.update_mc_attributes` This updates the mc-attributes of a box. It should only be used on boxes which don't contain structure elements. The arguments are a box, the mc-num and the type (as a number)

```
local function __tag_update_mc_attributes (head,mcnum,type)
```

```
 for n in node.traverse(head) do
   node.set_attribute(n,mccntattributeid,mcnum)
   node.set_attribute(n,mctypeattributeid,type)
   if n.id == HLIST or n.id == VLIST then
     __tag_update_mc_attributes (n.list,mcnum,type)
   end
 end
 return head
end
ltx.__tag.func.update_mc_attributes = __tag_update_mc_attributes
```

(*End of definition for* `ltx.__tag.func.update_mc_attributes`.)

`ltx.__tag.func.mark_page_elements` This is the main traversing function. See the lua comment for more details.

```
--[[
    Now follows the core function
    It wades through the shipout box and checks the attributes
    ARGUMENTS
    box: is a box,
    mcpagecnt: num, the current page cnt of mc (should start at -1 in shipout box), needed fo
    mccntprev: num, the attribute cnt of the previous node/whatever - if different we have a
    mcopen: num, records if some bdc/emc is open
    These arguments are only needed for log messages, if not present are replaces by fix stri
    name: string to describe the box
    mctypeprev: num, the type attribute of the previous node/whatever

    there are lots of logging messages currently. Should be cleaned up in due course.
    One should also find ways to make the function shorter.
--]]

function ltx.__tag.func.mark_page_elements (box,mcpagecnt,mccntprev,mcopen,name,mctypeprev)
  local name = name or ("SOMEBOX")
  local mctypeprev = mctypeprev or -1
  local abspage = status.total_pages + 1  -- the real counter is increased
                                          -- inside the box so one off
                                          -- if the callback is not used. (???)
  ltx.__tag.trace.log ("INFO TAG-ABSPAGE: " .. abspage,3)
  ltx.__tag.trace.log ("INFO TAG-ARGS: pagecnt".. mcpagecnt..
                    " prev "..mccntprev ..
                    " type prev "..mctypeprev,4)
  ltx.__tag.trace.log ("INFO TAG-TRAVERSING-BOX: ".. tostring(name)..
                    " TYPE ".. node.type(node.getid(box)),3)
  local head = box.head -- ShipoutBox is a vlist?
  if head then
    mccnthead, mctypehead,taghead = __tag_get_mc_cnt_type_tag (head)
    ltx.__tag.trace.log ("INFO TAG-HEAD: " ..
                      node.type(node.getid(head))..
                      " MC"..tostring(mccnthead)..
                      " => TAG " .. tostring(mctypehead)..
                      " => ".. tostring(taghead),3)
  else
    ltx.__tag.trace.log ("INFO TAG-NO-HEAD: head is "..
                       tostring(head),3)
  end
```

```
696  for n in node.traverse(head) do
697    local mccnt, mctype, tag = __tag_get_mc_cnt_type_tag (n)
698    local spaceattr = nodegetattribute(n,iwspaceattributeid)  or -1
699    ltx.__tag.trace.log ("INFO TAG-NODE: "..
700                         node.type(node.getid(n))..
701                        " MC".. tostring(mccnt)..
702                        " => TAG ".. tostring(mctype)..
703                        " => " ..  tostring(tag),3)
704    if n.id == HLIST
705    then -- enter the hlist
706     mcopen,mcpagecnt,mccntprev,mctypeprev=
707      ltx.__tag.func.mark_page_elements (n,mcpagecnt,mccntprev,mcopen,"INTERNAL HLIST",mctype
708    elseif n.id == VLIST then -- enter the vlist
709     mcopen,mcpagecnt,mccntprev,mctypeprev=
710      ltx.__tag.func.mark_page_elements (n,mcpagecnt,mccntprev,mcopen,"INTERNAL VLIST",mctype
711    elseif n.id == GLUE and not n.leader then -- at glue real space chars are inserted, but t
712                                      -- been done if the previous shipout wandering, so here it
713    elseif n.id == LOCAL_PAR then  -- local_par is ignored
714    elseif n.id == PENALTY then    -- penalty is ignored
715    elseif n.id == KERN then       -- kern is ignored
716     ltx.__tag.trace.log ("INFO TAG-KERN-SUBTYPE: "..
717       node.type(node.getid(n))..." "..n.subtype,4)
718    else
719     -- math is currently only logged.
720     -- we could mark the whole as math
721     -- for inner processing the mlist_to_hlist callback is probably needed.
722     if n.id == MATH then
723      ltx.__tag.trace.log("INFO TAG-MATH-SUBTYPE: "..
724        node.type(node.getid(n))..." "..__tag_get_mathsubtype(n),4)
725     end
726     -- endmath
727     ltx.__tag.trace.log("INFO TAG-MC-COMPARE: current "..
728               mccnt.." prev "..mccntprev,4)
729     if mccnt~=mccntprev then -- a new mc chunk
730      ltx.__tag.trace.log ("INFO TAG-NEW-MC-NODE: "..
731                           node.type(node.getid(n))..
732                          " MC"..tostring(mccnt)..
733                          " <=> PREVIOUS "..tostring(mccntprev),4)
734      if mcopen~=0 then -- there is a chunk open, close it (hope there is only one ...
735       box.list=__tag_insert_emc_node (box.list,n)
736       mcopen = mcopen - 1
737       ltx.__tag.trace.log ("INFO TAG-INSERT-EMC: " ..
738         mcpagecnt .. " MCOPEN = " .. mcopen,3)
739       if mcopen ~=0 then
740        ltx.__tag.trace.log ("WARN TAG-OPEN-MC: " .. mcopen,1)
741       end
742      end
743      if ltx.__tag.mc[mccnt] then
744       if ltx.__tag.mc[mccnt]["artifact"] then
745        ltx.__tag.trace.log("INFO TAG-INSERT-ARTIFACT: "..
746                            tostring(ltx.__tag.mc[mccnt]["artifact"]),3)
747        if ltx.__tag.mc[mccnt]["artifact"] == "" then
748         box.list = __tag_insert_bmc_node (box.list,n,"Artifact")
749        else
```

```
750          box.list = __tag_insert_bdc_node (box.list,n,"Artifact", "/Type /"..ltx.__tag.mc[mcc
751         end
752        else
753         ltx.__tag.trace.log("INFO TAG-INSERT-TAG: "..
754                             tostring(tag),3)
755         mcpagecnt = mcpagecnt +1
756         ltx.__tag.trace.log ("INFO TAG-INSERT-BDC: "..mcpagecnt,3)
757         local dict= "/MCID "..mcpagecnt
758         if ltx.__tag.mc[mccnt]["raw"] then
759          ltx.__tag.trace.log("INFO TAG-USE-RAW: "..
760            tostring(ltx.__tag.mc[mccnt]["raw"]),3)
761          dict= dict .. " " .. ltx.__tag.mc[mccnt]["raw"]
762         end
763         if ltx.__tag.mc[mccnt]["alt"] then
764          ltx.__tag.trace.log("INFO TAG-USE-ALT: "..
765             tostring(ltx.__tag.mc[mccnt]["alt"]),3)
766          dict= dict .. " " .. ltx.__tag.mc[mccnt]["alt"]
767         end
768         if ltx.__tag.mc[mccnt]["actualtext"] then
769          ltx.__tag.trace.log("INFO TAG-USE-ACTUALTEXT: "..
770            tostring(ltx.__tag.mc[mccnt]["actualtext"]),3)
771          dict= dict .. " " .. ltx.__tag.mc[mccnt]["actualtext"]
772         end
773         box.list = __tag_insert_bdc_node (box.list,n,tag, dict)
774         ltx.__tag.func.store_mc_kid (mccnt,mcpagecnt,abspage)
775         ltx.__tag.func.store_mc_in_page(mccnt,mcpagecnt,abspage)
776         ltx.__tag.trace.show_mc_data (mccnt,3)
777        end
778        mcopen = mcopen + 1
779       else
780        if tagunmarkedbool.mode == truebool.mode then
781         ltx.__tag.trace.log("INFO TAG-NOT-TAGGED: this has not been tagged, using artifact",2
782         box.list = __tag_insert_bmc_node (box.list,n,"Artifact")
783         mcopen = mcopen + 1
784        else
785         ltx.__tag.trace.log("WARN TAG-NOT-TAGGED: this has not been tagged",1)
786        end
787       end
788       mccntprev = mccnt
789      end
790    end -- end if
791  end -- end for
792  if head then
793    mccnthead, mctypehead,taghead = __tag_get_mc_cnt_type_tag (head)
794    ltx.__tag.trace.log ("INFO TAG-ENDHEAD: " ..
795                         node.type(node.getid(head))..
796                        " MC"..tostring(mccnthead)..
797                        " => TAG "..tostring(mctypehead)..
798                        " => "..tostring(taghead),4)
799  else
800    ltx.__tag.trace.log ("INFO TAG-ENDHEAD: ".. tostring(head),4)
801  end
802  ltx.__tag.trace.log ("INFO TAG-QUITTING-BOX "..
803                       tostring(name)..
```

```
                    " TYPE ".. node.type(node.getid(box)),4)
 return mcopen,mcpagecnt,mccntprev,mctypeprev
end

