The longtable package[*]

David Carlisle[†]

1996/05/24

Abstract

This package defines the longtable environment, a multi-page version of tabular.

List of Tables

1   Introduction

longtable   The longtable package defines a new environment, longtable, which has most of the features of the tabular environment, but produces tables which may be broken by TeX's standard page-breaking algorithm. It also shares some features with the table environment. In particular it uses the same counter, table, and has a similar \caption command. Also, the standard \listoftables command lists tables produced by either the table or longtable environments.

The following example uses most of the features of the longtable environment. An edited listing of the input for this example appears in Section 8.

Note: Various parts of the following table will **not** line up correctly until this document has been run through LaTeX several times. This is a characteristic feature of this package, as described below.

Table 1: A long table

*	This part appears at the top of the table		*
*	FIRST	SECOND	*
*	longtable columns are specified	in the	*
*	This goes at the	bottom.	*

---

[*] This file has version number v4.04, last revised 1996/05/24.

[†] The new algorithm for aligning 'chunks' of a table used in version 4 of this package was devised coded and documented by David Kastrup, dak@pool.informatik.rwth-aachen.de.

. . . . Page 1 . . . .

Table 1: (continued)

*	This part appears at the top of every other page		*
*	**First** ‖	**Second**	*
*	same way as in the tabular ‖	environment.	*
*	@{*}r||p{1in}@{*} ‖	in this case.	*
*	Each row ends with a ‖	\\ command.	*
*	The \\ command has an ‖	optional	*
*	argument, just as in ‖	the	*
*	tabular ‖	environment.	*
*	See the effect of \\[10pt] ‖	?	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Also \hline may be used, ‖	as in tabular.	*
*	That was a \hline ‖	.	*
*	That was \hline\hline ‖	.	*
‖	This is a \multicolumn{2}{||c||}		‖
*	If a page break occurs at a \hline then ‖	a line is drawn	*
*	at the bottom of one page and at the ‖	top of the next.	*
*	The [t] [b] [c] argument of tabular ‖	can not be used.	*
*	The optional argument may be one of ‖	[l] [r] [c]	*
*	to specify whether the table should be ‖	adjusted	*
*	to the left, right ‖	or centrally.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	Lots of lines ‖	like this.	*
*	This goes at the ‖	bottom.	*

Table 1: (continued)

*	This part appears at the top of every other page		*
*	**First**	**Second**	*
*Some lines may take up a lot of space, like this:		This last column* is a "p" column so this "row" of the table can take up several lines. Note however that TEX will never break a page within such a row. Page breaks only occur between rows of the table or at `\hline` commands.	
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	Lots[1] of lines	like this.	*
*	Lots of lines	like this[2]	*
*	Lots of lines	like this.	*
*	Lots of lines	like this.	*
*	These lines will	appear	*
*	in place of the	usual foot	*
*	at the end	of the table	*

2   Chunk Size

LTchunksize In order to TEX multi-page tables, it is necessary to break up the table into smaller chunks, so that TEX does not have to keep everything in memory at one time. By default **longtable** uses 20 rows per chunk, but this can be set by the user, with e.g., `\setcounter{LTchunksize}{10}`.[3] These chunks do not affect page breaking, thus if you are using a TEX with a lot of memory, you can set LTchunksize to be several pages of the table. TEX will run faster with a large LTchunksize. However, if necessary, **longtable** can work with LTchunksize set to 1, in which case the memory taken up is negligible. Note that if you use the commands for setting the table head or

---

[1]This is a footnote.

[2]**longtable** takes special precautions, so that footnotes may also be used in 'p' columns.

[3]You can also use the plain TEX syntax `\LTchunksize=10`.

A	tabular	environment
within	a floating	table

Table 2: A floating table

foot (see below), the LTchunksize must be at least as large as the number of rows in each of the head or foot sections.

This document specifies \setcounter{LTchunksize}{10}. If you look at the previous table, after the *first* run of LaTeX you will see that various parts of the table do not line up. LaTeX will also have printed a warning that the column widths had changed. longtable writes information onto the .aux file, so that it can line up the different chunks. Prior to version 4 of this package, this information was not used unless a \setlongtables command was issued, however, now the information is always used, using a new algorithm[4] and so \setlongtables is no longer needed. It is defined (but does nothing) for the benefit of old documents that use it.

3   Captions and Headings

At the start of the table one may specify lines which are to appear at the top of every
\endhead
\endfirsthead
page (under the headline, but before the other lines of the table). The lines are entered as normal, but the last \\ command is replaced by a \endhead command. If the first page should have a different heading, then this should be entered in the same way, and terminated with the \endfirsthead command. The LTchunksize should be at
\endfoot
\endlastfoot
least as large as the number of rows in the heading. There are also \endfoot and \endlastfoot commands which are used in the same way (at the *start* of the table) to specify rows (or an \hline) to appear at the bottom of each page. In certain situations, you may want to place lines which logically belong in the table body at the end of the firsthead, or the beginning of the lastfoot. This helps to control which lines appear on the first and last page of the table.
\caption
The \caption{...} command is essentially equivalent to
\multicolumn{n}{c}{\parbox{\LTcapwidth}{...}}
where n is the number of columns of the table. You may set the width of the caption with a command such as \setlength{\LTcapwidth}{2in} in the preamble of your document. The default is 4in. \caption also writes the information to produce an entry in the list of tables. As with the \caption command in the figure and table environments, an optional argument specifies the text to appear in the list of tables if this is different from the text to appear in the caption. Thus the caption for table 1 was specified as \caption[An optional table caption (used in the list of tables)]{A long table\label{long}}.

You may wish the caption on later pages to be different to that on the first page. In this case put the \caption command in the first heading, and put a subsidiary caption in a \caption[] command in the main heading. If the optional argument to \caption is empty, no entry is made in the list of tables. Alternatively, if you do not want the table number to be printed each time, use the \caption* command.

The captions are set based on the code for the article class. If you have redefined the standard \@makecaption command to produce a different format for the captions, you

---

[4]Due to David Kastrup.

may need to make similar changes to the longtable version, \LT@makecaption. See the code section for more details.

