Building User Interfaces With Tcl And Tk

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Tcl/Tk Tutorial, Part III

Outline

- **Basic structures: windows, widgets, processes.**
- **Creating widgets: class commands.**
- **Widget commands.**
- **Geometry management: the placer and the packer.**
- **Bindings.**
- **Other commands: send, focus, selection, window manager, grabs.**
- **Two examples: `showVars`, `mkDialog`.**

Structure Of A Tk Application

- **Widget hierarchy.**
- **One Tcl interpreter.**
- **One process** (can have > 1 application in a process)**.**
- **Widget: a window with a particular look and feel.**
- **Widget classes implemented by Tk:**

Frame	Menubutton	Canvas
Label	Menu	Scrollbar
Button	Message	Scale
Checkbutton	Entry	Listbox
Radiobutton	Text	Toplevel

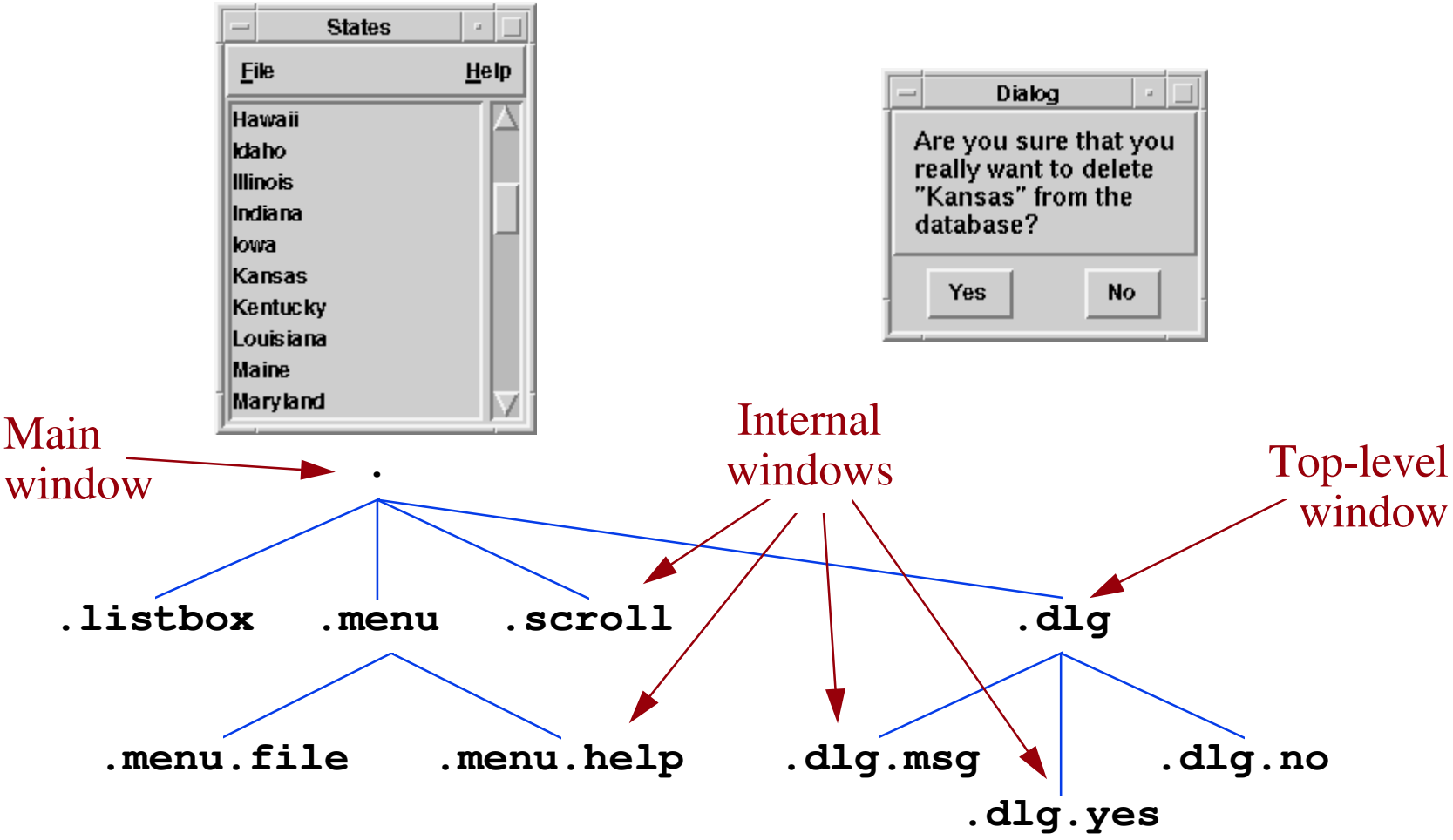
Hawaii
Idaho
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Maryland

