The Mjølner BETA System
Lidskjalv: User Interface Framework

Reference Manual

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Contents

OVERVIEW OF LIDSKJALV **1**

THE LIDSKJALV LIBRARIES **3**

CHAPTER 1: THE GUIENV LIBRARY **5**

Menu facilities *6*
Window facilities *7*
USING THE GUIENV LIBRARY 8
EXAMPLES OF USE OF THE GUENV FRAGMENT 9
INTERFACE DESCRIPTIONS OF THE GUIENV LIBRARY 12

CHAPTER 2: THE STDDIALOGS LIBRARY **39**

USING THE STDDIALOGS LIBRARY 39
EXAMPLES OF USE OF THE STDDIALOGS FRAGMENT 39
INTERFACE DESCRIPTIONS OF THE STDDIALOGS LIBRARY 41

CHAPTER 3: THE CONTROLS LIBRARY **43**

USING THE CONTROLS LIBRARY 45
EXAMPLES OF USE OF THE CONTROLS FRAGMENT 45
INTERFACE DESCRIPTIONS OF THE CONTROLS LIBRARY 48

CHAPTER 4: THE FIELDS LIBRARY **55**

USING THE FIELDS LIBRARY 56
EXAMPLES OF USE OF THE FIELDS FRAGMENT 56
INTERFACE DESCRIPTIONS OF THE FIELDS LIBRARY 59

CHAPTER 5: THE FIGUREITEMS LIBRARY **67**

USING THE FIGUREITEMS LIBRARY 68
EXAMPLES OF USE OF THE FIGUREITEMS FRAGMENT 68
INTERFACE DESCRIPTIONS OF THE FIGUREITEMS LIBRARY 71

CHAPTER 6: THE SCROLLLISTS LIBRARY **75**

USING THE SCROLLLISTS LIBRARY 75
EXAMPLES OF USE OF THE SCROLLLISTS FRAGMENT 76
INTERFACE DESCRIPTIONS OF THE SCROLLLISTS LIBRARY 78

CHAPTER 7: THE GRAPHMATH LIBRARY **83**

USING THE GRAPHMATH LIBRARY 83
EXAMPLES OF USE OF THE GRAPHMATH FRAGMENT 83
INTERFACE DESCRIPTIONS OF THE GRAPHMATH LIBRARY 85

CHAPTER 8: THE GRAPHICS LIBRARY **93**

USING THE GRAPHICS LIBRARY 93
EXAMPLES OF USE OF THE GRAPHICS FRAGMENT 93
INTERFACE DESCRIPTIONS OF THE GRAPHICS LIBRARY 95

CHAPTER 9: THE RASTER LIBRARY **99**

USING THE RASTER LIBRARY 99
EXAMPLES OF USE OF THE RASTER FRAGMENT 99
INTERFACE DESCRIPTIONS OF THE RASTER LIBRARY 101

CHAPTER 10: THE STYLEDTEXT LIBRARY 105

USING THE STYLEDTEXT LIBRARY 105
EXAMPLES OF USE OF THE STYLEDTEXT FRAGMENT 105
INTERFACE DESCRIPTIONS OF THE STYLEDTEXT LIBRARY 106

CHAPTER 11: THE GUIENVACTIONS LIBRARY 107

USING THE GUIENVACTIONS LIBRARY 107
EXAMPLES OF USE OF THE GUIENVACTIONS FRAGMENT 107
INTERFACE DESCRIPTIONS OF THE GUIENVACTIONS LIBRARY 109

CHAPTER 12: THE CONTROLACTIONS LIBRARY 113

USING THE CONTROLACTIONS LIBRARY 113
EXAMPLES OF USE OF THE CONTROLACTIONS FRAGMENT 113
INTERFACE DESCRIPTIONS OF THE CONTROLACTIONS LIBRARY 115

CHAPTER 13: THE FIELDSACTIONS LIBRARY 117

USING THE FIELDSACTIONS LIBRARY 117
EXAMPLES OF USE OF THE FIELDSACTIONS FRAGMENT 117
INTERFACE DESCRIPTIONS OF THE FIELDSACTIONS LIBRARY 119

CHAPTER 14: THE GUIENVALL LIBRARY 121

USING THE GUIENVALL LIBRARY 121
INTERFACE DESCRIPTIONS OF THE GUIENVALL LIBRARY 122

CHAPTER 15: THE GUIENVSYSTEMENV LIBRARY 123

USING THE GUIENVSYSTEMENV LIBRARY 123
INTERFACE DESCRIPTIONS OF THE GUIENVSYSTEMENV LIBRARY 124

APPENDIX A: DEMO PROGRAMS 125

APPENDIX B: IMPLEMENTATION DESIGN 127

REFERENCES 131

INDEX 133

Overview of Lidskjalv

Platform independemt user interface construction Framework

Lidskjalv[1] is an platform independent object-oriented user interface construction framework for constructing user interfaces that are easily portable between the Macintosh window system, the X Window System (based on Motif Widgets), and the Microsoft Windows (Windows NT or Windows 95).

This document contains the object-oriented model for Lidskjalv, along with an overview of the interface files for Lidskjalv.

Available on X Window System, Macintosh, Windows 95 and Windows NT

The Lidskjalv model is based on previous experiences in developing object-oriented user interface construction frameworks for the Macintosh window system, and the X Window System (based on Athena and Motif Widgets). It has been an important design criterion to make a model that deals with the construction of portable user interfaces in such a way that the details of the look-and-feel of the Lidskjalv applications will conform to the standardised look-and-feel at the specific platform; i.e. the interface will appear to the user as a genuine Motif interface when running in a Motif environment, and will appear as a genuine Macintosh application when running in a Macintosh environment, etc. However, not all issues can be dealt with without the co-operation from the application programmer. To give an example: if the application programmer decides that the windows in the application should contain individual menubars, there is no way this application can conform with the Macintosh User Interface Guidelines. However, Lidskjalv will allow the application programmer to specify individual window menubars on a Macintosh. However, the application programmer might use other facilities of Lidskjalv to deal with this issue of window-specific menubars, such that the code is purely portable across look-and-feel.

Based on object-oriented abstraction and automated event handling

Lidskjalv defines abstractions for all commonly used interface objects, such as window, menubar, menu, button, text fields, figure items, scrolling lists, etc. Each interface object takes care of the interactions related to itself, and it is the responsibility of the entire framework to ensure that the user interactions (such as mouse button presses, key presses, etc.) are taken care of and converted internally into invocations of virtual procedures of the appropriate interface object - that is, no application programmer needs to handle user interaction at the event level of the underlying platform.

Lidskjalv is realised in the form of a class, guienv, whose instance acts as the framework for the user interface, taking care of all platform dependent event handling, etc.

[1] Lidskjalv is the name of the Odin's high throne, from which he is able to look into all Worlds and see everything that happens.

The Lidskjalv Libraries

The Lidskjalv libraries consists of 15 libraries (fragments):

Modulized design

- `guienv`
- `stddialogs`
- `control`
- `fields`
- `figureitems`
- `scrolllist`
- `graphmath`
- `graphics`
- `raster`
- `styledtext`
- `guienvactions`
- `controlsactions`
- `fieldsactions`
- `guienvall`
- `guienvsystemenv`

Basic framework

The `guienv` library defines the basic facilities of the Lidskjav framework (as described above). All Lidskjav programs must include at least the `guienv` fragment.

Standard dialogs

The `stddialogs` library includes a few predefined patterns for simple, standard dialogs, such as fileSelectionDialog.

Buttons, etc.

The `control` library includes facilities for specifying control `interfaceObjects` (such as `buttons` etc.) as described above.

Text fields etc.

The `fields` library includes facilities for specifying field `interfaceObjects` (such as static text fields, editable textfields, etc.)

Ovals, rects, etc.

The `figureitems` library includes facilities for specifying basic graphics `interfaceObjects` (such as lines, ovals, etc.)

Scrolling lists

The `scrolllist` library includes facilities for specifying scrolling `interfaceObjects` (such as scrolling lists etc.)

Graphical calculations

The `graphmath` library includes facilities for graphics computations, such as definition and manipulation of point, rectangle, etc.)

Simple graphics

The `graphics` library includes facilities for simple graphics, such as line drawings.

Raster images

The `raster` library includes facilities for manipulating raster images (currently only partially implemented).

Styled text

The `styledtext` library includes facilities for working with styled text (i.e text in different fonts and styles). Currently only available on Macintosh platforms.

Advanced event handling

The `guienvactions` library defines the actions related to the `interfaceObjects`, defined in the `guienv` library (more on actions later).

The `controlsactions` library defines the actions related to the `interfaceObjects`, defined in the `controls` library.

The `fieldssactions` library defines the actions related to the `interfaceObjects`, defined in the `fields` library.

Entire Lidskjalv framework

The `guienvall` library is a very simple library, including all the above libraries. Used for easy access to the entire suite of facilities in `guienv`.

Cooperation with cuncurrency

The `guienvsystemenv` library is a very simple library that enables concurrency and `guienv` to work perfectly together.

Utilities

Besides these libraries, the Lidskjalv user interface framework includes a number of utility libraries. These libraries are located in the `utils` sub-directory of the Lidskvalv directory tree. It should be noted, that these libraries contains many very useful facilities, but these libraries are not described in this manual.

Event handling

Events as virtual invocations

One of the strengths of the Lidskjalv libraries is the ease with which the event handling is conducted. Essentially, the Lidskjalv libraries takes care of all the details of the event dispatching and handling. The Lidskjalv libraries essentially converts all event occurrences into invocation of special virtual patterns within the appropriate user interface object (e.g. the one below the mouse pointer). In the Lidskjalv documentation, these virtual patterns are often referred to as the event patterns (or simply events). The application programmer only has to further bind these event patterns of the individual user interface objects to specify the actions to be taken in response to user interaction.

Chapter 1: The guienv Library

Guienv is the most basic library of the Lidskjalv libraries. Guienv implements the most often used elements of a graphical user interface, such as menus, windows, etc. along with a lot of supporting facilities.

Menus, windows, interfaceObjects, basic event handling

The prime elements of guienv is the definition of the menu system and the facilities for defining windows along with facilities for handling the events (such as mouse button press), originating from the user interface (menus, windows, etc.).

The most important classes, defined in guienv are:

- **InterfaceObject** interfaceObject is the root of the hierarchy of interface components in Lidskjalv.
- **MenuBar** menuBar is a class, defining the facilities for defining menubars. The global menubar (if any) is accessed through the applicationMenubar attribute. StandardMenubar defines the standard menubar, used by most applications.
- **Menu** menu is a class, defining the facilities for menus, both menus of menubars, menus associated with buttons, and popup menus.
- **Window** window defines the facilities for defining and manipulation windows, and sharedWindow is a preliminary design of an interface into a shared window system.

The rest of the attributes defines various other facilities for accessing different other aspects of the window system.

The most important class in Lidskjalv is interfaceObject. It defines the facilities available for controlling all interface components in guienv.

InterfaceObject

interfaceObject implements the basic facilities for all interaction:

- open and close is invoked when the interfaceObject is opened and closed on the screen.
- enableEventType and disableEventType are used to control which interactions, this interfaceObject is willing to respond to (default is that all event types are enabled).
- layoutType and layout are the facilities for gaining layout information to be stored, e.g. in the OODB.
- Most attributes relate to event handling. Event is the superpattern for all event patterns (such as mouseDovn and refresh). These events are invoked by the underlying system as the result of, e.g. user interactions.

Event Handling

Event handling in guienv is handled through defining virtual further bindings in which the actions to be executed as the result of an event, is specified. Each interfaceObject type defined a series of event virtuels in the eventhandler virtual pattern, and users of these interfaceObjects may then further bind this eventhandler, and in this further binding specify the actions to be executed for the particuler events, defined for that type of interfaceObject.

Event handling in interfaceObject

The basic `eventhandler` (defined in `interfaceObject`) defines the following events: `onMouseDown`, `onMouseUp`, `onKeyDown`, `onIdle`, `onRefresh`, `onActivate`, and `onDeactivate`. Some of these events carry global information on the state of the keyboard and mouse.

Actions associated with events

In order to support more dynamic event handling, it is also possible dynamically to attach actions before or after the predefined actions for an event. This is done by specifying an instance of (a subpattern of) `action` and then either prepend or append it to the already attached actions (using the `prependAction` or `appendAction` operations). An action can be retracted again by the `deleteAction` operation.

Actions

Parallel to the event hierarchy is an `action` hierarchy. An action (e.g. `mouseDownAction` and `refreshAction`) can be associated with an event, such that the actions will be invoked either before or after the events itself. These actions are defined in separate libraries, see chapters 11-13.

In order to control the `interfaceObject's` sensibility to individuel event types, the operations `enableEventType` and `disableEventType` are available.

Menu facilities

The menu facilities are centred around the concept of menubars. In `guienv`, there may be any number of menubars: an application menubar, and a menubar associated with each window. In both cases, these menubars are specified as instances of the `menubar` pattern:

Menubar

`menubar` implements the facilities for defining menubars.

- `append`, `delete` and `clear` are used for manipulating the menus in the menubar.
- `appendMenubar`, `replaceMenubar`, and `deleteMenubar` is used for manipulating a menubar as part of another menubar (e.g. appending all menus in one menubar to another menubar).
- `scan` facilitates scanning all menus associated with this menubar.

The application menu can be specified by further binding the `menubarType` virtual. If a standard application menubar is what you want, just further bind to `standardMenuBar`.

StandardMenubar

`StandardMenubar` defines the following important attributes:

- `standardFileMenu` and `standardEditMenu` defines the standard file and edit menus. `fileMenu`, `theFileMenu` and `editMenu`, `theEditMenu` are facilities for specifying different file and edit menus.

The application menubar can be changed and accessed through the `applicationMenubar` attribute.

Menu

The individual menus in a menubar is specified as instances of the pattern `menu`. `menu` defines the following important attributes:

- `name` defines the name of this menu.
- `onSelect` is invoked when selecting in the menu. Further bind this attribute (defined in the local `eventhandler` virtual) to specify the actions to be executed when this manu is selected in the menubar.
- `menuItem` and `dynamicMenuItem` are used to define the individual menu items, and `action` is used to specify actions to be associated with dynamic menuItems (see later).
- `append`, `delete`, `clear` and `scan` are used for manipulating the menu items of this menu.
- `popUp` is used to pop-up this menu.

- `enable` and `disable` is used to control whether the menu is enabled or disabled in the menubar.

MenuItem

The pattern `menuItem` is the facility for defining the individual items in a menu. Most attributes (`name`, `key`, `checked`, etc.) define the visual appearance of the menu item. Besides the following important attributes are defined:

- `onStatus` is used to define when the menu item is selectable.
- `onSelect` is used to specify the actions to be executed when the menu item is selected.
- `subMenu` is used to attach an entire menu to a menu item (i.e. creating a hierarchical menu).

Dynamic menuItem

The `menuItem` pattern assumes that the same actions always must be executed when a menu item is selected. If however, we want a more dynamic behaviour, the pattern `dynamicMenuItem` must be used. This pattern allows actions to be associated dynamically with the particular menu item. `dynamicMenuItem` idefines the following important attributes:

- `attach` and `detach` is used to associate the actions with this `dynamicMenuItem`.

MenuAction

The actions to be associated with a `dynamicMenuItem` must be instances of the `menuAction` pattern.

Window facilities

Window

`window` defines the means for creating windows in applications. It defines the following important attributes:

- The events: `onAboutToClose`, `onActivate`, etc. are the facilities for specifying actions to be executed as consequence of user interactions.
- `theMenubar` and `menubarType` are the means for associating a menubar with this window. And `menubarVisible` controls whether the menubar should be visible.
- `title` is used for specifying the window title.
- `position, frame` and `size` are used to control the location of the window.
- `floating` controls whether this window will float on top of all other windows.
- `show` and `hide` is used to control the visibility of the window.
- `showModal` specifies that this window will be shown as a modal window.
- `bringToFront`, `bringBack` and `bringBehind` is used to control the stacking order of this window.
- `target` is used to control the keyboard focus within this window.
- `windowItem` is the central facility for defining the contents of windows. WindowItems can be attached to windows (more details later).
- `canvas` is a subclass of windowItem, implementing a local coordinate system. Just as windows, more than one windowItem may be associated with a canvas. Canvas function as a mean for grouping windowItems within windows (or other canvasses).

WindowItem

`windowItem` is the central class for specifying the contents of windows (and canvasses). The contents of windows are one instance of canvas, simplifying the design.

- the events: `onVisibilityChanged`, `onFrameChanged`, `onFatherFrameChanged`, `onMouseUp`, etc. are the means for specifying actions to be executed as the consequence of user interactions (directly or indirectly).
- `father` is a reference to the canvas (and thereby possibly the window), this `windowItem` is associated with.
- `frame`, `position`, `move` and `size` is used to control the location of the `windowItem` within the `father` canvas.
- `bindLeft`, `bindRight`, `bindBottom` and `bindTop` is used to control the behaviour of this `windowItem` when the `father` canvas has changed frame.
- `show` and `hide` is used to control whether this `windowItem` is visible on its `father` canvas.
- `enable` and `disable` is used to control whether this `windowItem` reacts to mouse and keyboard interactions.
- `theCursor` and `cursorType` is used to control the cursor to be displayed within this `windowItem`.
- `dragOutline` and `dragResize` are facilities to be used for interactive manipulations of this `windowItem`.

Canvas

`canvas` is the only `windowItem` subclass that allows attachment of other `windowItems`. In this respect, canvasses resemble windows (that uses a canvas to contain the windowItems of the window).

Using the guienv Library

The Lidskjalv libraries consists of a number of BETA fragments, where the fragment `guienv` describes the basic patterns of the library.

Other libraries

The fragments `control`, `fields`, `scrolllist`, `figureitems` etc. contain additional facilities to those defined in `guienv`. This chapter and the next chapters gives a thorough description of each of these fragments. Along with the descriptions, examples are given to illustrate the intended use.

Guienv pattern

The `guienv` fragment consists of a single pattern `guienv` where the attributes of a graphical application are described. Patterns like `window` and `menu` are described inside `guienv`.

By specializing `guienv`, the user can develop a Lidskjalv application using the predefined patterns and objects in `guienv`.

Lidskjalv application

A Lidskjalv application is invoked by executing an instance of the `guienv` specialization. Any Lidskjalv application must therefore have the following outline:

```
ORIGIN '~beta/guienv/v1.4/guienv'
--- program: descriptor ---
guienv
  (# ...
  do ...
  #)
```

Separate fragments

In order to reduce the complexity of simple applications, more advanced facilities of Lidskjalv are located in separate fragments. To utilize these facilities, the above outline of a typical Lidskjalv application must be augmented by specifying the additional facilities used. This is done by including the fragment containing the facility. The facilities are located in separate fragments, such as `control`, `fields`, `scrolllist` and `figureitems`. These fragments can be included as follows:

```
     ORIGIN '~beta/guienv/v1.4/guienv';
     INCLUDE '~beta/guienv/v1.4/control'
     --- program: descriptor ---
     guienv
       (# ...
       do ...
       #)
```

where, in this case `control`, is the name of the desired fragment. If more than one additional facility is needed, the `INCLUDE` line is simply repeated with the names of the other fragments.

The basic pattern in `guienv` is `interfaceObject`, which is the common superpattern for all patterns describing interaction with the user.

When `guienv` executes `inner`, a global event handler is started. This event handler loops until the attribute `terminate` is executed. When an event occurs, the global event handler distributes the event to the `interfaceObject` in question. It could be a menu or the active window.

Examples of Use of the guenv Fragment

Demo programs

The demo programs in this manual can be found in the reference demo subdirectory in the guienv directory. The location of the directory in installation-dependent – ask the systems administrator – the default location is :

`~beta/guienv/v1.4/demo/ReferenceDemos`

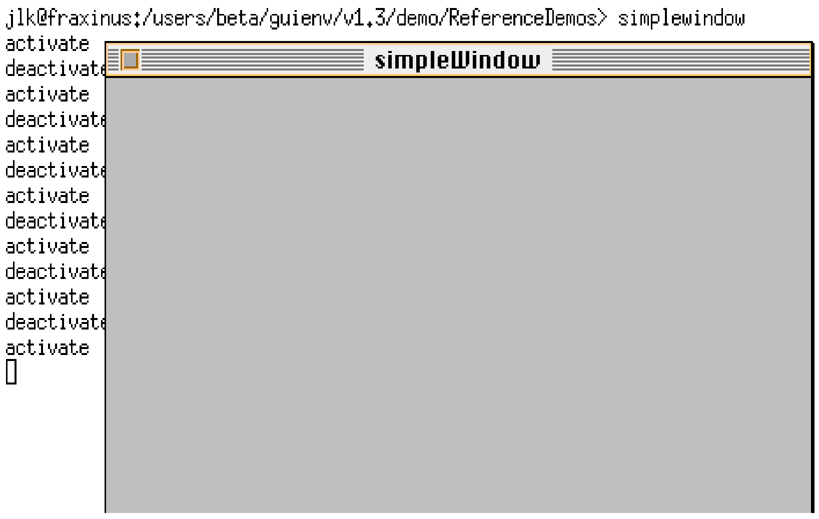
The demo directory contains many more demo programs than is included in this manual. Please inspect the demo directory for other illustrative demo programs. Appendix A contains a short overview of the demos in the demo directory.

Simple window

This demo program is nearly the simplest possible Lidskjalv program. It opens one window and prints activate (resp. deactivate) each time the window is made active (resp. inactive).

simple-window.bet

```
ORIGIN '~beta/guienv/v1.4/guienv';
(* This demo shows how to create a very simple window and it
 * illustrates the activate/deactivate event.
 *)
--- program: descriptor ---
guienv
(# simpleWindow: @window
     (# eventHandler::
          (# onAboutToClose:: (# do terminate #);
             onActivate::
               (# do 'activate' -> putline #);
             onDeactivate::
               (# do 'deactivate' -> putline #)
          #);
        open::
          (# do (400,400) -> size #)
     #)
do simpleWindow.open
#)
```



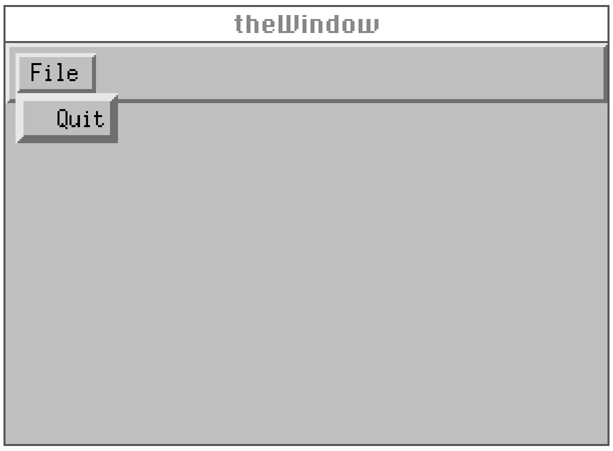
```
jlk@fraxinus:/users/beta/guienv/v1.3/demo/ReferenceDemos> simplewindow
activate
deactivate
activate
deactivate
activate
deactivate
activate
deactivate
activate
deactivate
activate
deactivate
activate
```

Standard menu and events

This demo program illustrates the use of standard menubar where the file menu only has one menuItem. It also illustrates how to further bind noMouseUp, onMouseDown and onKeyDown event patterns.

windowWithStandardMenubar.bet

```
ORIGIN '~beta/guienv/v1.4/guienv';
(* This demo shows how to create a simple window with a
 * standardMenubar where the file menu only has one menuitem. It also
 * illustrates how to further bind the onMouseDown, onMouseUp,
 * onKeyDown event patterns.
 *)
--- program: descriptor ---
guienv
(# theWindow: @window
     (# menubarType:: standardMenubar
          (# fileMenu::
               (# quitItem: @menuitem
                    (# open::
                         (# do 'Quit' -> name #);
                      eventHandler::
                         (# onSelect::
                              (# do terminate #)
                         #)
                    #);
                  open::
                    (#
                    do 'File' -> name;
                       quitItem.open; quitItem[] -> append
                    #)
               #)
          #);
        eventHandler::
          (# onAboutToClose:: (# do terminate #);
             onMouseDown::
               (#
               do 'MouseDown: ' -> puttext;
                  buttonState -> putint;
                  (if doubleClick then
                      ' doubleclick' -> puttext
                  if);
                  newLine
               #);
             onMouseUp::
               (#
               do 'onMouseUp ' -> puttext;
                  buttonState -> putint;
                  (if doubleClick then
                      ' doubleclick' -> puttext
                  if);
                  newLine
               #);
             onKeyDown::
               (#
               do 'onKeyDown: ' -> puttext;
                  ch -> put;
                  newLine
               #)
          #)
     #)
do theWindow.open
#)
```