A more convenient method of customising captions is given by the caption(2) package, which provides commands for customising captions, and arranges that the captions in standard environments, and many environments provided by packages (including longtable) are modified in a compatible manner.

You may use the \label command so that you can cross reference longtables with \ref. Note however, that the \label command should not be used in a heading that may appear more than once. Place it either in the firsthead, or in the body of the table. It should not be the *first* command in any entry.

4   Multicolumn entries

The \multicolumn command may be used in longtable in exactly the same way as for tabular. So you may want to skip this section, which is rather technical, however coping with \multicolumn is one of the main problems for an environment such as longtable. The main effect that a user will see is that certain combinations of \multicolumn entries will result in a document needing more runs of LaTeX before the various 'chunks' of a table align.

The examples in this section are set with LTchunksize set to the minimum value of one, to demonstrate the effects when \multicolumn entries occur in different chunks.

Consider Table 3. In the second chunk, longtable sees the wide multicolumn entry. At this point it thinks that the first two columns are very narrow. All the width of the multicolumn entry is assumed to be in the third column. (This is a 'feature' of TeX's primitive \halign command.) longtable then passes the information that there is a wide third column to the later chunks, with the result that the first pass over the table is too wide.

If the 'saved row' from this first pass was re-inserted into the table on the next pass, the table would line up in two passes, but would be much two wide.

\kill   The solution to this problem used in Versions 1 and 2, was to use a \kill line. If a line is \killed, by using \kill rather than \\ at the end of the line, it is used in calculating column widths, but removed from the final table. Thus entering \killed copies of the last two rows before the wide multicolumn entry would mean that \halign 'saw' the wide entries in the first two columns, and so would not widen the third column by so much to make room for the multicolumn entry.

In Version 3, a new solution was introduced. If the saved row in the .aux file was not being used, longtable used a special 'draft' form of \multicolumn, this modified the definition, so the spanning entry was never considered to be wider than the columns it spanned. So after the first pass, the .aux file stored the widest normal entry for each column, no column was widened due to \spanned columns. By default longtable ignored the .aux file, and so each run of LaTeX was considered a first pass. Once the \setlongtables declaration was given, the saved row in the .aux file, and the proper definition of \multicolumn were used. If any \multicolumn entry caused one of the columns to be widened, this information could not be passed back to earlier chunks, and so the table would not correctly line up until the third pass. This algorithm always converged in three passes as described above, but in examples such as the ones in Tables 3–6, the final widths were not optimal as the width of column 2, which is determined by a \multicolumn entry was not known when the final width for column 3 was fixed, due to the fact that *both* \multicolumn commands were switched

Table 3: A difficult \multicolumn combination: pass 1

1	2	3		
wide multicolumn spanning 1–3				
multicolumn 1–2		3		
wide 1	2		3	

Table 4: A difficult \multicolumn combination: pass 2

1	2	3
wide multicolumn spanning 1–3		
multicolumn 1–2		3
wide 1	2	3

Table 5: A difficult \multicolumn combination: pass 3

1	2	3
wide multicolumn spanning 1–3		
multicolumn 1–2		3
wide 1	2	3

Table 6: A difficult \multicolumn combination: pass 4

1	2	3
wide multicolumn spanning 1–3		
multicolumn 1–2		3
wide 1	2	3

from 'draft' mode to 'normal' mode at the same time.

Version 4 alleviates the problem considerably. The first pass of the table will indeed have the third column much too wide. However, on the next pass longtable will notice the error and reduce the column width accordingly. If this has to propagate to chunks before the \multicolumn one, an additional pass will, of course, be needed. It is possible to construct tables where this rippling up of the correct widths taks several passes to 'converge' and produce a table with all chunks aligned. However in order to need many passes one needs to construct a table with many overlapping \multicolumn entries, all being wider than the natural widths of the columns they span, and all occuring in different chunks. In the typical case the algorithm will converge after three or four passes, and, the benefits of not needing to edit the document before the final run to add \setlongtables, and the better choice of final column widths in the case of multiple \multicolumn entries will hopefully more than pay for the extra passes that may possibly be needed.

So Table 3 converges after 4 passes, as seen in Table 6.

You can still speed the convergence by introducing judicious \kill lines, if you happen to have constellations like the above.

If you object even to LATEX-ing a file twice, you should make the first line of every longtable a \kill line that contains the widest entry to be used in each column. All chunks will then line up on the first pass.

5 Adjustment

The optional argument argument of longtable controls the horizontal alignment of the table. The possible options are [c], [r] and [l], for centring, right and left adjustment, respectively. Normally centring is the default, but this document specifies

\LTleft
\LTright

```
\setlength\LTleft\parindent
\setlength\LTright\fill
```

in the preamble, which means that the tables are set flush left, but indented by the usual paragraph indentation. Any lengths can be specified for these two parameters, but at least one of them should be a rubber length so that it fills up the width of the page, unless rubber lengths are added between the columns using the \extracolsep command. For instance

```
\begin{tabular*}{\textwidth}{@{\extracolsep{...}}...}
```

produces a full width table, to get a similar effect with longtable specify

```
\setlength\LTleft{0pt}
\setlength\LTright{0pt}
\begin{longtable}{@{\extracolsep{...}}...}
```

6 Changes

This section highlights the major changes since version 2. A more detailed change log may be produced at the end of the code listing if the ltxdoc.cfg file specifies

```
\AtBeginDocument{\RecordChanges}
\AtEndDocument{\PrintChanges}
```

Changes made between versions 2 and 3.

- The mechanism for adding the head and foot of the table has been completely rewritten. With this new mechanism, longtable does not need to issue a \clearpage at the start of the table, and so the table may start half way down a page. Also the \endlastfoot command which could not safely be implemented under the old scheme, has been added.

- longtable now issues an error if started in the scope of \twocolumn, or the multicols environment.

- The separate documentation file longtable.tex has been merged with the package file, longtable.dtx using Mittelbach's doc package.

- Support for footnotes has been added. Note however that \footnote will not work in the 'head' or 'foot' sections of the table. In order to put a footnote in those sections (e.g., inside a caption), use \footnotemark at that point, and \footnotetext anywhere in the table *body* that will fall on the same page.