File

Help

States
File
Help
Hawaii
Idaho
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Maryland

Types Of Windows



Creating Widgets

- **Each widget has a class: button, listbox, scrollbar, etc.**
- **One class command for each class, used to create instances:**

```
button .a.b -text Quit -command exit
scrollbar .x -orient horizontal
```

Configuration Options

- **Defined by class. For buttons:**

`-activebackground`	`-disabledforeground`	`-justify`	`-underline`
`-activeforeground`	`-font`	`-padx`	`-width`
`-anchor`	`-foreground`	`-pady`	`-wraplength`
`-background`	`-height`	`-relief`	
`-bitmap`	`-highlightbackground`	`-state`	
`-borderwidth`	`-highlightcolor`	`-takefocus`	
`-command`	`-highlightthickness`	`-text`	
`-cursor`	`-image`	`-textvariable`	

- **If not specified in command, taken from option database:**
  - –Loaded from **`RESOURCE_MANAGER`** property or **`.Xdefaults`** file.
  - –May be set, queried with **`option`** command.
- **If not in option database, default provided by class.**

Widget Commands

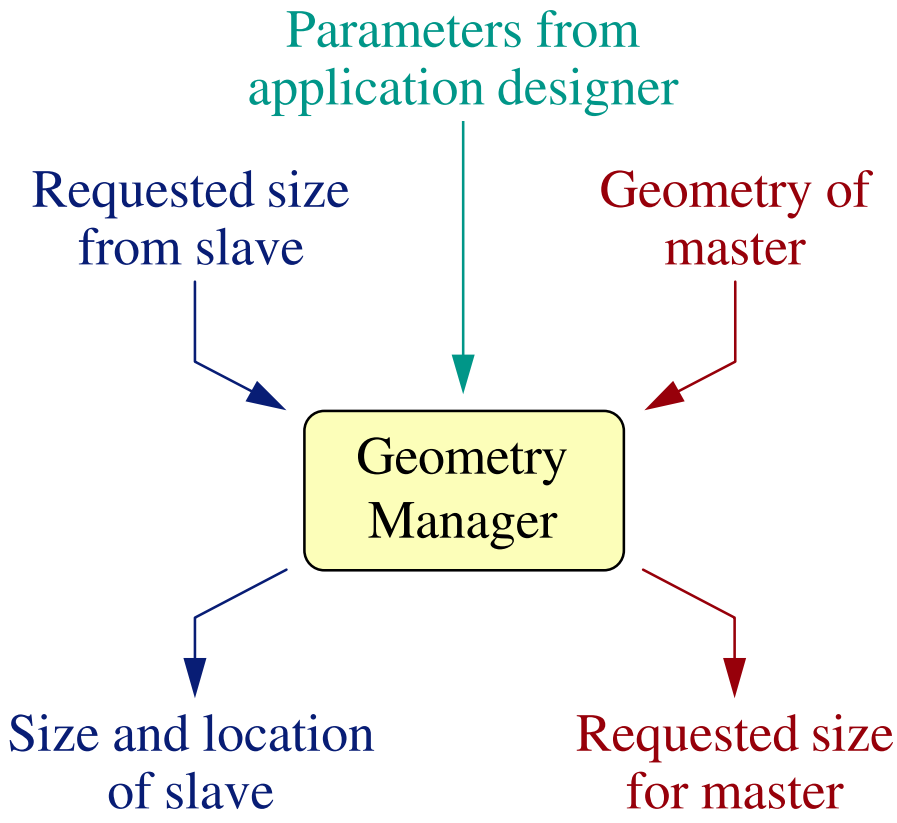
- **Tcl command for each widget, named after widget.**
- **Used to reconfigure, manipulate widget:**

```
button .a.b
.a.b configure -relief sunken
.a.b flash
scrollbar .x
.x set 0.2 0.7
.x get
```