Interface Descriptions of the guienv Library

```
ORIGIN '~beta/basiclib/v1.5/betaenv';
INCLUDE '~beta/containers/v1.5/list';
INCLUDE 'graphmath';
INCLUDE 'raster';
INCLUDE 'layout';
BODY  'private/guienvbody'
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
-- lib: attributes --
GUIenv:
  (# <<SLOT guienvLib: attributes>>;
     onStartApplication:<
       (* is called when this application is started with no
        * documents. You can for example further bind this to show a
        * splash screen
        *)
       object;
     onIdle:<
       (* is executed whenever this application receives an
        * idle-event
        *)
       object;
     onOpenDocument:<
       (* is called whenever a user opens a document created by this
        * application
        *)
       (# fileName: ^text;
       enter fileName[]
       do INNER
       #);
     onPrintDocument:<
       (* is called whenever a user prints a document created by this
        * application
        *)
       (# openPrinter:< (# do INNER #);
          closePrinter:< (# do INNER #);
          fileName: ^text;
       enter fileName[]
       do openPrinter; INNER; closePrinter
       #);
     terminate:
       (* will terminate the entire application if invoked *)
       (# do ... #);
     applicationMenubar:
       (* applicationMenubar is used to install a menubar with
        * functionality that is common for all parts for the
        * application.
        *)
```

```
    (# theMenubar: ^menubarType
    enter (# enter theMenubar[] do ... #)
    exit (# do ... exit theMenuBar[] #)
    #);
  menubarType:<
    (* if further bound, an instance of menubarType is
     * automatically installed for the application. Further bind it
     * to standardMenubar if you want the standard menubar (file
     * and edit menu)
     *)
    menubar;
  interfaceObject:
    (* superpattern for all objects used for interaction with the
     * user
     *)
    (# <<SLOT interfaceObjectLib: attributes>>;
       theEventhandler:
         (* The only instance of the eventhandler virtual *)
         @eventhandler;
       eventhandler:<
         (* Encapsulates the patterns related to event handling *)
         (# <<SLOT eventhandlerLib: attributes>>;
            event:
              (* the abstract superpattern of all events *)
              (# <<SLOT eventLib: attributes>>;
              do ...;
              #) (* event *);
            basicEvent: event
              (* abstract superpattern for all events
               * originating directly from the OS
               *)
              (# <<SLOT basicEventLib: attributes>>;
                 shiftKey: booleanValue
                   (* true if the shiftkey was the down, when
                    * THIS(basicEvent) occurred
                    *)
                   (#
                   do ...;
                   #);
                 altKey: booleanValue
                   (* true if the altkey was the down, when
                    * THIS(basicEvent) occurred
                    *)
                   (#
                   do ...;
                   #);
                 metaKey: booleanValue
                   (* true if the metakey was the down, when
                    * THIS(basicEvent) occurred
                    *)
                   (#
                   do ...;
                   #);
                 controlKey: booleanValue
                   (* true if the controlkey was the down, when
                    * THIS(basicEvent) occurred
                    *)
                   (#
                   do ...;
                   #);
                 buttonState: integerValue
                   (* the number designating the button, which was
                    * pressed down, when THIS(basicEvent) occurred
                    * - 0 means 'no button'.  This value depe nds
                    * on the number of buttons on the mouse -
                    * Typically 1, 2 or 3.
                    *)
                   (#
                   do ...
                   #);
                 when: integerValue
                   (* the tick count when THIS(basicEvent)
                    * occurred.  1 tick = 1/60 sec.
                    *)
                   (#
                   do ...
                   #);
                 globalPosition:
                   (* global coordinates of the mouse, when
                    * THIS(basicEvent) occurred
                    *)
                   (# p: @point;
                   do ...;
                   exit p
                   #);
                 localPosition:
                   (* local coordinates of the mouse, when
                    * THIS(basicEvent) occurred - relative to
                    * THIS(inteefaceObject)
                    *)
                   (# p: @point;
                   do ...;
                   exit p
                   #);
              do INNER;
              #);
            mouseEvent: basicEvent
              (* abstract superpattern for events related to the
               * mouse
               *)
              (# <<SLOT mouseEventLib: attributes>>;
                 doubleClick: booleanValue
                   (* true if THIS(mouseEvent) is a doubleclick.
                    * For a mouse click to qualify as doubleclick
                    * it must happen close in time and space, and
                    * with the same mouse button
                    *)
                   (#
                   do ...;
                   #);
              do INNER;
              #);
            keyEvent: basicEvent
              (* abstract superpattern for events related to the
               * keyboard.
               *)
              (# <<SLOT keyEventLib: attributes>>;
                 ch:
                   (* the key on the keyboard, related to
                    * THIS(keyEvent)
                    *)
                   (# theChar: @char;
                   do ...;
                   exit theChar
                   #);
             do INNER
              #);
            mouseDown: mouseEvent
              (* This event occurs when the user presses any mouse
               * button down on THIS(interfaceObject)
               *)
              (# <<SLOT mouseDownLib: attributes>>;
                 delay:
                   (* used to wait for period ticks to pass, while
                    * mouse.isStillDown is true, and then execute
                    * INNER.  If mouseStillDown becomes false
                    * before period ticks, INNER is not executed
                    *)
                   (# period: @integer
                   enter period
                   do ...
                   #)
              do INNER
              #);
            onMouseDown:< mouseDown;
            mouseUp: mouseEvent
              (* This event occurs when the user releases any
               * mouse button after having pressed it on
               * THIS(interfaceObject)
               *)
              (# do INNER #);
            onMouseUp:< mouseUp;
            keyDown: keyEvent
              (* Occurs when the user presses a key, related to
               * THIS(interfaceObject)
               *)
              (# do INNER #);
            onKeyDown:< keyDown;
            idle: basicEvent
              (* Idle is sent when nothing else happens, not all
               * interfaceobjects receive idle in all situations
               *)
              (# do INNER #);
            onIdle:< idle;
            refresh: basicEvent
              (* This event tells THIS(interfaceobject), that it
               * needs to redraw itself. UpdateRect is the
               * rectangle that needs to be updated expressed
               * in the coordinate system of this(interfaceObject).
               *)
              (# updateRect:
                   (# value: ^rectangle;
                   ...
                   exit value[]
                   #)
              do INNER
              #);
            onRefresh:< refresh;
            activate: basicEvent
              (* Send when THIS(interfaceObject) becomes active *)
```

```
          (# do INNER #);
        onActivate:< activate;
        deactivate: basicEvent
          (* Send when THIS(interfaceObject) becomes inactive
           *)
          (# do INNER #);
        onDeactivate:< deactivate;
     #);
   action:
     (* Actions is a means of subscribing to events.  The
      * desired event is specified by further binding
      * eventType.  Actions can be prepended or appended to
      * THIS(interfaceobject).  When some event is called, the
      * prepended actions for the event is called *before* the
      * INNER and the appended actions are called after.
      *)
     (# <<SLOT actionLib: attributes>>;
        eventType:< theEventhandler.event;
        theEvent: ^eventType;
     enter theEvent[]
     do INNER;
     #);
   prependAction:
     (* Prepends the action, so it will be executed before the
      * event is subscribes to
      *)
     (# theAction: ^action;
     enter theAction[]
     do ...;
     #);
   appendAction:
     (* Appends the action, so it will be executed after the
      * event is subscribes to.
      *)
     (# theAction: ^action;
     enter theAction[]
     do ...;
     #);
   deleteAction:
     (* Remove the action *)
     (# theAction: ^action;
     enter theAction[]
     do ...;
     #);
   open:<
     (* must be called before any other operation on
      * THIS(interfaceObject).
      *)
     (# create:< (# do ... #);
     do ...
     #);
   close:<
     (* closes THIS(interfaceObject) and dispose all related
      *              structures
      *)
     (# do ... #);
   enableEventType:<
     (* makes THIS(interfaceObject) sensible to the specified
      * type of events
      *)
```

```
            (# ev: ##theEventhandler.event
            enter ev##
            do ...
            #);
          disableEventType:<
            (* makes THIS(interfaceObject) insensible to the
             * specified type of events
             *)
            (# ev: ##theEventhandler.event
            enter ev##
            do ...
            #);
          layoutType:< interfaceObjectLayout;
          layout:
            (* used to gain access to the layout properties of
             * THIS(interfaceObject) such that it can be e.g. saved in
             * a persistent store.  If the attributes are given as
             * enter parameter to layout, these properties will become
             * the properties of THIS(interfaceObject)
             *)
            (#
            enter putLayout
            exit getLayout
            #);
          putLayout:<
            (# attributes: ^layoutType
            enter attributes[]
            do ...
            #);
          getLayout:<
            (# attributes: ^layoutType;
            do ...
            exit attributes[]
            #);
          interfaceObjectException: exception
            (* abstract superpattern for exceptiosn related to
             * THIS(interfaceObject).
             *)
            (#
            do ...
            #);
          notOpenedException: interfaceObjectException
            (# location: ^text
            enter location[]
            do ...;
            #);
          notOpenedError:<
            (* this exception is raised if any operation is performed
             * on THIS(interfaceObject) is called before open is
             * called.  This will also happen if "close" is called
             * twice
             *)
            notOpenedException;
          private: @...;
       do INNER
       #) (* interfaceObject *);
     menubar: interfaceObject
       (* menubar is a bar containing the titles of the contained
        * menus. A menu is pulled down by clicking at the title,
        * allowing the user to select a menuitem in the menu.  A
```

```
 * menubar is only visible if it is installed - either as the
 * global menubar or as the menubar in some window.
 *)
(# <<SLOT menubarLib: attributes>>;
   append:
     (* inserts a menu after all menues in the menubar.  If
      * the menu is already in the menu bar, nothing happens
      *)
     (# theMenu: ^menu;
     enter theMenu[]
     do ...
     #);
   delete:
     (* deletes a menu from the menu bar. The menu titles
      * following the deleted menu will move over to fill the
      * vacancy
      *)
     (# theMenu: ^menu
     enter theMenu[]
     do ...
     #);
   clear:
     (* removes all menues from the menu bar when you want to
      * start with new menues
      *)
     ...;
   appendMenubar:
     (* inserts all menues in another menubar after all menues
      * in THIS(menubar).  This is the same as calling
      * insertMenubar with NONE as afterMenu.
      *)
     (# theMenubar: ^menubartype;
     enter theMenubar[]
     do ...
     #);
   replaceMenubar:
     (* replace all menues in theMenubar with all menues in
      * replacementMenubar in THIS(menubar).
      *)
     (# theMenubar, replacementMenubar: ^menubartype
     enter (theMenubar[], replacementMenubar[])
     do ...
     #);
   deleteMenubar:
     (* deletes all menues in theMenubar from
      * THIS(menubar). The menu titles following the menues in
      * the deleted menubar will move over to fill the vacancy
      *)
     (# theMenubar: ^menubartype
     enter theMenubar[]
     do ...
     #);
   scan:
     (* iterates over all menues currently inserted in the
      * menubar
      *)
     (# current: ^menu;
     do ...; #);
   open::<(# create::< (# do ... #);
     do ...;
```

```
          #);
        close::<
          (#
          do ...;
          #);
        putLayout::< (* private *) (# ... #);
        getLayout::< (* private *) (# ... #);
        private: @...;
   #) (* menubar *);
 menu: interfaceObject
   (* menu contains a group of menuitems and is usefull for
    * letting the user perform commands or set settings in the
    * application. A menu can be installed in a menubar, as a
    * submenu to some menuitem or simply be popped up on the
    * screen.
    *)
   (# <<SLOT menuLib: attributes>>;
      name:
        (* the name of the menu as shown in the menubar.  if the
         * menu is not in a menubar, the name is not visible
         *)
        (# theName: ^text
        enter (# enter theName[] do ... #)
        exit (# do ... exit theName[] #)
        #);
      eventhandler::<
        (# select: event
             (* executed when the user selects THIS(menu) (or
              * pops it up) just before the menu is shown.
              *)
             (# do INNER #);
           onSelect:< select;
        #);
      menuitem: interfaceObject
        (* menuitem is used for letting the user perform commands
         * in the application or display the state of some option,
         * by checking and unchecking the menuitem. It can also
         * serve as the title of a submenu.
         *)
        (# <<SLOT menuitemLib: attributes>>;
           key:
             (* the key shortcut of THIS(menuitem), allows the
              * user to select THIS(menuitem) without using the
              * mouse.
              *)
             (# c: @char
             enter (# enter c do ... #)
             exit (# do ... exit c #)
             #);
           name:
             (* models the name of THIS(menuitem).  Evaluate the
              * enter-part to set the name.  Evaluate the
              * exit-part to get the name
              *)
             (# t: ^text;
             enter (# enter t[] do ... #)
             exit (# do ... exit t[] #)
             #);
           checked:
             (* when THIS(menuitem) is checked, a check mark is
              * displayed at the left side the menuitem
              *)
             (# checked: @boolean
             enter (# enter checked do ... #)
             exit (# do ... exit checked #)
             #);
           subMenu:
             (* if a submenu is attached to THIS(menuitem), that
              * menu is pulled down by selecting
              * THIS(menuitem). In that case onSelect is never
              * issued for THIS(menuitem)
              *)
             (# theMenu: ^menu;
             enter (# enter theMenu[] do ... #)
             exit (# do ... exit theMenu[] #)
             #);
           position: IntegerValue
             (* the position of THIS(menuitem) in its menu,
              * separator items are counted as well
              *)
             (#
             do ...
             #);
           eventhandler::<
             (# onStatus:< booleanValue
                  (* executed just before THIS(menuitem) is
                   * shown.  should return true if THIS(menuitem)
                   * is enabled.  Default is true
                   *)
                  (# do ... #);
                select: event
                  (* executed when THIS(menuitem) is selected in
                   * the menu.  If a submenu is attached, it will
                   * not be executed - instead the submenu is
                   * pulled down
                   *)
                  (# do INNER #);
                onSelect:< select;
             #);
           open::<(# create::< (# do ... #);
             do ...;
             #);
           layoutType::< menuitemLayout;
           putLayout::< (* private *) (# ... #);
           getLayout::< (* private *) (# ... #);
           private: @...;
        do INNER
        #) (* menuitem *);
      dynamicMenuitem: menuitem
        (* dynamic menuitem does not call its own onStatus and
         * onSelect events, instead these events are called on the
         * attached action, if any is attached
         *)
        (# <<SLOT dynamicItemLib: attributes>>;
           theAction: ^menuAction;
           attach:
             (* anAction is attached to THIS(menuitem) *)
             (# anAction: ^menuAction;
             enter anAction[]
             do ...
```

```
       #);
     detach:
       (* the menuitemHandler that is currently attached to
        * THIS(menuitem) is detached, meaning that no action
        * is attached
        *)
       ...;
     eventhandler::<(# onStatus::< (# do ... #);
          onSelect::< (# do ... #);
       #);
  #) (* dynamicMenuitem *);
menuAction:
  (* a menuAction can dynamicly be attached to
   * dynamicMenuitems within THIS(menu), meaning that the
   * onStatus and onSelect events of THIS(menuAction) will
   * be executed instead of these events of the
   * dynamicMenuitem. The pointer "theMenuitem" refers to
   * the dynamicMenuitem THIS(menuAction) is currently
   * attached to
   *)
  (# theMenuitem:
       (* the menuitem THIS(menuAction) is attached to *)
       ^dynamicMenuitem;
     onStatus:< booleanValue
       (* this status is evaluated instead of the status of
        * the actual menuitem (theMenuitem) THIS(menuAction)
        * is attached to.  Default returns true
        *)
       (# do ... #);
     onSelect:<
       (* onSelect is executed from the hit of the actual
        * dynamicMenuitem THIS(action) is attached to
        *)
       object;
  #) (* action *);
separator: menuitem
  (* defines a menu separator, which is a unselectable line
   * in the menu, dividing groups of menuitems.
   *)
  (# open::<(# create::< (# do ... #);
       do ...;
       #);
     close::< (# do ...; #);
  #);
append:
  (* appends the menuitem to THIS(menu) *)
  (# theMenuitem: ^menuitem
  enter theMenuitem[]
  do ...
  #);
delete:
  (* deletes the menuitem from THIS(menu) *)
  (# theMenuitem: ^menuitem
  enter theMenuitem[]
  do ...
  #);
scan:
  (* iterates over all menuitems in THIS(menu) *)
  (# current: ^menuitem
  do ...;
```

```
       #);
     clear:
       (* deletes all menuitems in  THIS(menu) *)
       (#
       do ...
       #);
     noOfMenuitems: integerValue
       (* returns the number of menuitems in THIS(menu) *)
       (# do ... #);
     popUp:
       (* THIS(menu) is popped up as follows: The menuitem
        * indexed by "popupWith" is selected (not checked but
        * hilited) and popupAt is the top left corner of that
        * menuitem in the coordinate system of the popupIn
        * window.
        *)
       (# popupWith: @integer;
          popupAt: @point;
          popupIn: ^window.windowitem;
       enter (popupWith,popupAt,popupIn[])
       do ...
       #);
     getMenuitemByNumber:
       (* returns a reference to the menuitem at the specified
        * position in the menu
        *)
       (# number: @integer;
          theMenuitem: ^menuitem;
       enter number
       do ...
       exit theMenuitem[]
       #);
     enable: (* enable THIS(menu) *)
       ...;
     disable: (* disable THIS(menu) *)
       ...;
     enabled:< booleanValue
       (* should return true if THIS(menu) is enabled *)
       (# do ... #);
     open::<
       (* the menu is not automatically inserted in the
        * menubar. You have to do this yourself
        *)
       (# create::< (# do ... #);
       do ...
       #);
     close::< (# do ... #);
     layoutType::< menuLayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* menu *);
standardMenubar: menubar
  (# standardFileMenu: menu
       (# newMenuitem: @dynamicMenuitem;
          openMenuitem: @dynamicMenuitem;
          closeMenuitem: @dynamicMenuitem;
          saveMenuitem: @dynamicMenuitem;
          saveAsMenuitem: @dynamicMenuitem;
          revertMenuitem: @dynamicMenuitem;
```

```
               printMenuitem: @dynamicMenuitem;
               pageSetUpMenuitem: @dynamicMenuitem;
               quitMenuitem: @dynamicMenuitem;
               open::< (# do ... #);
            #) (* standardFileMenu *);
          fileMenu:< menu;
          theFileMenu: ^fileMenu;
          standardEditMenu: menu
            (# undoMenuitem: @dynamicMenuitem;
               cutMenuitem: @dynamicMenuitem;
               copyMenuitem: @dynamicMenuitem;
               pasteMenuitem: @dynamicMenuitem;
               clearMenuitem: @dynamicMenuitem;
               open::< (# do ... #);
            #) (* standardEditMenu *);
          editMenu:< menu;
          theEditMenu: ^editMenu;
          open::<
            (#
            do ...;
            #);
     #);
   window: interfaceObject
     (* user interaction with the window such as dragging and
      * resizing is taken care of by the window manager.  Anything
      * visible you may want to place in the window is subpatterns
      * of the abstract pattern windowitem, which is a subpattern of
      * interfaceObject. The window can be used as a modal dialog by
      * means of the pattern "showModal"
      *)
     (# <<SLOT windowLib: attributes>>;
        eventhandler::<
          (# aboutToClose: event
                (* is called whenever the user has performed an
                 * action that causes THIS(window) to close.  Further
                 * bind this to perform actions before the window is
                 * actually closed.  You can prevent the window from
                 * closing by assigning false to the boolean
                 * 'okToClose'
                 *)
                (# okToClose: @boolean
                do true -> okToClose;
                   INNER
                exit okToClose
                #);
              onAboutToClose:<  aboutToClose;
              onActivate::<
                (* is send to contents, which takes care of sending
                 * the event to all children
                 *)
                (# do ... #);
              onDeactivate::<
                (* is send to contents, which takes care of sending
                 * the event to all children
                 *)
                (# do ... #);
          #);
        theMenubar:
          (* is used to install a menubar for THIS(window), and to
           * gain access to the menubar of THIS(window)
           *)
          (# theBar: ^menubartype
          enter (# enter theBar[] do ... #)
          exit (# do ... exit theBar[] #)
          #);
        menubarType:<
          (* if further bound, an instance of menubarType is
           * automatically installed for THIS(window)
           *)
          menubar;
        menubarVisible:<
          (* Specifies if the menubar should be visible. *)
          trueObject;
        floating:
          (* if floating is set to true the window will remain on
           * top of all non-float windows
           *)
          (# isFloating: @boolean;
          enter (# enter isFloating do ... #)
          exit (# do ... exit isFloating #)
          #);
        title:
          (* the title of the window is displayed in the windows
           * title-bar if the window has one.
           *)
          (# theTitle: ^text
          enter (# enter theTitle[] do ... #)
          exit (# do ... exit theTitle[] #)
          #);
        position:
          (* the window's position is the coordinates of the
           * topLeft corner of the window's inside rectangle on the
           * screen
           *)
          (# pt: @point;
          enter (# enter pt do ... #)
          exit (# do ... exit pt #)
          #);
        size:
          (* the size is the size of the inside rectangle of the
           * window
           *)
          (# width, height: @integer;
          enter (# enter (width, height) do ... #)
          exit (# do ... exit (width, height) #)
          #);
        frame:
          (* the frame is defined as the rectangle THIS(window)
           * occupies on the screen = (position,position + size)
           *)
          (# theFrame: @rectangle;
          enter (# enter theFrame do ... #)
          exit (# do ... exit theFrame #)
          #);
        insideRectangle:
          (* the inside rectangle is the window's content rectangle
           * in terms of local coordinates in the window.  The top
           * left corner is (0, 0) and the bottom right corner is
           * the window's size
           *)
          (# theRectangle: @rectangle;
          do ...
          exit theRectangle
          #);
        show:
          (* shows THIS(window) in front of other windows *)
          (# do ... #);
        showModal:
          (* shows THIS(window) in a modal way. Interaction with
           * other windows is prevented until THIS(window) is either
           * closed or hidden, and then showModal returns to the
           * caller
           *)
          ...;
        hide:
          (* hides THIS(window), i.e. make it invisible without
           * destroying it. Can be made visible again using show
           *)
          (# do ... #);
        maxSize:
          (* use this to set the maximum size THIS(window) is
           * allowed to get, when resized by the user. maxSize
           * doesn't affect the behaviour of setSize.
           *)
          (# width, height: @integer;
          enter (# enter (width, height) do ... #)
          exit (# do ... exit (width, height) #)
          #);
        minSize:
          (* use this to set the minimum size THIS(window) is
           * allowed to get, when resized by the user. minSize
           * doesn't affect the behaviour of setSize
           *)
          (#  width, height: @integer;
          enter (# enter (width, height) do ... #)
          exit (# do ... exit (width, height) #)
          #);
        bringToFront:
          (* THIS(window) is brought to the front of all other
           * windows
           *)
          ...;
        bringBack:
          (* THIS(window) is placed behind all other windows *)
          ...;
        bringBehind:
          (* THIS(window) is placed behind the window referred to
           * by "theWindow"
           *)
          (# theWindow: ^window;
          enter theWindow[]
          do ...;
          #);
        update:
          (* Updates the window by posting a refresh event.  If
           * emmediate is true, the refresh event will be processed
           * immediately.
           *)
          (# immediate: @boolean;
          enter immediate
          do ...;
          #);
        contents:
          (* The contents of THIS(window) is the father of all
           * other windowitems in THIS(window).
           *)
          (# theContents: ^canvas;
          ...
          exit theContents[]
          #);
        target:
          (* the window's target is a reference to the windowitem
           * that receives keyDown. You are responsible for making
           * sure the window's target is the windowitem that is
           * affected by menu commands. The eventhandler of
           * windowitem has two events: "enableTarget" and
           * "disableTarget". When a windowitem is becomming the new
           * target, first "disableTarget" is called for the old
           * target then "enableTarget" is called for the new target
           *)
          (# theTarget: ^windowitem;
          enter (# enter theTarget[] do ... #)
          exit (# do ... exit theTarget[] #)
          #);
        windowitem: interfaceObject
          (* superclass for all interfaceobjects in this window.  A
           * windowitem is always part of a canvas (father)
           *)
          (# <<SLOT windowitemLib: attributes>>;
             eventhandler::<
               (# visibleChanged: event
                    (* is called, when THIS(windowitem) is hidden
                     * or shown
                     *)
                    (# do INNER #);
                  onVisibleChanged:< visibleChanged;
                  frameChanged: event
                    (* is called whenever the frame of
                     * THIS(windowitem) is changed
                     *)
                    (# oldFrame, newFrame: @rectangle;
                    enter (oldFrame, newFrame)
                    do INNER
                    #);
                  onFrameChanged:< frameChanged;
                  fatherFrameChanged: event
                    (* is called when the frame of the father of
                     * THIS(windowitem) is changed
                     *)
                    (# oldFrame, newFrame: @rectangle;
                    enter (oldFrame, newFrame)
                    do INNER
                    #);
                  onFatherFrameChanged:< fatherFrameChanged;
                  enabledChanged: event
                    (* is called, when THIS(windowitem) is
                     * enabled/disabled
                     *)
                    (# do INNER #);
                  onEnabledChanged:< enabledChanged;
                  enableTarget: event
                    (* is called when THIS(windowitem) is becomming
                     * target in the window
                     *)
                    (# do INNER #);
                  onEnableTarget:< enableTarget;
                  disableTarget: event
                    (* is called when THIS(windowitem) was target
                     * and another windowitem is becomming target
                     *)
                    (# do INNER #);
                  onDisableTarget:< disableTarget;
                  borderVisibleChanged: event
                    (* is called, when the border of
                     * THIS(windowitem) is shown or hidden
                     *)
                    (# do INNER #);
                  onBorderVisibleChanged:< borderVisibleChanged;
                  borderStyleChanged: event
                    (* is called, when the border style of
                     * THIS(windowitem) is changed
                     *)
                    (# do INNER #);
                  onBorderStyleChanged:< borderStyleChanged;
                  theCursorChanged: event
                    (* is called, when THIS(windowitem) is assigned
                     * a new cursor
                     *)
                    (# do INNER #);
                  onTheCursorChanged:< theCursorChanged;
                  hiliteChanged: event
                    (* Is called when THIS(windowitem) is hilited
                     * or dehilited
                     *)
                    (# do INNER; #);
                  onHiliteChanged:< hiliteChanged;
                  onRefresh::< (# do ... #);
               #);
             father: ^
               (* father is the canvas that THIS(windowitem) is a
                * child of
                *)
               canvas;
             frame:
               (* the frame is defined as the rectangle
                * THIS(windowitem) occupies in the coordinate system
                * of the father. When the frame is changed
                * THIS(windowitem) is updated and the father is
                * informed about the change.  If you need other
                * actions to take place, when changing the frame,
                * you must further bind the event onFrameChanged
                *)
               (# theFrame: @rectangle;
               enter (# enter theFrame do ... #)
               exit (# do ... exit theFrame #)
               #);
             position:
               (* the position of THIS(windowitem) is defined as
                * the topLeft corner of the bounding frame. When the
                * position is changed, the frame is changed, so the
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    * onFrameChanged event is called
    *)
   (# pt: @point;
   enter (# enter pt do ... #)
   exit (# do ... exit pt #)
   #);
move:
   (* moves THIS(windowitem) relative (dh, dv), by
    * setting the position, meaning that the
    * onFrameChanged event is called
    *)
   (# dh, dv: @integer;
   enter (dh, dv)
   do ...;
   #);
size:
   (* the size of THIS(windowitem) is defined as the
    * height and width of the bounding frame. When the
    * size is changed, the frame is changed, so the
    * onFrameChanged event is called
    *)
   (# width, height: @integer;
   enter (# enter (width, height) do ... #)
   exit (# do ... exit (width, height) #)
   #);
bindLeft, bindRight, bindBottom, bindTop: @
   (* these attributes specify how THIS(windowitem)
    * shall behave when the father changes it's
    * frame. If e.g. "bindLeft" is true, the leftSide
    * will have the same constant distance to the
    * leftSide of the father, when the father is resized
    *)
   boolean;
visible:
   (* an invisible windowitem will be ingored w.r.t.
    * user interaction (it is not visible on the screen)
    *)
   (# value: @boolean;
   enter (# enter value do ... #)
   exit (# do ... exit value #)
   #);
hilite:
   (# value: @boolean;
   enter (# enter value do ... #)
   exit (# do ... exit value #)
   #);
show:
   (* makes THIS(windowitem) visible *)
   ...;
hide:
   (* makes THIS(windowitem) invisible *)
   ... ;
enabled:
   (* if THIS(windowitem) is enabled it receives mouse
    * events or key events
    *)
   (# value: @boolean
   enter (# enter value do ... #)
   exit (# do ... exit value #)
   #);
```

```
enable:
  (* enables THIS(windowitem) so it can receive mouse
   * or key events
   *)
  (# do ... #);
disable:
  (* disables THIS(windowitem) so it does not receive
   * any mouse or key events
   *)
  (# do ... #);
border: @
  (* the border around THIS(windowitem) makes it
   * apparent, where it is located on the screen.
   *)
  (# visible:
       (* if the border is visible, the insideRect of
        * THIS(windowitem) is inset depending on the
        * style of the border.
        *)
       (# value: @boolean;
       enter (# enter value ... #)
       exit (# ... exit value #)
       #);
     style:
       (* the border style can be one of the
        * following:
        *   borderStyles.simple:
        *      A simple one pixel wide border.
        *   borderStyles.shadowIn:
        *      Draws the border so THIS(windowitem)
        *      appears inset.
        *   borderStyles.shadowOut:
        *      Draws the border so THIS(windowitem)
        *      appears outset.
        *   borderStyles.etchedIn:
        *      Draws the border using a double line
        *      giving the effect of a line etched
        *      into the window.
        *   borderStyles.etchedOut:
        *      Draws the border using a double line
        *      giving the effect of a line comming
        *      out of the window.
        *)
       (# value: @integer;
       enter (# enter value ... #)
       exit (# ... exit value #)
       #);
  #);
insideRectangle:
  (* insideRectangle is the area inside the border of
   * THIS(windowitem).
   *)
  (# theRectangle: @rectangle;
  ...
  exit theRectangle
  #);
theCursor:
  (* theCursor is used to install a cursor for
   * THIS(windowitem), and to gain access to the cursor
   * of THIS(windowitem)
```

```
     *)
    (# theCur: ^cursor;
    enter (# enter theCur[] do ... #)
    exit (# do ... exit theCur[] #)
    #);
  cursorType:<
    (* if further bound, an instance of cursorType is
     * automatically installed for THIS(windowitem)
     *)
    cursor;
  trackMouse:
    (* this is a control pattern usually evaluated from
     * a mouseDown eventhandler. Initially 'mousePress'
     * is evaluated, then 'mouseMove' is evaluated
     * whenever the mouse moves as long as the mouse is
     * stillDown - (h, v) will be the horizontal and
     * vertical distance the mouse has moved since the
     * last call to 'mouseMove'.  When the user releases
     * the mouse, 'mouseRelease' is evaluated.  If the
     * mouse isn't stillDown (see stillDown) when track
     * is called nothing will happen.  All the
     * coordinates are local to THIS(WindowItem).
     *)
    (# mousePress:< object;
       mouseMove:<
         (# h, v: @integer;
         enter (h, v)
         do INNER
         #);
       mouseRelease:< object;
       curPt, prevPt: @point;
    do ...
    #);
  drag:
    (* lets the user drag a gray outline of this
     * windowitem
     *)
    ...;
  resize:
    (* lets the user resize this windowitem by dragging
     * a gray outline
     *)
    ...;
  update:
    (* THIS(windowitem) is updated, by posting an
     * refresh event to the window. If "immediate" is
     * true the update is performed immediately,
     * otherwise the update is performed, when there is
     * no other event waiting (this is normally what you
     * want)
     *)
    (# immediate: @boolean;
    enter immediate
    do ...
    #);
  open::<
    (* initially a windowitem is visible and active *)
    (# create::< (# do ... #);
    enter father[]
    do ...;
```

```
          #);
        close::<
          (* no actions are performed at this level *)
          (# do ... #);
        print:<(# openPage:< (# do INNER #);
          do INNER
          #);
        layoutType::< windowitemLayout;
        putLayout::< (* private *) (# ... #);
        getLayout::< (* private *) (# ... #);
        private: @...;
   #); (* windowitem *)
 separator: windowitem
   (* a separator is a horzontal or vertical separating line
    *)
   (# <<SLOT separatorLib: attributes>>;
        eventhandler::<
          (# styleChanged: event
               (* Called when the style is changed *)
               (# do INNER #);
             onStyleChanged:< styleChanged;
             onRefresh::< (# ... #);
          #);
        vertical:<
          (* Further bind to specify the orientation of
           * THIS(separator) default is horizontal
           *)
          booleanObject;
        style:
          (* the  style can be one of the following:
           *   lineStyles.singleLine:
           *     A single line is drawn.
           *   lineStyles.doubleLine:
           *     A double line is drawn.
           *   lineStyles.dashedSingleLine:
           *     A dashed single line is drawn.
           *   lineStyles.dashedDoubleLine:
           *     A dashed double line is drawn.
           *   lineStyles.etchedIn:
           *     A double line is drawn giving the effect of
           *     a line etched into the window.
           *   lineStyles.etchedOut:
           *     A double line is drawn giving the effect of
           *     a line comming of of the window.
           *)
          (# value: @integer;
          enter (# enter value ... #)
          exit (# ... exit value #)
          #);
        open::<(# create::< (# ... #);
          ...
          #);
        close::<(# ... #);
        layoutType::< separatorLayout;
        putLayout::< (* private *) (# ... #);
        getLayout::< (* private *) (# ... #);
        private: @...;
   #);
 canvas: windowitem
   (* A canvas is a sub-window in the window.  Only the
      * windowitems located inside the frame of THIS(canvas)
      * will be visible
      *)
   (# <<SLOT canvasLib: attributes>>;
        eventhandler::<
          (# childFrameChanged: event
               (* is called when a child of THIS(canvas) has
                * changed frame
                *)
               (# oldFrame, newFrame: @rectangle;
               enter (oldFrame, newFrame)
               do INNER
               #);
             onChildFrameChanged:< childFrameChanged;
             onActivate::< (# do ...; #);
             onDeactivate::< (# do ...; #);
             onMouseDown::< (# do ... #);
             onRefresh::< (# do ... #);
             onMouseUp::< (# do ... #);
             onFrameChanged::< (# do ... #);
          #);
        selection: @
          (# add:
               (# theWindowitem: ^windowitem;
               enter theWindowitem[]
               do ...;
               #);
             set:
               (# theWindowitem: ^windowitem;
               enter theWindowitem[]
               do ...;
               #);
             remove:
               (# theWindowitem: ^windowitem;
               enter theWindowitem[]
               do ...;
               #);
             empty: booleanValue
               (#
               do ...;
               #);
             scan:
               (# current: ^windowitem;
               do ...;
               #);
             clear:
               (#
               do ...;
               #);
          #);
        scan:
          (* Scan operation on the children of THIS(canvas) *)
          (# current: ^windowitem;
          do ...;
          #);
        open::<
          (* The canvas is opened and displayed. *)
          (# create::< (# do ... #);
          do ...
          #);
```

```
                close::<
                  (* close is called for all the children of
                   * THIS(canvas)
                   *)
                  (# do ... #);
                print::<(# openPage::< (# do ... #);
                  do INNER;
                  #);
                layoutType::< canvasLayout;
                putLayout::< (* private *) (# ... #);
                getLayout::< (* private *) (# ... #);
                private: @...;
             #) (* canvas *);
           localToGlobal:
             (* Translate the point from global coordinates to window
              * coordinates.
              *)
             (# local, global: @point;
             enter local
             ...
             exit global
             #);
           globalToLocal:
             (* Translates the point to window coordinates to global
              * local coordinates
              *)
             (# global, local: @point;
             enter global
             ...
             exit local
             #);
           open::< (# create::< (# do ... #);
             do ...
             #);
           close::<
             (* the windows close operation is normally automatically
              * called from the content's aboutToGoAway event.  You can
              * also call it directly. theContents.close is called to
              * close all of the windows internal structures
              *)
             (# do ... #);
           layoutType::< windowLayout;
           putLayout::< (* private *) (# ... #);
           getLayout::< (* private *) (# ... #);
           <<SLOT BifrostAttributes: attributes>>;
           private: @...;
        #) (* window *);
     sharedWindow: window
        (* preliminary design of a shared window pattern, based on the
         * Norwegian proposal
         *)
        (# addDisplay:
             (# connection: ^guienv
             enter connection[]
             do ...
             #);
           removeDisplay:
             (# connection: ^guienv
             enter connection[]
             do ...
```

```
          #);
        teleCursor: cursor
          (# #);
        theTeleCursor: ^teleCursor;
      #);
    cursor:
      (* A cursor is the raster attached to the mouse pointer *)
      (# <<SLOT cursorLib: attributes>>;
        private: @... #);
    textStyle:
      (* textStyle is font, size and face. You can use this pattern
       * to communicate stylic changes to layout-text and
       * document-text - or to get information about the dimension of
       * text drawn in a specific textStyle
       *)
      (# <<SLOT textStyleLib: attributes>>;
        name:
          (* models the name of the font of THIS(textStyle). *)
          (# theName: ^text;
          enter (# enter theName[] do ... #)
          exit (#  do ... exit theName[] #)
          #);
        size:
          (# value: @integer;
          enter (# enter value do ... #)
          exit (# do ... exit value #)
          #);
        face:
          (# value: @integer;
          enter (# enter value do ... #)
          exit (# do ... exit value #)
          #);
        ascent: integerValue
          (* ascent is the maximum amount of pixels a character
           * drawn in THIS(textStyle) will go above the base line
           *)
          (# do ... #);
        descent: integerValue
          (* descent is the maximum amount of pixels a character
           * drawn in THIS(textStyle) will go below the base line
           *)
          (# do ... #);
        leading: integerValue
          (* leading is the vertical distance between the descent
           * of one line and the ascent of the next line
           *)
          (# do ... #);
        lineHeight: integerValue
          (* the line height (in pixels) is determined by adding
           * the ascent, descent, and leading
           *)
          (# do ... #);
        maxChWidth: integerValue
          (* the greatest distance the pen will move when a
           * character is drawn
           *)
          (# do ... #);
        widthOfChar: integerValue
          (* in most fonts the width of the characters
           * differs. This method returns the width of the character
           * "ch" when drawn in THIS(textStyle)
           *)
          (# ch: @char
          enter ch
          do ...
          #);
        widthOfText: integerValue
          (* widthOfText returns the width of the given text
           * string, when drawn in THIS(textStyle), which it
           * calculates by adding the charWidths of all the
           * characters in the string
           *)
          (# str: ^text
          enter str[]
          do ...
          #);
        availableSizes:
          (* an INNER is executed for all available sizes in the
           * font of THIS(textStyle)
           *)
          (# thisSize: @integer;
          do ...
          #);
        private: @...;
     #) (* textStyle *);
   color:
     (* A Color has three components: red, green and blue. *)
     (# red,green,blue: @integer;
     enter (red,green,blue)
     exit (red,green,blue)
     #);
   clipboard: @
     (* models the clipboard, which is used to transport pictures
      * and text between applications
      *)
     (# <<SLOT clipBoardLib: attributes>>;
        hasText: booleanValue
          (* returns true if the contents of the clipBoard is text
           *)
          (# do ... #);
        textContents:
          (* evaluate the enter-part to set the clipboards
           * text-contents, and evaluate the exit-part to get the
           * clipboards text-contents.  If the clipboard doesn't
           * contain text, NONE is returned.  You can call hasText,
           * before calling getTextContents to determine if there is
           * text to get
           *)
          (# txt: ^text;
          enter (# enter txt[] do ... #)
          exit (# do ... exit txt[] #)
          #);
        clearContents:
          (* call this to empty all contents of the clipboard *)
          (# do ...; #);
     #) (* clipboard *);
   mouse: @
     (* models the mouse *)
     (# <<SLOT mouseLib: attributes>>;
        globalPosition:
          (* the global position of the mouse is returned. You
           * can't set the position
           *)
          (# pt: @point;
          do ...
          exit pt
          #);
        buttonState: integerValue
          (* the number designating the button, currently pressed
           * down - 0 means 'no button'.  This value depends on the
           * number of buttons on the mouse - Typically 1, 2 or 3.
           *)
          (#
          do ...;
          #);
        busyCursor:
          (* A busy cursor is a sign to the user that the
           * application are doing some processing. You will
           * normally use cursors.watch for this purpose. Set
           * busyCursor to none, when done processing.
           *)
          (# theCur: ^cursor;
          enter (#  enter theCur[] do ... #)
          exit (# do ... exit theCur[] #)
          #);
    #) (* mouse *);
  system: @
    (* models different properties of the current system *)
    (# <<SLOT systemLib: attributes>>;
        screenRectangle:
          (* the rectangle of the main screen. *)
          (# theRectangle: @rectangle;
          do ...
          exit theRectangle
          #);
        screenRgn:
          (* the region defining the screen(s) *)
          (# rgn: ^region;
          do ...
          exit rgn[]
          #);
        systemTextStyle:
          (* the textStyle used by the system to draw menutitles
           * etc.
           *)
          @textStyle;
        beep:
          (* beeps using the current beep in the system *)
          ...;
        wait:
          (* delays the specified number of ticks (1 tick = 1/60
           * sec.)
           *)
          (# ticks: @integer;
          enter ticks
          do ...;
          #);
    #) (* system *);
  transferMode: (#  #);
  transferModes: @
```

```
    (# copy,
       invertCopy,
       erase,
       andBlend,
       orBlend,
       xorBlend,
       notAndBlend,
       notOrBlend: @transferMode;
    #);
  textFaces: @
    (# <<SLOT textFacesLib: attributes>>;
       plain: (# exit  0 #);
       bold: (# exit  1 #);
       italic: (# exit  2 #);
    #);
  patterns: @
    (# black, dkGray, gray, ltGray, white: ^raster #);
  cursors: @
    (# arrow, iBeam, watch, cross, plus: @cursor #);
  borderStyles: @
    (# simple: (# exit 1 #);
       etchedOut: (# exit 2 #);
       etchedIn: (# exit 3 #);
       shadowIn: (# exit 4 #);
       shadowOut: (# exit 5 #);
    #);
  separatorStyles: @
    (# singleLine: (# exit 1 #);
       doubleLine: (# exit 2 #);
       singleDashedLine: (# exit 3 #);
       doubleDashedLine: (# exit 4 #);
       etchedIn: (# exit 5 #);
       etchedOut: (# exit 6 #);
    #);
  private: @...;
  bifrostprivate: @...;
  trace:
    (* For debugging. If doTrace is true, INNER is called. *)
    (#
    do (if doTrace then INNER if);
    #);
  doTrace: @Boolean;
  debuggraphic: @boolean
    (* If true, display verbose bifrost debug trace. Defaults to
     * false
     *);
  displaywarnings: @boolean
    (* If displayWarnings is true, various warnings about bifrost
     * errors that are not fatal, but may affect the behaviour, is
     * displayed. Defaults to true.
     *);

  (* Additions needed for systemenv *)
  doSetup:
    (#
    do (if not setupDone then
              ...;
              true -> setupDone
       if)
    #);
```

```
   setupDone: @Boolean;
   XsystemEnvPresent: @Boolean;
   (* TRUE if this is a XsystemEnv program.  In this case,
    * callbacks are executed by a separate thread as synchronisation
    * via semaphores between x-callbacks and other coroutines would
    * not be possible otherwise. (It could lead to suspend of
    * coroutines with C stackparts.  If TRUE,
    * XsystemEnvHandleCallback should not be NONE.
    *)
   XsystemEnvHandleCallbackP:
     (# cb: ^Object; enter cb[] do INNER #);
   XsystemEnvHandleCallback:
     ^XsystemEnvHandleCallbackP;
do ...
#) (* GUIenv *)
```