- The treatment of \multicolumn has changed, making \kill lines unnecessary, at the price of sometimes requiring a third pass through LaTeX.

- The \newpage command now works inside a longtable.

Changes made between versions 3 and 4.

- A new algorithm is used for aligning chunks. As well as the widest width in each column, longtable remembers which chunk produced this maximum. This allows it to check that the maximum is still achieved in later runs. As longtable can now deal with columns shrinking as the file is edited, the \setlongtables system is no longer needed and is disabled.

- An extra benefit of the new algorithm's ability to deal with 'shrinking' columns is that it can give better (narrower) column widths in the case of overlapping \multicolumn entries in different chunks than the previous algorithm produced.

- The 'draft' multicolumn system has been removed, along with related commands such as \LTmulticolumn.

- The disadvantage of the new algorithm is that it can take more passes. The theoretical maximum is approximately twice the length of a 'chain' of columns with overlapping \multicolumn entries, although in practice it usually converges as fast as the old version. (Which always converged in three passes once \setlongtables was activated.)

7 Summary

Table 7: A summary of longtable commands

Parameters		
\LTleft	Glue to the left of the table.	(\fill)
\LTright	Glue to the right of the table.	(\fill)
\LTpre	Glue before the the table.	(\bigskipamount)
\LTpost	Glue after the the table.	(\bigskipamount)
\LTcapwidth	The width of a parbox containing the caption.	(4in)
LTchunksize	The number of rows per chunk.	(20)
Setlongtables		
\setlongtables	Use column widths from the previous run.	
Optional arguments to \begin{longtable}		
none	Position as specified by \LTleft and \LTright.	
[c]	Centre the table.	
[l]	Place the table flush left.	
[r]	Place the table flush right.	
Commands to end table rows		
\\	Specifies the end of a row.	
\tabularnewline	Alternative to \\ for use in the scope of \raggedright and similar commands that redefine \\.	
\kill	Row is 'killed', but is used in calculating widths.	
\endhead	Specifies rows to appear at the top of every page.	
\endfirsthead	Specifies rows to appear at the top the first page.	
\endfoot	Specifies rows to appear at the bottom of every page.	
\endlastfoot	Specifies rows to appear at the bottom of the last page.	
longtable caption commands		
\caption{foo}	Caption 'Table ?: foo', and a 'foo' entry in the list of tables.	
\caption[bar]{foo}	Caption 'Table ?: foo', and a 'bar' entry in the list of tables.	
\caption[]{foo}	Caption 'Table ?: foo', but no entry in the list of tables.	
\caption*{foo}	Caption 'foo', but no entry in the list of tables.	
Other commands available inside longtable		
\newpage	Force a page break.	
\footnote	Footnotes, but may not be used in the table head & foot.	
\footnotemark	Footnotemark, May be used in the table head & foot.	
\footnotetext	Footnote text, Use in the table body.	

8   Verbatim highlights from Table 1

```
\begin{longtable}{@{*}r||p{1in}@{*}}
KILLED & LINE!!!! \kill
\caption[An optional table caption ...]{A long table\label{long}}\\
\hline\hline
\multicolumn{2}{@{*}c@{*}}%
     {This part appears at the top of the table}\\
\textsc{First}&\textsc{Second}\\
\hline\hline
\endfirsthead
\caption[]{(continued)}\\
\hline\hline
\multicolumn{2}{@{*}c@{*}}%
      {This part appears at the top of every other page}\\
\textbf{First}&\textbf{Second}\\
\hline\hline
\endhead
\hline
This goes at the&bottom.\\
\hline
\endfoot
\hline
These lines will&appear\\
in place of the & usual foot\\
at the end& of the table\\
\hline
\endlastfoot
\env{longtable}  columns  are specified& in the \\
same way as  in the \env{tabular}& environment.\\
...
\multicolumn{2}{||c||}{This is a ...}\\
...
Some lines may take...&
    \raggedleft This last column is a ''p'' column...
    \tabularnewline
...
Lots of lines& like this.\\
...
\hline
Lots\footnote{...} of lines& like this.\\
Lots   of   lines& like this\footnote{...}\\
\hline
Lots of lines& like this.\\
...
\end{longtable}
```

9 The Macros

1 ⟨∗package⟩

9.1 Initial code

Before declaring the package options, we must define some defaults here.

\LT@err The error generating command

```
2 \def\LT@err{\PackageError{longtable}}
```

\LT@warn The warning generating command

```
3 \def\LT@warn{\PackageWarning{longtable}}
```

\LT@final@warn If any longtables have not aligned, generate a warning at the end of the run at \AtEndDocument.

```
4 \def\LT@final@warn{%
5   \AtEndDocument{%
6     \LT@warn{Table widths have changed. Rerun LaTeX.\@gobbletwo}}%
7   \global\let\LT@final@warn\relax}
```

9.2 Options

The first two options deal with error handling. They are compatible with the options used by the tracefnt package.

errorshow *Only* show errors on the terminal. 'warnings' are just sent to the log file.

```
8 \DeclareOption{errorshow}{%
9   \def\LT@warn{\PackageInfo{longtable}}}
```

pausing Make every warning message into an error so TeX stops. May be useful for debugging.

```
10 \DeclareOption{pausing}{%
11   \def\LT@warn#1{%
12     \LT@err{#1}{This is not really an error}}}
```

set The next options are just alternative syntax for the \setlongtables declaration.
final

```
13 \DeclareOption{set}{}
14 \DeclareOption{final}{}

15 \ProcessOptions
```

9.3 User Setable Parameters

\LTleft Glue to the left and right of the table, default \fill (ie centred).
\LTright
```
16 \newskip\LTleft        \LTleft=\fill
17 \newskip\LTright       \LTright=\fill
```

\LTpre Glue before and after the longtable. \bigskip by default.
\LTpost
```
18 \newskip\LTpre         \LTpre=\bigskipamount
19 \newskip\LTpost        \LTpost=\bigskipamount
```

\LTchunksize Chunk size (The number of rows taken per \halign). Default 20.

```
20 \newcount\LTchunksize \LTchunksize=20
```