```

(*End of 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.

```
function ltx.__tag.func.mark_shipout (box)
 mcopen = ltx.__tag.func.mark_page_elements (box,-1,-100,0,"Shipout",-1)
 if mcopen~=0 then -- there is a chunk open, close it (hope there is only one ...
  local emcnode = __tag_backend_create_emc_node ()
  local list = box.list
  if list then
     list = node.insert_after (list,node.tail(list),emcnode)
     mcopen = mcopen - 1
     ltx.__tag.trace.log ("INFO SHIPOUT-INSERT-LAST-EMC: MCOPEN " .. mcopen,3)
  else
     ltx.__tag.trace.log ("WARN SHIPOUT-UPS: this shouldn't happen",0)
  end
  if mcopen ~=0 then
     ltx.__tag.trace.log ("WARN SHIPOUT-MC-OPEN: " .. mcopen,1)
  end
 end
end
```

(*End of 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.

```
function ltx.__tag.func.fill_parent_tree_line (page)
     -- we need to get page-> i=kid -> mcnum -> structnum
     -- pay attention: the kid numbers and the page number in the parent tree start with 0!
    local numsentry =""
    local pdfpage = page-1
    if ltx.__tag.page[page] and ltx.__tag.page[page][0] then
     mcchunks=#ltx.__tag.page[page]
     ltx.__tag.trace.log("INFO PARENTTREE-NUM:  page "..
                   page.." has "..mcchunks.."+1 Elements ",4)
     for i=0,mcchunks do
     -- what does this log??
      ltx.__tag.trace.log("INFO PARENTTREE-CHUNKS:  "..
        ltx.__tag.page[page][i],4)
     end
     if mcchunks == 0 then
      -- only one chunk so no need for an array
      local mcnum  = ltx.__tag.page[page][0]
      local structnum = ltx.__tag.mc[mcnum]["parent"]
      local propname  = "g__tag_struct_"..structnum.."_prop"
```

```
      --local objref   =  ltx.__tag.tables[propname]["objref"] or "XXXX"
      local objref = __tag_pdf_object_ref('__tag/struct',structnum)
      ltx.__tag.trace.log("INFO PARENTTREE-STRUCT-OBJREF:  =====>"..
        tostring(objref),5)
      numsentry = pdfpage .. " [".. objref .. "]"
      ltx.__tag.trace.log("INFO PARENTTREE-NUMENTRY: page " ..
        page.. " num entry = ".. numsentry,3)
     else
      numsentry = pdfpage .. " ["
       for i=0,mcchunks do
        local mcnum  = ltx.__tag.page[page][i]
        local structnum = ltx.__tag.mc[mcnum]["parent"] or 0
        local propname  = "g__tag_struct_"..structnum.."_prop"
        --local objref   =  ltx.__tag.tables[propname]["objref"] or "XXXX"
        local objref = __tag_pdf_object_ref('__tag/struct',structnum)
        numsentry = numsentry .. " ".. objref
       end
      numsentry = numsentry .. "] "
      ltx.__tag.trace.log("INFO PARENTTREE-NUMENTRY: page " ..
        page.. " num entry = ".. numsentry,3)
     end
    else
      ltx.__tag.trace.log ("INFO PARENTTREE-NO-DATA: page "..page,3)
      numsentry = pdfpage.." []"
    end
    return numsentry
end

function ltx.__tag.func.output_parenttree (abspage)
 for i=1,abspage do
  line = ltx.__tag.func.fill_parent_tree_line (i) .. "^^J"
  tex.sprint(catlatex,line)
 end
end
```

(*End of definition for* `ltx.__tag.func.fill_parent_tree_line` *and* `ltx.__tag.func.output_parenttree`.)

s_softhyphen_pre␣␣␣␣process_softhyphen_post First some local definitions. Since these are only needed locally everything gets wrapped into a block.

```
do
  local properties = node.get_properties_table()
  local is_soft_hyphen_prop = 'tagpdf.rewrite-softhyphen.is_soft_hyphen'
  local hyphen_char = 0x2D
  local soft_hyphen_char = 0xAD
```

A lookup table to test if the font supports the soft hyphen glyph.

```
  local softhyphen_fonts = setmetatable({}, {__index = function(t, fid)
    local fdir = identifiers[fid]
    local format = fdir and fdir.format
    local result = (format == 'opentype' or format == 'truetype')
    local characters = fdir and fdir.characters
    result = result and (characters and characters[soft_hyphen_char]) ~= nil
    t[fid] = result
    return result
  end})
```

A pre shaping callback to mark hyphens as being hyphenation hyphens. This runs before shaping to avoid affecting hyphens moved into discretionaries during shaping.

```
892  local function process_softhyphen_pre(head, _context, _dir)
893    if softhyphenbool.mode ~= truebool.mode then return true end
894    for disc, sub in node.traverse_id(DISC, head) do
895      if sub == explicit_disc or sub == regular_disc then
896        for n, _ch, _f in node.traverse_char(disc.pre) do
897          local props = properties[n]
898          if not props then
899            props = {}
900            properties[n] = props
901          end
902          props[is_soft_hyphen_prop] = true
903        end
904      end
905    end
906    return true
907  end
908
```

Finally do the actual replacement after shaping. No checking for double processing here since the operation is idempotent.

```
909  local function process_softhyphen_post(head, _context, _dir)
910    if softhyphenbool.mode ~= truebool.mode then return true end
911    for disc, sub in node.traverse_id(DISC, head) do
912      for n, ch, fid in node.traverse_glyph(disc.pre) do
913        local props = properties[n]
914        if softhyphen_fonts[fid] and ch == hyphen_char and props and props[is_soft_hyphen_pro
915          n.char = soft_hyphen_char
916          props.glyph_info = nil
917        end
918      end
919    end
920    return true
921  end
922
923  luatexbase.add_to_callback('pre_shaping_filter', process_softhyphen_pre, 'tagpdf.rewrite-
   softhyphen')
924  luatexbase.add_to_callback('post_shaping_filter', process_softhyphen_post, 'tagpdf.rewrite-
   softhyphen')
925 end
```

(*End of definition for* `process_softhyphen_pre` *and* `process_softhyphen_post`*. This function is documented on page* ??.)