Chapter 2: The stddialogs Library

This fragment contains a few standard dialogs (more will be added later):

- `noteUser` which brings up a simple dialog with a message, and waits for the user to press the OK button. **NoteUser**
- `alertUser`, similar to `noteUser`. **AlertUser**
- `fileSelectionDialog` brings up a standard file selection dialog. **FileSelection-Dialog**
- `fileCreationDialog` brings up a standard create/save file dialog. **FileCreation-Dialog**

Using the stddialogs Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `stddialogs` must be included as follows:

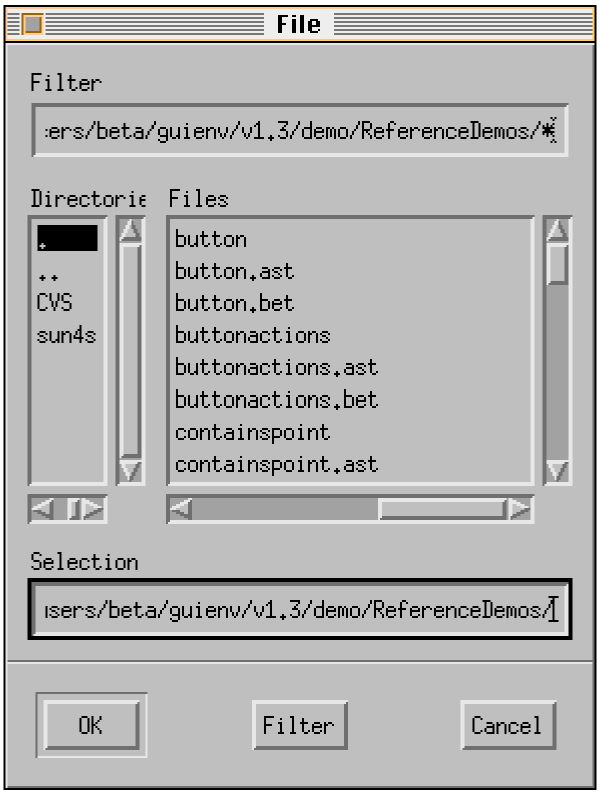
```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/stddialogs'
--- program: descriptor ---
guienv(# ...
      do ...
         ... -> fileSelectionDialog -> ...;
         ...
      #)
```

Examples of Use of the stddialogs Fragment

This demo program illustrates the use of the standard file selection dialog. The name of the file selected in the dialog is printed on the screen.

file.bet

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/stddialogs';
(* This demo shows how to use the fileSelectionDialog pattern.  The
 * name of the file selected in the dialog is printed on the screen.
 *)
-- program: descriptor --
guienv
(# theWindow: @window
     (# eventHandler::
          (# onAboutToClose:: (# do terminate #);
             onMouseUp::
               (# name: ^text;
               do theWindow[] -> fileSelectionDialog -> name[];
                  (if name[]=NONE then
                      'Selected Cancel' -> putline
                   else
                      name[] -> putline
                  if)
               #)
          #)
     #)
do theWindow.open
#)
```



Filter: :ers/beta/guienv/v1.3/demo/ReferenceDemos/*

Directories: . .. CVS sun4s

Files: button button.ast button.bet buttonactions buttonactions.ast buttonactions.bet containspoint containspoint.ast

Selection: ısers/beta/guienv/v1.3/demo/ReferenceDemos/

Interface Descriptions of the stddialogs Library

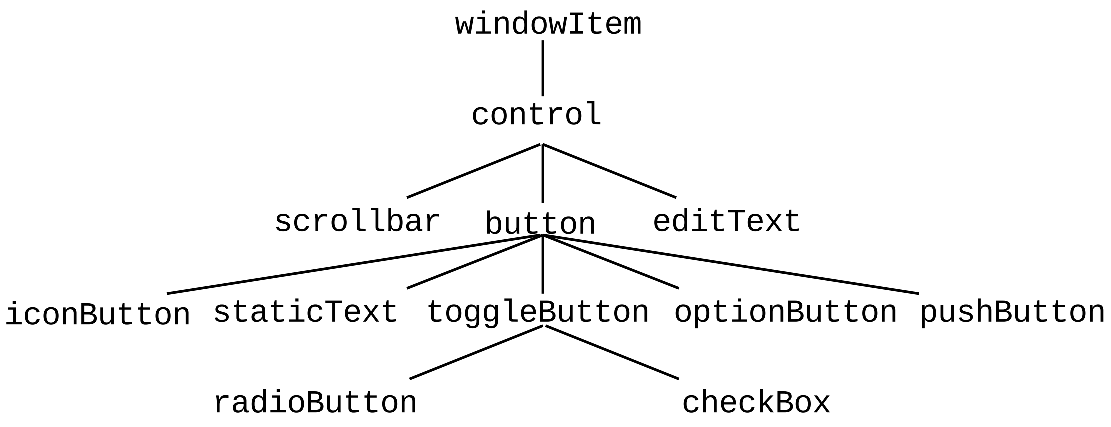
```
ORIGIN 'guienv';
BODY 'private/stddialogsbody'
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *
 * The intent of this fragment is that is should contain verious
 * standard dialogs, such as noteUser, alertUser, fileSelectionDialog,
 * etc.
 *)
-- guienvLib: attributes --
dialog:
  (* Dialog is an abstract superpattern for activating
   * modal dialogs. In the INNER of this(dialog) you
   * can assign values to owner and dialogTitle to control
   * these features of the dialog.
   *
   * If the dialogwindow has a titlebar the title is used.
   * If the owner is specified, the dialog is centered
   * inside that window. If owner is NONE, the dialog is centered
   * on the screen.
   *)
  (# owner: ^window;
     title: ^text;
     private: @...;
  enter owner[]
  ...
  #);

messageDialog: dialog
  (* MessageDialog is an abstract superpattern for dialogs with
   * a simple message.
   *
   * The message can be specified by evaluating the enter part, eg.
   *   (NONE, 'You have new mail', 'Mail Dialog')-> noteUser;
   *
   * and in the INNER:
   *   newMailDialog: noteUser
   *    (# do 'You have new mail' -> message[] #);
   *)
  (# message:
       ^text;
     messageDialogPrivate: @...;
  enter (message[], title[])
  ...
  #);
noteUser: messageDialog
  (* A note user dialog are used for neutral messages.
   * No additional features are defined here.
   *)
  (#
  ...
  #);
alertUser: messageDialog
  (* AlertUsers brings up a simple messagedialog
   * with a warning icon. Use it to warn to user of
   * som dangerous condition.
   *)
  (#
  ...
  #);