`\c@LTchunksize` Added in V3.07 to allow the LATEX syntax `\setcounter{LTchunksize}{10}`.

```
21 \let\c@LTchunksize\LTchunksize
```

`\LTcapwidth` Width of the `\parbox` containing the caption. Default 4in.

```
22 \newdimen\LTcapwidth  \LTcapwidth=4in
```

9.4 Internal Parameters

`\LT@head`
`\LT@firsthead`
`\LT@foot`
`\LT@lastfoot`

Boxes for the table head and foot.

```
23 \newbox\LT@head
24 \newbox\LT@firsthead
25 \newbox\LT@foot
26 \newbox\LT@lastfoot
```

`\LT@cols` Counter for number of columns.

```
27 \newcount\LT@cols
```

`\LT@rows` Counter for rows up to chunksize.

```
28 \newcount\LT@rows
```

`\c@LT@tables` Counter for the tables, added in V3.02. Previous versions just used the LATEX counter `table`, but this fails if `table` is reset during a document, eg report class resets it every chapter.

This was changed from `\newcount\LT@tables` in V3.04. LATEX counters are preserved correctly when `\includeonly` is used. In the rest of the file `\LT@tables` has been replaced by `\c@LT@tables` without further comment.

```
29 \newcounter{LT@tables}
```

`\c@LT@chunks` We need to count through the chunks of our tables from Version 4 on.

```
30 \newcounter{LT@chunks}[LT@tables]
```

`\c@table`
`\fnum@table`
`\tablename`

If the `table` counter is not defined (eg in `letter` style), define it. (Added in V3.06.)

```
31 \ifx\c@table\undefined
32   \newcounter{table}
33   \def\fnum@table{\tablename~\thetable}
34 \fi
35 \ifx\tablename\undefined
36   \def\tablename{Table}
37 \fi
```

`\LT@out` In a normal style, longtable uses the `.aux` file to record the column widths. With `letter.sty`, use a separate `.lta` file. (Added in V3.06.)

Not needed for new letter class.

```
\ifx\startlabels\undefined
  \let\@auxout\@auxout
\else
  {\@input{\jobname.lta}}%
  \newwrite\@auxout
  \immediate\openout\@auxout=\jobname.lta
\fi
```

\LT@p@ftn   Temporary storage for footnote text in a 'p' column.

```
38 \newtoks\LT@p@ftn
```

\LT@end@pen   Special penalty for the end of the table. Done this way to save using up a count register.

```
39 \mathchardef\LT@end@pen=30000
```

9.5   The **longtable** environment

\longtable   Called by \begin{longtable}. This implementation does not work in multiple column formats. \par added at V3.04.

```
40 \def\longtable{%
41   \par
42   \ifx\multicols\@undefined
43   \else
44     \ifnum\col@number>\@ne
45       \@twocolumntrue
46     \fi
47   \fi
48   \if@twocolumn
49     \LT@err{longtable not in 1-column mode}\@ehc
50   \fi
51   \begingroup
```

Check for an optional argument.

```
52   \@ifnextchar[\LT@array{\LT@array[x]}}
```

\LT@array   Start setting the alignment. Based on \@array from the LaTeX kernel and the array package.

     Since Version 3.02, longtable has used the internal counter \c@LT@tables. The LaTeX counter table is still incremented so that \caption works correctly.

```
53 \def\LT@array[#1]#2{%
54   \refstepcounter{table}\stepcounter{LT@tables}%
```

Set up the glue around the table if an optional argument given.

```
55   \if l#1%
56     \LTleft\z@ \LTright\fill
57   \else\if r#1%
58     \LTleft\fill \LTright\z@
59   \else\if c#1%
60     \LTleft\fill \LTright\fill
61   \fi\fi\fi
```

Set up these internal commands for longtable.

```
   \global\let\LT@mcw@rn\relax
```

```
62   \let\LT@mcol\multicolumn
```

Now redefine \@tabarray to restore \hline and \multicolumn so that arrays and tabulars nested in longtable (or in page headings on longtable pages) work out OK. Saving the original definitions done here so that you can load the array package before or after longtable.

```
63   \let\LT@@tabarray\@tabarray
64   \let\LT@@hl\hline
65   \def\@tabarray{%
66     \let\hline\LT@@hl
```

```
      \let\multicolumn\LT@mcol
67      \LT@@tabarray}%
68    \let\\\LT@tabularcr\let\tabularnewline\\%
69    \def\newpage{\noalign{\break}}%
70    \let\hline\LT@hline \let\kill\LT@kill\let\caption\LT@caption
71    \@tempdima\ht\strutbox
```

Set up internal commands according to Lamport or Mittelbach.

```
72    \ifx\extrarowheight\@undefined
```

Initialise these commands as in tabular from the LaTeX kernel.

```
73      \let\@acol\@tabacol
74      \let\@classz\@tabclassz \let\@classiv\@tabclassiv
75      \def\@startpbox{\vtop\LT@startpbox}\let\LT@LL@FM@cr\@tabularcr
76    \else
```

Initialise these commands as in array. \d@llar replaced by \d@llarbegin \d@llarend in V3.03 to match array V2.0h. We do not need to set \d@llarbegin and \d@llarend as the array package gives them the correct values at the top level.

```
77      \advance\@tempdima\extrarowheight
78      \col@sep\tabcolsep
79      \let\@startpbox\LT@startpbox\let\LT@LL@FM@cr\@arraycr
80    \fi
```

The rest of this macro is mainly based on array package, but should work for the standard tabular too.

```
81    \setbox\@arstrutbox\hbox{\vrule
82      \@height \arraystretch \@tempdima
83      \@depth \arraystretch \dp \strutbox
84      \@width \z@}%
85    \let\@sharp##\let\protect\relax
```

Interpret the preamble argument.

```
86      \begingroup
87        \@mkpream{#2}%
```

We need to rename \@preamble here as F.M.'s scheme uses \global, and we may need to nest \@mkpream, eg for \multicolumn or an array. We do not need to worry about nested longtables though!

```
88      \xdef\LT@bchunk{%
89        \global\advance\c@LT@chunks\@ne
90        \global\LT@rows\z@\setbox\z@\vbox\bgroup
91        \tabskip\LTleft\halign to\hsize\bgroup
92      \tabskip\z@ \@arstrut \@preamble \tabskip\LTright \cr}%
93    \endgroup
```

