LaTeX3: Using the layers

It's alright ma, it's only witchcraft

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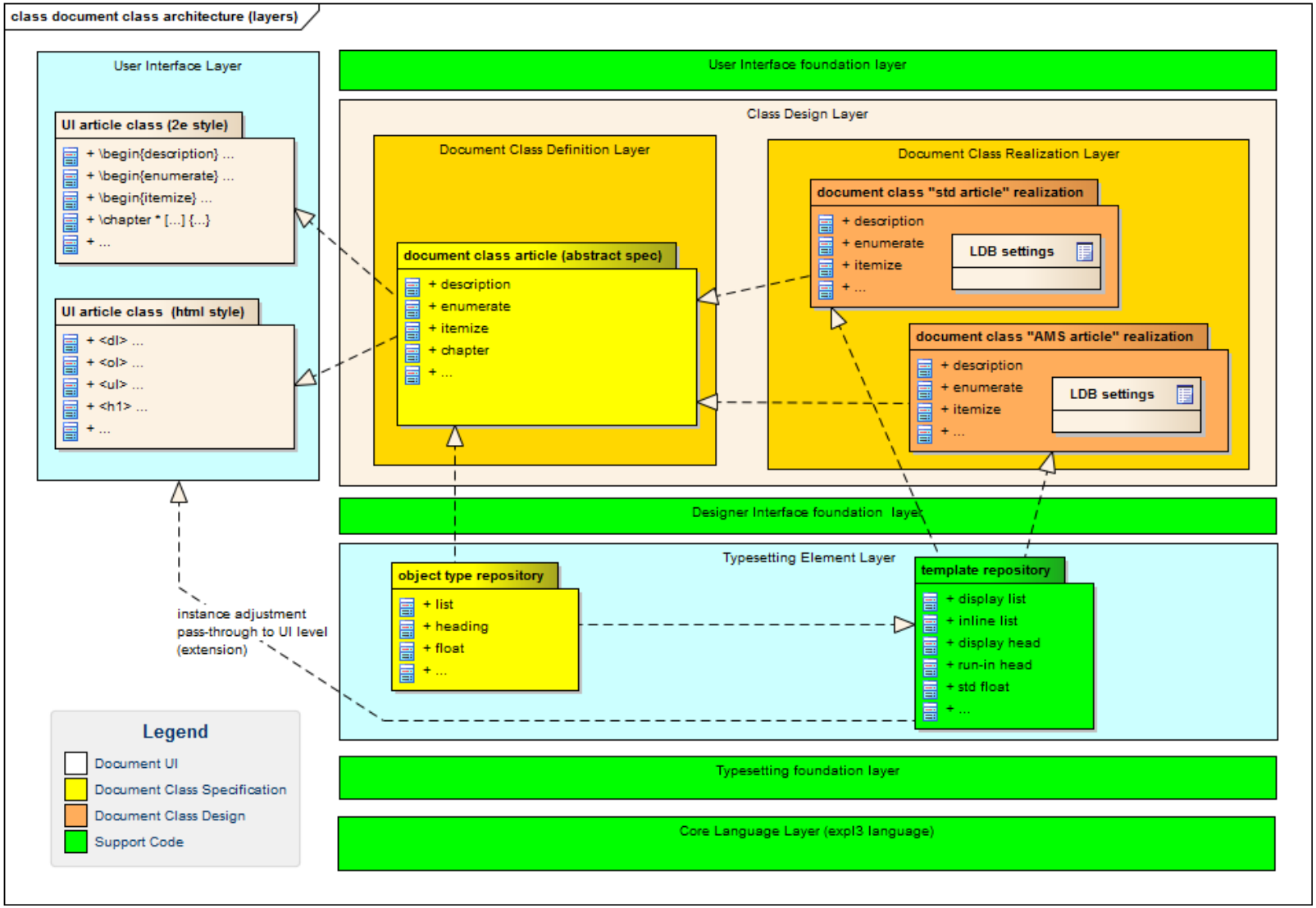
Outline

LaTeX3 layers



Layers of abstraction

Code Data structures and commands to build higher-level typesetting elements

Functionality Typesetting elements that can be customized to show varying behaviours

Design Specific elements and formatting from the functionality layer

User User level syntax to call instances

The LaTeX 2_ε situation

User `\section * [⟨TOC⟩] {⟨heading⟩}`

Design Use of `\@startsection`:
sets appearance of sections

Functionality Arguments of `\@startsection`:
e.g. vertical space above below, *etc.*

Code
```
\if@noskipsec \leavevmode \fi
\addpenalty
...
```

The design layer
Describing design

Ideally, document design could be written independent of code

> *Section headers will be set in 16 point sanserif, with space before the section of 6 points and after of 6 points unless immediately followed by a subsection in which case . . .*

Some ideas on this problem in xtemplate plus the 'LaTeX data base': these are difficult problems!