- **Widget command is deleted when widget is destroyed.**
- **Principle: all state should be readable, modifiable, anytime.**

Geometry Management

- **Widgets don't control their own positions and sizes: geometry managers do.**
- **Widgets don't even appear on the screen until managed by a geometry manager.**
- **Geometry manager = algorithm for arranging slave windows relative to a master window.**



The Placer

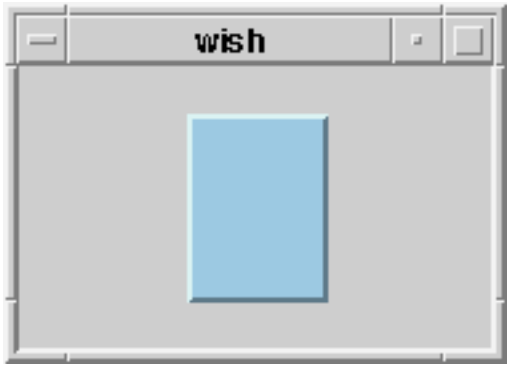
- **Simple but not very powerful.**
- **Each slave placed individually relative to its master.**

```
place .x -x 0 -y 0
```

```
place .x -x 1.0c -rely 0.5 -anchor w
```

The Placer, cont'd

```
place .x -relx 0.5 -rely 0.5 \
-height 2c -anchor center
```

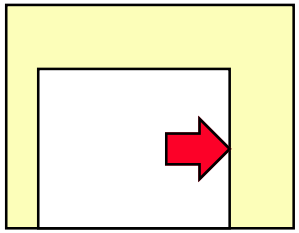



```
place .x -relheight 0.5 \
-relwidth 0.5 -relx 0 -rely 0.5
```

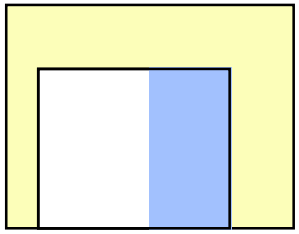
The Packer

- **More powerful than the placer.**
- **Arranges groups of slaves together (packing list).**
- **Packs slaves around edges of master's cavity.**
- **For each slave, in order:**

1. Pick side of cavity.

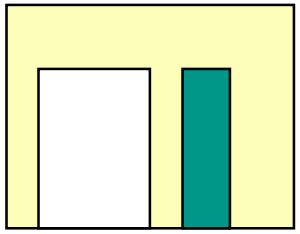


2. Slice off parcel for slave.



3. Optionally grow slave to fill parcel.

4. Position slave in parcel.



The Packer: Choosing Sides

```
button .ok -text OK
button .cancel -text Cancel
button .help -text Help
pack .ok .cancel .help -side left
```

```
.cancel configure -text "Cancel Command"
```

```
pack .ok .cancel .help -side top
```

The Packer: Padding

```
pack .ok .cancel .help -side left \
-padx 2m -pady 1m
```

```
pack .ok .cancel .help -side left \
-ipadx 2m -ipady 1m
```

```
pack .ok .cancel .help -side left \
-padx 2m -pady 1m -ipadx 2m -ipady 1m
```

The Packer: Filling

Stretch widgets to fill parcels:

```
pack .ok .cancel .help -side top
```

```
pack .ok .cancel .help -side top -fill x
```