Find out how many columns we have (store in \LT@cols).

```
94    \expandafter\LT@nofcols\LT@bchunk&\LT@nofcols
```

Get the saved row from \LT@i...\LT@ix (from the .aux file), or make a new blank row.

```
95    \LT@make@row
```

A few more internal commands for longtable.

```
96    \let\@endpbox\LT@endpbox
97    \m@th\let\par\@empty
98    \everycr{}\lineskip\z@\baselineskip\z@
```

Start the first chunk.

```
99    \LT@bchunk}
```

\LT@start   This macro starts the process of putting the table on the current page. It is not called until either a \\ or \endlongtable command ends a chunk, as we do not know until that point which of the four possible head or foot sections have been specified.

It begins by redefining itself, so that the table is only started once! Until V3.04, was redefined to \relax, now use \endgraf to force the page-breaker to wake up.

```
100 \def\LT@start{%
101    \let\LT@start\endgraf
102    \endgraf\penalty\z@\vskip\LTpre
```

Start a new page if there is not enough room for the table head, foot, and one extra line.

```
103    \dimen@\pagetotal
104    \advance\dimen@ \ht\ifvoid\LT@firsthead\LT@head\else\LT@firsthead\fi
105    \advance\dimen@ \dp\ifvoid\LT@firsthead\LT@head\else\LT@firsthead\fi
106    \advance\dimen@ \ht\LT@foot
```

At this point I used to add \ht\@arstrutbox and \dp\@arstrutbox as a measure of a row size. However this can fail spectacularly for p columns which might be much larger. Previous versions could end up with the table starting with a foot, then a page break then a head *then* a 'first head'! So now measure the first line of the table accurately by \vsplitting it out of the first chunk.

```
107    \dimen@ii\vfuzz
108    \vfuzz\maxdimen
109       \setbox\tw@\copy\z@
110       \setbox\tw@\vsplit\tw@ to \ht\@arstrutbox
111       \setbox\tw@\vbox{\unvbox\tw@}%
112    \vfuzz\dimen@ii
113    \advance\dimen@ \ht
114          \ifdim\ht\@arstrutbox>\ht\tw@\@arstrutbox\else\tw@\fi
115    \advance\dimen@\dp
116          \ifdim\dp\@arstrutbox>\dp\tw@\@arstrutbox\else\tw@\fi
117    \advance\dimen@ -\pagegoal
118    \ifdim \dimen@>\z@\vfil\break\fi
```

Store height of page minus table foot in \@colroom.

```
119       \global\@colroom\@colht
```

If the foot is non empty, reduce the \vsize and \@colroom accordingly.

```
120    \ifvoid\LT@foot\else
121       \advance\vsize-\ht\LT@foot
122       \global\advance\@colroom-\ht\LT@foot
123       \dimen@\pagegoal\advance\dimen@-\ht\LT@foot\pagegoal\dimen@
124       \maxdepth\z@
125    \fi
```

Put the table head on the page, and then switch to the new output routine.

```
126    \ifvoid\LT@firsthead\copy\LT@head\else\box\LT@firsthead\fi
127    \output{\LT@output}}
```

\endlongtable   Called by \end{longtable}.

```
128 \def\endlongtable{%
```

Essentially add a final \\. But as we now know the number of actual chunks, we first strip away all entries referring to a maximum entry beyond the table (this can only happen if a table has been shortened, or the table numbering has gone awry). In that case we at least start collecting valid new information with the last chunk of this table, by removing the width constraint.

```
129    \crcr
130    \noalign{%
131      \let\LT@entry\LT@entry@chop
132      \xdef\LT@save@row{\LT@save@row}}%
133    \LT@echunk
134    \LT@start
135    \unvbox\z@
136    \LT@get@widths
```

Write the dummy row to the `.aux` file. Since V3.06, use `.lta` for `letter.sty`.

```
137    \if@filesw
138      {\let\LT@entry\LT@entry@write\immediate\write\@auxout{%
```

Since Version 3.02, longtable has used the internal counter \c@LT@tables rather than the LATEX counter table. This information looks entirely different from version 3 information. Still, we don't need to rename the macro name because later code will consider the information to have no columns, and thus will throw the old data away.

```
139        \gdef\expandafter\noexpand
140          \csname LT@\romannumeral\c@LT@tables\endcsname
141            {\LT@save@row}}}%
142    \fi
```

At this point used to issue a warning if a \multicolumn has been set in draft mode.

```
    \LT@mcw@rn
```

If the last chunk has different widths than the first, warn the user. Also trigger a warning to rerun LATEX at the end of the document.

```
143    \ifx\LT@save@row\LT@@save@row
144    \else
145      \LT@warn{Column widths have changed\MessageBreak
146              in table \thetable}%
147      \LT@final@warn
148    \fi
```

Force one more go with the longtable output routine.

```
149    \endgraf\penalty -\LT@end@pen
```

Now close the group to return to the standard routine.

```
150    \endgroup
```

Reset \@mparbottom to allow marginpars close to the end of the table.[5]

```
151    \global\@mparbottom\z@
152    \pagegoal\vsize
153    \endgraf\penalty\z@\addvspace\LTpost
```

Footnotes. As done in the multicol package.

```
154    \ifvoid\footins\else\insert\footins{}\fi}
```

---

[5]This can not be the correct. However if it is omitted, there is a problem with marginpars, for example on page 3 of this document. Any Output Routine Gurus out there?

9.6 Counting Columns

Columns are counted by examining \@preamble, rather than simply getting \@mkpream to increment the counter as it builds the preamble so that this package works with many of the packages which add extra column specifiers to LaTeX's standard ones.

Version 1 counted \@sharp's to calculate the number of columns, this was changed for Version 2 as it does not work with the NFSS. Now count &'s. (lfonts.new (and now the Standard LaTeX definition) defines \@tabclassz so that \@sharp is inside a group.)