926 ⟨/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.

```
⟨@@=tag⟩
⟨*header⟩
\ProvidesExplPackage {tagpdf-roles-code} {2024-09-11} {0.99e}
 {part of tagpdf - code related to roles and structure names}
⟨/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.

```
\prop_new:N     \g__tag_role_tags_NS_prop
```

(*End of 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 dependent 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.

```
\prop_new:N     \g__tag_role_tags_class_prop
```

(*End of 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/dflt/2022

latex-book https://www.latex-project.org/ns/book/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.

```
\prop_new:N \g__tag_role_NS_prop
```

(*End of 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.

```
\prop_new:N \g__tag_role_index_prop
```

(*End of definition for* `\g__tag_role_index_prop`.)

\l__tag_role_debug_prop This variable is used to pass more infos to debug messages.

```
\prop_new:N \l__tag_role_debug_prop
```

(*End of 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
\l__tag_role_tag_namespace_tmpb_tl
\l__tag_role_role_tmpa_tl
\l__tag_role_role_namespace_tmpa_tl
\l__tag_role_tmpa_seq

```
\tl_new:N \l__tag_role_tag_tmpa_tl
\tl_new:N \l__tag_role_tag_namespace_tmpa_tl
\tl_new:N \l__tag_role_tag_namespace_tmpb_tl
\tl_new:N \l__tag_role_role_tmpa_tl
\tl_new:N \l__tag_role_role_namespace_tmpa_tl
\seq_new:N\l__tag_role_tmpa_seq
```

(*End of 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
\g__tag_role_rolemap_prop

This is the object which contains the normal RoleMap. It is probably not needed in pdf 2.0 but currently kept.

```
\pdfdict_new:n {g__tag_role/RoleMap_dict}
\prop_new:N \g__tag_role_rolemap_prop
```

(*End of 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

```
\pdf_version_compare:NnTF < {2.0}
 {
   \cs_new_protected:Npn \__tag_role_NS_new:nnn #1 #2 #3
    {
      \prop_new:c { g__tag_role_NS_#1_prop }
      \prop_new:c { g__tag_role_NS_#1_class_prop }
      \prop_gput:Nne \g__tag_role_NS_prop {#1}{}
    }
 }
 {
  \cs_new_protected:Npn \__tag_role_NS_new:nnn #1 #2 #3
    {
      \prop_new:c { g__tag_role_NS_#1_prop }
      \prop_new:c { g__tag_role_NS_#1_class_prop }
      \pdf_object_new:n {tag/NS/#1}
      \pdfdict_new:n     {g__tag_role/Namespace_#1_dict}
      \pdf_object_new:n {__tag/RoleMapNS/#1}
      \pdfdict_new:n     {g__tag_role/RoleMapNS_#1_dict}
      \pdfdict_gput:nnn
        {g__tag_role/Namespace_#1_dict}
        {Type}
        {/Namespace}
      \pdf_string_from_unicode:nnN{utf8/string}{#2}\l__tag_tmpa_str
      \tl_if_empty:NF \l__tag_tmpa_str
        {
          \pdfdict_gput:nne
            {g__tag_role/Namespace_#1_dict}
            {NS}
            {\l__tag_tmpa_str}
        }
      %RoleMapNS is added in tree
      \tl_if_empty:nF  {#3}
```

```
      {
        \pdfdict_gput:nne{g__tag_role/Namespace_#1_dict}
         {Schema}{#3}
      }
     \prop_gput:Nne \g__tag_role_NS_prop {#1}{\pdf_object_ref:n{tag/NS/#1}~}
   }
}
```

(*End of 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`

```
\str_const:Ne \c__tag_role_userNS_id_str
  { data:,
    \int_to_Hex:n{\int_rand:n {65535}}
    \int_to_Hex:n{\int_rand:n {65535}}
    -
    \int_to_Hex:n{\int_rand:n {65535}}
    -
    \int_to_Hex:n{\int_rand:n {65535}}
    -
    \int_to_Hex:n{\int_rand:n {65535}}
    -
    \int_to_Hex:n{\int_rand:n {16777215}}
    \int_to_Hex:n{\int_rand:n {16777215}}
  }
```

(*End of definition for* `\c__tag_role_userNS_id_str`.)

Now we setup the standard names spaces. The mathml space is loaded also for pdf < 2.0 but not added to RoleMap unless a boolean is set to true with `tagpdf-setup{mathml-tags}`.

```
\bool_new:N \g__tag_role_add_mathml_bool
\__tag_role_NS_new:nnn {pdf}   {http://iso.org/pdf/ssn}{}
\__tag_role_NS_new:nnn {pdf2}  {http://iso.org/pdf2/ssn}{}
\__tag_role_NS_new:nnn {mathml}{http://www.w3.org/1998/Math/MathML}{}
\__tag_role_NS_new:nnn {latex} {https://www.latex-project.org/ns/dflt/2022}{}
\__tag_role_NS_new:nnn {latex-book} {https://www.latex-project.org/ns/book/2022}{}
\exp_args:Nne
  \__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.

```
\pdf_version_compare:NnTF < {2.0}
  {
   \sys_if_engine_luatex:TF
    {
```

```
      \cs_new_protected:Npn \__tag_role_alloctag:nnn #1 #2 #3 %#1 tagname, ns, type
       {
         \lua_now:e { ltx.__tag.func.alloctag ('#1') }
         \prop_gput:Nnn \g__tag_role_tags_NS_prop   {#1}{#2}
         \prop_gput:cnn {g__tag_role_NS_#2_prop}  {#1}{}{}
         \prop_gput:Nnn \g__tag_role_tags_class_prop {#1}{#3}
         \prop_gput:cnn {g__tag_role_NS_#2_class_prop}  {#1}{--UNUSED--}
       }
    }
    {
      \cs_new_protected:Npn \__tag_role_alloctag:nnn #1 #2 #3
       {
         \prop_gput:Nnn \g__tag_role_tags_NS_prop   {#1}{#2}
         \prop_gput:cnn {g__tag_role_NS_#2_prop}  {#1}{}{}
         \prop_gput:Nnn \g__tag_role_tags_class_prop {#1}{#3}
         \prop_gput:cnn {g__tag_role_NS_#2_class_prop}  {#1}{--UNUSED--}
       }
    }
  }
  {
   \sys_if_engine_luatex:TF
    {
      \cs_new_protected:Npn \__tag_role_alloctag:nnn #1 #2 #3 %#1 tagname, ns, type
       {
         \lua_now:e { ltx.__tag.func.alloctag ('#1') }
         \prop_gput:Nnn \g__tag_role_tags_NS_prop   {#1}{#2}
         \prop_gput:cnn {g__tag_role_NS_#2_prop}  {#1}{}{}
         \prop_gput:Nnn \g__tag_role_tags_class_prop {#1}{--UNUSED--}
         \prop_gput:cnn {g__tag_role_NS_#2_class_prop}  {#1}{#3}
       }
    }
    {
      \cs_new_protected:Npn \__tag_role_alloctag:nnn #1 #2 #3
       {
         \prop_gput:Nnn \g__tag_role_tags_NS_prop   {#1}{#2}
         \prop_gput:cnn {g__tag_role_NS_#2_prop}  {#1}{}{}
         \prop_gput:Nnn \g__tag_role_tags_class_prop {#1}{--UNUSED--}
         \prop_gput:cnn {g__tag_role_NS_#2_class_prop}  {#1}{#3}
       }
    }
  }
\cs_generate_variant:Nn  \__tag_role_alloctag:nnn {nnV}
```

