CHAPTER 26

The Grid Geometry Manager

This chapter explores the `grid` geometry manager that positions widgets on a grid that automatically adjusts its size. Grid was added in Tk 4.1.

The `grid` geometry manager arranges widgets on a grid with variable-sized rows and columns. You specify the rows and columns occupied by each widget, and the grid is adjusted to accommodate all the widgets it contains. This is ideal for creating table-like layouts. The manager also has sophisticated facilities for controlling row and column sizes and the dynamic resize behavior. By introducing subframes with grids of their own, you can create arbitrary layouts.

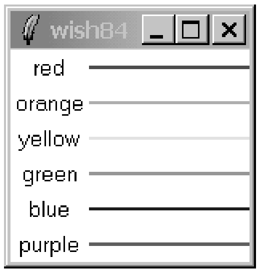
Don't `pack` and `grid` into the same manager widget.

As discussed on page 395, you can use a combination of `pack` and `grid` to create your display. But for each individual manager widget, you must use only one of `pack` or `grid` to manage all of its immediate children.

A Basic Grid

Example 26–1 uses `grid` to lay out a set of labels and frames in two parallel columns. It takes advantage of the relative placement feature of `grid`. Instead of specifying rows and columns, the order of `grid` commands and their arguments implies the layout. Each `grid` command starts a new row, and the order of the widgets in the `grid` command determines the column. In the example, there are two columns, and each iteration of the loop adds a new row. `grid` makes each column just wide enough to hold the biggest widget. Widgets that are smaller are centered in their cell. That's why the labels appear centered in their column:

Example 26–1 A basic grid.

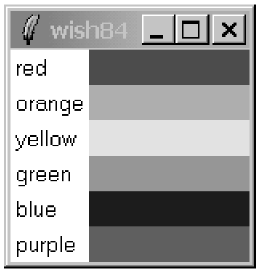


```
foreach color {red orange yellow green blue purple} {
   label .l$color -text $color -bg white
   frame .f$color -background $color -width 100 -height 2
   grid .l$color .f$color
}
```

The `-sticky` Setting

If a grid cell is larger than the widget inside it, you can control the size and position of the widget with the `-sticky` option. The `-sticky` option combines the functions of `-fill` and `-anchor` used with the `pack` geometry manager. You specify to which sides of its cell a widget sticks. You can specify any combination of `n`, `e`, `w`, and `s` to stick a widget to the top, right, left, and bottom sides of its cell. You can concatenate these letters together (e.g., `news`) or uses spaces or commas to separate them (e.g., `n,e,w,s`). Example 26–2 uses `-sticky w` to left justify the labels, and `-sticky ns` to stretch the color frames to the full height of their row:

Example 26–2 A grid with `sticky` settings.



```
foreach color {red orange yellow green blue purple} {
   label .l$color -text $color -bg white
   frame .f$color -background $color -width 100 -height 2
   grid .l$color .f$color
   grid .l$color -sticky w
   grid .f$color -sticky ns
}
```

Example 26–2 uses `grid` in two ways. The first `grid` in the loop fixes the positions of the widgets because it is the first time they are assigned to the master. The next `grid` commands modify the existing parameters; they just adjust the `-sticky` setting because their row and column positions are already known.

You can specify row and column positions explicitly with the `-row` and `-column` attributes. This is generally more work than using the relative placement, but it is necessary if you need to dynamically move a widget into a different cell. Example 26–3 keeps track of rows and columns explicitly and achieves the same layout as Example 26–2:

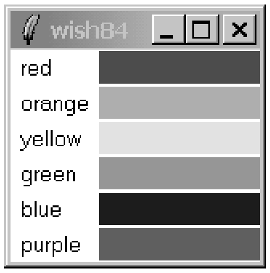
Example 26–3 A grid with row and column specifications.

```
set row 0
foreach color {red orange yellow green blue purple} {
   label .l$color -text $color -bg white
   frame .f$color -background $color -width 100
   grid .l$color -row $row -column 0 -sticky w
   grid .f$color -row $row -column 1 -sticky ns
   incr row
}
```

External Padding with -padx and -pady

You can keep a widget away from the edge of its cell with the `-padx` and `-pady` settings. Example 26–4 uses external padding to shift the labels away from the left edge, and to keep some blank space between the color bars:

Example 26–4 A grid with external padding.