The Packer: Filling, cont'd

```
pack .menu -side top
pack .scrollbar -side right
pack .listbox
```

```
pack .menu -side top -fill x
pack .scrollbar -side right -fill y
pack .listbox
```

The Packer: Expansion

Increase parcel size to absorb extra space in master:

```
pack .ok .cancel .help -side left
```

```
pack .ok .cancel -side left
pack .help -side left -expand true
```

```
pack .ok .cancel -side left
pack .help -side left \
    -expand true -fill x
```

The Packer: Expansion, cont'd

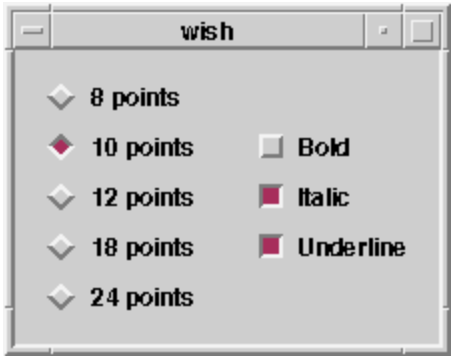
```
pack .ok .cancel .help -side left \
    -expand true
```

```
pack .ok .cancel .help -side left \
    -expand 1 -fill both
```

Hierarchical Packing

Use additional frames to create more complex arrangements:

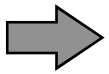
```
frame .left
pack .left -side left -padx 3m -pady 3m
frame .right
pack .right -side right -padx 3m -pady 3m
foreach size {8 10 12 18 24} {
    radiobutton .pts$size -variable pts \
        -value $size -text "$size points"
}
pack .pts8 .pts10 .pts12 .pts18 .pts24 \
    -in .left -side top -anchor w
checkbutton .bold -text Bold \
    -variable bold
checkbutton .italic -text Italic \
    -variable italic
checkbutton .underline -text Underline \
    -variable underline
pack .bold .italic .underline \
    -in .right -side top -anchor w
```



Connections

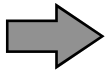
- **How to make widgets work together with application, other widgets? Tcl scripts.**
- **Widget actions are Tcl commands:**

```
button .a.b -command exit
```

button release  `exit`

- **Widgets use Tcl commands to communicate with each other:**

```
scrollbar .s -command ".text yview"
```

click on arrow  `.text yview scroll 1 unit`

- **Application uses widget commands to communicate with widgets.**

Bindings

- **Associate Tcl scripts with X events:**

```
bind .b <Control-h> {backspace .t}
```

- **Use tags to select one or more windows:**
  - Name of window: `.b`
  - Widget class: `Text`
  - All windows: `all`
  - Arbitrary string: `foo`, `bar`, ...

Bindings: Specifying Events

- **Specifying events:**

```
<Double-Control-ButtonPress-1>
```

```
<3>
<KeyPress>
a
```

Bindings: Substitutions

- **% substitutions in binding scripts:**
  - Coordinates from event: `%x` and `%y`.
  - Window: `%W`.
  - Character from event: `%A`.
  - Many more...
- **Examples:**

```
bind .c <B1-Motion> {move %x %y}
bind .t <KeyPress> {insert %A}
bind all <Help> {help %W}
```

Binding Order

- What if multiple bindings match an event?

```
bind .t a ...
bind all <KeyPress> ...
```

- One binding triggers per tag: most specific.
- Default order of tags: widget, class, toplevel, `all`.
- Can change tags with `bindtags` command:

```
bindtags .b {MyButton .b foo all}
```

- Can use `break` to skip later tags.
- Note: these rules apply only to Tk 4.0.

More On Bindings

- **Text and canvas widgets support bindings internally:**
  - Associate tags with text or graphics:

```
.t tag add foo 1.0 2.0
.c create rect 1c 1c 2c 2c -tags foo
```

  - Associate bindings with tags:

```
.t bind foo <1> {...}
.c bind foo <Enter> {...}
```

- **Bindings always execute at global level:**
  - If binding created in procedure, procedure's local variables aren't available at event-time.