fileDialog: dialog
  (* FileDialog is an abstract superpattern for
   * file selection and file creation (On some platforms
   * these two dialogs are actually the same).
   *
   * The filter is an wildcard like: '*.c'. If filter is none, '*'
   * is used.
   * The path is the a path to the default directory in the dialog.
   * If path is none, the working directory is used.
   * Label is the label for the textfield displaying the current
   * selection.
   * filter, path, label, filename, title may be set in the do -part.
   *)
  (# filter, path, label, fileName: ^text;
     fileDialogPrivate: @...;
  ...
  exit fileName[]
  #);
fileSelectionDialog: fileDialog
  (* brings up a standard file selection dialog *)
  (# ... #);
fileCreationDialog: fileDialog
  (* brings up a standard file creation dialog *)
  (# ... #);
```

Chapter 3: The controls Library

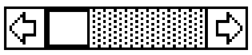
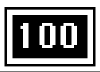
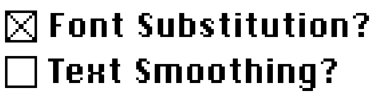
The `controls` library contains a series of subpatterns of `windowItem`, intended primarily to be used in dialog boxes (e.g. buttons, check boxes, etc.).

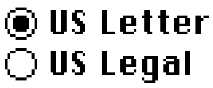
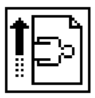
Buttons, check boxes, etc.

These subpatterns are called controls, and the inheritance tree of controls in the `controls` library is:



To illustrate the facilities, we have included the Macintosh graphical elements associated with these classes. Naturally, the graphical elements will appear differently on the Motif and Win32 platforms:

Control pattern name	Image	Description
`scrollbar`		Used for various scrolling purposes.
`staticText`		Used to specify permanent text in the dialog (usually explanatory text).
`editText`		Used to allow the user to enter some text.
`pushButton`		A button is used to specify some actions to be taken.
`optionButton`		Used to specify a button with associated pop-up menu.
`checkBox`		A check box is usually used together with other check boxes to present the user with a group of non-exclusive options.

`radioButton`		A radio box is usually used together with other radio boxes to present the user with a group of exclusive options.
`iconButton`		An icon is used to show a minor picture in the dialog.

Control

`Control` is the superclass of all classes in the `controls` hierarchy. Most facilities of this class are intended for the implementation of the subclasses, and not relevant for most users of Lidskjalv.

Scrollbar

`Scrollbars` are dials which the user can control to specify a value between 0 and some maximum value. The `scrollbar` pattern has attributes for controlling the scroll step (`scrollAmount`) and the maximum value of the scrollbar (`maxValue`). The current value of the scrollbar can be obtained and changed by the `value` attribute.

The event handling of `scrollbar` defines several new events, e.g. `onThumbMoved` which is invoked when the scroll thumb have been moved by the user, and `onPageUp` which is invoked when the user presses the pageUp area in the `scrollbar`.

The orientation of the scrollbar is controlled by the `vertical` attribute (binding `vertical` to `trueObject` sets the orientation to vertical). The length of the scrollbar is manipulated through the `length` attribute.

EditText

`EditText` is a very single line text editor, primarily usable for small amounts of text (such as file names etc.) in dialogs. The text must be in the same text style.

- `style` is used to specify the font information to be used for the text in this editText.
- `contents` is a reference to the text of this editText.

Button

`Button` is the general superpattern for all controls that may act as buttons (i.e. react to menu button clicks), and may have a label associated with them.

`Button` has attributes for accessing and changing the label (`label`), and for accessing and changing the text style of the label (`style`).

- the evnts: `onLabelChanged` and `onStyleChanged` are invoked when the label or style have been changed.
- `label` is the text displayed in (or immediately along with) the button.
- `style` is used to define the font to be used when displaying the label.

PushButton

`PushButton` is a simple button that reacts to mouse clicks. `PushButton` does not define additional attributes. The `label` of a `pushButton` is shown inside the button.

StaticText

`StaticText` is a simple text label, and mostly used for informative text in dialogs and for labeling `editText` fields. `StaticText` does not define any additional attributes.

IconButton

`IconButton` is a simple button with a icon defining its appearance. The `label` of an `icon` button may be shown centered below the `icon`, The `showLabel` attribute is used for controlling whether the `label` should be shown or not.

- the event: `onShowLabelChanged` is invoked when the label have been changed.

- `showLabel` is used to control whether the label should be displayed along with the icon.

OptionButton

An `optionButton` has an associated menu, that pops up when the user clicks at the `optionButton`. The button text of the `optionButton` is automatically updated to display the currently selected item in the `menu`. The currently selected menu item is accessible through the `currentItem` attribute. The `menu` connected to this `optionButton` is an instance of the `menu` pattern defined in `guienv`. The menu is connected through the `popUpMenu` attribute.

- the events: `onCurrentItemChanged` and `onPopupMenuChanged` are invoked when the a new item is selected in the associated menu, respectively when the menu is changed.
- `popupMenu` is used to specify the menu to be popped up from this button.
- `currentItem` is the last selected menu item.

ToggleButton

`ToggleButton` is the general superpattern for on/off buttons.

- the event: `onStateChanged` is used to specify the actions to be executed when the state of the toggleButton have been changed.
- `state` is used to control the state of this `toggleButton`.

RadioButton

`RadioButton` is a kind of `toggleButton` mostly used in a radio button cluster (several `radioButton`s of which only *one* can be on at any time - this must however be ensured by the application programmer in the current version). No additional attributes are defined.

CheckBox

`CheckBox` is mostly used for setting options in e.g. dialog boxes. Is intended to be used in checkbox groups. No additional attributes are defined.

DefaultButton

`DefaultButton` is used for specifying the button to act as the default button (i.e. be activated by a carriage return). `DefaultButton` takes a reference to the button to be used as default as enter parameter. Currently not implemented on Motif.

Using the controls Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `controls` must be included as follows:

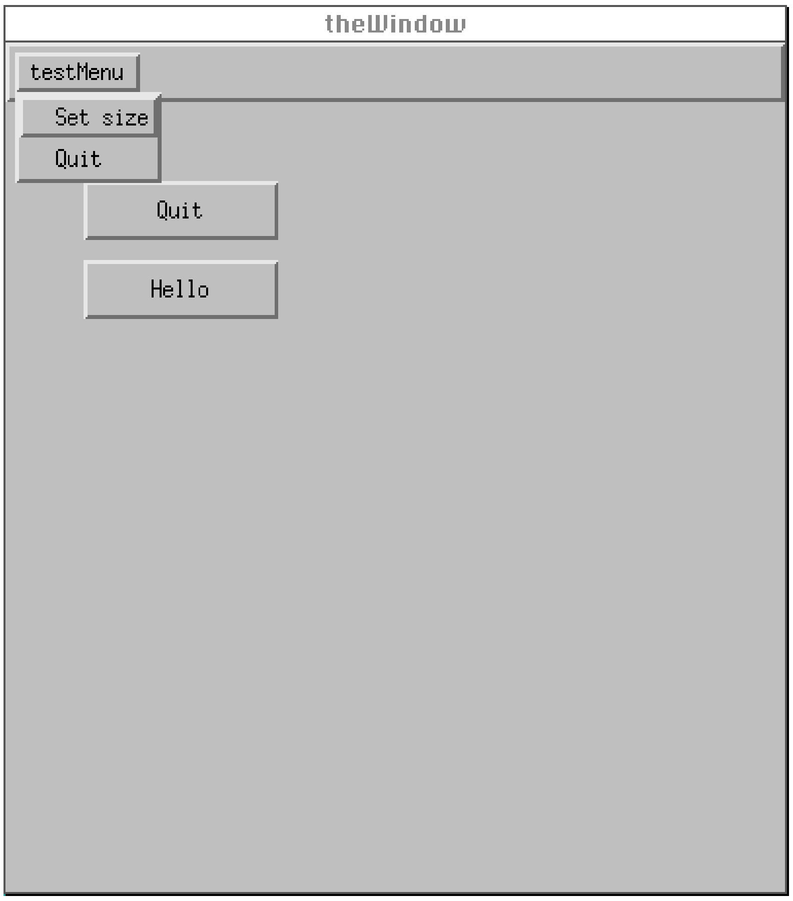
```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/controls'
--- program: descriptor ---
guienv(# pb: @pushButton;
         ...
      do ...
         ... -> pb.label;
         ...
      #)
```

Examples of Use of the controls Fragment

This example .illustrates how to create a window with two pushbuttons, and give a button a new size at runtime.

button.bet

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/controls';
(* This demo shows how to create a window with two pushButtons, and
 *  how to give a button a new size on runtime.
 *)
--- program: descriptor ---
guienv
(# theWindow: @window
     (# menubarType::
          (# testMenu: @menu
               (# sizeItem: @menuItem
                    (# open::
                         (# do 'Set size' -> name #);
                       eventHandler::
                         (# onSelect::
                              (# do (200,200)->helloButton.size #);
                         #);
                    #);
                  quitItem: @menuItem
                    (# open::
                         (# do 'Quit' -> name #);
                       eventHandler::
                         (# onSelect::
                              (# do terminate #);
                         #);
                    #);
                  open::
                    (#
                    do sizeItem.open; sizeItem[] -> append;
                       quitItem.open; quitItem[] -> append
                    #)
               #);
             open::
               (#
               do testMenu.open; testMenu[] -> append
               #)
          #);
        quitButton: @pushButton
          (# eventHandler::
               (# onMouseUp::
                    (#
                    do 'Good bye, World' -> putline;
                       terminate
                    #)
               #);
             open::
               (#
               do (40,40) -> position;
                  (100,30) -> size;
                  'Quit' -> label
               #)
          #);
        helloButton: @pushButton
          (# eventHandler::
               (# onLabelChanged::
                    (#
                    do 'helloButton.onLabelChanged' -> putline
                    #);
                  onMouseUp::
                    (#
                    do 'Hello, World - My name is ' -> puttext;
                       label -> putline
                    #)
               #);
             open::
               (#
               do (40,80) -> position;
                  (100,30) -> size;
                  'hello,world' -> putline;
                  'Hello' -> label
               #)
          #);
        eventhandler::
          (# onAboutToClose:: (# do terminate #) #);
        open::
          (#
          do (400,400) -> size;
             quitButton.open;
             helloButton.open;
             contents -> target
          #)
     #)
do theWindow.open
#)
```



Interface Descriptions of the controls Library

```
ORIGIN 'guienv';
BODY 'private/controlsbody';
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
-- windowLib: attributes --
control: windowitem
  (* a control is a graphical object in the window that the user can
   * use to perform actions. All user interaction with the control
   * that can result in an action should give some kind of visual
   * feedback.
   *)
  (# <<SLOT controlLib: attributes>>;
     open::< (# create::< (# do ... #);
       do ...
       #);
     close::< (# do ... #);
     layoutType::< controllayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* control *);
scrollbar: control
  (* A scrollbar controls the scrolling of a textfield or picture
   * etc.
   *)
  (# <<SLOT scrollbarLib: attributes>>;
     eventhandler::<
       (# thumbMoved: event
            (* is called whenever a user has moved the thumb of
             * THIS(scrollbar)
             *)
            (# amount: @integer;
            enter amount
            do ...;
            #);
          onThumbMoved:< thumbMoved;
          pageDown: event
            (* called when the user clicks in the page down area *)
            (# do ...; #);
          onPageDown:< pageDown;
          pageUp: event
            (* called when the user clicks in the page up area *)
            (# do ... #);
          onPageUp:< pageUp;
          buttonDown: event
            (* called when the user clicks at the down button *)
            (# do ... #);
          onButtonDown:< buttonDown;
          buttonUp: event
            (* called when the user clicks at the up button *)
            (# do ... #);
          onButtonUp:< buttonUp;
          pageScrollAmountChanged: event
            (* called when the scrollamount is changed *)
            (# do INNER; #);
          onPageScrollAmountChanged:< pageScrollAmountChanged;
          scrollAmountChanged: event
            (* called when the scrollamount is changed *)
            (# do INNER; #);
          onScrollAmountChanged:< scrollAmountChanged;
          maxValueChanged: event
            (* called when the max value is changed *)
            (# do INNER; #);
          onMaxValueChanged:< maxValueChanged;
          valueChanged: event
            (* called when the value is changed *)
            (# do INNER; #);
          onValueChanged:< valueChanged;
          onFrameChanged::<(# do ... #);
          onRefresh::<(# do ... #);
          onMouseDown::<(# do ... #);
          onActivate::<(# do ... #);
          onDeactivate::<(# do ... #);
       #);
     vertical:<
       (* Specifies if THIS(scrollbar) is vertical, false is the
        * default value
        *)
       booleanValue;
     scrollAmount:
       (* scrollAmount is the amount the scrollbars thumb will move,
        * when the user clicks in the up button or in the down button
        *)
       (# value: @integer
       enter (# enter value do ... #)
       exit (# do ... exit value #)
       #);
     pageScrollAmount:
       (* pageScrollAmount is the amount the scrollbars thumb will
        * move, when the user clicks in the page down or page up area
        *)
       (# value: @integer;
       enter (# enter value do ... #)
       exit (# do ... exit value #)
       #);
     maxValue:
       (* this combines setMaxValue and getMaxValue.  Evaluate the
        * enter part to set the maximum value and evaluate the exit
        * part to get the maximum value
        *)
       (# value: @integer
       enter (# enter value do ... #)
       exit  (# do ... exit value #)
       #);
     value:
       (* evaluate the enter part to set the value and evaluate the
        * exit part to the maximum value.  The thumb of the scrollbar
        * is drawn acording to maxValue and the current value. That
```

```
            * is, if maxValue is 100 and value is 50, the thumb will be
            * drawn in the middle of the scrollbar
            *)
           (#  pos: @integer;
           enter (# enter  pos do ... #)
           exit  (# do ... exit pos #)
           #);
         length:
           (* the length is either the height or the width of the frame
            * depending of the orientation
            *)
           (# theLength: @integer;
           enter (# enter theLength do ... #)
           exit (# do ... exit theLength #)
           #);
         open::< (# create::< (# do ... #);
           do ...
           #);
         close::< (# do ...; #);
         putLayout::< (* private *) (# ... #);
         getLayout::< (* private *) (# ... #);
         layoutType::< scrollbarlayout;
         private: @...;
      #) (* scrollbar *);

   button: control
      (* this is the abstract superpattern for all button-like controls *)
      (# <<SLOT buttonLib: attributes>>;
         eventhandler::<
           (# labelChanged: event
                (* is called whenever the label is changed *)
                (# do INNER; #);
              onLabelChanged:< labelChanged;
              styleChanged: event
                (* is called whenever the style is changed *)
                (# do INNER #);
              onStyleChanged:< styleChanged;
              onFrameChanged::<(# do ... #);
              onRefresh::<(# do ... #);
              onMouseDown::<(# do ... #);
           #);
         label:
           (* the label is the text displayed in THIS(button).  The event
            * labelChanged is called, when the label is changed
            *)
           (# theLabel: ^text;
           enter (# enter theLabel[] do ... #)
           exit (# do ... exit theLabel[]  #)
           #);
         style:
           (* the text style used for drawing the label  *)
           (# theStyle: ^textStyle
           enter (# enter theStyle[] do ... #)
           exit  (# do ... exit theStyle[] #)
           #);
         open::< (# create::< (# do ... #);
           do ...
           #);
         close::< (# do ... #);
         putLayout::< (* private *) (# ... #);
```

```
     getLayout::< (* private *) (# ... #);
     layoutType::< buttonlayout;
     private: @...;
  #) (* button *);
pushButton: button
  (* this is a button like the OK and Cancel buttons in dialogs *)
  (# <<SLOT pushButtonLib: attributes>>;
     open::< (# create::< (# do ... #);
       do ...
       #);
     close::< (# do ... #);
     layoutType::< pushButtonlayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* pushButton *);
staticText: button
  (* normally a staticText is used to label editText fields *)
  (# <<SLOT staticTextLib: attributes>>;
     eventhandler::<
       (# onRefresh::<(# do ...#);
       #);
     open::< (# create::< (# do ... #);
       do ...
       #);
     close::< (# do ... #);
     layoutType::< staticTextlayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* staticText *);
iconButton: button
  (* an icon has a label, which is drawn centered just below the
   * image of the icon
   *)
  (# <<SLOT iconButtonLib: attributes>>;
     eventhandler::<
       (# showLabelChanged: event
            (* called when showLabel is changed *)
            (# do INNER #);
          onShowLabelChanged:< showLabelChanged;
          iconChanged: event
            (* Called when the icon is changed *)
            (# do INNER #);
          onIconChanged:< iconChanged;
          onRefresh::< (# do ... #);
          onHiliteChanged::< (# do ... #);
       #);
     showLabel:
       (* if true, the label is shown centered under the image of the
        * Icon
        *)
       (# doShow: @boolean
       enter (# enter doShow do ... #)
       exit (# do ... exit doShow #)
       #);
     icon:
       (# theIcon: ^raster;
       enter (# enter theIcon[] do ... #)
       exit (# do ...; exit theIcon[] #)
```

```
          #);
        open::< (# create::< (# do ... #);
          do ...
          #);
        close::< (# do ... #);
        layoutType::< iconButtonlayout;
        putLayout::< (* private *) (# ... #);
        getLayout::< (* private *) (# ... #);
        private: @...;
     #) (* iconButton *);
   optionButton: button
     (* a optionButton has a menu, which pops up, when the user clicks
      * at the button. A normal way to use a optionButton is to set the
      * label of the button to the current selected item in the menu
      *)
     (# <<SLOT optionButtonLib: attributes>>;
        eventhandler::<
          (# currentItemChanged: event
               (* called when currentItem is changed *)
               (# do INNER #);
             onCurrentItemChanged:< currentItemChanged;
             popUpMenuChanged: event
               (* called when popUpMenu is changed *)
               (# do INNER #);
             onPopUpMenuChanged:< popUpMenuChanged;
             onLabelChanged::< (# do ... #);
             onStyleChanged::< (# do ... #);
          #);
        currentItem:
          (* the current item is the number of the item, which name is
           * currently shown in the popup box.  You can get a reference
           * to that item by calling: currentItem ->
           * theMenu.getItemByNumber -> theItem[];
           *)
          (# itemNo: @integer
          enter (# enter itemNo do ... #)
          exit (# do ... exit itemNo #)
          #);
        popupMenu:
          (* evaluate the enter part to set the menu that pops up in
           * THIS(optionButton). And evaluate the exit part to get the
           * menu
           *)
          (# popupMenu: ^menu;
          enter (# enter popupMenu[] do ... #)
          exit (# do ... exit PopupMenu[] #)
          #);
        open::< (# create::< (# do ... #);
          do ...
          #);
        close::< (# do ... #);
        layoutType::< optionButtonlayout;
        putLayout::< (* private *) (# ... #);
        getLayout::< (* private *) (# ... #);
        private: @...;
     #) (* optionButton *);
   toggleButton: button
     (* this is the abstract superpattern for all buttons that toggle
      * between two states (on/off buttons)
      *)
```

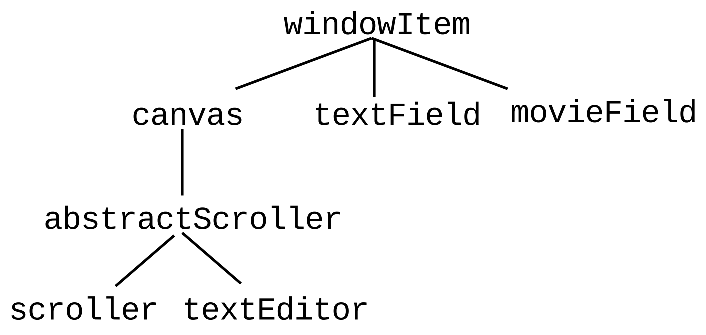
```
  (# <<SLOT toggleButtonLib: attributes>>;
     eventhandler::<
       (# stateChanged: event
            (* this event is called whenever the state of
             * THIS(toggleButton) is changed
             *)
            (# do INNER #);
          onStateChanged:< stateChanged;
       #);
     state:
       (# theState: @boolean;
       enter (# enter theState do ... #)
       exit (# do ... exit theState #)
       #);
     open::<(# create::< (# do ... #);
       do ...
       #);
     close::< (# do ... #);
     layoutType::< toggleButtonlayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* toggleButton *);
radioButton: toggleButton
  (* a radioButton is mostly used in a radiobutton cluster, where
   * only one radioButton is set at a time. A radioButton is thus
   * useful to let the user choose among different alternatives
   *)
  (# <<SLOT radioButtonLib: attributes>>;
     open::< (# create::< (# do ... #);
       do ...
       #);
     close::< (# do ... #);
     layoutType::< radioButtonlayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* radioButton *);
checkBox: toggleButton
  (* this is useful for setting options in dialogs *)
  (# <<SLOT checkBoxLib: attributes>>;
     open::< (# create::< (# do ... #);
       do ...
       #);
     close::< (# do ... #);
     layoutType::< checkBoxlayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* checkBox *);
editText: control
  (* this is a simple version of textField. Only one textStyle is
   * allowed.  The purpose of this control is to build dialogs
   *)
  (# <<SLOT editTextLib: attributes>>;
     style:
       (* an editText can only have one textStyle.  Evaluate the
        * enter part to set the textStyle.  Evaluate the exit part to
        * get the textStyle
        *)
```

```
          (# txStyle: ^textStyle
          enter (# enter txStyle[] do ... #)
          exit (# do ... exit txStyle[] #)
          #);
        contents:
          (* the contents of an editText is text.  Evaluate the enter
           * part to set the contents, and evaluate the exit part to get
           * the contents
           *)
          (# str: ^text
          enter (# enter str[] do ... #)
          exit (# do ... exit str[] #)
          #);
        eventhandler::<
          (# onFrameChanged::<(# do ... #);
             onKeyDown::<(# do ... #);
             onMouseDown::<(# do ... #);
             onRefresh::<(# do ... #);
             onEnableTarget::<(# do ... #);
             onDisableTarget::<(# do ... #);
          #);
        open::<
          (* the textStyle of THIS(editText) is initially set to the
           * system's textStyle
           *)
          (# create::< (# do ... #);
          do ...
          #);
        close::< (# do ... #);
        layoutType::< editTextlayout;
        putLayout::< (* private *) (# ... #);
        getLayout::< (* private *) (# ... #);
        private: @...;
      #) (* editText *);
    defaultButton:
      (* the defaultButton in the window recieves a mouseUp event when
       * the user presses the return-key
       *)
      (# theButton: ^button
      enter (# enter theButton[] do ... #)
      exit (# do ... exit theButton[] #)
      #) (* defaultButton *);
```

Chapter 4: The fields Library

Text fields and scrollers

The `fields` library contains five advanced subpatterns of `windowItem`. These patterns are used for displaying movies and editable text fields (with and without scrolling facilities), and for scrolling a group of `windowItem`s using scrollbars.



TextField

`TextField` is an alternative to the `editText` control with extended facilities for cut/copy/paste, selection handling, etc. `TextField` contains many attributes supporting many different text editing functions: changing text style, deleting and inserting text, etc. Furthermore, `textField` has an additional event `onTextChanged` which will be invoked each time the text `contents` have been changed.

A readonly `textField` can be implemented simply by further binding the `onBeforeChange` virtual and here specify `false->allow`.

`TextField` takes care of most interaction with the user and many applications using `textField` need not do anything else but extract the text `contents` of the `textField` instance at the appropriate time.

AbstractScroller

`AbstractScroller` is a subpattern of `canvas` and implements a scrolling facility for any `windowItem` type (specified through the `contentsType` virtual attribute). An `abstractScroller` contains two scrollbars (one vertical and one horizontal), and the `windowItem` will scroll according to the manipulations of these scrollbars.

TextEditor

TextEditor is a subpattern of `abstractScroller` (with `contentsType` further bound to `textField`) and is an alternative to `textField`, offering additional scrolling facilities. `TextEditor` is a full-fledged text editor with full editing and scrolling. No additional attributes are defined.

`TextEditor` takes care of most interaction with the user and many applications using `textEditor` need not do anything else but extract the text `contents` of the `textEditor` instance at the appropriate time.

Scroller

`Scroller` is another subpattern of `abstractScroller` (with `contentsType` further bound to `canvas`) that can scroll all `windowItems` attached to the canvas.

MovieField

`MovieField` is intended for displaying video (not implemented yet).

Using the fields Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `fields` must be included as follows:

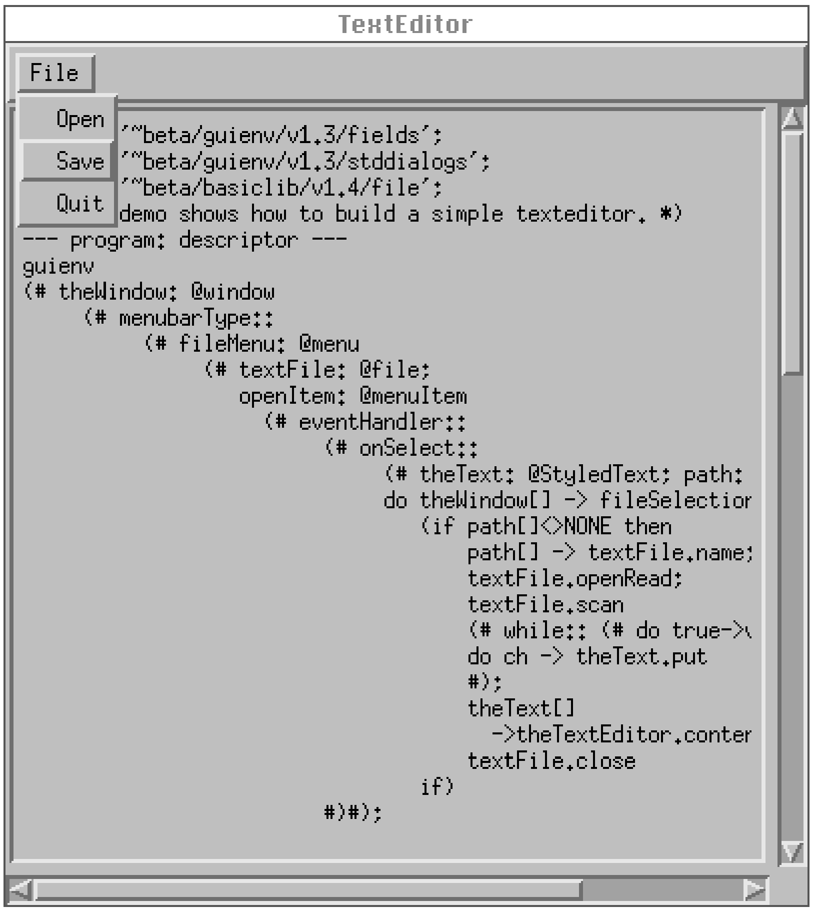
```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/fields'
--- program: descriptor ---
guienv(# te: @textEditor;
         ...
      do ...
         ... -> te..contents.selection;
         ...
      #)
```

Examples of Use of the fields Fragment

This demo program illustrates the facilities for constructing standard text editors.

texteditor.bet

```
ORIGIN  '~beta/guienv/v1.4/fields';
INCLUDE '~beta/guienv/v1.4/stddialogs';
INCLUDE '~beta/basiclib/v1.5/file';
(* This demo shows how to build a simple texteditor. *)
--- program: descriptor ---
guienv
(# theWindow: @window
     (# menubarType::
          (# fileMenu: @menu
               (# textFile: @file;
                  openItem: @menuItem
                    (# eventHandler::
                         (# onSelect::
                              (# theText: @StyledText; path: ^text;
                              do theWindow[] -> fileSelectionDialog ->
path[];
                                 (if path[]<>NONE then
                                     path[] -> textFile.name;
                                     textFile.openRead;
                                     textFile.scan
                                     (# while:: (# do true->value #);
                                     do ch -> theText.put
                                     #);
                                     theText[]
                                       -
>theTextEditor.contents.contents;
                                     textFile.close
                                 if)
                         #)#);
                       open:: (# do 'Open' -> name #)
                    #);
                  saveItem: @menuItem
                    (# eventHandler::
                         (# onSelect::
                              (# theText: @Text; tempName: ^text;
                              do textFile.name -> tempName[];
                                 (if tempName.length>0 then
                                     textFile.openWrite;
                                     theTextEditor.contents.contents
                                       ->textFile.puttext;
                                     textFile.close
                                 if)
                         #)#);
                       open::
                         (# do 'Save' -> name #)
                    #);
                  quitItem: @menuItem
                    (# eventHandler::
                         (# onSelect:: (# do terminate #) #);
                       open::
                         (# do 'Quit' -> name #)
                    #);
                  open::
                    (#
                    do 'File' -> name;
                       openItem.open; openItem[] -> append;
                       saveItem.open; saveItem[] -> append;
                       quitItem.open; quitItem[] -> append
               #)#);
             open::
               (# do fileMenu.open; fileMenu[] -> append #)
          #); (* menubarType *)
        eventhandler::
          (# onAboutToClose:: (# do terminate #) #);
        thetextEditor: @textEditor
          (# open::
               (#
               do 'TextEditor' -> title;
                  theWindow.size -> size;
                  true -> bindBottom -> bindRight
               #)
          #);
        open::
          (#
          do 'thetextEditor' -> title;
             (400,400) -> size;
             thetextEditor.open
          #)
     #)
do theWindow.open
#)
```



```
        '~beta/guienv/v1.3/fields';
        '~beta/guienv/v1.3/stddialogs';
        '~beta/basiclib/v1.4/file';
        demo shows how to build a simple texteditor. *)
--- program: descriptor ---
guienv
(# theWindow: @window
     (# menubarType::
          (# fileMenu: @menu
               (# textFile: @file;
                  openItem: @menuItem
                    (# eventHandler::
                         (# onSelect::
                              (# theText: @StyledText; path:
                              do theWindow[] -> fileSelectior
                                 (if path[]<>NONE then
                                     path[] -> textFile.name;
                                     textFile.openRead;
                                     textFile.scan
                                     (# while:: (# do true->\
                                     do ch -> theText.put
                                     #);
                                     theText[]
                                       ->theTextEditor.conter
                                     textFile.close
                                 if)
                         #)#);
```