\LT@nofcols   Find the next &, then look ahead to see what is next.

```
155 \def\LT@nofcols#1&{%
156    \futurelet\@let@token\LT@n@fcols}
```

\LT@n@fcols   Add one, then stop at an \LT@nofcols or look for the next &. The \expandafter trick was added in Version 3, also the name changed from \@LT@nofcols to preserve the \LT@ naming convention.

```
157 \def\LT@n@fcols{%
158    \advance\LT@cols\@ne
159    \ifx\@let@token\LT@nofcols
160       \expandafter\@gobble
161    \else
162       \expandafter\LT@nofcols
163    \fi}
```

9.7 The \\ and \kill Commands

\LT@tabularcr   The internal definition of \\.

```
164 \def\LT@tabularcr{%
```

Increment the counter, and do tabular's \\ or finish the chunk.
The \expandafter trick was added in Version 3.

```
165    \global\advance\LT@rows\@ne
166    \ifnum\LT@rows=\LTchunksize
167       \expandafter\LT@t@bularcr
168    \else
169       \expandafter\LT@LL@FM@cr
170    \fi}
```

\LT@t@bularcr   This definition also accepts *, which acts in the same way as \\. tabular does this, but longtable probably ought to make * prevent page breaking. {\ifnum0='}\fi added in version 3.01, required if the first entry is empty. The above in fact is not good enough, as with array package it can introduce a { } group in math mode, which changes the spacing. So use the following variant. Added in v3.14.

```
171 \def\LT@t@bularcr{%
172    \relax\iffalse{\fi\ifnum0='}\fi
173    \@ifstar\LT@xtabularcr\LT@xtabularcr}
```

\LT@xtabularcr   This justs looks for an optional argument.

```
174 \def\LT@xtabularcr{%
175    \@ifnextchar[\LT@argtabularcr\LT@ntabularcr}
```

\LT@ntabularcr — The version with no optional argument. `\ifnum0=`{\fi}` added in version 3.01. Changed in 3.14.

```
176 \def\LT@ntabularcr{%
177   \ifnum0=`{}\fi
178   \LT@echunk
179   \LT@start
180   \unvbox\z@
181   \LT@get@widths
182   \LT@bchunk}
```

\LT@argtabularcr — The version with an optional argument. `\ifnum0=`{\fi}` added in version 3.01. Changed in 3.14.

```
183 \def\LT@argtabularcr[#1]{%
184   \ifnum0=`{}\fi
185   \ifdim #1>\z@
186     \unskip\@xargarraycr{#1}%
187   \else
188     \@yargarraycr{#1}%
189   \fi
```

Add the dummy row, and finish the \halign.

```
190   \LT@echunk
191   \LT@start
192   \unvbox\z@
193   \LT@get@widths
194   \LT@bchunk}
```

\LT@echunk — This ends the current chunk, and removes the dummy row.

```
195 \def\LT@echunk{%
196   \crcr\LT@save@row\cr\egroup
197   \global\setbox\@ne\lastbox
198   \egroup}
```

\LT@entry — We here give the 'basic' definition of \LT@entry, namely that used in alignment templates. It has a \kern only if the maximum is imposed from a different chunk. The \ifhmode test reveals the first entry, when we don't want to add an &.

```
199 \def\LT@entry#1#2{%
200   \ifhmode\@firstofone{&}\fi\omit
201   \ifnum#1=\c@LT@chunks
202   \else
203     \kern#2\relax
204   \fi}
```

\LT@entry@chop — This definition for the argument of \LT@save@row is used to scrap all those maxima which could not be verified because they occur after the end of the table. This can happen only if a table has been shortened (or the sequencing got mixed up) since the previous run. Note that this is premature: the last chunk still is going to be set, and with the chopped limits.

```
205 \def\LT@entry@chop#1#2{%
206   \noexpand\LT@entry
207     {\ifnum#1>\c@LT@chunks
208        1}{0pt%
209      \else
```

```
210        #1}{#2%
211        \fi}}
```

\LT@entry@write   To write an entry for the aux file, we use a slightly surprising definition which has the sole purpose of avoiding overfull lines (which might break TEX's limits when reading the aux file, probably you'd need to have a few hundred columns before this happened but. . .).

```
212 \def\LT@entry@write{%
213    \@percentchar^^J\@spaces
214    \noexpand\LT@entry}
```

\LT@kill   This ends the current chunk as above, but strips off two rows, the 'dummy row' and the 'killed row' before starting the next chunk. Since V3.04, the old chunk is reboxed at the start of the box containing the next chunk. This allows \kill to be used in headers, which must be processed in a single box.

```
215 \def\LT@kill{%
216    \LT@echunk
217    \LT@get@widths
218    \expandafter\LT@rebox\LT@bchunk}
```

\LT@rebox   Drop the old chunk (box0) back at the top of the new chunk, removing the killed row. This macro added at V3.04.

```
219 \def\LT@rebox#1\bgroup{%
220    #1\bgroup
221    \unvbox\z@
222    \unskip
223    \setbox\z@\lastbox}
```

9.8 The Dummy Row

The dummy row is kept inside of the macro \LT@save@row.

\LT@blank@row   Create a blank row if we are not using the info in the .aux file.
\LT@build@blank

```
224 \def\LT@blank@row{%
225    \xdef\LT@save@row{\expandafter\LT@build@blank
226       \romannumeral\number\LT@cols 001 }}
```

Whoops! What's that supposed to be? A drop-in replacement for the first task of Appendix D in the TEXbook. The \romannumeral produces \LT@cols instances of m followed by i. The below macro then replaces the ms by appropriate entries.

```
227 \def\LT@build@blank#1{%
228    \if#1m%
229       \noexpand\LT@entry{1}{0pt}%
230       \expandafter\LT@build@blank
231    \fi}
```

\LT@make@row   Prior to version 4, by default did not use information in the .aux file but now we can define \LT@make@row to use the .aux file, even on the 'draft' passes.

```
232 \def\LT@make@row{%
233    \global\expandafter\let\expandafter\LT@save@row
234       \csname LT@\romannumeral\c@LT@tables\endcsname
235    \ifx\LT@save@row\relax
236       \LT@blank@row
```

Now a slightly difficult part comes. Before we decide making the template from the `.aux`
file info we check that the number of fields has remained the same. If it hasn't, either the
table format has changed, or we have the wrong table altogether. In both cases, we decide
to better drop all gathered information and start over.