(*End of 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.

```
\cs_new_protected:Nn \__tag_role_add_tag:nn % (new) name, reference to old
  {
```

checks and messages

```
    \__tag_check_add_tag_role:nn {#1}{#2}
    \prop_if_in:NnF \g__tag_role_tags_NS_prop {#1}
      {
        \int_compare:nNnT {\l__tag_loglevel_int} > { 0 }
          {
            \msg_info:nnn { tag }{new-tag}{#1}
          }
      }
```

now the addition

```
    \prop_get:NnN \g__tag_role_tags_class_prop {#2}\l__tag_tmpa_tl
    \quark_if_no_value:NT \l__tag_tmpa_tl
      {
        \tl_set:Nn\l__tag_tmpa_tl{--UNKNOWN--}
      }
    \__tag_role_alloctag:nnV {#1}{user}\l__tag_tmpa_tl
```

We resolve rolemapping recursively so that all targets are stored as standard tags.

```
    \tl_if_empty:nF { #2 }
      {
        \prop_get:NnN \g__tag_role_rolemap_prop {#2}\l__tag_tmpa_tl
        \quark_if_no_value:NTF \l__tag_tmpa_tl
          {
            \prop_gput:Nne \g__tag_role_rolemap_prop {#1}{\tl_to_str:n{#2}}
          }
          {
            \prop_gput:NnV \g__tag_role_rolemap_prop {#1}\l__tag_tmpa_tl
          }
      }
  }
\cs_generate_variant:Nn \__tag_role_add_tag:nn {VV,ne}
```

(*End of 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`

```
\pdf_version_compare:NnT < {2.0}
 {
   \cs_new:Npn \__tag_role_get:nnNN #1#2#3#4 %#1 tag, #2 NS, #3 tlvar which hold the role tag
    {
      \prop_get:NnNF \g__tag_role_rolemap_prop {#1}#3
        {
          \tl_set:Nn #3 {#1}
        }
      \tl_set:Nn #4 {}
    }
   \cs_generate_variant:Nn \__tag_role_get:nnNN {VVNN}
 }

```

(*End of 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

```
\cs_new_protected:Nn \__tag_role_add_tag:nnnn %tag/namespace/role/namespace
  {
    \__tag_check_add_tag_role:nnn {#1/#2}{#3}{#4}
    \int_compare:nNnT {\l__tag_loglevel_int} > { 0 }
      {
        \msg_info:nnn { tag }{new-tag}{#1}
      }
    \prop_if_exist:cTF
     { g__tag_role_NS_#4_class_prop }
     {
       \prop_get:cnN { g__tag_role_NS_#4_class_prop } {#3}\l__tag_tmpa_tl
       \quark_if_no_value:NT \l__tag_tmpa_tl
        {
          \tl_set:Nn\l__tag_tmpa_tl{--UNKNOWN--}
        }
     }
     { \tl_set:Nn\l__tag_tmpa_tl{--UNKNOWN--} }
    \__tag_role_alloctag:nnV {#1}{#2}\l__tag_tmpa_tl
```

Do not remap standard tags. TODO add warning?

```
    \tl_if_in:nnF {-pdf-pdf2-mathml-}{-#2-}
     {
       \pdfdict_gput:nne {g__tag_role/RoleMapNS_#2_dict}{#1}
          {
            [
              \pdf_name_from_unicode_e:n{#3}
              \c_space_tl
              \pdf_object_ref:n {tag/NS/#4}
            ]
          }
     }
```

We resolve rolemapping recursively so that all targets are stored as standard tags for the tests.

```
    \tl_if_empty:nF { #2 }
      {
        \prop_get:cnN { g__tag_role_NS_#4_prop } {#3}\l__tag_tmpa_tl
        \quark_if_no_value:NTF \l__tag_tmpa_tl
          {
            \prop_gput:cne { g__tag_role_NS_#2_prop } {#1}
              {{\tl_to_str:n{#3}}{\tl_to_str:n{#4}}}
          }
          {
            \prop_gput:cno { g__tag_role_NS_#2_prop } {#1}{\l__tag_tmpa_tl}
          }
      }
```

We also store into the pdf 1.7 rolemapping so that we can add that as fallback for pdf 1.7 processor

```
     \bool_if:NT \l__tag_role_update_bool
       {
         \tl_if_empty:nF { #3 }
```

```
          {
            \tl_if_eq:nnF{#1}{#3}
             {
              \prop_get:NnN \g__tag_role_rolemap_prop {#3}\l__tag_tmpa_tl
               \quark_if_no_value:NTF \l__tag_tmpa_tl
                {
                  \prop_gput:Nne \g__tag_role_rolemap_prop {#1}{\tl_to_str:n{#3}}
                }
                {
                  \prop_gput:NnV \g__tag_role_rolemap_prop {#1}\l__tag_tmpa_tl
                }
              }
           }
       }
   }
\cs_generate_variant:Nn \__tag_role_add_tag:nnnn {VVVV}
```

(*End of 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`

```
\pdf_version_compare:NnF < {2.0}
 {
   \cs_new:Npn \__tag_role_get:nnNN #1#2#3#4
     %#1 tag, #2 NS,
     %#3 tlvar which hold the role tag
     %#4 tlvar which hold the name of the target NS
    {
      \prop_if_exist:cTF {g__tag_role_NS_#2_prop}
       {
        \prop_get:cnNTF {g__tag_role_NS_#2_prop} {#1}\l__tag_get_tmpc_tl
          {
           \tl_set:Ne #3 {\exp_last_unbraced:NV\use_i:nn   \l__tag_get_tmpc_tl}
           \tl_set:Ne #4 {\exp_last_unbraced:NV\use_ii:nn  \l__tag_get_tmpc_tl}
          }
          {
           \msg_warning:nnn { tag } {role-unknown-tag} { #1 }
           \tl_set:Nn #3 {#1}
           \tl_set:Nn #4 {#2}
          }
       }
       {
          \msg_warning:nnn { tag } {role-unknown-NS} { #2 }
          \tl_set:Nn #3 {#1}
          \tl_set:Nn #4 {#2}
       }
    }
   \cs_generate_variant:Nn \__tag_role_get:nnNN {VVNN}
 }
```