Interface Descriptions of the fields Library

```
ORIGIN 'guienv';
INCLUDE 'controls';
INCLUDE 'styledtext';
BODY 'private/fieldsbody';
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
-- windowLib: attributes --
movie: (# #) (* ONLY defined to make this fragment compilable *);
movieField: windowItem
  (# <<SLOT movieFieldLib: attributes>>;
     contents:
       (* the movie shown in THIS(movieField) *)
       (# theMovie: ^movie
       enter (# enter theMovie[] do ... #)
       exit (# do ... exit theMovie[] #)
       #);
     scaleToFit:
       (* if true, contents will be scaled to fit in
        * THIS(movieField).  Otherwise, it will be clipped.
        *)
       (# value: @boolean;
       enter (# enter value do ... #)
       exit (# do ... exit value #)
       #);
     open::< (# create::< (# do ... #);
       do ...
       #);
     close::<
       (#
       do ...;
       #);
     layoutType::< movieFieldLayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* movieField *);
textField: windowItem
  (* this is a simple field that is used to edit styled text.  There
   * is no scroll functionality, use the textEditor pattern, if
   * scrolling is required. The normal editing commands cut, copy,
   * paste, clear are supported. THIS(textField) has to be the
   * window's target, when editing is performed. this can be obtained
   * by calling THIS(textField)[] -> target... this is automatically
   * done when the user clicks in a textField that isn't the target
   * already
   *)
  (# <<SLOT textFieldLib: attributes>>;
     eventhandler::<
       (# textChanged: event
            (* this event is called whenever the text in
             * THIS(textField) is changed
             *)
            (# do INNER #);
          onTextChanged:< textChanged;
          beforeChange: event
            (* This is called before any change is performed in
             * THIS(textField) If allow is set to false, then change
             * is not performed.  Position indicates where in the
             * textfield, the text is inserted or deleted. Length
             * indicates how many characters is inserted or
             * deleted. If length is negative, then the characters are
             * deleted - otherwise they are inserted.
             *)
            (# position,length: @integer;
               allow: @boolean;
               theText:
                 (* The text beeing inserted when lenght > 0 *)
                 (# value: ^text;
                 ...
                 exit value[]
                 #);
            enter (position,length)
            do true -> allow;
               INNER;
            exit allow
            #);
          onBeforeChange:< beforeChange;
          onFrameChanged::<(# do ... #);
          onKeyDown::<(# do ... #);
          onMouseDown::<(# do ... #);
          onMouseUp::<(# do ... #);
          onRefresh::<(# do ... #);
          onEnableTarget::<(# do ... #);
          onDisableTarget::<(# do ... #);
          onIdle::<(# do ... #);
       #);
     paste:
       (* this method pastes text from the clipboard into
        * THIS(textField) at the current insertion point or replaces
        * the current selection.  The text is styled according to the
        * style information found in the scrap; if there is none, it
        * is given the same style as the first character of the
        * replaced selection (or that of the preceding character if
        * the selection is an insertion point)
        *)
       (# do ... #);
     copy:
       (* the current selection is copied into the clipboard with the
        * associated style information. If the current selection is an
        * insertion point the clipboard is emptied
        *)
       (# do ... #);
     cut:
       (* the current selection is first copied into the clipBoard
        * and then deleted
        *)
       (# do ... #);
     clear:
       (* the current selection is deleted, and the clipboard is not
        * affected.  Calling delete is the same as pressing backspace
        *)
       (# do ... #);
     contents:
       (* the text in THIS(textField) *)
       (# theText: ^styledText;
       enter (# enter theText[]  do ... #)
       exit (# do ... exit theText[] #)
       #);
     getChar:
       (* returns the character at position (pos) in THIS(textField).
        * The return character (ASCII.cr) and other control characters
        * count
        *)
       (# pos: @integer;
          ch: @char;
       enter pos
       do ...
       exit ch
       #);
     length: integerValue
       (* returns the number of characters in THIS(textField) *)
       (# do ... #);
     all:
       (* if you want to scan all the text in THIS(textField), use:
        * all -> scanText(#...#)
        *)
       (# exit (0,length) #);
     scanText:
       (* INNER is called for every character from position start to
        * end in THIS(textField). The variable ch is the current
        * character
        *)
       (# start,end: @integer;
          ch: @char;
       enter (start,end)
       do ...
       #);
     posToPt:
       (* Calculates the coordinates of the character number `pos' in
        * the textField.
        *)
       (# pos: @integer;
          pt: @point;
       enter pos
       do ...;
       exit pt
       #);
     ptToPos:
       (* Calculates the character that are located at the specified
        * coordinates in the textField.
        *)
       (# pos: @integer;
          pt: @point;
       enter pt
       do ...;
       exit pos
       #);
     selection: @
       (* selection is the current range of characters in this
        * (textField) that is selected. Start is the position in the
        * text of the first character of the selection and end is the
        * position of the last.  If the selection is an insertion
        * point, "start" and "end" will be the position of the
        * character just after the carret
        *)
       (# start: integerValue
            (# do ... #);
          end: integerValue
            (# do ... #);
          contents:
            (* returns the text selected in THIS(textField) *)
            (# theText: ^text;
            do ...
            exit theText[]
            #);
          scrollIntoView:
            (* scrollIntoView makes sure the Selection is visible,
             * scrolling the textField, if necesary
             *)
            ...;
          set:
            (* this makes [theStart,theEnd] the new selection *)
            (# theStart,theEnd: @integer;
            enter (theStart,theEnd)
            do ...
            #);
          get: (# exit (start,end) #);
       enter set
       exit get
       #) (* selection *);
     defaultStyle:
       (* The default style is the style that is used when the
        * textfield has been completely empty and new text is entered.
        *)
       (# style: ^textStyle;
       enter (# enter style[] do ... #)
       exit (# do ... exit style[] #)
       #);
     isOneStyle:
       (* this function returns a textStyle if the range of
        * characters [start,end] has the same style - in which case
        * "theStyle" will be set to that textStyle - Otherwise
        * theStyle will be NONE
        *)
       (# start,end: @integer;
          theStyle: ^textStyle;
       enter (start,end)
       do ...
       exit theStyle[]
       #);
     setOneSize:
       (* this makes the range of characters [start,end] have the
        * same size specified by "theSize"
        *)
       (# start,end: @integer;
          theSize: @integer;
       enter (start,end,theSize)
       do ...
       #);
     setOneFont:
       (* this makes the range of characters [start,end] have the
        * same font specified by "theFont"
        *)
       (# start,end: @integer;
          theFont: ^text;
       enter (start,end,theFont[])
       do ...
       #);
     setOneFace:
       (* this makes the range of characters [start,end] have the
        * same face (textFaces.italic, textFaces.bold etc.) specified
        * by "theFace". If doToggle is true and the face specified
        * exists across the entire selected range, that face is
        * removed (turned off).  Otherwise, all of the selected text
        * is set to include that face
        *)
       (# start,end: @integer;
          doToggle: @boolean;
          theFace: @integer;
       enter (start,end,theFace,doToggle)
       do ...
       #);
     setOneStyle:
       (* this makes the range of characters [start,end] have the
        * same continous style specified by "theStyle"
        *)
       (# start,end: @integer;
          theStyle: @textStyle;
       enter (start,end,theStyle)
       do ...
       #);
     scanTextWithStyle:
       (* this is a control pattern that calls an INNER for all
        * characters in THIS(textField) with the style "theStyle".
        * The variable "ch" is the current character
        *)
       (# theStyle: ^textStyle;
          ch: @char;
       enter theStyle[]
       do ...
       #);
     margin:
       (* use this pattern to set or retrieve the left- and top
        * margin of the text in THIS(textField).  The left margin is
        * the distance from the left bound of THIS(textField) to the
        * text in THIS(textField).  The top margin is the distance
        * from the upper bound of THIS(textField) to the text in
        * THIS(textField)
        *)
       (# leftMargin,topMargin: @integer;
       enter (# enter (leftMargin,topMargin) do ... #)
       exit (# do ... exit (leftMargin,topMargin) #)
       #);
     insert:
       (* insert takes the specified text and inserts it just before
        * the selection range in THIS(textField). Insert doesn't
        * affect either the current selection range or the clipboard
        *)
```

```
          (# theText: ^text;
          enter theText[]
          do ...
          #);
        delete:
          (* deletes the characters in the current selection range *)
          (# do ... #);

        open::< (# create::< (# do ... #);
          do ...
          #);
        close::< (# do ... #);
        layoutType::< textFieldLayout;
        putLayout::< (* private *) (# ... #);
        getLayout::< (* private *) (# ... #);
        private: @...;
      #) (* textField *);
    abstractScroller: canvas
      (* this is an abstract superpattern for objects with two
       * scrollbars.  The abstractScroller consist of a canvas containing
       * the virtual definition of contents that models the object that is
       * scrolled and the two scrollbars.  It also defines the virtual
       * procedure patterns scroll and adjustscrolling
       *)
      (# <<SLOT abstractScrollerLib: attributes>>;
        contentsType:< (* this describes the object that is scrolled *)
          windowItem;
        contents: @contentsType;
        scroll:<
          (* this is a superpattern for scrolling functionality of
           * THIS(abstractScroller).  The contents are scrolled "dh"
           * pixels to the right and "dv" pixels down
           *)
          (# dh,dv: @integer
          enter (dh,dv)
          do ...;
          #);
        open::< (# create::< (# do ... #);
          do ...
          #);
        close::< (# do ... #);
        layoutType::< abstractScrollerLayout;
        putLayout::< (* private *) (# ... #);
        getLayout::< (* private *) (# ... #);
        private: @...;
      #) (* abstractScroller *);
    textEditor: abstractScroller
      (* this models a texteditor, that is a textfield with two
       * scrollbars
       *)
      (# <<SLOT textEditorLib: attributes>>;
        contentsType::<
          textField;
        scroll::<(# do ... #);
        open::< (# create::< (# do ... #);
          do ...
          #);
        close::<(# do ... #);
        layoutType::< textEditorLayout;
        putLayout::< (* private *) (# ... #);
```

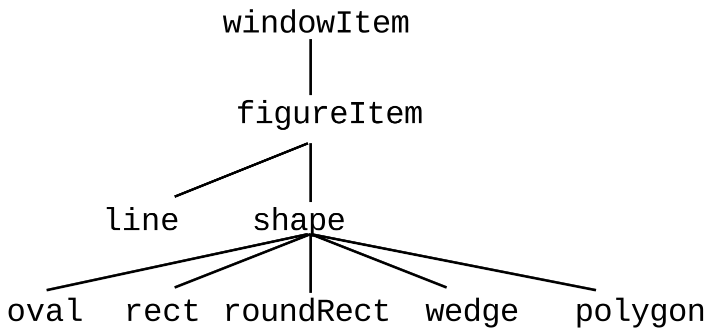
```
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* textEditor *);
scroller: abstractScroller
  (* this is a general scroller, which can scroll an entire canvas *)
  (# <<SLOT scrollerLib: attributes>>;
     contentsType::<
       canvas;
     scroll::< (# do ... #);
     open::< (# create::< (# do ... #);
       do ...
       #);
     close::<(# do ...; #);
     eventhandler::<
       (# onFrameChanged::<
            (#
            do ...;
            #);
       #);
     layoutType::< scrollerLayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* scroller *);
```

Chapter 5: The figureitems Library

Interactive vector graphics

The `figureitems` library is implementing a relative simple vector graphics system, sufficient for many purposes. For more advanced graphics, the Mjølner BETA System contains a full-fledged 2D graphics library, called Bifrost (see [MIA 91-13] and [MIA 91-19]).

The vector graphics patterns are all subpatterns of `figureItem`. `FigureItem` is a subpattern of `windowItem`, and inherits all the event handling etc., allowing `figureItem`s to react to user manipulations.



FigureItem

`FigureItem` is the general superpattern for all vector graphics patterns, implementing the common attributes of all graphics patterns. All `figureItem`s have the attribute `pen`. `Pen` is an object used for drawing the `figureItem`. `Pen` has attributes for defining the drawing pattern of `pen`, for defining the foreground and background color of pen`,` and for defining the size (rectangle) of `pen`.

Line

`Line` is used for drawing straight lines. The `start` and `end` attributes are used for controlling the starting (resp. ending) points of the `line`.

Shape

`Shape` is the general superpattern for all `figureItem`s that can be filled with some paint. It defines one additional attribute, `fill`. `Fill` is an object used for modeling the properties of the paint used for filling the `figureItem`. `Fill` has attributes for defining the drawing pattern being used for the paint, and for defining the foreground and background color of the paint.

Oval and Rect

`Oval` and `Rect` are very similar in not defining any additional attributes.

RoundRect

`RoundRect` is similar to `rect` but with round corners. The roundness of the corners are defined as ovals and controlled through the `roundness` attribute.

Wedge

`Wedge` defines a “piece of cake” and defines `startAngle` and `endAngle` for controlling the wedge.

Polygon

`Polygon` is a collection of points defining a connected set of straight lines. `Polygon` defines one additional attribute, `points`, used to control the points in the `polygon`.

Using the figureitems Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `figureitems` must be included as follows:

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/figureitems'
--- program: descriptor ---
guienv(# l: @line;
         ...
      do ...
         ps1 -> l.start;
         ps2 -> l.end;
         ...
      #)
```

Examples of Use of the figureitems Fragment

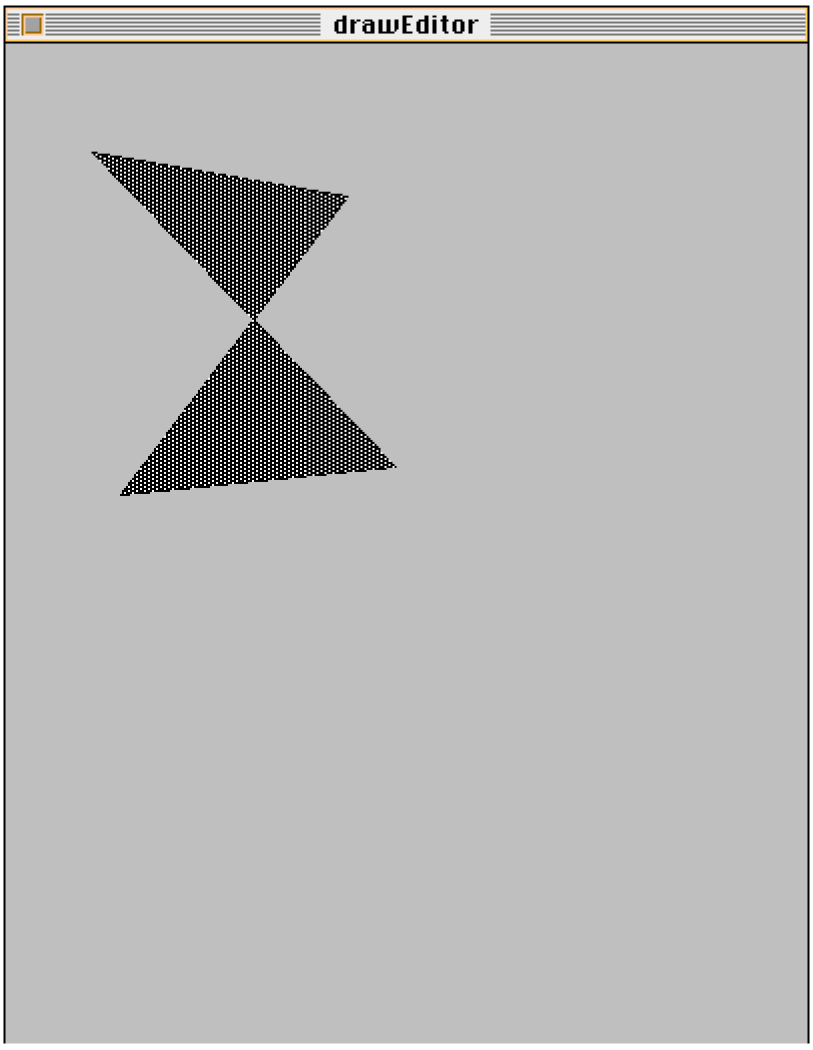
This demo program is a little more elaborate. It is a simple draw editor in which you interactively can draw lines and polygons.

draw.bet

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/figureitems';
(* This demo gives an example of how you can draw lines and polygons
 * with mouse using the figureitems "line" and "polygon".  Clicking
 * with the left mouse button defines a node in the polygon/line,
 * clicking with the right mouse button ends the definition of the
 * polygon/line and draws it on the screen.
 *)
--- program: descriptor ---
guienv
(# drawEditor: @window
     (# points: @
          (# ps: [16] ^point;
             top: @integer;
             init:
               (#
               do 0 -> top;
                  (for i: ps.range repeat
                       &point[] -> ps[i][]
                  for)
               #);
             clear:
               (# do 0 -> top #);
             add:
               (# p: @point;
                  size: @integer
               enter p
               do top + 1 -> top;
                  (if top > ps.range then
                      ps.range -> size;
                      size -> ps.extend;
                      (for i: size repeat
                           &point[] -> ps[size + i][]
```

```
                 for)
             if);
             p -> ps[top]
          #);
     exit ps[1:top]
     #);
   polygonEditor: polygon
     (# open::
          (# do patterns.dkgray[] -> fill.tile #);
        eventHandler::
          (# onMouseDown::
               (#
               do drag;
                  this(polygonEditor)[] -> father.selection.set
               #)
          #)
     #);
   lineEditor: line
     (# eventHandler::
          (# onMouseDown::
               (#
               do drag;
                  this(lineEditor)[] -> father.selection.set
               #)
          #)
     #);
   definingPoly: @boolean;
   eventHandler::
     (# onAboutToClose:: (# do terminate #);
        onMouseDown::
          (# ps: [0] ^point
          do (if definingPoly then
                 (if buttonState
                  //1 then
                     localPosition -> points.add
                  //3 then
                     localPosition -> points.add;
                     points -> ps;
                     (if ps.range > 2 then
                         ps -> createPolygon
                      else
                         ps -> createLine
                     if);
                     false -> definingPoly
                 if);
              else
                 (if buttonState=1 then
                     true -> definingPoly;
                     points.clear;
                     localPosition -> points.add
                 if)
             if)
          #)
     #);
   createPolygon:
     (# ps: [0] ^point;
        poly: ^polygon
     enter ps
     do &polygonEditor[] -> poly[];
        poly.open;
```

```
                     ps -> poly.points
                  #);
                createLine:
                  (# l: ^line;
                     ps: [0] ^point
                  enter ps
                  do &lineEditor[] -> l[];
                     l.open;
                     ps[1] -> l.start;
                     ps[2] -> l.end
                  #);
                open::
                  (#
                  do (400,500) -> size;
                     contents -> target;
                     points.init
                  #)
           #)
        do drawEditor.open
        #)
```



Interface Descriptions of the figureitems Library

```
ORIGIN 'guienv';
BODY 'private/figureitemsbody'
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
-- windowLib: attributes --
figureItem: windowitem
  (* superclass for all vector graphics *)
  (# <<SLOT figureItemLib: attributes>>;
     pen: @
       (* this item models the properties of the pen used to draw the
        * outline of THIS(figureItem)
        *)
       (# foregroundColor:
            (* sets the foreground color of the pen used to draw
             * THIS(figureItem)
             *)
            (# theColor: @color;
            enter (# enter theColor do ... #)
            exit (# do ... exit theColor #)
            #);
          backgroundColor:
            (* sets the background color of the pen used to draw
             * THIS(figureItem)
             *)
            (# theColor: @color;
            enter (# enter theColor do ... #)
            exit (# do ... exit theColor #)
            #);
          stipple:
            (* The pattern used for stippling when drawing with the
             * pen
             *)
            (# p: ^raster;
            enter (# enter p[] do ... #)
            exit (# do ... exit p[] #)
            #);
          size:
            (* sets the size of the pen used to draw THIS(figureItem)
             *)
            (# value: @integer;
            enter (# enter value do ... #)
            exit (# do ... exit value #)
            #);
       #) (* pen *);
     open::<
       (* The initialy pen characteristics of THIS(figureItem) are
        *   stiple          = patterns.black
        *   foreGroundColor = colors.black
```

```
          *   backGroundColor = colors.white
          *   size      = 1
          *)
         (# create::< (# do ... #);
         do ...
         #);
       eventhandler::<
         (# onRefresh::<(# do ...; #);
         #);
       layoutType::< figureItemLayout;
       putLayout::< (* private *) (# ... #);
       getLayout::< (* private *) (# ... #);
       private: @...;
  #) (* figureItem *);
line: figureItem
  (* straight line defined by a startPt and a endPt *)
  (# <<SLOT lineLib: attributes>>;
     start:
       (# theStart: @point;
       enter (# enter theStart do ... #)
       exit (# do ... exit theStart #)
       #);
     end:
       (# theEnd: @point;
       enter (# enter theEnd do ... #)
       exit (# do ... exit theEnd #)
       #);
     open::< (# do ... #);
     eventhandler::<
       (# onRefresh::<(# do ... #);
          onFrameChanged::<(# do ... #);
          onHiliteChanged::<(#  do ... #);
       #);
     layoutType::< lineLayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* line *);
shape: figureItem
  (* figures that can be filled *)
  (# <<SLOT shapeLib: attributes>>;
     fill: @
       (* This item models the properties of the fill of THIS(shape)
        *)
       (# tile:
            (* Sets the tile raster used to fill THIS(figureItem) *)
            (# p: ^raster;
            enter (# enter p[] do ... #)
            exit (# do ... exit p[] #)
            #);
          foregroundColor:
            (* Sets the foreground color of the pen used to draw
             * THIS(figureItem).
             *)
            (# theColor: @color;
            enter (# enter theColor do ... #)
            exit (# do ... exit theColor #)
            #);
          backgroundColor:
            (* Sets the background color of the pen used to draw
             * THIS(figureItem).
             *)
            (# theColor: @color;
            enter (# enter theColor do ... #)
            exit (# do ... exit theColor #)
            #);
       #);
     open::<
       (* The fill of THIS(shape) is initially:
        *   colorForeground = black
        *   colorBackground = white
        *)
       (# do ... #);
     eventhandler::<
       (# onRefresh::<(# do ... #);
          onHiliteChanged::<(#  do ... #);
       #);
     layoutType::< shapeLayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* shape *);
oval: shape
  (* the oval is defined by a rectangle *)
  (# <<SLOT ovalLib: attributes>>;
     open::< (# do ... #);
     eventhandler::<
       (# onRefresh::<(# do ... #);
       #);
     layoutType::< ovalLayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
  #) (* oval *);
rect: shape
  (# <<SLOT rectLib: attributes>>;
     open::< (# do ... #);
     eventhandler::<
       (# onRefresh::<(# do ... #);
       #);
     layoutType::< rectLayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
  #) (* rect *);
roundRect: shape
  (* rectangular shape with rounded corners *)
  (# <<SLOT roundRectLib: attributes>>;
     open::< (# do ... #);
     roundness:
       (* the corner roundness is specified by means of an Oval *)
       (# theOvalHeight,theOvalWidth: @integer;
       enter (# enter (theOvalHeight,theOvalWidth) do ... #)
       exit (# do ... exit (theOvalHeight,theOvalWidth) #)
       #);
     eventhandler::<
       (# onRefresh::<(# do ... #);
       #);
     layoutType::< roundRectLayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* roundRect *);
wedge: shape
  (* a piece of cake *)
  (# <<SLOT wedgeLib: attributes>>;
     open::< (# do ... #);
     startAngle:
       (* evaluate the enter part to set the angle, where THIS(wedge)
        * starts.  Evaluate the exit part to get it
        *)
       (# angle: @integer;
       enter (# enter angle do ... #)
       exit (# do ... exit angle #)
       #);
     endAngle:
       (* evaluate the enter part to set the angle, where THIS(wedge)
        * ends.  Evaluate the exit part to get it
        *)
       (# angle: @integer;
       enter (# enter angle do ... #)
       exit (# do ... exit angle #)
       #);
     eventhandler::<
       (# onRefresh::<(# do ... #);
       #);
     layoutType::< wedgeLayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* wedge *);
polygon: shape
  (# <<SLOT polygonLib: attributes>>;
     points:
       (* set or get the points that represents THIS(polygon).  There
        * must be at least 3 points
        *)
       (# thePoints: [3] ^point;
       enter (# enter thePoints do ... #)
       exit (# do ... exit thePoints #)
       #);
     open::<
       (#
       do ...;
       #);
     eventhandler::<
       (# onRefresh::<(# do ... #);
          onFrameChanged::<(# do ... #);
       #);
     layoutType::< polygonLayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* polygon *);
```

Chapter 6: The scrolllists Library

Scrolling lists

The `scrolllists` library contains two subpatterns of `windowItem` which implements scrolling lists:

$$\begin{tikzcd}
\texttt{windowItem} \arrow[d, dash] \\
\texttt{scrollList} \arrow[d, dash] \\
\texttt{textScrollList}
\end{tikzcd}$$

Scro'llList

`ScrollList` is a general superpattern realizing the basic functionality of displaying and scrolling in a list of equally sized elements (including facilities for managing single and multiple selections of the elements in the `scrollList`).

`ScrollList` contains attributes for inserting and deleting elements as well as for managing the selections (inserting, deleting, scanning and testing).

`ScrollList` is an abstract pattern that cannot be instantiated.

TextScrollList

`TextScrollList` is a minor augmentation of `scrollList` to make support for scrolling lists of text elements. Adds three additional attributes: `setText`, `getText` and `style`, which allows for accessing and changing the text and the text style of the individual text elements in the `scrollList`.