Quoting Hell

- **Often want binding script to use some information from binding-time, some from event-time.**
- **Use list commands to generate scripts.**
- **Use procedures to separate event-time information from bind-time information.**

```
bind .x <1> {set y [expr $a + $b]}
```

Use bind-time value

Use event-time value

Wrong

```
bind .x <1> "set y [expr $a + $b]"
```

Right

```
proc sety a {
    global b y
    set y [expr $a + $b]
}
bind .x <1> [list sety $a]
```

Other Tk Commands

- **The selection:**

```
selection get
selection get FILE_NAME
```

- **Issuing commands to other Tk applications:**

```
send tgdb "break tkEval.c:200"
winfo interps
⇨ wish tgdb ppres
```

- **Window information:**

```
winfo width .x
winfo children .
winfo containing $x $y
```

Access To Other X Facilities

- **Keyboard focus:**

```
focus .x.y
```

- **Communication with window manager:**

```
wm title . "Editing main.c"
wm geometry . 300x200
wm iconify .
```

- **Deleting windows:**

```
destroy .x
```

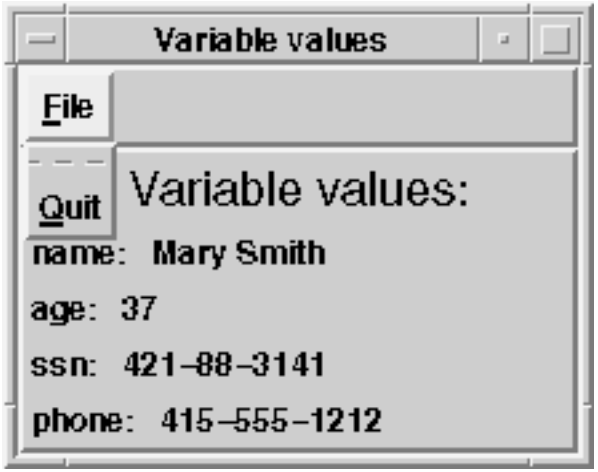
- **Grabs:**

```
grab .x
grab release .x
```

Example #1: `showVars`

- **Displays values of one or more values, updates automatically:**

```
showVars .vars name age ssn phone
```

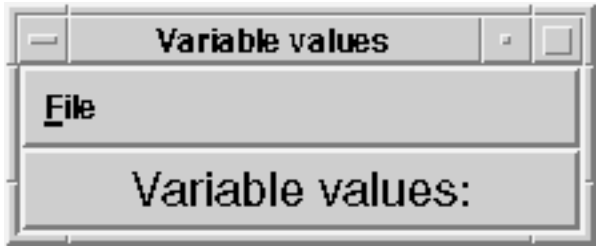


showVars, cont'd

```
proc showVars {w args} {
    toplevel $w
    wm title $w "Variable values"
    frame $w.menu -relief raised -bd 2
    pack $w.menu -side top -fill x
    menubutton $w.menu.file -text File \
        -menu $w.menu.file.m -underline 0
    pack $w.menu.file -side left
    menu $w.menu.file.m
    $w.menu.file.m add command -label Quit \
        -command "destroy $w" -underline 0
    ...
}
```

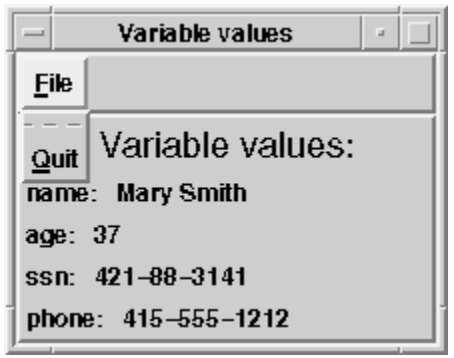
showVars, cont'd

```
proc showVars {w args} {
    ...
    frame $w.bot -relief raised -bd 2
    pack $w.bot -side bottom -fill both
    label $w.bot.title -width 20 -anchor center \
        -text "Variable values:" -font \
        -Adobe-Helvetica-Medium-r-normal--*-180-*-*-*-*-*-*-
    pack $w.bot.title -side top -fill x
    ...
}
```