(*End of 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 special name spaces shouldn't update the default role or add to the rolemap again, they only store the values for later uses. We use a boolean here.

```
\bool_new:N\l__tag_role_update_bool
\bool_set_true:N \l__tag_role_update_bool
\pdf_version_compare:NnTF < {2.0}
 {
  \cs_new_protected:Npn \__tag_role_read_namespace_line:nw #1#2,#3,#4,#5,#6\q_stop %
   % #1 NS, #2 tag, #3 rolemap, #4 NS rolemap #5 type
    {
      \tl_if_empty:nF { #2 }
       {
        \bool_if:NTF \l__tag_role_update_bool
         {
          \tl_if_empty:nTF {#5}
            {
              \prop_get:NnN \g__tag_role_tags_class_prop  {#3}\l__tag_tmpa_tl
              \quark_if_no_value:NT \l__tag_tmpa_tl
                {
                  \tl_set:Nn\l__tag_tmpa_tl{--UNKNOWN--}
                }
            }
            {
              \tl_set:Nn \l__tag_tmpa_tl {#5}
            }
          \__tag_role_alloctag:nnV {#2}{#1}\l__tag_tmpa_tl
          \tl_if_eq:nnF {#2}{#3}
           {
            \__tag_role_add_tag:nn {#2}{#3}
           }
          \prop_gput:cnn {g__tag_role_NS_#1_prop}  {#2}{{#3}{}}
         }
         {
           \prop_gput:cnn {g__tag_role_NS_#1_prop}  {#2}{{#3}{}}
           \prop_gput:cnn {g__tag_role_NS_#1_class_prop}  {#2}{--UNUSED--}
         }
       }
    }
 }
 {
   \cs_new_protected:Npn \__tag_role_read_namespace_line:nw #1#2,#3,#4,#5,#6\q_stop %
    % #1 NS, #2 tag, #3 rolemap, #4 NS rolemap #5 type
    {
      \tl_if_empty:nF {#2}
       {
        \tl_if_empty:nTF {#5}
         {
           \prop_get:cnN { g__tag_role_NS_#4_class_prop } {#3}\l__tag_tmpa_tl
           \quark_if_no_value:NT \l__tag_tmpa_tl
```

```
            {
              \tl_set:Nn\l__tag_tmpa_tl{--UNKNOWN--}
            }
         }
         {
           \tl_set:Nn \l__tag_tmpa_tl {#5}
         }
        \__tag_role_alloctag:nnV {#2}{#1}\l__tag_tmpa_tl
        \bool_lazy_and:nnT
           { ! \tl_if_empty_p:n {#3} }{! \str_if_eq_p:nn {#1}{pdf2}}
           {
            \__tag_role_add_tag:nnnn {#2}{#1}{#3}{#4}
           }
        \prop_gput:cnn {g__tag_role_NS_#1_prop}  {#2}{{#3}{#4}}
       }
    }
 }
```

(*End of definition for* `\__tag_role_read_namespace_line:nw`.)

`\__tag_role_read_namespace:nn` This command reads a namespace file in the format tagpdf-ns-XX.def

```
\cs_new_protected:Npn \__tag_role_read_namespace:nn #1 #2 %name of namespace #2 name of file
  {
    \prop_if_exist:cF {g__tag_role_NS_#1_prop}
      { \msg_warning:nnn {tag}{namespace-unknown}{#1} }
    \file_if_exist:nTF { tagpdf-ns-#2.def }
     {
       \ior_open:Nn \g_tmpa_ior {tagpdf-ns-#2.def}
       \msg_info:nnn {tag}{read-namespace}{#2}
       \ior_map_inline:Nn \g_tmpa_ior
         {
           \__tag_role_read_namespace_line:nw {#1} ##1,,,,\q_stop
         }
       \ior_close:N\g_tmpa_ior
     }
     {
      \msg_info:nnn{tag}{namespace-missing}{#2}
     }
  }

```

(*End of definition for* `\__tag_role_read_namespace:nn`.)

`\__tag_role_read_namespace:n` This command reads the default namespace file.

```
\cs_new_protected:Npn \__tag_role_read_namespace:n #1 %name of namespace
  {
    \__tag_role_read_namespace:nn {#1}{#1}
  }
```

(*End of 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: if two namespace define the same tag, the last one defines which one is used if the namespace is not explicitly given.

```
\__tag_role_read_namespace:n {pdf}
\__tag_role_read_namespace:n {pdf2}
\__tag_role_read_namespace:n {mathml}
```

in pdf 1.7 the following namespaces should only store the settings for later use:

```
\bool_set_false:N\l__tag_role_update_bool
\__tag_role_read_namespace:n {latex-book}
\bool_set_true:N\l__tag_role_update_bool
\__tag_role_read_namespace:n {latex}
\__tag_role_read_namespace:nn {latex} {latex-lab}
\__tag_role_read_namespace:n {pdf}
\__tag_role_read_namespace:n {pdf2}
```

But is the class provides a `\chapter` command then we switch

```
\pdf_version_compare:NnTF < {2.0}
  {
    \hook_gput_code:nnn {begindocument}{tagpdf}
      {
        \bool_lazy_and:nnT
         {
           \cs_if_exist_p:N \chapter
         }
         {
           \cs_if_exist_p:N \c@chapter
         }
         {
           \prop_map_inline:cn{g__tag_role_NS_latex-book_prop}
             {
               \__tag_role_add_tag:ne {#1}{\use_i:nn #2\c_empty_tl\c_empty_tl}
             }
         }
      }
  }
  {
    \hook_gput_code:nnn {begindocument}{tagpdf}
      {
        \bool_lazy_and:nnT
         {
           \cs_if_exist_p:N \chapter
         }
         {
           \cs_if_exist_p:N \c@chapter
         }
         {
           \prop_map_inline:cn{g__tag_role_NS_latex-book_prop}
             {
               \prop_gput:Nnn \g__tag_role_tags_NS_prop    { #1 }{ latex-book }
               \prop_gput:Nne
                \g__tag_role_rolemap_prop {#1}{\use_i:nn  #2\c_empty_tl\c_empty_tl}
             }
         }
```

```
    }
  }
```

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.

```
\intarray_new:Nn \g__tag_role_parent_child_intarray {6000}
```

(*End of 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 of 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!

```
\cs_new_protected:Npn \__tag_store_parent_child_rule:nnn #1 #2 #3 % num parent, num child, #3
  {
    \intarray_gset:Nnn \g__tag_role_parent_child_intarray
      { #1#2 }{0\prop_item:Nn\c__tag_role_rules_prop{#3}}
  }
```

(*End of 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

```
\int_zero:N  \l__tag_tmpa_int
```

Open the file depending on the PDF version

```
\pdf_version_compare:NnTF < {2.0}
  {
    \ior_open:Nn \g_tmpa_ior {tagpdf-parent-child.csv}
  }
  {
    \ior_open:Nn \g_tmpa_ior {tagpdf-parent-child-2.csv}
  }
```

Now the main loop over the file

```
\ior_map_inline:Nn \g_tmpa_ior
  {
```

ignore lines containing only comments

```
    \tl_if_empty:nF{#1}
      {
```

count the lines ...

```
        \int_incr:N\l__tag_tmpa_int
```

put the line into a seq. Attention! empty cells are dropped.

```
        \seq_set_from_clist:Nn\l__tag_tmpa_seq { #1 }
        \int_compare:nNnTF {\l__tag_tmpa_int}=1
```