The functionality layer


```
\def\@startsection#1#2#3#4#5#6{%
  \if@noskipsec \leavevmode \fi
  \par
  \@tempskipa #4\relax
  \@afterindenttrue
  \ifdim \@tempskipa <\z@
    \@tempskipa -\@tempskipa \@afterindentfalse
  \fi
  \if@nobreak
    \everypar{}%
  \else
    \addpenalty\@secpenalty\addvspace\@tempskipa
  \fi
  \@ifstar
    {\@ssect{#3}{#4}{#5}{#6}}%
    {\@dblarg{\@sect{#1}{#2}{#3}{#4}{#5}{#6}}}
```

The code layer

- Where do you find documentation for each of the following?
- Which can you use in your own code?

```
\def\@float#1{%
  \@ifnextchar[%
    {\@xfloat{#1}}%
    {\edef\reserved@a
      {\noexpand\@xfloat{#1}[\csname fps@#1\endcsname]}%
     \reserved@a}}
\def\@dblfloat{%
  \if@twocolumn\let\reserved@a\@dbflt\else
    \let\reserved@a\@float\fi
  \reserved@a}
\def\@xfloat #1[#2]{%
  \@nodocument
  \def \@captype {#1}%
  ...
```

Outline

\newcommand in LaTeX 2ε

With a star . . .


```
\newcommand*{\foo}{Code with no arguments}

\newcommand*{\foo}[2]{Code using #1 and #2}

\newcommand*{\foo}[2][]{Code using #1 and #2}

\newcommand*{\foo}[2][default]
  {Code using #1 and #2}
```

\newcommand in LaTeX 2ε

. . . or without


```
\newcommand {\foo}{Code with no arguments}

\newcommand {\foo}[2]{Code using #1 and #2}

\newcommand {\foo}[2][]{Code using #1 and #2}

\newcommand {\foo}[2][default]
  {Code using #1 and #2}
```

The aims of xparse

- Separate syntax from functionality
- Define all arguments in one place
- Intersperse mandatory and optional arguments
- More types of argument without code
- Mix long and short arguments
- Create engine robust commands
- Informative error messages

\...DocumentCommand

- \NewDocumentCommand
- \RenewDocumentCommand
- \ProvideDocumentCommand
- \DeclareDocumentCommand

\...DocumentCommand

- \NewDocumentCommand
- \RenewDocumentCommand
- \ProvideDocumentCommand
- \DeclareDocumentCommand

Syntax

\DeclareDocumentCommand {\⟨*command*⟩}
{⟨*arg. spec.*⟩} {⟨*code*⟩}

Mandatory arguments


```
\DeclareDocumentCommand{\foo}{ }
  {Code using no arguments}

\DeclareDocumentCommand{\foo}{ m }
  {Code using #1}

\DeclareDocumentCommand{\foo}{ m m }
  {Code using #1 and #2}

\DeclareDocumentCommand{\foo}{ m m m }
  {Code using #1, #2 and #3}
```

Mandatory arguments
Mixing short and long


```
\DeclareDocumentCommand{\foo}{ m m m }
  {Three short arguments}

\DeclareDocumentCommand{\foo}{ +m +m +m }
  {Three long arguments}

\DeclareDocumentCommand{\foo}{ m +m m }
  {Only #2 is long}
```

Optional arguments
(Almost) like LaTeX 2ε


```
\DeclareDocumentCommand{\foo}{ O{} }
  {One optional argument}

\DeclareDocumentCommand{\foo}{ O{default} m }
  {First argument optional with default value}
```

Optional arguments

Beyond LaTeX 2ε


```
\DeclareDocumentCommand{\foo}{ O{} O{} m }
  {Two optionals then a mandatory}

\DeclareDocumentCommand{\foo}{ o m }
  {%
    \IfNoValueTF{#1}%
      {Code for just #2}%
      {Code for #1 and #2}%
  }
```

Optional arguments

Beyond LaTeX 2ε


```
\newcommand*{\foo}[2][]
  {Code here}

\foo[\baz[arg1]]{arg2}

#1 = \baz[arg1
#2 = ]
```

Optional arguments

Beyond LaTeX 2ε


```
\DeclareDocumentCommand{\foo}{ O{} m }
  {Code here}

\foo[\baz[arg1]]{arg2}

#1 = \baz[arg1]
#2 = arg2
```