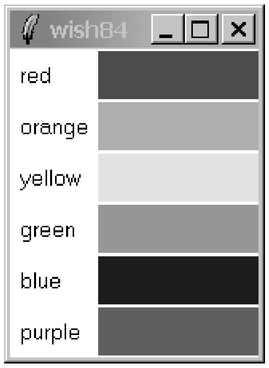
```
foreach color {red orange yellow green blue purple} {
   label .l$color -text $color -bg white
   frame .f$color -background $color -width 100 -height 2
   grid .l$color .f$color
   grid .l$color -sticky w -padx 3
   grid .f$color -sticky ns -pady 1
}
```

Tk 8.4 added the ability to specify asymmetric padding as a list of two screen distances. For example, `-padx {0.125i 0.25i}` adds 1/8 inch of padding to the left and 1/4 inch padding to the right of a widget.

Internal Padding with `-ipadx` and `-ipady`

You can give a widget more display space than it normally needs with internal padding. The internal padding increases the size of the grid. In contrast, a `-sticky` setting might stretch a widget, but it will not change the size of the grid. Example 26–5 makes the labels taller with `-ipady`:

Example 26–5 A grid with internal padding.



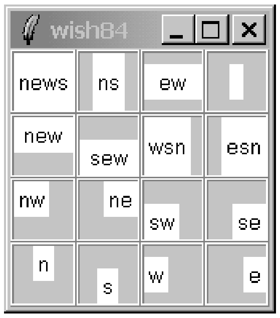
```
foreach color {red orange yellow green blue purple} {
    label .l$color -text $color -bg white
    frame .f$color -background $color -width 100 -height 2
    grid .l$color .f$color
    grid .l$color -sticky w -padx 3 -ipady 5
    grid .f$color -sticky ns -pady 1
}
```

Multiple Widgets in a Cell

Example 26–6 shows all possible `-sticky` settings. It uses the ability to put more than one widget into a grid cell. A large square frame is put in each cell, and then a label is put into the same cell with a different `-sticky` setting. It is important to create the frame first so it is below the label. Window stacking is discussed on page 409. External padding is used to keep the labels away from the edge so that they do not hide the `-ridge` relief of the frames.

Example 26–6 All combinations of `-sticky` settings.

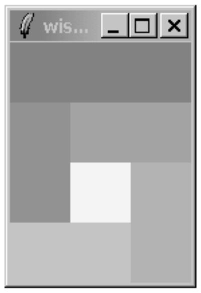
```
set index 0
foreach x {news ns ew  " " new sew wsn esn nw ne sw se n s w e} {
    frame .f$x -borderwidth 2 -relief ridge -width 40 -height 40
    grid .f$x -sticky news \
        -row [expr {$index/4}] -column [expr {$index%4}]
    label .l$x -text $x -background white
    grid .l$x -sticky $x -padx 2 -pady 2 \
        -row [expr {$index/4}] -column [expr {$index%4}]
    incr index
}
```



Spanning Rows and Columns

A widget can occupy more than one cell. The `-rowspan` and `-columnspan` attributes indicate how many rows and columns are occupied by a widget. Example 26–7 uses explicit `row`, `column`, `rowspan`, and `columnspan` specifications:

Example 26–7 Explicit row and column span.



```
. config -bg white
foreach color {888 999 aaa bbb ccc fff} {
   frame .$color -bg #$color -width 40 -height 40
}
grid .888 -row 0 -column 0 -columnspan 3 -sticky news
grid .999 -row 1 -column 0 -rowspan 2 -sticky news
grid .aaa -row 1 -column 1 -columnspan 2 -sticky news
grid .bbb -row 2 -column 2 -rowspan 2 -sticky news
grid .ccc -row 3 -column 0 -columnspan 2 -sticky news
grid .fff -row 2 -column 1 -sticky news
```

You can also use special syntax in `grid` commands that imply row and column placement. Special characters represent a cell that is spanned or skipped:

`-` represents a spanned column.
`^` represents a spanned row.
`x` represents a skipped cell.