This handles the header line. It gives the tags 2-digit numbers

```
          {
            \seq_map_indexed_inline:Nn \l__tag_tmpa_seq
              {
                \prop_gput:Nne\g__tag_role_index_prop
                  {##2}
                  {\int_compare:nNnT{##1}<{10}{0}##1}
              }
          }
```

now the data lines.

```
        {
          \seq_set_from_clist:Nn\l__tag_tmpa_seq { #1 }
```

get the name of the child tag from the first column

```
          \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`

```
          \prop_get:NVN \g__tag_role_index_prop \l__tag_tmpa_tl \l__tag_tmpb_tl
```

remove column 2+3

```
          \seq_pop_left:NN\l__tag_tmpa_seq\l__tag_tmpa_tl
          \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.

```
          \seq_map_indexed_inline:Nn \l__tag_tmpa_seq
            {
              \exp_args:Nne
              \__tag_store_parent_child_rule:nnn {##1}{\l__tag_tmpb_tl}{ ##2 }
            }
        }
    }
}
```

close the read handle.

```
\ior_close:N\g_tmpa_ior
```

The Root, Hn and mathml tags are special and need to be added explicitly

```
\prop_get:NnN\g__tag_role_index_prop{StructTreeRoot}\l__tag_tmpa_tl
\prop_gput:Nne\g__tag_role_index_prop{Root}{\l__tag_tmpa_tl}
\prop_get:NnN\g__tag_role_index_prop{Hn}\l__tag_tmpa_tl
\pdf_version_compare:NnTF < {2.0}
  {
    \int_step_inline:nn{6}
      {
        \prop_gput:Nne\g__tag_role_index_prop{H#1}{\l__tag_tmpa_tl}
      }
  }
  {
    \int_step_inline:nn{10}
      {
        \prop_gput:Nne\g__tag_role_index_prop{H#1}{\l__tag_tmpa_tl}
      }
```

all mathml tags are currently handled identically

```
    \prop_get:NnN\g__tag_role_index_prop {mathml}\l__tag_tmpa_tl
    \prop_get:NnN\g__tag_role_index_prop {math}\l__tag_tmpb_tl
    \prop_map_inline:Nn \g__tag_role_NS_mathml_prop
      {
        \prop_gput:NnV\g__tag_role_index_prop{#1}\l__tag_tmpa_tl
      }
    \prop_gput:NnV\g__tag_role_index_prop{math}\l__tag_tmpb_tl
  }
```

1.6.2 Retrieving the parent-child rule

__tag_role_get_parent_child_rule:nnnN

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.

```
\tl_new:N \l__tag_parent_child_check_tl
\cs_new_protected:Npn \__tag_role_get_parent_child_rule:nnnN #1 #2 #3 #4
  % #1 parent (string) #2 child (string) #3 text for messages (eg. about Div or Rolemapping)
  % #4 tl for state
  {
     \prop_get:NnN \g__tag_role_index_prop{#1}\l__tag_tmpa_tl
     \prop_get:NnN \g__tag_role_index_prop{#2}\l__tag_tmpb_tl
     \bool_lazy_and:nnTF
       { ! \quark_if_no_value_p:N \l__tag_tmpa_tl }
       { ! \quark_if_no_value_p:N \l__tag_tmpb_tl }
       {
```

Get the rule from the intarray

```
         \tl_set:Ne#4
           {
             \intarray_item:Nn
              \g__tag_role_parent_child_intarray
             {\l__tag_tmpa_tl\l__tag_tmpb_tl}
           }
```

If the state is something is wrong ...

```
         \int_compare:nNnT
           {#4} = {\prop_item:Nn\c__tag_role_rules_prop{}}
           {
             %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.

```
           }
```

This is the message, this can perhaps go into debug mode.

```
         \group_begin:
         \int_compare:nNnT {\l__tag_tmpa_int*\l__tag_loglevel_int} > { 0 }
           {
             \prop_get:NVNF\c__tag_role_rules_num_prop #4 \l__tag_tmpa_tl
               {
                 \tl_set:Nn \l__tag_tmpa_tl {unknown}
```

```
              }
            \tl_set:Nn \l__tag_tmpb_tl {#1}
            \msg_note:nneee
              { tag }
              { role-parent-child }
              { #1 }
              { #2 }
              {
                #4~(='\l__tag_tmpa_tl')
                 \iow_newline:
                 #3
              }
          }
          \group_end:
      }
      {
        \tl_set:Nn#4 {0}
        \msg_warning:nneee
          { tag }
          {role-parent-child}
          { #1 }
          { #2 }
          { unknown! }
      }
  }
\cs_generate_variant:Nn\__tag_role_get_parent_child_rule:nnnN {VVVN,VVnN}
```

(*End of 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 inheritation 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.

```
\pdf_version_compare:NnTF < {2.0}
  {
   \cs_new_protected:Npn \__tag_check_parent_child:nnnnN #1 #2 #3 #4 #5
    %#1 parent tag,#2 NS, #3 child tag, #4 NS, #5 tl var
     {
```

for debugging messages we store the arguments.

```
      \prop_put:Nnn \l__tag_role_debug_prop {parent} {#1}
      \prop_put:Nnn \l__tag_role_debug_prop {child}  {#3}
```

get the standard tags through rolemapping if needed at first the parent

```
      \prop_get:NnNTF \g__tag_role_index_prop {#1}\l__tag_tmpa_tl
        {
          \tl_set:Nn \l__tag_tmpa_tl {#1}
        }
        {
          \prop_get:NnNF \g__tag_role_rolemap_prop {#1}\l__tag_tmpa_tl
            {
              \tl_set:Nn \l__tag_tmpa_tl {\q_no_value}
            }
        }
```

now the child

```
      \prop_get:NnNTF \g__tag_role_index_prop {#3}\l__tag_tmpb_tl
        {
          \tl_set:Nn \l__tag_tmpb_tl {#3}
        }
        {
          \prop_get:NnNF \g__tag_role_rolemap_prop {#3}\l__tag_tmpb_tl
            {
              \tl_set:Nn \l__tag_tmpb_tl {\q_no_value}
            }
        }
```

if we got tags for parent and child we call the checking command

```
      \bool_lazy_and:nnTF
        { ! \quark_if_no_value_p:N \l__tag_tmpa_tl }
        { ! \quark_if_no_value_p:N \l__tag_tmpb_tl }
        {
          \__tag_role_get_parent_child_rule:VVnN
            \l__tag_tmpa_tl \l__tag_tmpb_tl
            {Rolemapped~from:~'#1'~-->~'#3'}
            #5
        }
        {
          \tl_set:Nn #5 {0}
          \msg_warning:nneee
           { tag }
           {role-parent-child}
           { #1 }
           { #3 }
           { unknown! }
        }
    }
   \cs_new_protected:Npn \__tag_check_parent_child:nnN #1#2#3
     {
       \__tag_check_parent_child:nnnnN {#1}{}{#2}{}#3
     }
}
```

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.