The expansion between `!...!` below will be empty if the number of `\LT@entry`
macros including arguments in `\LT@save@row` is equal to `\LT@cols`. If it is not
empty, we throw the row away and start from scratch.

```
237   \else
238     {\let\LT@entry\or
239      \if!%
240          \ifcase\expandafter\expandafter\expandafter\LT@cols
241          \expandafter\@gobble\LT@save@row
242          \or
243          \else
244             \relax
245          \fi
246        !%
247      \else
248          \aftergroup\LT@blank@row
249      \fi}%
250   \fi}
```

`\setlongtables`   Redefine `\LT@make@row` to use information in the `.aux` file, if there is a saved row
for this table with the right number of columns.

Since Version 3.02, longtable has used the internal counter `\c@LT@tables` rather
than the LaTeX counter table. The warning message was added at V3.04, as was the
`\global`, to stop save-stack overflow.

Since Version 4.01 `\setlongtables` does nothing as it is not needed, but is de-
fined as `\relax` for the benefit of old documents.

```
251 \let\setlongtables\relax
```

`\LT@get@widths`   This is the heart of longtable. If it were not for the table head and foot, this macro
together with the modified `\\` command would form the basis of quite a simple little
package file for long tables. It is closely modelled on the `\endvrulealign` macro of
appendix D of the TeXbook.

```
252 \def\LT@get@widths{%
```

`\global` added at V3.04, to stop save-stack overflow.

Loop through the last row, discarding glue, and saving box widths. At V3.04 changed the
scratch box to 2, as the new `\kill` requires that `\box0` be preserved.

```
253   \setbox\tw@\hbox{%
254     \unhbox\@ne
255     \let\LT@old@row\LT@save@row
256     \global\let\LT@save@row\@empty
257     \count@\LT@cols
258     \loop
259       \unskip
260       \setbox\tw@\lastbox
261     \ifhbox\tw@
262       \LT@def@row
263       \advance\count@\m@ne
264     \repeat}%
```

Remember the widths if we are in the first chunk.

```
265    \ifx\LT@@save@row\@undefined
266      \let\LT@@save@row\LT@save@row
267    \fi}
```

\LT@def@row   Add a column to the dummy row. Name changed from `\defLT@save@row` in Version 3, to preserve the `\LT@` naming convention.

```
268 \def\LT@def@row{%
```

We start by picking the respective entry from our old row. These redefinitions of `\LT@entry` are local to the group started in `\LT@get@widths`.

```
269    \let\LT@entry\or
270    \edef\@tempa{%
271      \ifcase\expandafter\count@\LT@old@row
272      \else
273        {1}{0pt}%
274      \fi}%
```

Now we tack the right combination in front of `\LT@save@row`:

```
275    \let\LT@entry\relax
276    \xdef\LT@save@row{%
277      \LT@entry
278      \expandafter\LT@max@sel\@tempa
279      \LT@save@row}}
```

\LT@max@sel   And this is how to select the right combination. Note that we take the old maximum information only if the size does not change in *either* direction. If the size has grown, we of course have a new maximum. If the size has shrunk, the old maximum (which was explicitly not enforced because of being in the current chunk) is invalid, and we start with this chunk as the new size. Note that even in the case of equality we *must* use the `\the\wd\tw@` construct instead of #2 because #2 might be read in from the file, and so could have `\catcode` 11 versions of p and t in it which we want to be replaced by their 'proper' `\catcode` 12 versions.

```
280 \def\LT@max@sel#1#2{%
281    {\ifdim#2=\wd\tw@
282        #1%
283      \else
284        \number\c@LT@chunks
285      \fi}%
286    {\the\wd\tw@}}
```

9.9   The `\hline` Command

\LT@hline   `\hline` and `\hline\hline` both produce *two* lines. The only difference being the glue and penalties between them. This is so that a page break at a `\hline` produces a line on both pages.[6] Also this `\hline` is more like a `\cline{1-\LT@cols}`. tabular's `\hline` would draw lines the full width of the page.

```
287 \def\LT@hline{%
288   \noalign{\ifnum0=`}\fi
289     \penalty\@M
290     \futurelet\@let@token\LT@@hline}
```

---

[6]longtable has always done this, but perhaps it would be better if hlines were *omitted* at a page break, as the head and foot usually put a hline here anyway.

\LT@@hline   This code is based on \cline. Two copies of the line are produced, as described above.

```
291 \def\LT@@hline{%
292   \ifx\@let@token\hline
293     \global\let\@gtempa\@gobble
294     \gdef\LT@sep{\penalty-\@medpenalty\vskip\doublerulesep}%
295   \else
296     \global\let\@gtempa\@empty
297     \gdef\LT@sep{\penalty-\@lowpenalty\vskip-\arrayrulewidth}%
298   \fi
299   \ifnum0=`{\fi}%
300   \multispan\LT@cols
301     \unskip\leaders\hrule\@height\arrayrulewidth\hfill\cr
302   \noalign{\LT@sep}%
303   \multispan\LT@cols
304     \unskip\leaders\hrule\@height\arrayrulewidth\hfill\cr
305   \noalign{\penalty\@M}%
306   \@gtempa}
```

9.10   Captions

\LT@caption   The caption is \multicolumn{\LT@cols}{c}{⟨*a parbox with the table's caption*⟩}

```
307 \def\LT@caption{%
308   \noalign\bgroup
309     \@ifnextchar[{\egroup\LT@c@ption\@firstofone}\LT@capti@n}
```

\LT@c@ption   Caption command (with [optional argument]). \protect added in Version 3. \fnum@table added at V3.05.

```
310 \def\LT@c@ption#1[#2]#3{%
311   \LT@makecaption#1\fnum@table{#3}%
312   \def\@tempa{#2}%
313   \ifx\@tempa\@empty\else
314     {\let\\\space
315     \addcontentsline{lot}{table}{\protect\numberline{\thetable}{#2}}}%
316   \fi}
```