Using the scrolllists Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `scrolllists` must be included as follows:

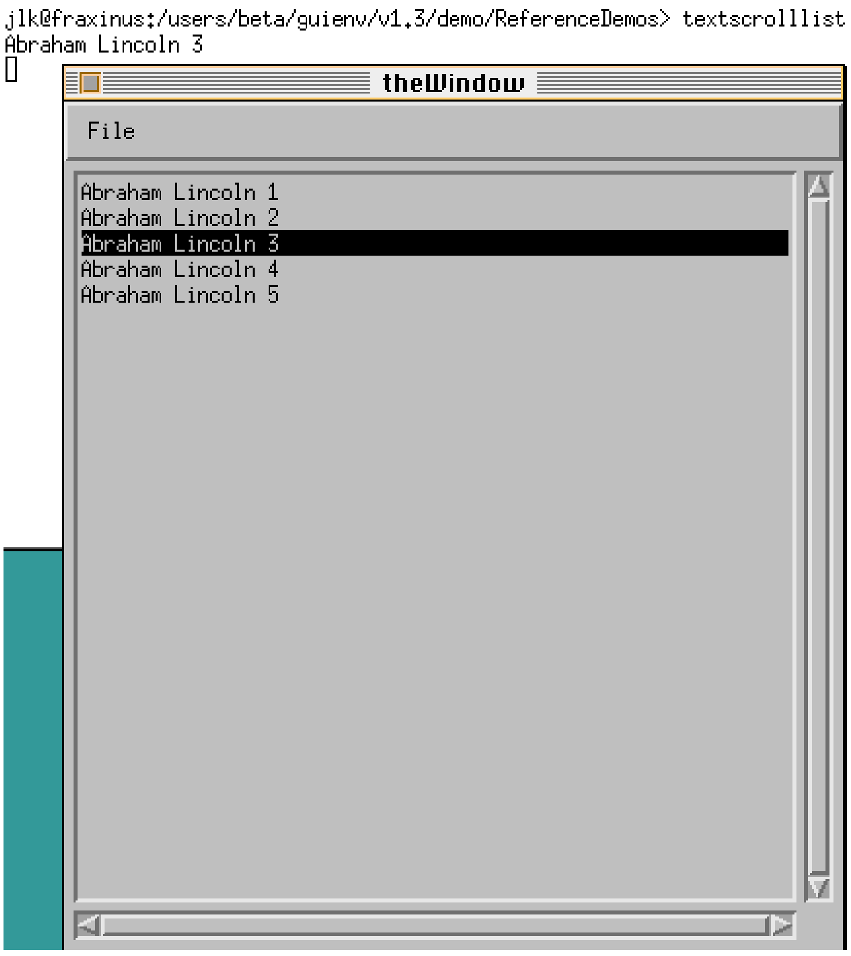
```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/scrolllists'
--- program: descriptor ---
guienv(# tsl: @textScrollList;
         ...
      do ...
         tsl.selection.first -> ...;
         ...
      #)
```

Examples of Use of the scrolllists Fragment

This example .illustrates how to use the textscrolllist windowItem.

textscrolllist.bet

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/scrolllists';
(* This demo gives a simple example of how to use the textScrollList
 * windowitem.
 *)
--- program: descriptor ---
guienv
(# theWindow: @window
     (# menubarType::
          (# fileMenu: @menu
               (# quitItem: @menuItem
                    (# eventHandler::
                         (# onSelect::
                              (# do terminate #);
                         #);
                       open::
                         (# do 'Quit' -> name #)
                    #);
                  open::
                    (#
                    do 'File' -> name;
                       quitItem.open; quitItem[] -> append
                    #)
               #);
             open::
               (#
               do fileMenu.open; fileMenu[] -> append
               #)
          #);
        eventhandler::
          (# onAboutToClose:: (# do terminate #) #);
        theTextScrollList: @textScrollList
          (# eventHandler::
               (# onMouseDown::
                    (#
                    do (if doubleClick then
                            selection.first -> gettext -> putline
                       if)
                    #)
               #);
             open::
               (# v: @point;
                  noOfItems: @integer
               do (5,5) -> position;
                  theWindow.size -> v;
                  (10,10) -> v.subtract;
                  v -> size;
                  true -> bindBottom;
                  true -> bindRight;
                  5 -> append;
                  theTextScrollList.numberOfItems -> noOfItems;
                  (noOfItems-4,'Abraham Lincoln 1') -> settext;
                  (noOfItems-3,'Abraham Lincoln 2') -> settext;
                  (noOfItems-2,'Abraham Lincoln 3') -> settext;
                  (noOfItems-1,'Abraham Lincoln 4') -> settext;
                  (noOfItems,'Abraham Lincoln 5') -> settext
               #)
          #);
        open::
          (#
          do (400,400) -> size;
             theTextScrollList.open;
             theTextScrollList[] -> target
          #)
     #)
do theWindow.open
#)
```



```
jlk@fraxinus:/users/beta/guienv/v1.3/demo/ReferenceDemos> textscrolllist
Abraham Lincoln 3
```

```
Abraham Lincoln 1
Abraham Lincoln 2
Abraham Lincoln 3
Abraham Lincoln 4
Abraham Lincoln 5
```

Interface Descriptions of the scrolllists Library

```
ORIGIN 'guienv';
BODY 'private/scrolllistsbody';
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
-- windowLib: attributes --
scrollList: windowItem
  (# <<SLOT scrollListLib: attributes>>;
     numberOfItems: integerValue
       (* returns the number of items in THIS(scrollList). The items
        * in the scrollList are indexed from 1 to size. That is, size
        * is the index to the last item
        *)
       (# do ... #);
     insert:
       (* the specified number of items (numOfItems) are inserted
        * before the specified item (beforeItem). The items in the
        * scrollList are indexed from 1 to value returned by "size"
        *)
       (# beforeItem, numOfItems: @integer;
       enter (beforeItem, numOfItems)
       do ...
       #);
     prepend:
       (* the specified number of items (numOfItems) are inserted at
        * the beginning of THIS(scrollList). The items in the
        * scrollList are indexed from 1 to value returned by "size"
        *)
       (# numOfItems: @integer;
       enter numOfItems
       do ...
       #);
     append:
       (* the specified number of items (numOfItems) are inserted at
        * the end of THIS(scrollList). The items in the scrollList are
        * indexed from 1 to value returned by "size"
        *)
       (# numOfItems: @integer;
       enter numOfItems
       do ...
       #);
     delete:
       (* the specified range of items are deleted from
        * THIS(scrollList).  FirstItem is the index of the first item
        * to be deleted.  The items in the scrollList are indexed from
        * 1 to value returned by "size"
        *)
       (# firstItem, numOfItems: @integer;
       enter (firstItem, numOfItems)
```

```
    do ...
    #);
  deleteFirst:
    (* the specified range of items are deleted from the beginning
     * of THIS(scrollList). The items in the scrollList are indexed
     * from 1 to value returned by "size"
     *)
    (# numOfItems: @integer;
    enter numOfItems
    do ...
    #);
  deleteLast:
    (* the specified range of items are deleted from the beginning
     * of THIS(scrollList). The items in the scrollList are indexed
     * from 1 to value returned by "size"
     *)
    (# numOfItems: @integer;
    enter numOfItems
    do ...
    #);
  itemHeight:
    (* the height in pixels of a Item in THIS(scrollList) is the
     * same for all items.  Evaluate the enter-part to set the
     * height.  Evaluate the exit-part to get the height
     *)
    (# h: @integer;
    enter (# enter h do ... #)
    exit (#  do ... exit h #)
    #);
  singleSelection:
    (* if singleSelection is TRUE the user is only allowed to
     * select a single element in the list at a time.  Evaluate the
     * enter-part to set this property.  Evaluate the exit-part to
     * get this property
     *)
    (# isSingle: @boolean;
    enter (# enter isSingle do ... #)
    exit (# do ... exit isSingle  #)
    #);
  getItemRectangle:
    (* returns the rectangle occupied by the item specified by the
     * item index "theItem". The rectangle is in terms of the
     * coordinate system of the father of THIS(scrollList)
     *)
    (# theItem: @integer;
       theRectangle: @rectangle;
    enter theItem
    do ...
    exit theRectangle
    #);
  selection: @
    (# clear:
         (* deselects all items in THIS(scrollList) *)
         (# do ... #);
       scrollIntoView:
         (* scrolls THIS(scrollList) so the selected item are
          * visible
          *)
         (# do ... #);
       first: integerValue
         (* returns the index to the first selected item in
          * THIS(scrollList). There might be items between the
          * first and the last selected item that are not selected
          *)
         (# do ... #);
       last: integerValue
         (* returns the index to the last selected item in
          * THIS(scrollList). There might be items between the
          * first and the last selected item that are not selected
          *)
         (# do ... #);
       select:
         (* selects the item specified by the item index
          * "theItem".  if extend is TRUE the item is added to the
          * selection, otherwise the selection is first emptied
          *)
         (# theItem: @integer;
            extend: @boolean;
         enter (theItem,extend)
         do ...
         #);
       deselect:
         (* deselects the item specified by the item index
          * "theItem".  If the item wasn't selected nothing happens
          *)
         (# theItem: @integer;
         enter theItem
         do ...
         #);
       has: booleanValue
         (* returns whether the item specified by the item index
          * "theItem".  is selected
          *)
         (# theItem: @integer
         enter theItem
         do ...
         #);
    #) (* selection *);
  scanSelection:
    (# current: @integer;
    do ...
    #);
  scan:
    (# current: @integer;
    do ...
    #);
  open::< (# create::< (# do ... #);
    do ...
    #);
  close::< (# do ... #);
  eventhandler::<
    (# select: event
         (* Called, when the user selects an item in
          * this(scrollList). `Item' is the index of
          * the item in this(scrollList) and `doubleClick'
          * is true it the item was selected by a double
          * click.
          *)
         (# item: @integer;
            doubleClick: @boolean;
```

```
            enter (item, doubleClick)
            do INNER;
            #);
          onSelect:< select;
          onFrameChanged::<(# do ... #);
          onRefresh::<(# do ... #);
          onMouseDown::<(# do ... #);
          onActivate::<(# do ... #);
          onDeactivate::<(# do ... #);
       #);
     layoutType::< scrollListLayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
     private: @...;
  #) (* scrollList *);
textScrollList: scrollList
  (# <<SLOT textScrollListLib: attributes>>;
     setText:
       (* the item specified by the item index "theItem" is set to
        * the text "theText"
        *)
       (# theText: ^text;
          theItem: @integer;
       enter (theItem,theText[])
       do ...
       #);
     getText:
       (* the text in the item specified by the item index "theItem"
        * is returned
        *)
       (# theText: ^text;
          theItem: @integer;
       enter theItem
       do ...
       exit theText[]
       #);
     style:
       (* the style used to display the item texts in
        * THIS(textScrollList).  Evaluate the enter-part to set the
        * style.  Evaluate the exit-part to get the style
        *)
       (# setTextStyle:
            (# theStyle: ^textStyle;
            enter theStyle[]
            do ...
            #);
          getTextStyle:
            (# theStyle: ^textStyle;
            do ...
            exit theStyle[]
            #);
       enter setTextStyle
       exit getTextStyle
       #);
     open::< (# create::< (# do ... #);
       do ...
       #);
     close::< (# do ...; #);
     layoutType::< textScrollListLayout;
     putLayout::< (* private *) (# ... #);
     getLayout::< (* private *) (# ... #);
#) (* textScrollList *);
```

Chapter 7: The graphmath Library

Graphical computation

The graphmath library defines patterns for making graphical computations: point, rectangle, matrix, region, etc. Each of these patterns defines several operations.

- Point — `point` is used for making calculatiuons on 2D positions.
- Rectangle — `rectangle` is used for making calculations with 2D rectangles
- Matrix — `matrix` is used for making calculations with coordinat system transformations.
- Region — `region` is used for making calculations with 2D regions (i.e. areas in 2D, bounded by a polygon.)

Using the graphmath Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `graphmath` must be included as follows:

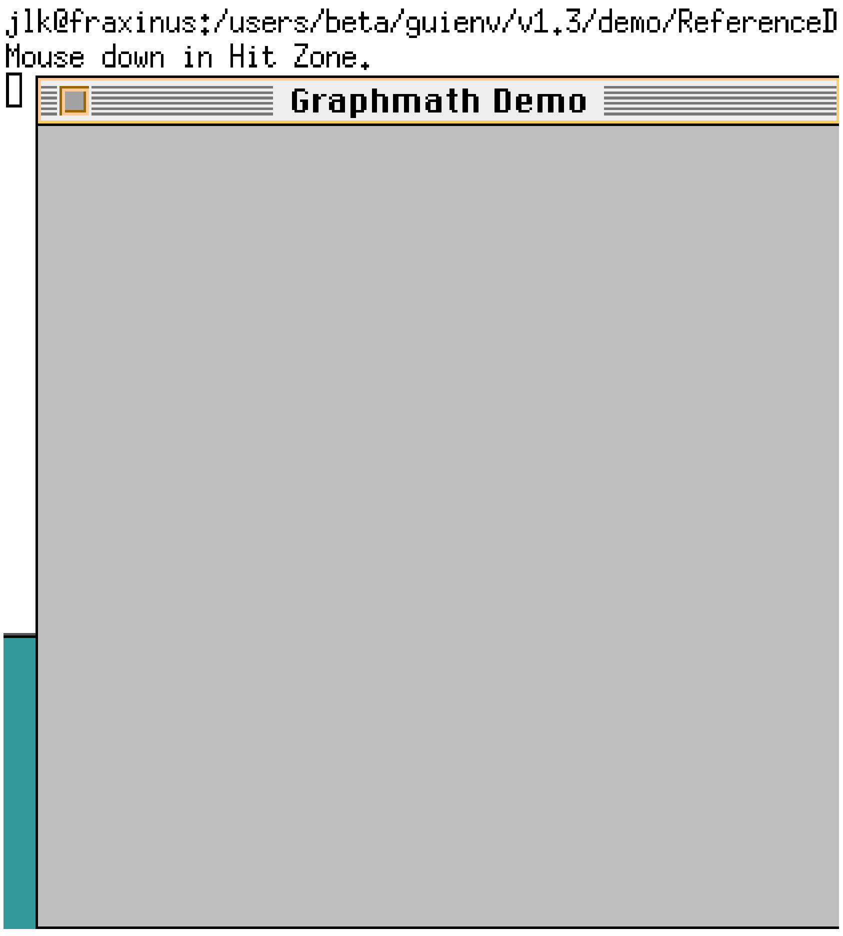
```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/graphmath'
--- program: descriptor ---
guienv(# p1, p2: @point;
         ...
      do ...
         p1 -> p2.inset -> ...;
         ...
      #)
```

Examples of Use of the graphmath Fragment

This example gives an example of how to use the containsPoint operation of a rectangle.

containspoint.bet

```
ORIGIN '~beta/guienv/v1.4/guienv';
(* This demo gives an example of how to use the containsPoint
 * operation of a rectangle.
 *)
--- program: descriptor ---
guienv
(# theWindow: @window
     (# hitZone: @rectangle;
        open::
          (#
          do 'Graphmath Demo' -> title;
             (40,40) -> position;
             (300,300) -> size;
             ((0,0), (30,30)) -> hitZone
          #);
        eventHandler::
          (# onAboutToClose:: (# do terminate #);
             onMouseDown::
               (#
               do (if localPosition -> hitZone.containsPoint then
                      'Mouse down in Hit Zone.' -> screen.putline
                  if)
               #)
          #)
     #)
do theWindow.open
#)
```



```
jlk@fraxinus:/users/beta/guienv/v1.3/demo/ReferenceD
Mouse down in Hit Zone.
```

Interface Descriptions of the graphmath Library

```
ORIGIN '~beta/basiclib/v1.5/betaenv';
BODY 'private/graphmathbody';
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
-- lib: attributes --
point:
  (* A point is defined as the intersection between a vertical line
   * and a horisontal line in the coordinate plane
   *)
  (# <<SLOT pointLib: attributes>>;
     v, h: @integer;
     add:
       (* adds the coordinates of p to the coordinates THIS(point) *)
       (# p: @point
       enter p
       do ...
       #);
     subtract:
       (* subtracts the coordinates of p from the coordinates of
        * THIS(point)
        *)
       (# p: @point
       enter p
       do ...
       #);
     isEqual: booleanValue
       (* compares THIS(point) to p and returns true if they are
        * equal or false if not
        *)
       (# p: @point
       enter p
       do ...
       #);
  enter (h, v)
  exit  (h, v)
  #) (* point *);
rectangle:
  (* rectangles are used to define areas on the screen, to assign
   * coordinate systems to graphic entities, and to specify the
   * location and sizes for various drawing commands.  A rectangle is
   * defined by two points topLeft, bottomRight, which denote the
   * top-left corner and the bottom-right corner of the rectangle
   *)
  (# <<SLOT rectangleLib: attributes>>;
     topLeft:
       (#
       enter (left, top)
       exit (left, top)
       #);
     bottomRight:
       (#
       enter (right, bottom)
       exit (right, bottom)
       #);
     left, top, right, bottom: @integer;

     set:
       (* assigns the four boundary coordinates to THIS(rectangle) *)
       (# left, top, right, bottom: @integer
       enter (left, top, right, bottom)
       do ...
       #);
     setFromPoints:
       (* sets THIS(rectangle) to the smallest rectangle that
        * encloses the two given points p1, p2
        *)
       (# p1, p2: @point;
       enter (p1, p2)
       do ...
       #);
     size:
       (* evaluate the enter part to set the width and height.
        * Evaluate the exit part to get the width and height
        *)
       (# w, h: @integer;
       enter (#  enter (w, h) do ... #)
       exit (# do ... exit (w, h)  #)
       #);
     offset:
       (* moves THIS(rectangle) by adding delta.h to each horizontal
        * coordinate and delta.v to each vertical coordinate
        *)
       (# delta: @point
       enter delta
       do ...
       #);
     inset:
       (* shrinks or expands THIS(rectangle). The left and right
        * sides are moved in by the amount specified by delta.h; the
        * top and bottom are moved toward the center by the amount
        * specified by delta.v.  If delta.h or delta.v is negative,
        * the appropriate pair of sides is moved outward instead of
        * inward
        *)
       (# delta: @point
       enter delta
       do ...
       #);
     intersection: booleanValue
       (* calculates the rectangle that is the intersection of src1
        * and src2, sets THIS(rectangle) to the intersection. Result
        * is set to true iff src1 and src2 indeed intersect
        *)
       (# src1, src2: @rectangle
       enter (src1, src2)
       do ...
       #);
     union:
       (* calculates the smallest rectangle that encloses src1 and
        * src2, and sets THIS(rectangle) to the result
        *)
       (# src1, src2: @rectangle
       enter (src1, src2)
       do ...
       #);
     containsPoint: booleanValue
       (* determines whether the pixel below and to the right of the
        * given coordinate point is enclosed in the specified
        * rectangle, and returns true if so or false if not
        *)
       (# p: @point
       enter p
       do ...
       #);
     pToAngle:
       (* calculates an integer angle between a line from the center
        * of the rectangle to thePoint and a line from the center of
        * the rectangle pointing straight up (12 o'clock high). The
        * angle is in degrees from 0 to 359, measured clockwise from
        * 12 oUclock, with 90 degrees at 3 o'clock, 180 at 6 o'clock,
        * and 270 at 9 o'clock
        *)
       (# thePoint: @point; angle: @integer
       enter thePoint
       do ...
       exit angle
       #);
     isEqual: booleanValue
       (* compares theRectangle to THIS(rectangle) and returns true
        * if they are equal or false if not. The two rectangles must
        * have identical boundary coordinates to be considered equal
        *)
       (# theRectangle: @rectangle
       enter theRectangle
       do ...
       #);
     isEmpty: booleanValue
       (* returns true if THIS(rectangle) is an empty rectangle or
        * false if not.  A rectangle is considered empty if the bottom
        * coordinate is less than or equal to the top or the right
        * coordinate is less than or equal to the left
        *)
       (# do ... #);
  enter (topLeft, bottomRight)
  exit  (topLeft, bottomRight)
  #) (* rectangle *);
matrix:
  (# << slot matrixLib: attributes>>;
     (* a  b  0
      * c  d  0
      * tx ty 1
      *)
     a, b, c, d, tx, ty: @real;
     inverse: ^matrix;
     mult: (* Multiply two matrices *)
       (# A, B, res: ^matrix;
       enter (A[], B[])
       do ...
```

```
          exit res[]
          #);
        transformPoint: @
          (# p, result: @point;
          enter p
          do ...
          exit result
          #);
        inverseTransformPoint: @
          (# p1, p2: @point;
          enter p1
          do ...
          exit p2
          #);
        transformRectangle: @
          (# r, result: @rectangle;
          enter r
          do ...
          exit result
          #);
        inverseTransformRectangle:
          (# r, result: @rectangle;
          enter r
          do ...
          exit result
          #);
        getInverse: @
          (# get: @...;
          do get;
          exit inverse[]
          #);
    enter (a, b, c, d, tx, ty)
    do INNER;
    exit (a, b, c, d, tx, ty)
    #);
  IDmatrix:
    (# ID: ^matrix
    do ...
    exit ID[]
    #);
  moveMatrix: matrix   (* A matrix specifying a translation *)
    (# itx, ity: @integer;
    enter (itx, ity)
    do ...
    #);
  scaleMatrix: matrix  (* A matrix specifying a scaling *)
    (#
    enter (a, d)
    do ...
    #);
  rotateMatrix: matrix (* A matrix specifying a rotation *)
    (# theta: @real;
    enter theta
    do ...
    #);
  ovalAngle:
    (* Returns the angle a (in radians) and cos(a), sin(a), assuming
     * that (x,y) is a point on the oval with center in (cx,cy) and
     * horizontal radius hr and verticalradius vr, i.e.
     *    (x,y) = (cx,cy) + (hr*cos(a),vr*sin(a))
     *)
    (# cx, cy, hr, vr, x, y: @integer;
        a, cos_a, sin_a: @real;
        angle: @...;
    enter (cx, cy, hr, vr, x, y)
    do angle
    exit (a, cos_a, sin_a)
    #);
  circleAngle:
    (* Returns the angle a (in radians) and cos(a), sin(a), assuming
     * that (x,y) is a point on the circle with center in (cx,cy) and
     * radius r, for some r i.e. (x,y) = (cx,cy) + (r*cos(a),r*sin(a))
     *)
    (# cx, cy, x, y: @integer;
        a, cos_a, sin_a: @real;
        angle: @...;
    enter (cx, cy, x, y)
    do angle
    exit (a, cos_a, sin_a)
    #);
  region:
    (* A region is a collection of spatially coherent points *)
    (# <<SLOT regionLib: attributes>>;
        bounds:
          (# theRectangle: @rectangle;
          do ...
          exit theRectangle
          #);
        allocate:
          (* allocates space for a new, variable-size region,
           * initializes it to the empty region defined by the rectangle
           * (0, 0)(0, 0)
           *)
          ...;
        dispose:
          (* releases the memory occupied by THIS(region). Use this only
           * after you are completely through with a temporary region
           *)
          ...;
        empty:
          (* destroys the previous structure of the given region, then
           * sets THIS(region) new to the empty region.
           *)
          ...;
        setFromRectangle:
          (* destroys the previous structure of THIS(region), and then
           * sets the new structure to the rectangle specified by
           * theRectangle
           *)
          (# theRectangle: @rectangle
          enter theRectangle
          do ...
          #);
        offset:
          (* moves THIS(region) on the coordinate plane, a distance of
           * delta.h horizontally and delta.v vertically
           *)
          (# delta: @point
          enter delta
          do ...
```

```
  #);
inset:
  (* shrinks or expands THIS(region). All points on the region
   * boundary are moved inwards a distance of dv vertically and
   * dh horizontally; if dh or dv is negative, the points are
   * moved outwards in that direction.  It leaves THIS(region)
   * centered at the same position, but moves the outline in -
   * for positive values of dh and dv - or out - for negative
   * values of dh and dv
   *)
  (# delta: @point
  enter delta
  do ...
  #);
intersection:
  (* calculates the intersection of two regions src1 and src2,
   * and sets THIS(region) to the intersection. This does not
   * create THIS(region); space must already have been allocated
   * for it.  THIS(region) can be one of the source regions, if
   * desired
   *)
  (# src1, src2: ^region
  enter (src1[], src2[])
  do ...
  #);
union:
  (* calculates the union of two regions src1 and src2, and sets
   * THIS(region) to the union. This does not create
   * THIS(region); space must already have been allocated for
   * THIS(region).  THIS(region) can be one of the source
   * regions, if desired
   *)
  (# src1, src2: ^region
  enter (src1[], src2[])
  do ...
  #);
difference:
  (* subtracts src2 from src1 and sets THIS(region) to the
   * difference.  This does not create THIS(region); space must
   * already have been allocated for it. THIS(region) can be one
   * of the source regions, if desired
   *)
  (# src1, src2: ^region
  enter (src1[], src2[])
  do ...
  #);
symDiff:
  (* calculates the difference between the union and the
   * intersection of src1 and src2 and places the result in
   * dstRgn.  This does not create THIS(region); space must
   * already have been allocated for it. THIS(region) can be one
   * of the source regions, if desired
   *)
  (# src1, src2: ^region
  enter (src1[], src2[])
  do ...
  #);
containsPoint: booleanValue
  (* checks whether the pixel below and to the right of pt is
   * within THIS(region), and returns true if so or false if not
```

```
         *)
        (# pt: @point
        enter pt
        do ...
        #);
      containsRectangle: booleanValue
        (* checks whether theRectangle intersects the specified
         * region, and returns true if the intersection encloses at
         * least one bit or false if not
         *)
        (# theRectangle: @rectangle
        enter theRectangle
        do ...
        #);
      isEqual: booleanValue
        (* compares THIS(region) to theRegion and returns true if they
         * are equal or false if not. THIS(region) and theRegion must
         * have identical sizes, shapes, and locations to be considered
         * equal.  If THIS(region) and theRegion are empty regions true
         * is returned as well
         *)
        (# theRegion: ^region
        enter theRegion
        do ...
        #);
      isEmpty: booleanValue
        (* returns true if THIS(region) is an empty region or false if
         * not
         *)
        (# do ... #);
      private: @...;
   enter (# r: ^region  enter r[] do ... #)
   exit  (# r: ^region do ... exit r[] #)
   #) (* region *);
```

Chapter 8: The graphics Library

The `graphics` library is defining a simple drawing system (without any event handling facilities). `Graphics` is intended for lightweight drawings in canvasses, dialogs, etc., where user interaction with the drawings are not important.

Simple lightweight graphics

`Graphics` defines a `pen` for controlling the color, size, etc. of the lines and points to be drawn. Furthermore, `graphics` defines seleval drawing operations, such as `moveTo`, `drawTo`, `drawSpot`, `drawLine`, etc.

Using the graphics Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `graphics` must be included as follows:

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/graphics'
--- program: descriptor ---
guienv(# bm: @bitmap;
         ...
      do ...
         ... -> bm.readFromX11File;
         ...
      #)
```

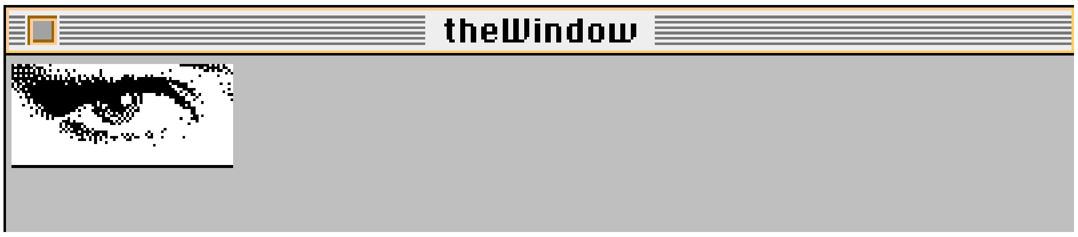
Examples of Use of the graphics Fragment