```
{
 \cs_new_protected:Npn \__tag_check_parent_child:nnN #1 #2 #3
   {
     \prop_get:NnN\g__tag_role_tags_NS_prop {#1}\l__tag_role_tag_namespace_tmpa_tl
     \prop_get:NnN\g__tag_role_tags_NS_prop {#2}\l__tag_role_tag_namespace_tmpb_tl
     \str_if_eq:nnT{#2}{MC}{\tl_clear:N \l__tag_role_tag_namespace_tmpb_tl}
     \bool_lazy_and:nnTF
       { ! \quark_if_no_value_p:N \l__tag_role_tag_namespace_tmpa_tl }
       { ! \quark_if_no_value_p:N \l__tag_role_tag_namespace_tmpb_tl }
       {
         \__tag_check_parent_child:nVnVN
           {#1}\l__tag_role_tag_namespace_tmpa_tl
           {#2}\l__tag_role_tag_namespace_tmpb_tl
```

```
              #3
          }
          {
            \tl_set:Nn #3 {0}
            \msg_warning:nneee
             { tag }
             {role-parent-child}
             { #1 }
             { #2 }
             { unknown! }
          }
      }
```

and now the real command.

```
   \cs_new_protected:Npn \__tag_check_parent_child:nnnnN #1 #2 #3 #4 #5 %tag,NS,tag,NS, tl va
      {
        \prop_put:Nnn \l__tag_role_debug_prop {parent} {#1/#2}
        \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

```
        \tl_if_empty:nTF  {#2}
          {
            \tl_set:Nn \l__tag_tmpa_tl {#1}
          }
          {
            \prop_if_exist:cTF { g__tag_role_NS_#2_prop }
              {
               \prop_get:cnNTF
                  { g__tag_role_NS_#2_prop }
                  {#1}
                  \l__tag_tmpa_tl
                  {
                    \tl_set:Ne \l__tag_tmpa_tl {\tl_head:N\l__tag_tmpa_tl}
                    \tl_if_empty:NT\l__tag_tmpa_tl
                      {
                        \tl_set:Nn \l__tag_tmpa_tl {#1}
                      }
                  }
                  {
                    \tl_set:Nn \l__tag_tmpa_tl {\q_no_value}
                  }
              }
              {
                \msg_warning:nnn { tag } {role-unknown-NS} { #2}
                \tl_set:Nn \l__tag_tmpa_tl {\q_no_value}
              }
          }
```

and the same for the child If the namespace is empty, we assume a standard tag, otherwise we retrieve the rolemapping from the namespace

```
        \tl_if_empty:nTF  {#4}
          {
            \tl_set:Nn \l__tag_tmpb_tl {#3}
          }
```

```
          {
            \prop_if_exist:cTF { g__tag_role_NS_#4_prop }
              {
               \prop_get:cnNTF
                 { g__tag_role_NS_#4_prop }
                 {#3}
                 \l__tag_tmpb_tl
                 {
                   \tl_set:Ne \l__tag_tmpb_tl { \tl_head:N\l__tag_tmpb_tl }
                   \tl_if_empty:NT\l__tag_tmpb_tl
                     {
                       \tl_set:Nn \l__tag_tmpb_tl {#3}
                     }
                 }
                 {
                   \tl_set:Nn \l__tag_tmpb_tl {\q_no_value}
                 }
              }
              {
                \msg_warning:nnn { tag } {role-unknown-NS} { #4}
                \tl_set:Nn \l__tag_tmpb_tl {\q_no_value}
              }
          }
```

and now get the relation

```
        \bool_lazy_and:nnTF
          { ! \quark_if_no_value_p:N \l__tag_tmpa_tl }
          { ! \quark_if_no_value_p:N \l__tag_tmpb_tl }
          {
            \__tag_role_get_parent_child_rule:VVnN
              \l__tag_tmpa_tl \l__tag_tmpb_tl
              {Rolemapped~from~'#1/#2'~~~>~'#3\str_if_empty:nF{#4}{/#4}'}
              #5
          }
          {
            \tl_set:Nn #5 {0}
            \msg_warning:nneee
             { tag }
             {role-parent-child}
             { #1 }
             { #3 }
             { unknown! }
          }
      }
  }
\cs_generate_variant:Nn\__tag_check_parent_child:nnN {VVN}
\cs_generate_variant:Nn\__tag_check_parent_child:nnnnN {VVVVN,nVnVN,VVnnN}
⟨/package⟩
```

(*End of definition for* `__tag_check_parent_child:nnnnN`.)

`\tag_check_child:nnTF`

```
⟨base⟩\prg_new_protected_conditional:Npnn \tag_check_child:nn #1 #2 {T,F,TF}{\prg_return_true
⟨*package⟩
\prg_set_protected_conditional:Npnn \tag_check_child:nn #1 #2 {T,F,TF}
```

```
{
  \seq_get:NN\g__tag_struct_stack_seq\l__tag_tmpa_tl
  \__tag_struct_get_parentrole:eNN
     {\l__tag_tmpa_tl}
     \l__tag_get_parent_tmpa_tl
     \l__tag_get_parent_tmpb_tl
  \__tag_check_parent_child:VVnnN
    \l__tag_get_parent_tmpa_tl
    \l__tag_get_parent_tmpb_tl
     {#1}{#2}
     \l__tag_parent_child_check_tl
  \int_compare:nNnTF {  \l__tag_parent_child_check_tl } < {0}
     {\prg_return_false:}
     {\prg_return_true:}
}
```

(*End of definition for* `\tag_check_child:nnTF`. *This function is documented on page* 159.)

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`

```
\tl_new:N \l__tag_role_remap_tag_tl
\tl_new:N \l__tag_role_remap_NS_tl
```

(*End of 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?

```
\cs_new_protected:Npn \__tag_role_remap: {  }
```

(*End of definition for* `\__tag_role_remap:`.)

`\__tag_role_remap_id:` This is copy in case we have to restore the main command.

```
\cs_set_eq:NN \__tag_role_remap_id: \__tag_role_remap:
```

(*End of definition for* `\__tag_role_remap_id:`.)

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)
role␣(rolemap-key)
role-namespace␣(rolemap-key)
role/new-tag␣(setup-key)
add-new-tag␣(deprecated)

```
\keys_define:nn { __tag / tag-role }
  {
    ,tag .tl_set:N = \l__tag_role_tag_tmpa_tl
    ,tag-namespace  .tl_set:N = \l__tag_role_tag_namespace_tmpa_tl
    ,role .tl_set:N = \l__tag_role_role_tmpa_tl
    ,role-namespace .tl_set:N = \l__tag_role_role_namespace_tmpa_tl
  }

\keys_define:nn { __tag / setup }
  {
     role/mathml-tags .bool_gset:N = \g__tag_role_add_mathml_bool
    ,role/new-tag .code:n =
     {
       \keys_set_known:nnnN
         {__tag/tag-role}
         {
           tag-namespace=user,
           role-namespace=, %so that we can test for it.
          #1
         }{__tag/tag-role}\l_tmpa_tl
       \tl_if_empty:NF \l_tmpa_tl
         {
           \exp_args:NNno \seq_set_split:Nnn \l_tmpa_seq { / } {\l_tmpa_tl/}
           \tl_set:Ne \l__tag_role_tag_tmpa_tl  { \seq_item:Nn \l_tmpa_seq {1} }
           \tl_set:Ne \l__tag_role_role_tmpa_tl { \seq_item:Nn \l_tmpa_seq {2} }
         }
      \tl_if_empty:NT \l__tag_role_role_namespace_tmpa_tl
         {
           \prop_get:NVNTF
             \g__tag_role_tags_NS_prop
             \l__tag_role_role_tmpa_tl
             \l__tag_role_role_namespace_tmpa_tl
             {
                \prop_if_in:NVF\g__tag_role_NS_prop \l__tag_role_role_namespace_tmpa_tl
                 {
                   \tl_set:Nn \l__tag_role_role_namespace_tmpa_tl {user}
                 }
             }
             {
               \tl_set:Nn \l__tag_role_role_namespace_tmpa_tl {user}
             }
         }
       \pdf_version_compare:NnTF < {2.0}
        {
         %TODO add check for emptyness?
           \__tag_role_add_tag:VV
               \l__tag_role_tag_tmpa_tl
               \l__tag_role_role_tmpa_tl
        }
        {
          \__tag_role_add_tag:VVVV
            \l__tag_role_tag_tmpa_tl
            \l__tag_role_tag_namespace_tmpa_tl
```

```
            \l__tag_role_role_tmpa_tl
            \l__tag_role_role_namespace_tmpa_tl
        }
     }
    ,role/map-tags .choice:
    ,role/map-tags/false .code:n = { \socket_assign_plug:nn { tag/struct/tag } {latex-tags} }
    ,role/map-tags/pdf   .code:n = { \socket_assign_plug:nn { tag/struct/tag } {pdf-tags} }
```

