

The `ltemplates.dtx` code*

Frank Mittelbach, Chris Rowley, David Carlisle, L^AT_EX Project[†]

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1 Introduction

There are three broad “layers” between putting down ideas into a source file and ending up with a typeset document. These layers of document writing are

1. authoring of the text with mark-up;
2. document layout design;
3. implementation (with T_EX programming) of the design.

We write the text as an author, and we see the visual output of the design after the document is generated; the T_EX implementation in the middle is the glue between the two.

L^AT_EX’s greatest success has been to standardise a system of mark-up that balances the trade-off between ease of reading and ease of writing to suit almost all forms of technical writing. It’s other original strength was a good background in typographical design; while the standard L^AT_EX 2_ε classes look somewhat dated now in terms of their visual design, their typography is generally sound (barring the occasional minor faults).

However, L^AT_EX 2_ε has always lacked a standard approach to customising the visual design of a document. Changing the looks of the standard classes involved either:

- Creating a new version of the implementation code of the class and editing it.
- Loading one of the many packages to customise certain elements of the standard classes.
- Loading a completely different document class, such as KOMA-Script or memoir, that allows easy customisation.

All three of these approaches have their drawbacks and learning curves.

The idea behind `ltemplates` is to cleanly separate the three layers introduced at the beginning of this section, so that document authors who are not programmers can easily change the design of their documents. `ltemplates` also makes it easier for L^AT_EX programmers to provide their own customisations on top of a pre-existing class.

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†E-mail: latex-team@latex-project.org

2 What is a document?

Besides the textual content of the words themselves, the source file of a document contains mark-up elements that add structure to the document. These elements include sectional divisions, figure/table captions, lists of various sorts, theorems/proofs, and so on. The list will be different for every document that can be written.

Each element can be represented logically without worrying about the formatting, with mark-up such as `\section`, `\caption`, `\begin{enumerate}` and so on. The output of each one of these document elements will be a typeset representation of the information marked up, and the visual arrangement and design of these elements can vary widely in producing a variety of desired outcomes.

For each type of document element, there may be design variations that contain the same sort of information but present it in slightly different ways. For example, the difference between a numbered and an unnumbered section, `\section` and `\section*`, or the difference between an itemised list or an enumerated list.

There are three distinct layers in the definition of “a document” at this level

1. semantic elements such as the ideas of sections and lists;
2. a set of design solutions for representing these elements visually;
3. specific variations for these designs that represent the elements in the document.

In the parlance of the template system, these are called types, templates, and instances, and they are discussed below in sections 4, 5, and 7, respectively.

3 Types, templates, and instances

By formally declaring documents to be composed of mark-up elements grouped into types, which are interpreted and typeset with a set of templates, each of which has one or more instances with which to compose each and every semantic unit of the text, we can cleanly separate the components of document construction.

All of the structures provided by the template system are global, and do not respect \TeX grouping.

4 Template types

An *template type* (sometimes just “type”) is an abstract idea of a document element that takes a fixed number of arguments corresponding to the information from the document author that it is representing. A sectioning type, for example, might take three inputs: “title”, “short title”, and “label”.

Any given document class will define which types are to be used in the document, and any template of a given type can be used to generate an instance for the type. (Of course, different templates will produce different typeset representations, but the underlying content will be the same.)

```
\NewTemplateType <template type> {<no. of args>}
```

This function defines an *<template type>* taking *<number of arguments>*, where the *<type>* is an abstraction as discussed above. For example,

```
\NewTemplateType{sectioning}{3}
```

creates a type “sectioning”, where each use of that type will need three arguments.

5 Templates

A *template* is a generalised design solution for representing the information of a specified type. Templates that do the same thing, but in different ways, are grouped together by their type and given separate names. There are two important parts to a template:

- the parameters it takes to vary the design it is producing;
- the implementation of the design.