This example illustrates reading a bitmap from a file and display it on the screen.

drawbitmap.bet

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/graphics';
(* This demo is an example showing how read a bitmap from a file, and
 * using the graphics pattern to draw the bitmap on the screen.
 *)
--- program: descriptor ---
guienv
(# bm: @bitMap;
   theWindow: @window
     (# eventhandler::
          (# onAboutToClose:: (# do terminate #) #);
        obj: @windowItem
          (# open::
```

```
                              (#
                              do (50,50) -> position;
                                 (bm.width,bm.height) -> size
                              #);
                            eventHandler::
                              (# onRefresh::
                                   (#
                                   do graphics
                                      (#
                                      do (bm[], (0, 0), (0, 0), bm.width,bm.height)
                                           -> drawRaster
                                      #)
                                   #);
                                 onMouseDown::
                                   (# do drag #)
                              #)
                       #);
                     open::
                       (#
                       do (400,400) -> size;
                          obj.open
                       #)
                #)
           do 'picture.x11' -> bm.readFromX11File;
              theWindow.open
           #)
```



Interface Descriptions of the graphics Library

```
ORIGIN 'guienv';
BODY 'private/graphicsbody'
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
-- windowitemLib: attributes --
graphics:
  (* The graphics pattern is intended to implement a basic drawing
   * facility for canvas's.
   *
   * THIS IS A PROPOSAL FOR EXTENDING "GUIENV", based on previous
   * discussions in the "GUIENV" design "team".
   *
   * The intended usage it for temporary drawings (i.e. non-permanent
   * in the sence of not automatic refresh etc., and non-interactive).
   * Can be used e.g. in the definition of borders, etc. on
   * interfaceObjects (if you make the graphics drawn on each refresh
   * of the interfaceObject).  Can be used for decorations, and for
   * grouping interfaceObject by enclosing them in a box etc.
   *)
  (# <<SLOT graphicsLib: attributes>>;
     pen:@
       (* defines the besic characteristics of the pen used for
        * drawing
        *)
       (# size:
            (# value: @integer;
            enter value do ...
            #);
          foregroundColor:
            (# theColor: @color;
            enter theColor do ...
            #);
          backgroundColor:
            (# theColor: @color;
            enter theColor do ...
            #);
          stipple:
            (# b: ^raster;
            enter b[] do ...
            #);
          mode:
            (* The transfer mode use specifies how new graphics are
             * mixed with the graphics already in the window
             *)
            (# m: ^transferMode;
            enter m[]
            do ...
            #);
       #);
     style:
       (* The textstyle used for drawing text.*)
       (# theTextStyle: ^textStyle
       enter theTextStyle[]
       do ...;
       #);
     move:
       (* move the pen to current position"+"p, without drawing
        * anything
        *)
       (# p: @point
       enter p do ...
       #);
     moveTo:
       (* move the pen to position p, without drawing anything *)
       (# p: @point
       enter p do ...
       #);
     draw:
       (* move the pen to current position"+"p, drawing a straigh
        * line between current position and the new position
        *)
       (# p: @point
       enter p do ...
       #);
     drawTo:
       (* move the pen to position p, drawing a straigh line between
        * current position and the new position
        *)
       (# p: @point
       enter p do ...
       #);
     drawSpot:
       (* Draws a single point *)
       (# p: @point
       enter p do ...
       #);
     drawLine:
       (* draws a line from p1 to p2. The pen position is not
        * affected
        *)
       (# p1, p2: @point
       enter (p1,p2) do ...
       #);
     drawText:
       (* Draws the text from the current pen-position, using the
        * drawing characteristics of the pen (tile, color etc.)
        *)
       (# t: ^text
       enter t[] do ...
       #);
     drawPolygon:
       (# points: [3] ^point
       enter points do ...
       #);
     drawRect:
       (# r: @rectangle
       enter r do ...
       #);
```

```
    drawRoundRect:
      (# r: @rectangle; roundness: @rectangle
      enter (r, roundness) do ...
      #);
    drawOval:
      (# r: @rectangle
      enter r do ...
      #);
    drawSlice:
      (# r: @rectangle; fromAngle, toAngle: @integer
      enter (r, fromAngle, toAngle) do ...
      #);
    fillPolygon:
      (# points: [3] ^point
      enter points do ...
      #);
    fillRect:
      (# r: @rectangle
      enter r do ...
      #);
    fillRoundRect:
      (# r: @rectangle; roundness: @rectangle
      enter (r, roundness) do ...
      #);
    fillOval:
      (# r: @rectangle
      enter r do ...
      #);
    fillSlice:
      (# r: @rectangle; fromAngle, toAngle: @integer
      enter (r, fromAngle, toAngle) do ...
      #);
    drawRaster:
      (# r: ^raster;
         from,to: @point;
         width,height: @integer;
      enter (r[],from,to,width,height) do ...
      #);
    private: @...;
 do ...;
 #);
```

Chapter 9: The raster Library

The raster library implements patterns for manipulating raster images. It defines the raster, bitmap, graymap, pixmap, and compressedPixmap patterns.

Raster images

- raster defines the common facilities for bitmap and pixmap. These includes the width and height of the raster, and facilities for getting and setting a pixel in the raster.

  Raster

- bitmap defines monochrome rasters (a pixel is one bit). Adds facilities for reading and writing bitmaps in different formats.

  Bitmap

- graymap defines grayscale rasters and is similar to bitmap, except that pixels are one byte large.

  Graymap

- pixmap defines color rasters and is similar to bitmaps, except that pixels here are three bytes (RGB values).

  Pixmap

- compressedPixmap is similar to pixmaps, except the images are stores compressed.

  CompressedPix-map

Note that graymap, pixmap and compressedPixmap are not implemented in this version.

Using the raster Library

Remember that in order to utilize this extension to Lidskjalv, the fragment raster must be included as follows:

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/raster'
--- program: descriptor ---
guienv(#
         ...
      do ...
         ...;
         ...
      #)
```

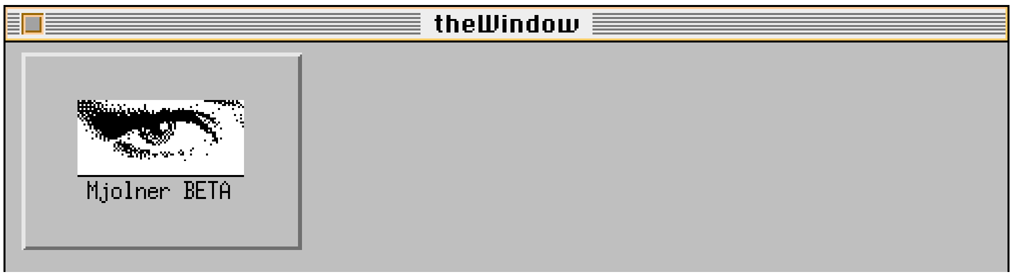
Examples of Use of the raster Fragment

This example illustrates how to use the bitMap pattern when creating an iconbutton.

iconbutton.bet

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/controls';
```

```
(* This demo shows how to use the bitMap pattern when creating an
 * iconButton control. Each time you click in the window a new
 * iconButton is created and positioned at the point where you click.
 *)
--- program: descriptor ---
guienv
(# theWindow: @window
     (# iconButtonType: iconButton
          (# bm: @bitMap;
             open::
               (#
               do 'picture.x11' -> bm.readFromX11File;
                  bm[] -> icon;
                  true -> showLabel;
                  'Mjolner BETA' -> label;
                  (140,100) -> size;
                  true -> border.visible;
                  borderStyles.shadowOut -> border.style
               #);
             eventHandler::
               (# onMouseDown::
                    (# do drag #)
               #)
          #);
        eventHandler::
          (# onAboutToClose:: (# do terminate #);
             onMouseDown::
               (# theIconButton: ^IconButtonType;
               do &iconButtonType[] -> theIconButton[];
                  theIconButton.open;
                  localPosition -> theIconButton.position
               #)
          #);
        open::
          (# do (500,500) -> size #)
     #)
do theWindow.open
#)
```



Interface Descriptions of the raster Library

```
ORIGIN '~beta/basiclib/v1.5/betaenv';
INCLUDE 'graphmath';
BODY 'private/rasterbody';
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
-- lib: attributes --
raster:
  (* generalization of bitmap and pixmap *)
  (# <<SLOT rasterLib: attributes>>;
     pixel:< Object;
     init:<
       (* Intializes the raster to have the specified width and
        * height. Allocates any data needed - you have to call dispose
        * to free that data.
        *)
       (# width, height: @integer;
       enter (width, height)
       do ...;
       #);
     dispose:<
       (* call this to dispose the memory occupied by THIS(raster)
        * when completely done with THIS(raster)
        *)
       (# do ...; #);
     width: integerValue
       (* returns the width set by init or by read operations *)
       (# do ...;#);
     height: integerValue
       (* returns the height set by init or by read operations *)
       (# do ...;#);
     hotspot:
       (* When used in a filling operation hotspot is placed in
        * hotspot of the shape being filled. Defaults to (0,0).
        *)
       (# p: @point;
       enter (# enter p do ... #)
       exit  (# do ... exit p #)
       #);
     putPixel:<
       (* Sets the pixel at location (i,j) in the raster. *)
       (# i, j: @integer; p: ^pixel;
       enter (i, j, p[])
       do ...;
       #);
     getPixel:<
       (* Returns the pixel at location (i,j) in the raster. *)
       (# i, j: @integer; p: ^pixel;
       enter (i,j)
```

```
        do ...;
        exit p[]
        #);
      copy:<
        (* Return a deep copy of THIS(raster) *)
        (# aCopy: ^raster;
        do ...;
        exit aCopy[]
        #);
      (* Private *)
      rasterprivatePart: @...;
   #);
 bitmap: raster
   (* Raster in which the pixels are booleans *)
   (# <<SLOT bitmapLib: attributes>>;
      pixel::<(# b: @boolean enter b exit b #);
      init::<(# do ...; #);
      dispose::<(# do ... #);
      putPixel::<(# do ...; #);
      getPixel::<(# do ...; #);
      copy::<(# do ... #);
      writeToPBMfile:
        (* Not Yet Implemented *)
        (# pbmfilename: ^text;
           rawbits: @boolean; (* If true, the RAWBITS format is used *)
        enter (pbmfilename[], rawbits)
        do ...;
        #);
      readFromPBMfile:
        (* Reads the contents of the PBMfile into THIS(bitmap) *)
        (# pbmfilename: ^text;
        enter pbmfilename[]
        do ...;
        #);
      writeToX11file:
        (# fileName: ^text;
        enter fileName[]
        do ...
        #);
      readFromX11file:
        (# fileName: ^text;
        enter fileName[]
        do ...
        #);
      (* Private *)
      bitmapPrivatePart: @ ...;
   #) (* bitmap *);
 graymap: raster
   (* Not Yet Implemented *)
   (# <<SLOT graymapLib: attributes>>;
      pixel::<(# g: @integer enter g exit g #);
      init::<(# do ...;#);
      dispose::<(# do ... #);
      putPixel::<(# do ...; #);
      getPixel::<(# do ...; #);
      copy::<(# do ... #);
      writeToPGMfile:
        (* Writes THIS(graymap) to the specified PGMfile *)
        (# pgmfilename: ^text;
           rawbits: @boolean; (* If true, the RAWBITS format is used *)
```

```
       enter (pgmfilename[],rawbits)
       do ...;
       #);
     readFromPGMfile:
       (* Reads the specified PGMfile into THIS(graymap) *)
       (# pgmfilename: ^text;
       enter pgmfilename[]
       do ...;
       #);
     (* Private *)
     graymapPrivatePart: @ ...;
  #) (* graymap *);
pixmap: raster
  (* Raster in which the pixels are RGB values *)
  (# <<SLOT pixmapLib: attributes>>;
     pixel::<(# r,g,b: @integer enter (r,g,b) exit (r,g,b) #);
     init::<
       (# maxVal: @integer; (* Maximum RGB value *)
       enter maxVal
       do ...;
       #);
     dispose::<(# do ... #);
     putPixel::<(# do ...; #);
     getPixel::<(# do ...; #);
     copy::< (# do ... #);
     writeToPPMfile:
       (* Not Yet Implemented *)
       (# ppmfilename: ^text;
          rawbits: @boolean; (* If true, the RAWBITS format is used *)
       enter (ppmfilename[],rawbits)
       do ...;
       #);
     readFromPPMfile:
       (* Not Yet Implemented *)
       (# ppmfilename: ^text;
       enter ppmfilename[]
       do ...;
       #);
     writeToX11file:
       (* Writes THIS(pixmap) to the specified file *)
       (# X11Filename: ^text;
       enter X11Filename[]
       do ...;
       #);
     readFromX11file:
       (* Reads the file into THIS(pixmap) *)
       (# X11Filename: ^text;
       enter X11Filename[]
       do ...;
       #);
     (* Private *)
     pixmapPrivatePart: @ ...;
  #) (* pixmap *);
compressedPixmap: pixmap
  (* Not Yet Implemented *)
  (# <<SLOT CPixmapLib: attributes>>;
     init::<(# do ...; #);
     dispose::<(# do ... #);
     putPixel::<(# do ...; #);
     getPixel::<(# do ...; #);
```

```
    copy::<(# do ... #);
    writeToPPMfile:
      (# ppmfilename: ^text;
         rawbits: @boolean; (* If true, the RAWBITS format is used *)
      enter (ppmfilename[], rawbits)
      do ...;
      #);
    readFromPPMfile:
      (# ppmfilename: ^text;
      enter ppmfilename[]
      do ...;
      #);
    (* Private *)
    cPixmapPrivatePart: @ ...;
#) (* compressedPixmap *);
```

Chapter 10: The styledtext Library

Text in multiple fonts

The `styledtext` library is a very small library, implementing the interface to styled text (text in multiple fonts etc.). It is not intended for regular Lidskjalv users, since these facilities are more easily available through other patterns in Lidskjalv (e.g the text editors).

The `styledtext` library is only available on Macintosh versions. Future releases of Lidskjalv will include some `styledtext` library on all platforms, however, possibly with a different definition.

Using the styledtext Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `styledtext` must be included as follows:

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/styledtext'
--- program: descriptor ---
guienv(# st: @styledText;
         ...
      do ...
         ... -> st.put;
         ...
      #)
```

Examples of Use of the styledtext Fragment

No demoes, since this extension is not implemented yet.

Interface Descriptions of the styledtext Library

```
ORIGIN '~beta/basiclib/v1.5/file'
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
-- lib: attributes --
styledText: text(# styleInfo: @integer #);
```

Chapter 11: The guienvactions Library

As described in chapter 1, the event handling facilities in `guienv` includes facilities for attaching actions before and after the predefined actions of an `interfaceObject`. These actions are created as instances of the `action` pattern. However, in order to be able to access the informations related to the specific event, specialized action patterns are defined for each event type. These actions are defined in this library (and those described in chapter 12 and 13).

Advanced event handling and actions

Using the guienvactions Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `guienvactions` must be included as follows:

```
     ORIGIN '~beta/guienv/v1.4/guienv';
     INCLUDE '~beta/guienv/v1.4/guienvactions'
     --- program: descriptor ---
     guienv(# beforeKeyDown: @keyDownAction
                 (# do 'Hello' -> putText #);
              ...
           do ...
              beforeKeyDown[] -> prependAction;
              ...
           #)
```

Examples of Use of the guienvactions Fragment

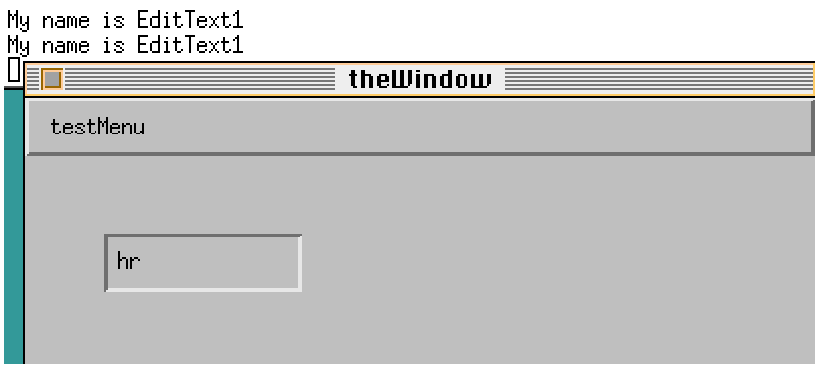
Using keyboard actions

This demo program illustrates the action facilities by attaching actions to be executed before and after onKeyDown events in a edittext control.

keyboardactions.bet

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/controls';
INCLUDE '~beta/guienv/v1.4/guienvactions';
(* This demo shows how to prepend/append actions to keyDown events in
 * an editText control.
 *)
--- program: descriptor ---
guienv
(# theWindow: @window
     (# menubarType::
```

```
                  (# testMenu: @menu
                       (# quitItem: @menuItem
                            (# open::
                                 (# do 'Quit' -> name #);
                               eventHandler::
                                 (# onSelect::
                                      (# do terminate #)
                                 #)
                            #);
                          open::
                            (# do quitItem.open;  quitItem[] -> append #)
                       #);
                     open::
                       (# do testMenu.open; testMenu[] -> append #)
                  #);
                eventhandler::
                  (# onAboutToClose:: (# do terminate #) #);
                editText1: @editText
                  (# beforeKeyDown: @keyDownAction
                       (# do 'My ' -> puttext #);
                     afterKeyDown1: @keyDownAction
                       (# do 'is ' -> puttext #);
                     afterKeyDown2: @keyDownAction
                       (# do 'EditText1' -> putline #);
                     open::
                       (#
                       do (40,40) -> position;
                          (100,30) -> size;
                          beforeKeyDown[] -> prependAction;
                          afterKeyDown1[] -> appendAction;
                          afterKeyDown2[] -> appendAction
                       #);
                     eventHandler::
                       (# onKeyDown::
                            (# do 'name ' -> puttext #)
                       #)
                  #);
                open::
                  (#
                  do (400,400) -> size;
                     editText1.open;
                     contents -> target
                  #)
             #)
        do theWindow.open
        #)
```



```
My name is EditText1
My name is EditText1
```

Interface Descriptions of the guienvactions Library

```
ORIGIN 'guienv'
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
-- interfaceobjectLib: attributes --
basicEventAction: action
  (# eventType::< theEventhandler.basicEvent;
  do INNER
  #);
mouseEventAction: basicEventAction
  (# eventType::< theEventhandler.mouseEvent;
  do INNER
  #);
mouseDownAction: mouseEventAction
  (# eventType::< theEventhandler.mouseDown
  do INNER
  #);
mouseUpAction: mouseEventAction
  (# eventType::< theEventhandler.mouseUp;
  do INNER
  #);
keyEventAction: basicEventAction
  (# eventType::< theEventhandler.keyEvent;
  do INNER
  #);
keyDownAction: keyEventAction
  (# eventType::< theEventhandler.keyDown;
  do INNER
  #);
idleAction: basicEventAction
  (# eventType::< theEventhandler.idle;
  do INNER;
  #);
refreshAction: basicEventAction
  (# eventType::< theEventhandler.refresh
  do INNER
  #);
activateAction: basicEventAction
  (# eventType::< theEventhandler.activate
  do INNER
  #);
deactivateAction: basicEventAction
  (# eventType::< theEventhandler.deactivate
  do INNER
  #);

-- windowLib: attributes --
aboutToCloseAction: action
  (# eventType::< theEventhandler.aboutToClose;
  do INNER;
  #);

-- menuitemLib: attributes --
selectAction: action
  (# eventType::< theEventhandler.select;
  do INNER
  #);

-- menuLib: attributes --
selectAction: action
  (# eventType::< theEventhandler.select;
  do INNER
  #);

-- windowitemLib: attributes --
visibleChangedAction: action
  (# eventType::< theEventhandler.visibleChanged
  do INNER
  #);
frameChangedAction: action
  (# eventType::< theEventhandler.frameChanged
  do INNER
  #);
fatherFrameChangedAction: action
  (# eventType::< theEventhandler.fatherFrameChanged
  do INNER
  #);
enabledChangedAction: action
  (# eventType::< theEventhandler.enabledChanged
  do INNER
  #);
enableTargetAction: action
  (# eventType::< theEventhandler.enableTarget
  do INNER
  #);
disableTargetAction: action
  (# eventType::< theEventhandler.disableTarget
  do INNER
  #);
borderVisibleChangedAction: action
  (# eventType::< theEventhandler.borderVisibleChanged;
  do INNER
  #);
borderStyleChangedAction: action
  (# eventType::< theEventhandler.borderStyleChanged;
  do INNER
  #);
theCursorChangedAction: action
  (# eventType::< theEventhandler.theCursorChanged;
  do INNER
  #);
hiliteChangedAction: action
  (# eventType::< theEventhandler.hiliteChanged
  do INNER
  #);

-- separatorLib: attributes --
styleChangedAction: action
  (# eventType::< theEventhandler.styleChanged;
  do INNER
  #);

-- canvasLib: attributes --
childFrameChangedAction: action
  (# eventType::< theEventhandler.childFrameChanged
  do INNER
  #);
```

Chapter 12: The controlactions Library

The `controlactions` library defines the actions related to the events, related to the `interfaceObject`s, described in the `control` library.

Actions for controls

Using the controlactions Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `controlactions` must be included as follows:

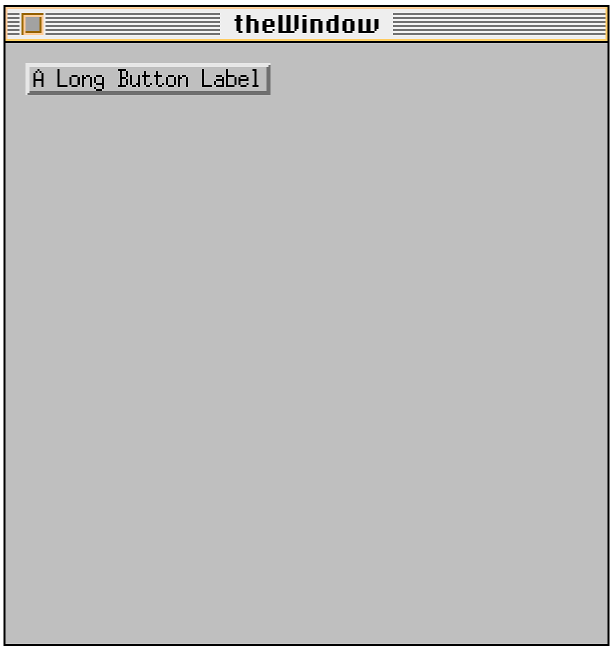
```
     ORIGIN '~beta/guienv/v1.4/guienv';
     INCLUDE '~beta/guienv/v1.4/controlactions'
     --- program: descriptor ---
     guienv(# lca: @labelChangedAction;
                ...
           do ...
                lca[] -> appendAction;
                ...
           #)
```

Examples of Use of the controlactions Fragment

This example illustrates how to use the labelChangedAction to adjust the size of a pushButton to the length of its label.

buttonactions.bet

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/controls';
INCLUDE '~beta/guienv/v1.4/controlsactions';
(* This demo shows how to use the labelChangedAction to adjust the
 * size of a pushButton to the length of its label.  The action is
 * created by remote access to show that actions can be added without
 * specializing the button.
 *)
--- program: descriptor ---
guienv
(# theWindow: @window
     (# theLabelChanged: @aButton.labelChangedAction
          (# theTextStyle: ^textStyle; widthOfLabel: @integer;
             lw,lh: @integer
          do aButton.size -> (lw,lh);
             aButton.style -> theTextStyle[];
             aButton.label -> theTextStyle.widthOfText ->
widthOfLabel;
             (if (lw < widthOfLabel + 6) then
                 widthOfLabel + 6 -> lw
             if);
             (if (lh < theTextStyle.lineHeight + 2) then
                 theTextStyle.lineHeight + 2 -> lh
             if);
             (lw,lh) -> aButton.size
          #);
        aButton: @pushButton;
        eventhandler::
          (# onAboutToClose:: (# do terminate #) #);
        open::
          (#
          do (40,40) -> position;
             (300,300) -> size;
             aButton.open;
             (10,10) -> aButton.position;
             (50,16) -> aButton.size;
             'Button1' -> aButton.label;
             theLabelChanged[] -> aButton.appendAction;
             'A Long Button Label' -> aButton.label
          #)
     #)
do theWindow.open
#)
```



Interface Descriptions of the controlactions Library

```
ORIGIN 'controls';
INCLUDE 'guienvactions';
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
-- scrollbarLib: attributes --
thumbMovedAction: action
  (# eventType::< theEventhandler.thumbMoved
  do INNER
  #);
pageDownAction: action
  (# eventType::< theEventhandler.pageDown
  do INNER
  #);
pageUpAction: action
  (# eventType::< theEventhandler.pageUp
  do INNER
  #);
buttonDownAction: action
  (# eventType::< theEventhandler.buttonDown
  do INNER
  #);
buttonUpAction: action
  (# eventType::< theEventhandler.buttonUp
  do INNER
  #);
pageScrollAmountChangedAction: action
  (# eventType::< theEventhandler.pageScrollAmountChanged
  do INNER
  #);
scrollAmountChangedAction: action
  (# eventType::< theEventhandler.scrollAmountChanged
  do INNER
  #);
maxValueChangedAction: action
  (# eventType::< theEventhandler.maxValueChanged
  do INNER
  #);
valueChangedAction: action
  (# eventType::< theEventhandler.valueChanged
  do INNER
  #);

-- buttonLib: attributes --
labelChangedAction: action
  (# eventType::< theEventhandler.labelChanged
  do INNER;
  #);
styleChangedAction: action
```

```
  (# eventType::< theEventhandler.styleChanged
  do INNER
  #);

-- iconButtonLib: attributes --
showLabelChangedAction: action
  (# eventType::< theEventhandler.showLabelChanged;
  do INNER
  #);
iconChangedAction: action
  (# eventType::< theEventhandler.iconChanged
  do INNER;
  #);

-- optionButtonLib: attributes --
currentItemChangedAction: action
  (# eventType::< theEventhandler.currentItemChanged
  do INNER
  #);
popUpMenuChangedAction: action
  (# eventType::< theEventhandler.popUpMenuChanged;
  do INNER
  #);

-- toggleButtonLib: attributes --
stateChangedAction: action
  (# eventType::< theEventhandler.stateChanged;
  do INNER
  #);
```

Chapter 13: The fieldsactions Library

Actions for fields

The `fieldsactions` library defines the actions related to the events, related to the `interfaceObjects`, described in the `fields` library.