\LT@capti@n   Caption command (no [optional argument])

```
317 \def\LT@capti@n{%
318   \@ifstar
319     {\egroup\LT@c@ption\@gobble[]}%
320     {\egroup\@xdblarg{\LT@c@ption\@firstofone}}}
```

\LT@makecaption   Put the caption in a box of width 0pt, so that it never affects the column widths. Inside that is a \parbox of width \LTcapwidth.

```
321 \def\LT@makecaption#1#2#3{%
322   \LT@mcol\LT@cols c{\hbox to\z@{\hss\parbox[t]\LTcapwidth{%
```

Based on article class \@makecaption, #1 is \@gobble in star form, and \@firstofone otherwise.

```
323     \sbox\@tempboxa{#1{#2: }#3}%
324     \ifdim\wd\@tempboxa>\hsize
325       #1{#2: }#3%
326     \else
327       \hbox to\hsize{\hfil\box\@tempboxa\hfil}%
```

```
328     \fi
329     \endgraf\vskip\baselineskip}%
330   \hss}}}
```

9.11 The Output Routine

The method used here for interfacing a special purpose output routine to the standard LaTeX routine is lifted straight out of F. Mittelbach's multicol package.

\LT@output   Actually this is not so bad, with FM leading the way.

```
331 \def\LT@output{%
332   \ifnum\outputpenalty <-\@Mi
333     \ifnum\outputpenalty > -\LT@end@pen
```

If this was a float or a marginpar we complain.

```
334       \LT@err{floats and marginpars not allowed in a longtable}\@ehc
335     \else
```

We have reached the end of the table, on the scroll at least,

```
336       \setbox\z@\vbox{\unvbox\@cclv}%
337       \ifdim \ht\LT@lastfoot>\ht\LT@foot
```

The last foot might not fit, so:[7]

```
338         \dimen@\pagegoal
339         \advance\dimen@-\ht\LT@lastfoot
340         \ifdim\dimen@<\ht\z@
341           \setbox\@cclv\vbox{\unvbox\z@\copy\LT@foot\vss}%
342           \@makecol
343           \@outputpage
344           \setbox\z@\vbox{\box\LT@head}%
```

End of `\ifdim\dimen@<\ht\@cclc`.

```
345         \fi
```

End of `\ifdim \ht\LT@lastfoot > \ht\LT@foot`.

```
346       \fi
```

Reset `\@colroom`.

```
347       \global\@colroom\@colht
348       \global\vsize\@colht
```

Put the last page of the table on to the main vertical list.

```
349       \vbox
350         {\unvbox\z@\box\ifvoid\LT@lastfoot\LT@foot\else\LT@lastfoot\fi}%
```

End of `\ifnum\outputpenalty > -\LT@end@pen`.

```
351     \fi
```

Else `\outputpenalty > -\@Mi`.

```
352   \else
```

If we have not reached the end of the table,

```
353     \setbox\@cclv\vbox{\unvbox\@cclv\copy\LT@foot\vss}%
354     \@makecol
355     \@outputpage
```

---

[7]An alternative would be to vsplit off a bit of the last chunk, so that the last page did not just have head and foot sections, but it is hard to do this in a consistent manner.

Reset `\vsize`.

356   `\global\vsize\@colroom`

Put the head at the top of the next page.

357   `\copy\LT@head`

End of `\ifnum\outputpenalty <-\@Mi`.

358   `\fi}`

9.12   Commands for the the table head and foot

`\LT@end@hd@ft`   The core of `\endhead` and friends. Store the current chunk in the box specified by `#1`. Issue an error if the table has already started. Then start a new chunk.

359 `\def\LT@end@hd@ft#1{%`
360   `\LT@echunk`

Changed from `\relax` to `\endgraf` at V3.04, see `\LT@start`.

361   `\ifx\LT@start\endgraf`
362   `\LT@err`
363   `{Longtable head or foot not at start of table}%`
364   `{Increase LTchunksize}%`
365   `\fi`
366   `\setbox#1\box\z@`
367   `\LT@get@widths`
368   `\LT@bchunk}`

`\endfirsthead`   Call `\LT@end@hd@ft` with the appropriate box.

`\endhead` 369 `\def\endfirsthead{\LT@end@hd@ft\LT@firsthead}`
`\endfoot` 370 `\def\endhead{\LT@end@hd@ft\LT@head}`
`\endlastfoot` 371 `\def\endfoot{\LT@end@hd@ft\LT@foot}`
372 `\def\endlastfoot{\LT@end@hd@ft\LT@lastfoot}`

9.13   The `\multicolumn` command

Earlier versions needed a special 'draft' form of `\multicolumn`. This is not needed in version 4, and so these commands have been removed.

`\LTmulticolumn`

`\LT@mcwarn`

9.14   Footnotes

The standard `\footnote` command works in a c column, but we need to modify the definition in a p column to overcome the extra level of boxing. These macros are based on the array package, but should be OK for the standard tabular.

`\LT@startpbox`   Add extra code to switch the definition of `\@footnotetext`.

373 `\def\LT@startpbox#1{%`
374   `\bgroup`
375   `\let\@footnotetext\LT@p@ftntext`
376   `\hsize#1%`
377   `\@arrayparboxrestore`
378   `\vrule \@height \ht\@arstrutbox \@width \z@}`

\LT@endpbox   After the parbox is closed, expand \LT@p@ftn which will execute a series of
               \footnotetext[⟨*num*⟩]{⟨*note*⟩}
               commands. After being lifted out of the parbox, they can migrate on their own from here.

```
379 \def\LT@endpbox{%
380   \@finalstrut\@arstrutbox
381   \egroup
382   \the\LT@p@ftn
383   \global\LT@p@ftn{}%
384   \hfil}
```

\LT@p@ftntext   Inside the 'p' column, just save up the footnote text in a token register.

```
385 \def\LT@p@ftntext#1{%
386   \edef\@tempa{\the\LT@p@ftn\noexpand\footnotetext[\the\c@footnote]}%
387   \global\LT@p@ftn\expandafter{\@tempa{#1}}}%

388 ⟨/package⟩
```