As a document author or designer does not care about the implementation but rather only the interface to the template, these two aspects of the template definition are split into two independent declarations, `\DeclareTemplateInterface` and `\DeclareTemplateCode`.

```
\DeclareTemplateInterface <type> {<template>} {<no. of args>}  
  {<key list>}
```

A *<template>* interface is declared for a particular *<type>*, where the *<number of arguments>* must agree with the type declaration. The interface itself is defined by the *<key list>*, which is itself a key–value list taking a specialized format:

```
<key1> : <key type1> ,  
<key2> : <key type2> ,  
<key3> : <key type3> = <default3> ,  
<key4> : <key type4> = <default4> ,  
...
```

Each *<key>* name should consist of ASCII characters, with the exception of `,` `=` and `␣`. The recommended form for key names is to use lower case letters, with dashes to separate out different parts. Spaces are ignored in key names, so they can be included or missed out at will. Each *<key>* must have a *<key type>*, which defined the type of input that the *<key>* requires. A full list of key types is given in Table 1. Each key may have a *<default>* value, which will be used in by the template if the *<key>* is not set explicitly. The *<default>* should be of the correct form to be accepted by the *<key type>* of the *<key>*: this is not checked by the code. Expressions for numerical values are evaluated when the template is used, thus for example values given in terms of `em` or `ex` will be set respecting the prevailing font.

Key-type	Description of input
<code>boolean</code>	<code>true</code> or <code>false</code>
<code>choice{⟨choices⟩}</code>	A list of pre-defined <code>⟨choices⟩</code>
<code>commalist</code>	A comma-separated list
<code>function{⟨N⟩}</code>	A function definition with N arguments (N from 0 to 9)
<code>instance{⟨name⟩}</code>	An instance of type <code>⟨name⟩</code>
<code>integer</code>	An integer or integer expression
<code>length</code>	A fixed length
<code>muskip</code>	A math length with shrink and stretch components
<code>real</code>	A real (floating point) value
<code>skip</code>	A length with shrink and stretch components
<code>tokenlist</code>	A token list: any text or commands

Table 1: Key-types for defining template interfaces with `\DeclareTemplateInterface`.

`\KeyValue` `\KeyValue {⟨key name⟩}`

There are occasions where the default (or value) for one key should be taken from another. The `\KeyValue` function can be used to transfer this information without needing to know the internal implementation of the key:

```

\DeclareTemplateInterface { type } { template } { no. of args }
{
  key-name-1 : key-type = value ,
  key-name-2 : key-type = \KeyValue { key-name-1 },
  ...
}

```

Key-type	Description of binding
	Boolean variable, <i>e.g.</i> <code>\l_tmpa_bool</code>
<code>choice</code>	List of choice implementations (see Section 6)
<code>commalist</code>	Comma list, <i>e.g.</i> <code>\l_tmpa_clist</code>
<code>function</code>	Function taking N arguments, <i>e.g.</i> <code>\use_i:nn</code>
<code>instance</code>	
<code>integer</code>	Integer variable, <i>e.g.</i> <code>\l_tmpa_int</code>
<code>length</code>	Dimension variable, <i>e.g.</i> <code>\l_tmpa_dim</code>
<code>muskip</code>	Muskip variable, <i>e.g.</i> <code>\l_tmpa_muskip</code>
<code>real</code>	Floating-point variable, <i>e.g.</i> <code>\l_tmpa_fp</code>
<code>skip</code>	Skip variable, <i>e.g.</i> <code>\l_tmpa_skip</code>
<code>tokenlist</code>	Token list variable, <i>e.g.</i> <code>\l_tmpa_tl</code>

Table 2: Bindings required for different key types when defining template implementations with `\DeclareTemplateCode`. Apart from `code`, `choice` and `function` all of these accept the key word `global` to carry out a global assignment.

```

\DeclareTemplateCode \DeclareTemplateCode
  <{type}> <{template}> <{no. of args}>
  <{key bindings}> <{code}>

```

The relationship between a templates keys and the internal implementation is created using the `\DeclareTemplateCode` function. As with `\DeclareTemplateInterface`, the `<template>` name is given along with the `<type>` and `<number of arguments>` required. The `<key bindings>` argument is a key–value list which specifies the relationship between each `<key>` of the template interface with an underlying `<variable>`.

```

  <key1> = <variable1>,
  <key2> = <variable2>,
  <key3> = global <variable3>,
  <key4> = global <variable4>,
  ...