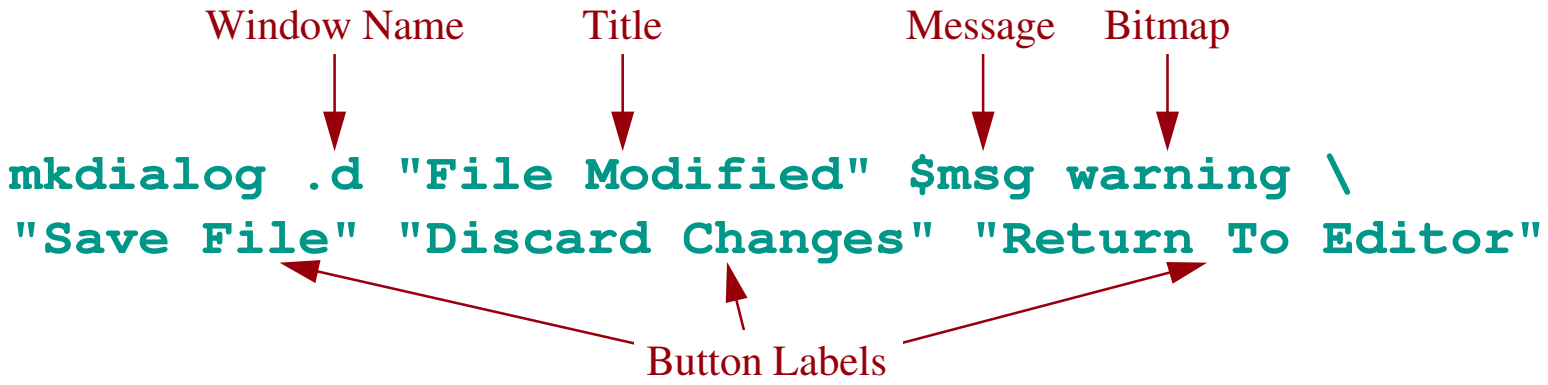
showVars, cont'd

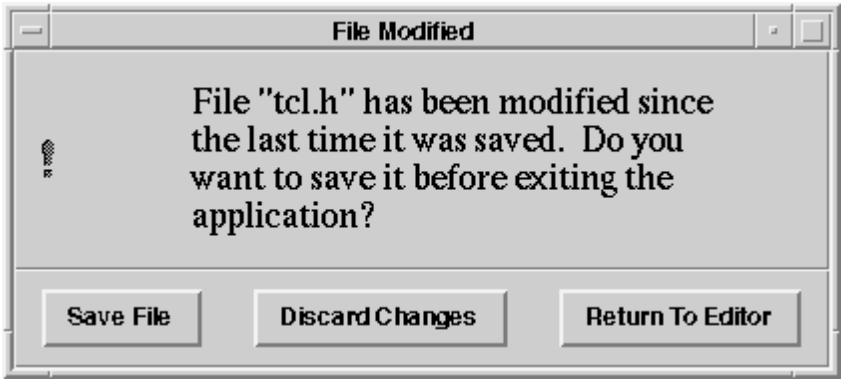
```
proc showVars {w args} {
    ...
    foreach i $args {
        frame $w.bot.$i
        pack $w.bot.$i -side top -anchor w
        label $w.bot.$i.name -text "$i: "
        label $w.bot.$i.value -textvariable $i
        pack $w.bot.$i.name -side left
        pack $w.bot.$i.value -side left
    }
}
showVars .vars name age ssn phone
```



Example #2: `mkDialog`

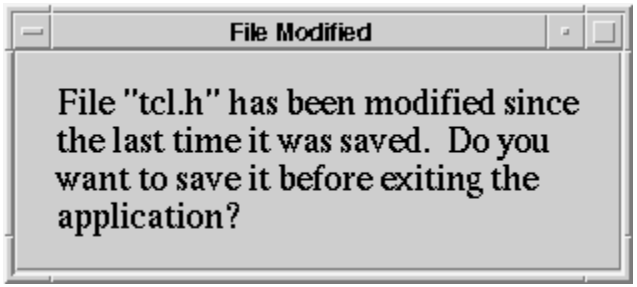
Creates dialog box, waits until button pressed, returns index.