A nice feature of the implicit row and column assignments is that it is easy to make minor changes to your layout. Example 26–8 achieves the same layout:

Example 26–8 Grid syntax row and column span.

```
. config -bg white
foreach color {888 999 aaa bbb ccc ddd fff} {
   frame .$color -bg #$color -width 40 -height 40
}
grid .888 -      -      -sticky news
grid .999 .aaa   -      -sticky news
grid ^    .fff   .bbb   -sticky news
grid .ccc -      ^      -sticky news
```

Row and Column Constraints

The `grid` manager supports attributes on whole rows and columns that affect their size and resize behavior. The `grid` command has a `rowconfigure` and `columnconfigure` operation to set and query these attributes:

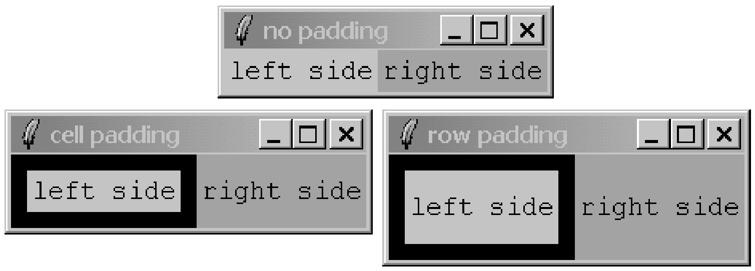
```
grid columnconfigure master col ?attributes?
grid rowconfigure master row ?attributes?
```

With no *`attributes`*, the current settings are returned. The *`row`* and *`col`* specifications can be lists instead of simple indices, so you can configure several rows or columns at once.

Row and Column Padding

The `-pad` attribute increases a row or column size. The initial size of a row or column is determined by the largest widget, and `-pad` adds to this size. This padding can be filled by the widget by using the `-sticky` attribute. Row and column padding works like internal padding because it is extra space that can be occupied by the widget's display. In contrast, the `-padx` and `-pady` attributes on an individual widget act like a spacer that keeps the widget away from the edge of the cell. Example 26–9 shows the difference. The row padding increases the height of the row, but the padding on `.f1` keeps it away from the edge of the cell:

Example 26–9 Row padding compared to cell padding.



```
. config -bg black
label .f1 -text left -bg #ccc
label .f2 -text right -bg #aaa
grid .f1 .f2 -sticky news        ;# no padding
grid .f1 -padx 10 -pady 10       ;# cell padding
grid rowconfigure . 0 -pad 20    ;# row padding
```

Minimum Size

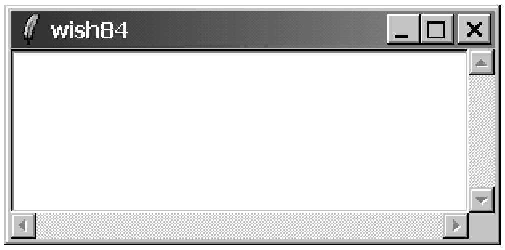
The `-minsize` attribute restricts a column or row to be a minimum size. The row or column can grow bigger if its widget requests it, but they will not get smaller than the minimum. One useful application of `-minsize` is to create empty rows or columns, which is more efficient than creating an extra frame.

Managing Resize Behavior

If the master frame is bigger than the required size of the grid, it shrinks to be just large enough to contain the grid. You can turn off the shrink-wrap behavior with `grid propagate`. If geometry propagation is off, then the grid is centered inside the master. If the master frame is too small to fit the grid, then the grid is anchored to the upper-left corner of the master and clipped on the bottom-right.

By default, rows and columns do not resize when you grow the master frame. You enable resizing by specifying a `-weight` for a row or column that is an integer value greater than zero. Example 26–10 grids a text widget and two scrollbars. The protocol between the scrollbar and the text widget is described on page 501. The text widget is in row 0, column 0, and both of these can expand. The vertical scrollbar is in row 0, column 1, so it only grows in the Y direction. The horizontal scrollbar is in row 1, column 0, so it only grows in the X direction:

Example 26–10 Gridding a text widget and scrollbar.



```
text .text -yscrollcommand ".yscroll set" \
   -xscrollcommand ".xscroll set"-width 40 -height 10
scrollbar .yscroll -command ".text yview" -orient vertical
scrollbar .xscroll -command ".text xview" -orient horizontal
grid .text .yscroll -sticky news
grid .xscroll -sticky ew
grid rowconfigure . 0 -weight 1
grid columnconfigure . 0 -weight 1
```

You can use different weights to let different rows and columns grow at different rates. However, there are some tricky issues because the resize behavior applies to extra space, not total space. For example, suppose there are four columns that have widths 10, 20, 30, and 40 pixels, for a total of 100. If the master frame is grown to 140 pixels wide, then there are 40 extra pixels. If each column has weight 1, then each column gets an equal share of the extra space, or 10 more pixels. Now suppose column 0 has weight 0, columns 1 and 2 have weight 1, and column 3 has weight 2. Column 0 will not grow, columns 1 and 2 will get 10 more pixels, and column 3 will get 20 more pixels. In most cases, weights of 0 or 1 make the most sense.