```

With the exception of the `choice`, `code` and `function` key types, the `<variable>` here should be the name of an existing L^AT_EX3 register. As illustrated, the key word “global” may be included in the listing to indicate that the `<variable>` should be assigned globally. A full list of variable bindings is given in Table 2.

The `<code>` argument of `\DeclareTemplateCode` is used as the replacement text for the template when it is used, either directly or as an instance. This may therefore accept arguments `#1`, `#2`, *etc.* as detailed by the `<number of arguments>` taken by the type.

```

\AssignTemplateKeys \AssignTemplateKeys

```

In the final argument of `\DeclareTemplateCode` the assignment of keys defined by the template may be delayed by including the command `\AssignTemplateKeys`. If this is *not* present, keys are assigned immediately before the template code. If `\AssignTemplateKeys` is present, assignment is delayed until this point. Note that the command must be *directly* present in the code, not placed within a nested command/macro.

```
\DeclareTemplateCopy \DeclareTemplateCopy
  {<type>} {<template2>} {<template1>}
```

Copies *<template1>* of *<type>* to a new name *<template2>*: the copy can then be edited independent of the original.

6 Multiple choices

The `choice` key type implements multiple choice input. At the interface level, only the list of valid choices is needed:

```
\DeclareTemplateInterface { foo } { bar } { 0 }
  { key-name : choice { A, B, C } }
```

where the choices are given as a comma-list (which must therefore be wrapped in braces). A default value can also be given:

```
\DeclareTemplateInterface { foo } { bar } { 0 }
  { key-name : choice { A, B, C } = A }
```

At the implementation level, each choice is associated with code, using a nested key-value list.

```
\DeclareTemplateCode { foo } { bar } { 0 }
  {
    key-name =
      {
        A = Code-A ,
        B = Code-B ,
        C = Code-C
      }
  }
  { ... }
```

The two choice lists should match, but in the implementation a special `unknown` choice is also available. This can be used to ignore values and implement an “else” branch:

```
\DeclareTemplateCode { foo } { bar } { 0 }
  {
    key-name =
      {
        A      = Code-A ,
        B      = Code-B ,
        C      = Code-C ,
        unknown = Else-code
      }
  }
  { ... }
```

The `unknown` entry must be the last one given, and should *not* be listed in the interface part of the template.

For keys which accept the values `true` and `false` both the boolean and choice key types can be used. As template interfaces are intended to prompt clarity at the design level, the boolean key type should be favoured, with the choice type reserved for keys which take arbitrary values.

7 Instances

After a template is defined it still needs to be put to use. The parameters that it expects need to be defined before it can be used in a document. Every time a template has parameters given to it, an *instance* is created, and this is the code that ends up in the document to perform the typesetting of whatever pieces of information are input into it.

For example, a template might say “here is a section with or without a number that might be centred or left aligned and print its contents in a certain font of a certain size, with a bit of a gap before and after it” whereas an instance declares “this is a section with a number, which is centred and set in 12 pt italic with a 10 pt skip before and a 12 pt skip after it”. Therefore, an instance is just a frozen version of a template with specific settings as chosen by the designer.

```
\DeclareInstance \DeclareInstance
  {<type>} {<instance>} {<template>} {<parameters>}
```

This function uses a $\langle\text{template}\rangle$ for an $\langle\text{type}\rangle$ to create an $\langle\text{instance}\rangle$. The $\langle\text{instance}\rangle$ will be set up using the $\langle\text{parameters}\rangle$, which will set some of the $\langle\text{keys}\rangle$ in the $\langle\text{template}\rangle$.