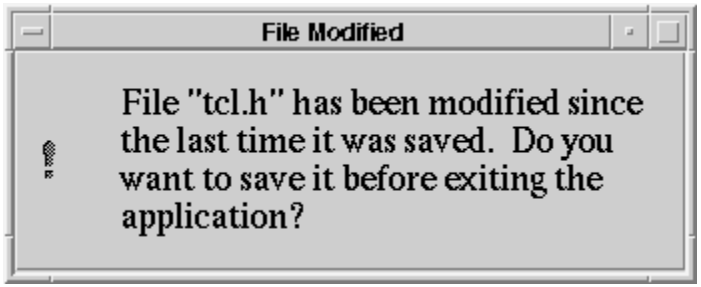
mkDialog, cont'd

```
proc mkDialog {w title text bitmap args} {
    toplevel $w
    wm title $w $title
    wm protocol $w WM_DELETE_WINDOW { }
    frame $w.top -relief raised -bd 1
    pack $w.top -side top -fill both
    frame $w.bot -relief raised -bd 1
    pack $w.bot -side bottom -fill both
    label $w.msg -wraplength 3i -text $text \
        -justify left -font \
        -Adobe-Times-Medium-R-Normal--*-180-*-*-*-*-*-*
    pack $w.msg -in $w.top -side right \
        -expand 1 -fill both -padx 3m -pady 3m
    ...
}
```



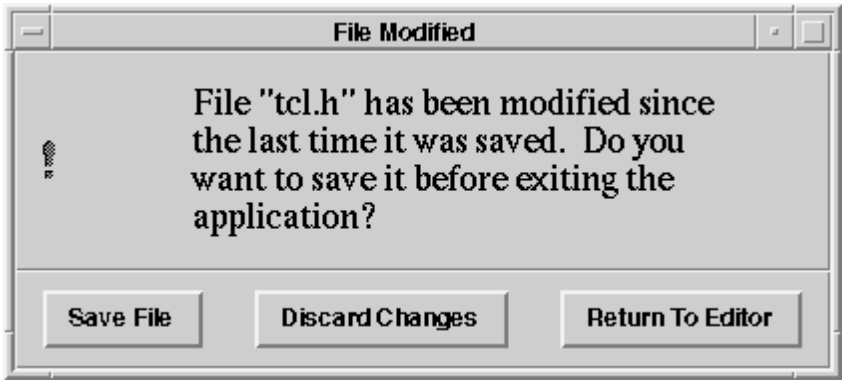
mkDialog, cont'd

```
proc mkdialog {w title text bitmap args} {
    ...
    if {$bitmap != ""} {
        label $w.bitmap -bitmap $bitmap
        pack $w.bitmap -in $w.top -side left \
            -padx 3m -pady 3m
    }
    ...
}
```



mkDialog, cont'd

```
proc mkDialog {w title text bitmap args} {
    ...
    set i 0
    foreach but $args {
        button $w.button$i -text $but \
            -command "set button $i"
        pack $w.button$i -in $w.bot -side left \
            -expand 1 -padx 3m -pady 2m
        incr i
    }
    ...
}
```



mkDialog, cont'd

```
proc mkDialog {w title text bitmap args} {
    global button
    ...
    grab $w
    set oldFocus [focus]
    focus $w
    tkwait variable button
    destroy $w
    focus $oldFocus
    return $button
}
```

Summary

- **Creating interfaces with Tk is easy:**
  - Create widgets.
  - Arrange with geometry managers.
  - Connect to application, each other.

- **Power from single scripting language:**
  - For specifying user interface.
  - For widgets to invoke application.
  - For widgets to communicate with each other.
  - For communicating with outside world.
  - For changing anything dynamically.