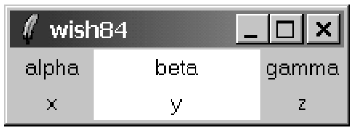
Weight works in reverse when shrinking.

If a row or column has to shrink, the weights are applied in reverse. A row or column with a higher weight will shrink more. For example, put two equal sized frames in columns with different weights. When the user makes the window bigger, the frame in the column with more weight gets larger more quickly. When the window is made smaller, that frame gets smaller more quickly.

Uniform Columns

The `-uniform` attribute makes it easy to create columns (or rows) that are the same width (or height). Use the `-uniform` attribute to create a group of columns (or rows). The value of the attribute can by anything (e.g., `xyz`). All columns (or rows) with the same `-uniform` attribute are in the same group. If they all have the same `-weight` value, then they are all the same size. If one column (or row) in a group has a `-weight` that is twice what the other columns (or rows) have, then it is twice as big. This is illustrated in Example 26–11.

Example 26–11 Uniform column width.



```
foreach x {alpha beta gamma x y z} {
   label .$x -text $x
}
.beta config -bg white
.y config -bg white
grid .alpha .beta .gamma -sticky news
grid .x .y .z -sticky news
grid columnconfigure . "0 1 2" -uniform group1 -weight 1
grid columnconfigure . 1 -weight 2
```

The `grid` Command

Table 26–1 summarizes the usage of the `grid` command. Table 26–2 summarizes the options for a widget set with the `grid configure` command.

Table 26–1 The `grid` command.

`grid bbox` *`master`* `?`*`c1 r1`*`? ?`*`c2 r2`*`?`	Returns the bounding box, of the whole grid, the cell at *`c1`*, *`r1`*, or the cells from *`c1`*, *`r1`* to *`c2`*, *`r2`*.
`grid columnconfigure` *`mas-ter col`* `?`*`options`*`?`	Sets or queries the configuration of *`col`*. Options are `-minsize`, `-weight`, `-pad`, and `-uniform`.
`grid configure` *`win`* `?`*`win`* `...? ?`*`options`*`?`	Grids one or more widgets according to the *`options`*, which are given in Table 26–2.
`grid forget` *`win`* `?`*`win`*`...?`	Unmaps the specified windows.
`grid info` *`win`*	Returns the grid options of *`win`*.
`grid location` *`master x y`*	Returns the cell column and row under the point *`x`*, *`y`* in *`master`*.
`grid propagate` *`master`* `?`*`boolean`*`?`	Enables or disables shrink-wrapping of *`master`*.
`grid rowconfigure` *`master row`* `?`*`options`*`?`	Sets or queries the configuration of *`row`*. Options are `-minsize`, `-weight`, `-pad`, and `-uniform`.
`grid remove` *`slave`*	Unmaps *`slave`*, but remember its configuration.
`grid size master`	Returns the number of columns and rows.
`grid slaves` *`win`* `?-row` *`r`*`? ?-column` *`c`*`?`	Returns the list of widgets managed by *`win`*, or just those in the specified row or column.

Table 26–2 Grid widget options.

`-in` *`win`*	Places inside *`win`*.
`-column` *`col`*	Column position. Columns count from zero.
`-columnspan` *`n`*	Spans *`n`* columns.
`-ipadx` *`pixels`*	Internal widget padding in the X direction, in screen units.
`-ipady` *`pixels`*	Internal widget padding in the Y direction, in screen units.
`-padx` *`pixels`*	External widget padding in the X direction, in screen units. May be a list of two screen units for asymmetric padding (Tk 8.4).
`-pady` *`pixels`*	External widget padding in the Y direction, in screen units. May be a list of two screen units for asymmetric padding (Tk 8.4).
`-row` *`row`*	Row position. Rows count from zero.
`-rowspan` *`n`*	Spans *`n`* rows.
`-sticky` *`how`*	Positions widget next to any combination of north (`n`), south (`s`), east (`e`), and west (`w`) sides of the cell. Use `{}` for center.

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