As a practical example, consider a type for document sections (which might include chapters, parts, sections, *etc.*), which is called **sectioning**. One possible template for this type might be called **basic**, and one instance of this template would be a numbered section. The instance declaration might read:

```
\DeclareInstance { sectioning } { section-num } { basic }
{
  numbered      = true ,
  justification = center ,
  font          =\normalsize\itshape ,
  before-skip   = 10pt ,
  after-skip    = 12pt ,
}
```

Of course, the key names here are entirely imaginary, but illustrate the general idea of fixing some settings.

```
\IfInstanceExistsT \IfInstanceExistsTF {<type>} {<instance>} {<true code>} {<false code>}
\IfInstanceExistsF
\IfInstanceExistsTF Tests if the named <instance> of a <type> exists, and then inserts the appropriate code
into the input stream.
```

```
\DeclareInstanceCopy \DeclareInstanceCopy
  {<type>} {<instance2>} {<instance1>}
Copies the <values> for <instance1> for an <type> to <instance2>.
```

8 Document interface

After the instances have been chosen, document commands must be declared to use those instances in the document. `\UseInstance` calls instances directly, and this command should be used internally in document-level mark-up.

\UseInstance `\UseInstance`
`{<type>} {<instance>} <arguments>`

Uses an `<instance>` of the `<type>`, which will require `<arguments>` as determined by the number specified for the `<type>`. The `<instance>` must have been declared before it can be used, otherwise an error is raised.

\UseTemplate `\UseTemplate {<type>} {<template>}`
`{<settings>} <arguments>`

Uses the `<template>` of the specified `<type>`, applying the `<settings>` and absorbing `<arguments>` as detailed by the `<type>` declaration. This in effect is the same as creating an instance using `\DeclareInstance` and immediately using it with `\UseInstance`, but without the instance having any further existence. It is therefore useful where a template needs to be used once.

This function can also be used as the argument to `instance` key types:

```
\DeclareInstance { type } { template } { instance }
{
  instance-key =
    \UseTemplate { type2 } { template2 } { <settings> }
}
```

9 Changing existing definitions

Template parameters may be assigned specific defaults for instances to use if the instance declaration doesn't explicit set those parameters. In some cases, the document designer will wish to edit these defaults to allow them to “cascade” to the instances. The alternative would be to set each parameter identically for each instance declaration, a tedious and error-prone process.

\EditTemplateDefaults `\EditTemplateDefaults`
`{<type>} {<template>} {<new defaults>}`

Edits the `<defaults>` for a `<template>` for an `<type>`. The `<new defaults>`, given as a key–value list, replace the existing defaults for the `<template>`. This means that the change will apply to instances declared after the editing, but that instances which have already been created are unaffected.

\EditInstance `\EditInstance`
`{<type>} {<instance>} {<new values>}`

Edits the `<values>` for an `<instance>` for an `<type>`. The `<new values>`, given as a key–value list, replace the existing values for the `<instance>`. This function is complementary to `\EditTemplateDefaults`: `\EditInstance` changes a single instance while leaving the template untouched.

10 *Ad hoc* adjustment of templates

`\SetTemplateKeys` `\SetTemplateKeys` $\langle type \rangle$ $\langle template \rangle$ $\langle keyvals \rangle$

At point of use it may be useful to apply changed to individual instances. This is supported as each template key is made available for adjustment using `\SetTemplateKeys`.

For example, after

```
\NewTypeType{MyObj}{0}
\DeclareTemplateInterface{MyObj}{TemplateA}{0}
{
  akey: tokenlist ,
  bkey: function{2}
}
\DeclareTemplateCode{MyObj}{TemplateA}{0}
{
  akey = SomeTokens ,
  bkey = \func:nn ,
}
```

the template keys could be adjusted in an *ad hoc* fashion using

```
\SetTemplateKeys{MyObj}{TemplateA}
{
  akey = OtherTokens ,
  bkey = \AltFunc:nn
}
```

11 Getting information about templates and instances

`\ShowInstanceValues` `\ShowInstanceValues` $\langle type \rangle$ $\langle instance \rangle$

Shows the $\langle values \rangle$ for an $\langle instance \rangle$ of the given $\langle type \rangle$ at the terminal.