Stars


```
\DeclareDocumentCommand{\foo}{ s m }
  {%
    \IfBooleanTF {#1}%
      {Process #2 with a star}%
      {Process #2 without a star}%
  }
```

Re-implementing \chapter
The original


```
\def\chapter{...\secdef\@chapter\@schapter}

% syntax support code:

\def\secdef#1#2{\@ifstar{#2}{\@dblarg{#1}}}
\def\@ifstar#1{\@ifnextchar *{\@firstoftwo{#1}}}
\long\def\@dblarg#1%
  {\kernel@ifnextchar[{#1}{\@xdblarg{#1}}}
\long\def\@xdblarg#1#2{#1[{#2}]{#2}}
```

Re-implementing \chapter

In xparse


```
\ExplSyntaxOn % So we don't worry about spaces!

\DeclareDocumentCommand { \chapter } { s o m }
  {
    \IfBooleanTF {#1}
      { \@schapter {#3} } % ignore [..] if given
      { \IfNoValueTF {#2}
          { \@chapter [#3] {#3} } % use title twice
          { \@chapter [#2] {#3} } % use [..] & title
        }
    }
```

Other argument types

- `d` An optional argument delimited by two tokens
- `g` An optional argument in braces (‘group’)
- `r` A mandatory argument delimited by two tokens (‘required’)
- `t` A single optional token
- `v` An argument read verbatim

Outline

Aims

- A complete coding environment
- Extensive set of basic and complex data types and control structures
- Consistent interfaces
- Fully documented
- Rigorously tested
- Clear guidance on what is usable
- ‘Best practice’ promoted by team
- . . .

A crash course in expl3

- Coding is done inside `\ExplSyntaxOn` ... `\ExplSyntaxOff`
- `:` and `_` are used *systematically* in names
- White space is ignored
- Separation of commands for internal use from those publicly-available (*documented*)
- Argument preprocessing instead of expansion based programming

Not much like TEX, is it?


```
\cs_new_protected:Npn \malmedal_output_reverse:
  {
    \seq_set_eq:NN \l__malmedal_temp_seq
      \g__malmedal_input_seq
    \seq_reverse:N \l__malmedal_temp_seq
    \int_set:Nn \l__malmedal_count_int
      { \seq_count:N \l__malmedal_temp_seq }
    \seq_map_inline:Nn \l__malmedal_temp_seq
      {
        \__malmedal_print:n {##1}
        \int_decr:N \l__malmedal_count_int
      }
  }
```

Not much like TEX, is it?


```
%<@@=malmedal>

\cs_new_protected:Npn \malmedal_output_reverse:
  {
    \seq_set_eq:NN \l_@@_temp_seq
      \g_@@_input_seq
    \seq_reverse:N \l_@@_temp_seq
    \int_set:Nn \l_@@_count_int
      { \seq_count:N \l_@@_temp_seq }
    \seq_map_inline:Nn \l_@@_temp_seq
      {
        \@@_print:n {##1}
        \int_decr:N \l_@@_count_int
      }
  }
```

Argument preprocessing

instead of expansion

LaTeX 2_ε code fragment for font selection:

```
\expandafter
   \in@
      \csname sym#3%
\expandafter
      \endcsname
\expandafter
      {\group@list}%
     ...
   \fi
```

Argument preprocessing
instead of expansion

LaTeX 2_ε code fragment for font selection:

```
\expandafter
   \in@
      \csname sym#3%
\expandafter
      \endcsname
\expandafter
      {\group@list}%
     ...
   \fi
```

How it could look like in expl3:

```
\seq_test_in:cVTF { sym #3 } \l_group_seq
                  { true code } { false code }
```

So you want to learn expl3?

- Read the documentation:
  - expl3
  - interface3
- Blog posts on `texdev.net`:
  search for ‘Programming LaTeX3’
- Ask questions on LaTeX-L or TeX-sx!

A lot done . . . usable . . . and used

- Code layer (expl3) works and is 'out there'
- xparse is much more powerful than `\newcommand`
- Using these allows implementation of new ideas for LaTeX3, e.g., xcoffins
- But also packages explicitly for LaTeX 2_ε such as
  - fontspec by Will Robertson
  - chemmacros by Clemens Niederberger
  - Media9 by Alexander Grahn
  - xpatch by Enrico Gregorio
  - . . .

. . . a lot left to do!

- Design layer is still to be solved
- The output routine is a major challenge
- There is always more to add to expl3
- Choosing what *not* to add to expl3 is also hard!

Himeji Castle 2013 under renovation

Himeji 2013

Himeji Castle 2014/15?

Picture by Arthena (2008)