deprecated names

```
    , mathml-tags .bool_gset:N = \g__tag_role_add_mathml_bool
    , add-new-tag .meta:n = {role/new-tag={#1}}
   }
```

⟨/package⟩

(*End of definition for* `tag (rolemap-key)` *and others. These functions are documented on page* 159.)

Part X
The tagpdf-space module
Code related to real space chars
Part of the tagpdf package

activate/space␣(setup-key)
interwordspace␣(deprecated)

This key allows to activate/deactivate the real space chars if the engine supports it. The allowed values are `true`, `on`, `false`, `off`. The old name of the key `interwordspace` is still supported but deprecated.

show-spaces␣(deprecated)

This key is deprecated. Use `debug/show=spaces` instead. 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.

```
⟨@@=tag⟩
⟨*header⟩
\ProvidesExplPackage {tagpdf-space-code} {2024-09-11} {0.99e}
 {part of tagpdf - code related to real space chars}
⟨/header⟩
```

1 Code for interword spaces

The code is engine/backend dependent. 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.

activate/spaces␣(setup-key)
interwordspace␣(deprecated)
show-spaces␣(deprecated)

```
⟨*package⟩
\bool_new:N\l__tag_showspaces_bool
\keys_define:nn { __tag / setup }
  {
    activate/spaces .choice:,
    activate/spaces/true .code:n =
      { \msg_warning:nne {tag}{sys-no-interwordspace}{\c_sys_engine_str}  },
    activate/spaces/false .code:n=
      { \msg_warning:nne {tag}{sys-no-interwordspace}{\c_sys_engine_str}  },
    activate/spaces .default:n = true,
    debug/show/spaces     .code:n = {\bool_set_true:N \l__tag_showspaces_bool},
    debug/show/spacesOff  .code:n = {\bool_set_false:N \l__tag_showspaces_bool},
```

deprecated versions:

```
    interwordspace .choices:nn = {true,on}{\keys_set:nn{__tag/setup}{activate/spaces={true}}}
    interwordspace .choices:nn = {false,off}{\keys_set:nn{__tag/setup}{activate/spaces={false
    interwordspace .default:n = {true},
```

```
    show-spaces    .choice:,
    show-spaces/true .meta:n =  {debug/show=spaces},
    show-spaces/false .meta:n = {debug/show=spacesOff},
    show-spaces .default:n = true
  }
\sys_if_engine_pdftex:T
  {
    \sys_if_output_pdf:TF
      {
        \pdfglyphtounicode{space}{0020}
        \keys_define:nn { __tag / setup }
          {
            activate/spaces/true .code:n  = { \AddToHook{shipout/firstpage}[tagpdf/space]{\pd
            activate/spaces/false .code:n = { \RemoveFromHook{shipout/firstpage}[tagpdf/space
            activate/spaces .default:n = true,
          }
      }
      {
        \keys_define:nn { __tag / setup }
          {
            activate/spaces .choices:nn = { true, false }
              { \msg_warning:nnn {tag}{sys-no-interwordspace}{dvi}  },
            activate/spaces .default:n = true,
          }
      }
  }


\sys_if_engine_luatex:T
  {
    \keys_define:nn { __tag / setup }
      {
        activate/spaces .choice:,
        activate/spaces/true .code:n =
                                  {
                                    \bool_gset_true:N \g__tag_active_space_bool
                                    \lua_now:e{ltx.__tag.func.markspaceon()}
                                  },
        activate/spaces/false .code:n =
                                  {
                                     \bool_gset_false:N \g__tag_active_space_bool
                                     \lua_now:e{ltx.__tag.func.markspaceoff()}
                                  },
        activate/spaces .default:n = true,
        debug/show/spaces    .code:n =
                                  {\lua_now:e{ltx.__tag.trace.showspaces=true}},
        debug/show/spacesOff .code:n =
                                  {\lua_now:e{ltx.__tag.trace.showspaces=nil}},
      }
  }
```

(*End of definition for* `activate/spaces (setup-key)`, `interwordspace (deprecated)`, *and* `show-spaces (deprecated)`. *These functions are documented on page* 6.)

`\__tag_fakespace:` For luatex we need a command for the fake space as equivalent of the pdftex primitive.

```
\sys_if_engine_luatex:T
  {
    \cs_new_protected:Nn \__tag_fakespace:
      {
        \group_begin:
        \lua_now:e{ltx.__tag.func.fakespace()}
        \skip_horizontal:n{\c_zero_skip}
        \group_end:
      }
  }
```

We need also a command to interrupt the insertion of real space chars in places where we want to insert manually special spaces. In pdftex this can be done with `\pdfinterwordspaceoff` and `\pdfinterwordspaceon`. These commands insert whatsits and this mean they act globally. In luatex a attribute is used to this effect, for consistency this is also set globally.

The off command sets the attributes in luatex.

`\tag_spacechar_on:`
`\tag_spacechar_off:`

```
\cs_new_protected:Npn \tag_spacechar_off: {}
\cs_new_protected:Npn \tag_spacechar_on: {}

\sys_if_engine_luatex:T
 {
   \cs_set_protected:Npn \tag_spacechar_off:
     {
       \lua_now:e
         {
           tex.setattribute
            (
             "global",
             luatexbase.attributes.g__tag_interwordspaceOff_attr,
             1
            )
         }
     }
   \cs_set_protected:Npn \tag_spacechar_on:
     {
       \lua_now:e
         {
           tex.setattribute
            (
             "global",
             luatexbase.attributes.g__tag_interwordspaceOff_attr,
             -2147483647
            )
         }
     }
 }
\sys_if_engine_pdftex:T
  {
    \sys_if_output_pdf:T
      {
       \cs_set_protected:Npn \tag_spacechar_off:
          {
```

```
            \pdfinterwordspaceoff
          }
        \cs_set_protected:Npn \tag_spacechar_on:
          {
            \pdfinterwordspaceon
          }
      }
  }
```

⟨/package⟩

(*End of definition for* `\__tag_fakespace:`, `\tag_spacechar_on:`, *and* `\tag_spacechar_off:`. *These functions are documented on page* ??.)

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