`\ShowTemplateCode` `\ShowTemplateCode` $\langle type \rangle$ $\langle template \rangle$

Shows the $\langle code \rangle$ of a $\langle template \rangle$ for an $\langle type \rangle$ in the terminal.

`\ShowTemplateDefaults` `\ShowTemplateDefaults` $\langle type \rangle$ $\langle template \rangle$

Shows the $\langle default \rangle$ values of a $\langle template \rangle$ for an $\langle type \rangle$ in the terminal.

`\ShowTemplateInterface` `\ShowTemplateInterface` $\langle type \rangle$ $\langle template \rangle$

Shows the $\langle keys \rangle$ and associated $\langle key types \rangle$ of a $\langle template \rangle$ for an $\langle type \rangle$ in the terminal.

`\ShowTemplateVariables` `\ShowTemplateVariables {<type>} {<template>}`

Shows the `<variables>` and associated `<keys>` of a `<template>` for an `<type>` in the terminal. Note that `code` and `choice` keys do not map directly to variables but to arbitrary code. For `choice` keys, each valid choice is shown as a separate entry in the list, with the key name and choice separated by a space, for example

```

Template 'example' of type 'example' has variable mapping:
> demo unknown => \def \demo {?}
> demo c => \def \demo {c}
> demo b => \def \demo {b}
> demo a => \def \demo {a}.

```

would be shown for a choice key `demo` with valid choices `a`, `b` and `c`, plus code for an `unknown` branch.

Index

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

A		int commands:	
<code>\AssignTemplateKeys</code>	<i>5</i>	<code>\l_tmpa_int</code>	<i>5</i>
B		K	
bool commands:		<code>\KeyValue</code>	
<code>\l_tmpa_bool</code>	<i>5</i>		<i>4</i>
C		M	
<code>\caption</code>		muskip commands:	
	<i>2</i>	<code>\l_tmpa_muskip</code>	<i>5</i>
clist commands:		N	
<code>\l_tmpa_clist</code>	<i>5</i>	<code>\NewTemplateType</code>	<i>3</i>
D		S	
<code>\DeclareInstance</code>	<i>7</i>	<code>\section</code>	<i>2</i>
<code>\DeclareInstanceCopy</code>	<i>7</i>	<code>\SetTemplateKeys</code>	<i>9</i>
<code>\DeclareTemplateCode</code>	<i>3</i>	<code>\ShowInstanceValues</code>	<i>9</i>
<code>\DeclareTemplateCopy</code>	<i>6</i>	<code>\ShowTemplateCode</code>	<i>9</i>
<code>\DeclareTemplateInterface</code>	<i>4</i>	<code>\ShowTemplateDefaults</code>	<i>9</i>
dim commands:		<code>\ShowTemplateInterface</code>	<i>9</i>
<code>\l_tmpa_dim</code>	<i>5</i>	<code>\ShowTemplateVariables</code>	<i>10</i>
E		skip commands:	
<code>\EditInstance</code>	<i>8</i>	<code>\l_tmpa_skip</code>	<i>5</i>
<code>\EditTemplateDefaults</code>	<i>8</i>	T	
F		tl commands:	
fp commands:		<code>\l_tmpa_tl</code>	<i>5</i>
<code>\l_tmpa_fp</code>	<i>5</i>	U	
I		use commands:	
<code>\IfInstanceExistsF</code>	<i>7</i>	<code>\use_i:nn</code>	<i>5</i>
<code>\IfInstanceExistsT</code>	<i>7</i>	<code>\UseInstance</code>	<i>8</i>
<code>\IfInstanceExistsTF</code>	<i>7</i>	<code>\UseTemplate</code>	<i>8</i>