Using the fieldsactions Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `fieldsactions` must be included as follows:

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/fieldsactions'
--- program: descriptor ---
guienv(# bca: @beforeChangeAction;
         ...
      do ...
         bca[] -> appendAction;
         ...
      #)
```

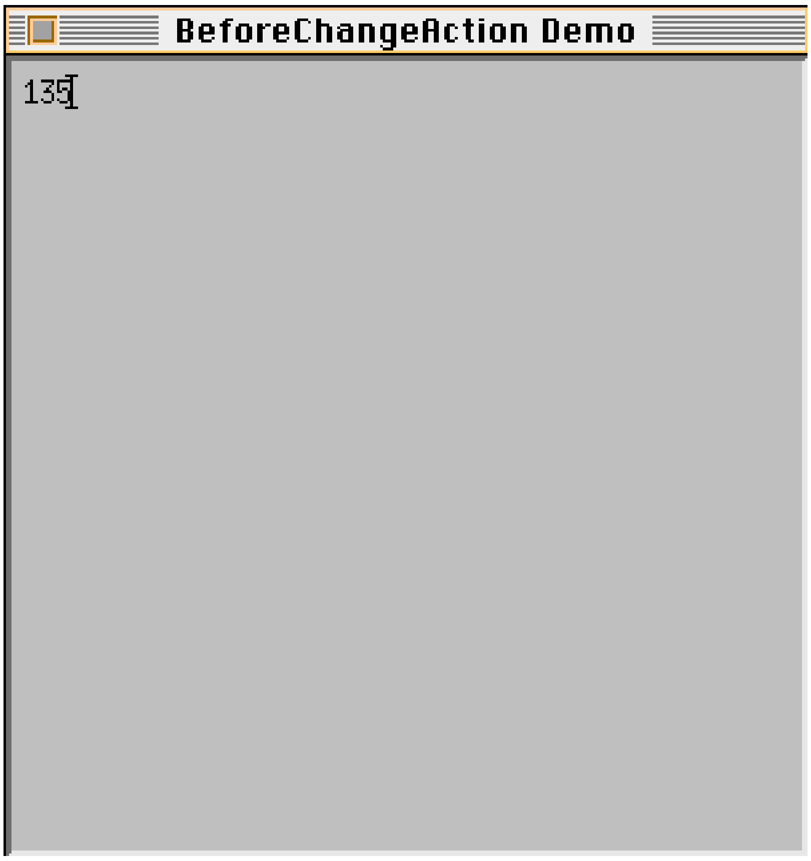
Examples of Use of the fieldsactions Fragment

This example illustrates how a beforeChangeAction can be udes to 'eat' every second keystroke in a textField.

textfield-actions.bet

```
ORIGIN '~beta/guienv/v1.4/guienv';
INCLUDE '~beta/guienv/v1.4/fields';
INCLUDE '~beta/guienv/v1.4/fieldsactions';
INCLUDE '~beta/guienv/v1.4/controls';
(* This is a silly demo that shows how a beforeChangeAction can be
 * used to 'eat' every second keystroke in a textField.
 *)
--- program: descriptor ---
guienv
(# allowEdit: @boolean;
   theWindow: @window
     (# theTextField: @textField
          (# aBeforeChangeAction: @beforeChangeAction
               (# do not allowEdit -> allowEdit #);
             eventHandler::
               (# onBeforeChange::
```

```
                        (# do allowEdit -> allow #);
                   #);
                 open::
                   (#
                   do true -> bindBottom -> bindRight;
                      aBeforeChangeAction[] -> appendAction
                   #)
              #);
            eventhandler::
              (# onAboutToClose:: (# do terminate #) #);
            open::
              (#
              do 'BeforeChangeAction Demo' -> title;
                 (40,40) -> position;
                 (300,300) -> size;
                 true -> allowEdit;
                 theTextfield.open;
                 (300,300) -> theTextfield.size
              #)
       #)
do theWindow.open
#)
```



```
135
```

Interface Descriptions of the fieldsactions Library

```
ORIGIN 'fields';
INCLUDE 'guienvactions';
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
-- textfieldLib: attributes --
textChangedAction: action
  (# eventType::< theEventhandler.textChanged
  do INNER;
  #);
beforeChangeAction: action
  (# eventType::< theEventhandler.beforeChange;
  do INNER;
  #);
```

Chapter 14: The guienvall Library

The entire Lidskjalv framework

'The `guienvall` library is a utility fragment, including all the Lidskjalv fragments. This library might be useful for the first-time user of Lidskjalv, since he then avoids being concerned with in which library a particular facility is defined. However, please remember, that using the `guienvall` library will increase your executable, since far to many facilities will be linked into your application.

Using the guienvall Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `guienvall` must be included as follows:

```
ORIGIN '~beta/guienv/v1.4/guienvall';
--- program: descriptor ---
guienv(# pb: @pushButton;
         ...
      do ...
         ... -> pb.label;
         ...
      #)
```

Interface Descriptions of the guienvall Library

```
ORIGIN 'guienv';
INCLUDE 'stddialogs';
INCLUDE 'controls';
INCLUDE 'fields';
INCLUDE 'figureitems';
INCLUDE 'scrolllists';
INCLUDE 'raster';
INCLUDE 'graphmath';
INCLUDE 'graphics';
INCLUDE 'styledtext';
INCLUDE 'guienvactions';
INCLUDE 'controlsactions';
INCLUDE 'fieldsactions';
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *)
[[ (* deliberate empty fragment file *)
---]]
```

Chapter 15: The guienvsystemenv Library

The `guienvsystemenv` library is intended to be used by application, utilizing both Lidskjalv and concurrency. Please refer to the proper manuals for more information on the concurrency facilities.

Concurrency and Lidskjalv

Using the guienvsystemenv Library

Remember that in order to utilize this extension to Lidskjalv, the fragment `guienvsystemenv` must be utilized as follows:

```
ORIGIN 'guienvsystemenv';
--- program: descriptor ---
systemEnv
(# setWindowEnv::< (# do myWindowEnv[] -> theWindowEnv[] #);
   myWindowEnv: @guienv (# ... #);
   ...
#)
```

Interface Descriptions of the guienvsystemenv Library

```
ORIGIN '~beta/basiclib/v1.5/basicsystemenv';
BODY 'private/X11/guienvxsystemenvbody';
(*
 * COPYRIGHT
 *       Copyright (C) Mjolner Informatics, 1991-96
 *       All rights reserved.
 *
 * GUIENVSYSTEMENV
 * ===============
 *
 * Use this fragment as the ORIGIN for concurrent programs
 * using the GUIENV libraries.
 *
 * The program should look something like:
 *
 * ORIGIN 'guienvsystemenv';
 * --- program: descriptor ---
 * systemEnv
 * (# setWindowEnv::< (# do myWindowEnv[] -> theWindowEnv[] #);
 *    myWindowEnv: @guienv (# ... #);
 *    ...
 * #)
 *
 * The 'setWindowEnv' virtual and 'theWindowEnv' reference are
 * declared in basicsystemenv.
 *
 * The guienv instance (myWindowEnv) assigned to theWindowEnv is
 * used for scheduling purposes to allow BETA coroutines to
 * cooperate with the event driven user interface.
 *
 * For concurrency details, see basicsystemenv.
 *)
[[ (* deliberate empty fragment file *)
---]]
```

Appendix A: Demo Programs

Overview of the available demo programs

The demo programs in this manual can be found in the reference demo subdirectory in the guienv directory. The location of the directory in installation-dependent – ask the systems administrator – the default location is :

`~beta/guienv/v1.4/demo/ReferenceDemos`.

The demo directory contains many more demo programs than is included in this manual. Please inspect the demo directory for other illustrative demo programs. The following is a short description of the demos in the demo directory:

1) `simplewindow.bet`

   This demo shows how to create a very simple window and it illustrates the activate/deactivate event.

2) `windowWithStandardMenubar.bet`

   This demo shows how to create a simple `window` with a `standardMenubar` where the file menu only has one `menuitem`. It also illustrates how to further bind the `onMouseDown`, `onMouseUp` and `onKeyDown` event patterns.

3) `file.bet`

   This demo shows how to use the `fileSelectionDialog` pattern. The name of the file selected in the dialog is printed on the screen.

4) `button.bet`

   This demo shows how to create a `window` with two `pushButton`s, and how to give a `button` a new size on runtime.

5) `texteditor.bet`

   This demo shows how to build a simple `texteditor`.

6) `draw.bet`

   This demo gives an example of how you can draw lines and polygons with mouse using the figureitems `line` and `polygon`. Clicking with the left mouse button defines a node in the polygon/line, clicking with the right mouse button ends the definition of the polygon/line and draws it on the screen.

7) `textscrolllist.bet`

   This demo gives a simple example of how to use the `textScrollList` windowitem.

8) `containspoint.bet`

   This demo gives an example of how to use the `containsPoint` operation of a rectangle.

9) `drawbitmap.bet`

   This demo is an example showing how read a bitmap from a file, and using the `graphics` pattern to draw the bitmap on the screen.

10) `iconbutton.bet`

This demo shows how to use the `bitMap` pattern when creating an `iconButton` control. Each time you click in the window a new iconButton is created and positioned at the point where you click.

11) `keyboardactions.bet`

    This demo shows how to prepend/append actions to `keyDown` events in an `editText` control.

12) `buttonactions.bet`

    This demo shows how to use the `labelChangedAction` to adjust the size of a `pushButton` to the length of its label. The action is created by remote access to show that actions can be added without specializing the button.

13) `textfieldactions.bet`

    This is a silly demo that shows how a `beforeChangeAction` can be used to 'eat' every second keystroke in a `textField`.

Appendix B: Implementation Design

The implementation design for the Lidskjalv framework mostly consists in selecting the widgets and gadgets for implementing the various Lidskjalv components. Below is a table, showing these correspondences for the three target platforms for Lidskjalv: Motif, Macintosh, and Windows (Win32 API).

Design considerations on multiple platforms

Lidskjalv	Motif	Macintosh	Win32 API
interfaceObject	widget	superclass for menus, windows, controls, etc.	
menuBar	RowColumn created as a menubar	menubar	Menubar
menu	RowColumn created as a menu	menu	Pop-up Menu
window	TopLevelShell-WidgetClass	window	window
menuitem	CascadeButton/ PushButton/ ToggleButton	menuitem	menuitem
windowitem	DrawingArea	superclass for controls, texteditors, etc.	ChildWindow (except for figureItems)
canvas	simple specialization of Composite	object defining a local coordinate system with clipping	object defining a local coordinate system with clipping
scroller	ScrolledWindow	a canvas with scrollbars	a canvas with scrollbars
textEditor	ScrolledText	texteditor	MultiLine EDIT Control
control	simple specialization of Core	control (scrollbars, buttons, etc.)	CONTROL
button	simple specialization of Core	superclass for pushbutton, checkbox, etc.	Button Control
pushButton	PushButton	pushbutton	PushButton
iconButton	PushButton showing an image, but with a label	an icon with a name underneath (like the finder icons)	

optionButton	OptionButton	popupmenu control	STATIC CONTROL + DROPDOWNLIST
staticText	Label	statictext item	Specialized window item
toggleButton	*abstract class*	superclass for checkbox and radiobutton	superclass for checkbox and radiobutton
radioButton	ToggleButton with indicatorType = ONE_OF_MANY	radiobutton	Button Control with BS_RADIO-BUTTON style
checkBox	ToggleButton with indicatorType = MANY_OF_MANY	checkbox	Button Control with BS_CHECKBOX style
scrollbar	Scrollbar	scrollbar	SCROLLBAR Control
editText	Text without scrollbars configured as a singleline field	edittext item (used for dialogs)	SingleLine EDIT Control
textField	Text without scrollbars configured as a multiline field	multiline textfield with no scrollbars	MultiLine EDIT Control
scrollList	*abstract class*	superclass for scrolllists	LISTBOX Control
textScrollList	List	scrolllist with one scrollbar, like in the standard file dialog	LISTBOX Control

in interfaceObject:

event	callback	callback functions called when different events occurs	callback functions called when different events occurs
action	eventHandler	callback functions called when different events occurs	callback functions called when different events occurs
open	init (XtCreateWiget/ XtManageChild)	creating and displaying the object	creating and displaying the object
close	destroy (XtDestroyWidget)	removing the object from the screen	removing the object from the screen
mouseDown	buttonPress	mouseDown	WM_LBUTTOMDOWN, WM_MBUTTOMDOWN, WM_RBUTTOMDOWN
mouseUp	buttonRelease	mouseUp	WM_LBUTTOMUP, WM_MBUTTOMUP, WM_RBUTTOMUP

in menu:

name	The LabelString of the CascadeButton	The name of the menu, as it appears in	The name of the menu, as it appears in

	the menu is connected to	the menubar	the menubar

in window:

refresh	exposure	update event	WM_PAINT
target	keyBoardFocus	the object that handles the keydown events	the object that handles the keydown events
showModal	the window shown as SYSTEM_MODAL	the window used as a modal dialog	the window used as an application modal dialog

in windowitem:

position	x,y	the topleft corner of the objects bounding box	x,y
size	width,height	the width and height of the bounding box	nWidth,nHeight
bindLeft, etc.	geometry constraints in Form	resize constraints	resize constraints
show	map	show	SW_SHOW
hide	unmap	hide	SW_HIDE

in scrollbar:

scrollAmount	increment	how much the scrollbar scrolls when the arrows are pressed	how much the scrollbar scrolls when the arrows are pressed
pageScroll-Amount	pageIncrement	how much the scrollbar scrolls when the page area are clicked	how much the scrollbar scrolls when the page area are clicked

in button descendants:

label	labelString	name	Text of Control
textStyle	fontList	font,face,size of the name	font,face,size of the TEXT Control

in toggleButton descendants:

state	set	state	check state

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Index

The entries in the index are the identifiers defined in the public interface of the libraries: The minor level entries refer to identifiers defined local to the identifier of the major level entry. For those index entries referring to patterns with super- or subpatterns within the library, these patterns are specified in special sections of the minor level index for that identifier.

A

a 87, 89
aboutToClose 23
. superpattern
. . event 23
aboutToCloseAction 109
. superpattern
. . action 109
abstractScroller 64
. subpatterns
scroller 65
textEditor 64
. superpattern
. . canvas 64
AbstractScroller 55
action 16
. subpatterns
aboutToCloseAction 109
basicEventAction 109
beforeChangeAction 119
borderStyleChangedAction 110
borderVisibleChangedAction 110
buttonDownAction 115
buttonUpAction 115
childFrameChangedAction 111
currentItemChangedAction 116
disableTargetAction 110
enabledChangedAction 110
enableTargetAction 110
fatherFrameChangedAction 110
frameChangedAction 110
hiliteChangedAction 110
iconChangedAction 116
labelChangedAction 115
maxValueChangedAction 115
pageDownAction 115
pageScrollAmountChangedAction.... 115
pageUpAction 115
popUpMenuChangedAction 116
scrollAmountChangedAction 115
selectAction 110
showLabelChangedAction 116
stateChangedAction 116
styleChangedAction 110, 115
textChangedAction 119
theCursorChangedAction 110
thumbMovedAction 115
valueChangedAction 115
visibleChangedAction 110
action 6, 107, 113, 117, 128
activate 15
. superpattern
. . basicEvent 15
activateAction 109
. superpattern
. . basicEventAction 109
add 32, 85
addDisplay 33
alertUser 42
. superpattern
. . messageDialog 42
alertUser 39
all 61
allocate 89
allow 55
altKey 13
. superpattern
. . booleanValue 13
andBlend 37
angle 89
append 18, 21, 78
append 6
appendAction 16
appendAction 6
appendMenubar 18
appendMenubar 6
applicationMenubar 12
applicationMenubar 5, 6
arrow 37
ascent 34
. superpattern
. . integerValue 34
Athena 1
attach 20
attach 7
availableSizes 35

B

b 87
backgroundColor 71, 72, 95
basicEvent 13
. superpattern
. . event 13
basicEventAction 109
. subpatterns
activateAction 109
deactivateAction 109
idleAction 109
keyEventAction 109
mouseEventAction 109
refreshAction 109
. superpattern
. . action 109
beep 36
beforeChange 60
. superpattern
. . event 60
beforeChangeAction 119
. superpattern
. . action 119
Bifrost 67
bifrostprivate 37
bindBottom 28
bindBottom 8
bindLeft 28
bindLeft 8, 129
bindRight 28
bindRight 8
bindTop 28
bindTop 8
bitmap 102
. superpattern
. . raster 102
bitmap 99
bitmapPrivatePart 102
black 37
blue 35
bold 37
border 29
borderStyleChanged 27
. superpattern
. . event 27
borderStyleChangedAction 110
. superpattern
. . action 110
borderStyles 37
borderVisibleChanged 27
. superpattern
. . event 27
borderVisibleChangedAction 110
. superpattern
. . action 110
bottom 86
bottomRight 86
bounds 89
bringBack 25
bringBack 7
bringBehind 25
bringBehind 7
bringToFront 25
bringToFront 7
busyCursor 36
button 50
. subpatterns
iconButton 51
optionButton 52
pushButton 51
staticText 51
toggleButton 52
. superpattern
. . control 50
Button 44, 127
button text 45
buttonDown 48
. superpattern
. . event 48
buttonDownAction 115
. superpattern
. . action 115
buttonState 14, 36
. superpattern
. . integerValue 14, 36
buttonUp 49
. superpattern
. . event 49
buttonUpAction 115
. superpattern
. . action 115

C

c 87
canvas 31
. subpatterns
abstractScroller 64
. superpattern
. . windowitem 31
canvas 7, 8, 55, 127
cb 38
ch 14
checkBox 53
. superpattern
. . toggleButton 53
checkBox 43, 45, 128
checked 19
checked 7
childFrameChanged 32
. superpattern
. . event 32
childFrameChangedAction 111
. superpattern
. . action 111
circleAngle 89
clear 18, 22, 32, 60, 79
clear 6
clearContents 35
clearMenuitem 23
clipboard 35

close16, 19, 22, 31, 33, 48, 50, 51, 52, 53, 54, 59, 64, 65, 80, 81
close... 5, 128
closeMenuitem..................................... 22
closePrinter.. 12
color.. 35
compressedPixmap...............................103
. superpattern
. . pixmap 103
compressedPixmap................................ 99
Concurrency and Lidskjalv 123
connection... 33
containsPoint.................................. 87, 90
. superpattern
. . booleanValue............................ 87
containsRectangle 91
. superpattern
. . booleanValue............................ 91
contents...................... 26, 54, 59, 61, 62, 64
contents... 44, 55
contentsType.................................. 64, 65
contentsType.. 55
control 48
. subpatterns
button 50
editText....................................... 53
scrollbar...................................... 48
. superpattern
. . windowitem.............................. 48
control 3, 44
control 127
controlactions.....................................113
controlKey... 13
. superpattern
. . booleanValue............................ 13
controls.. 43
controlsactions 3, 4
copy.......................... 37, 60, 102, 103, 104
copyMenuitem 23
cos_a.. 89
cPixmapPrivatePart..............................104
cross.. 37
curPt.. 30
currentItem... 52
currentItem... 45
currentItemChanged 52
. superpattern
. . event...................................... 52
currentItemChangedAction.....................116
. superpattern
. . action.....................................116
cursor 34
cursors... 37
cursorType 30
cursorType 8
cut... 60
cutMenuitem.. 23
cx 89
cy 89

D

d 87
deactivate..16
. superpattern
. . basicEvent 16
deactivateAction.................................. 109
. superpattern
. . basicEventAction 109
debuggraphic 37
defaultButton.......................................54
DefaultButton 45
defaultStyle 62
delay 15
delete 18, 21, 64, 78
delete 6
deleteAction 16
deleteAction 6
deleteFirst 79
deleteLast...79
deleteMenubar 18
deleteMenubar 6
Demo Programs...................................125
descent 34
. superpattern
. . integerValue..............................34
deselect..80
detach..21
detach... 7
dialog..41
. subpatterns
fileDialog.....................................42
messageDialog..............................41
difference...90
disable...22, 29
disable...7, 8
disableEventType 17
disableEventType 5, 6
disableTarget 27
. superpattern
. . event..27
disableTargetAction............................. 110
. superpattern
. . action.................................... 110
displaywarnings 37
dispose 89, 101, 102, 103
dkGray 37
doSetup 37
doTrace 37
doubleClick 14
. superpattern
. . booleanValue 14
doubleDashedLine 37
doubleLine 37
drag 30
dragOutline 8
dragResize.. 8
draw..96
drawLine..96
drawLine..93
drawOval 97

drawPolygon........96
drawRaster........97
drawRect........96
drawRoundRect........97
drawSlice........97
drawSpot........96
drawSpot........93
drawText........96
drawTo........96
drawTo........93
dynamicMenuitem........20
. superpattern
. . menuitem........20
dynamicMenuItem........6, 7

E

editMenu........23
editMenu........6
editText........53
. superpattern
. . control........53
editText........43, 44, 55, 128
empty........32, 89
. superpattern
. . booleanValue........32
enable........22, 29
enable........7, 8
enabled........22, 28
. superpattern
. . booleanValue........22
enabledChanged........26
. superpattern
. . event........26
enabledChangedAction........110
. superpattern
. . action........110
enableEventType........16
enableEventType........5, 6
enableTarget........27
. superpattern
. . event........27
enableTargetAction........110
. superpattern
. . action........110
end........62, 72
. superpattern
. . integerValue........62
end........67
endAngle........74
endAngle........67
erase........37
etchedIn........37
etchedOut........37
event........13
event........128
Event handling........5
eventhandler13, 19, 20, 21, 23, 26, 31, 32, 48, 50, 51, 52, 53, 54, 59, 65, 72, 73, 74, 80
eventhandler........5

F

face........34
father........27
father........8
fatherFrameChanged........26
. superpattern
. . event........26
fatherFrameChangedAction........110
. superpattern
. . action........110
fields........3, 55
fieldsactions........3, 117
fieldssactions........4
figureItem........71
. subpatterns
line........72
shape........72
. superpattern
. . windowitem........71
figureItem........67
figureitems........3, 67
fileCreationDialog........42
. superpattern
. . fileDialog........42
fileCreationDialog........39
fileDialog........42
. subpatterns
fileCreationDialog........42
fileSelectionDialog........42
. superpattern
. . dialog........42
fileMenu........23
fileMenu........6
fileName........12
fileSelectionDialog........42
. superpattern
. . fileDialog........42
fileSelectionDialog........39
fill72
Fill........67
fillOval........97
fillPolygon........97
fillRect........97
fillRoundRect........97
fillSlice........97
first........79
. superpattern
. . integerValue........79
floating........24
floating........7
foregroundColor........71, 72, 95
frame........24, 27
frame........7, 8
frameChanged........26
. superpattern
. . event........26
frameChangedAction........110
. superpattern
. . action........110

G

get.. 62
getChar.. 61
getInverse... 88
getItemRectangle................................. 79
getLayout17, 19, 20, 22, 31, 33, 48, 50, 51, 52, 53, 54, 59, 64, 65, 72, 73, 74, 81, 82
getMenuitemByNumber......................... 22
getPixel.............................. 101, 102, 103
getText.. 81
getText.. 75
global.. 33
globalPosition................................. 14, 35
globalToLocal..................................... 33
graphics... 95
graphics..3, 93
graphmath.......................................3, 83
gray... 37
graymap..102
. superpattern
. . raster.....................................102
graymap.. 99
graymapPrivatePart.............................103
green.. 35
GUIenv... 12
guienv...3, 5
guienvactions.................................. 3, 107
guienvall.....................................3, 4, 121
guienvsystemenv...........................3, 4, 123

H

h 85
has... 80
. superpattern
. . booleanValue............................ 80
hasText... 35
. superpattern
. . booleanValue............................ 35
height..101
. superpattern
. . integerValue............................101
height... 99
hide... 25, 28
hide...7, 8, 129
hilite... 28
hiliteChanged...................................... 27
. superpattern
. . event...................................... 27
hiliteChangedAction............................110
. superpattern
. . action.....................................110
hotspot..101
hr 89

I

iBeam... 37
icon.. 51
iconButton.. 51
. superpattern
. . button...................................... 51
iconButton.....................................44, 127
iconChanged..51
. superpattern
. . event..51
iconChangedAction..............................116
. superpattern
. . action.......................................116
ID88
idle...15
. superpattern
. . basicEvent................................15
idleAction..109
. superpattern
. . basicEventAction......................109
IDmatrix..88
Implementation Design.........................127
init......................................101, 102, 103
insert..63, 78
inset...86, 90
insideRectangle.................................24, 29
interfaceObject.....................................13
interfaceObject.............5, 107, 113, 117, 127
interfaceObjectException.........................17
. superpattern
. . exception..................................17
intersection......................................86, 90
. superpattern
. . booleanValue.............................86
inverse...87
inverseTransformPoint............................88
inverseTransformRectangle......................88
invertCopy..37
isEmpty...87, 91
. superpattern
. . booleanValue.............................87
isEqual.......................................85, 87, 91
. superpattern
. . booleanValue.............................85
isOneStyle..62
italic..37
itemHeight..79
itx88
ity88

K

key..19
key... 7
keyDown...15
. superpattern
. . keyEvent...................................15
keyDownAction.....................................109
. superpattern
. . keyEventAction........................109
keyEvent...14
. superpattern
. . basicEvent.................................14
keyEventAction.....................................109
. subpatterns
keyDownAction...........................109
. superpattern
. . basicEventAction......................109

L

label....50
label....44
label....129
labelChanged....50
. superpattern
. . event....50
labelChangedAction....115
. superpattern
. . action....115
last....80
. superpattern
. . integerValue....80
layout....17
layout....5
layoutType17, 20, 22, 31, 33, 48, 50, 51, 52, 53, 54, 59, 64, 65, 72, 73, 74, 81
layoutType....5
leading....34
. superpattern
. . integerValue....34
left....86
length....50, 61
. superpattern
. . integerValue....50
length....44
Lidskjalv....1, 127
Lidskjalv application....8
Lidskjalv framework....121
lightweight drawing....93
line....72
. superpattern
. . figureItem....72
Line....67
lineHeight....34
. superpattern
. . integerValue....34
local....33
localPosition....14
localToGlobal....33
ltGray....37

M

Macintosh....127
margin....63
matrix....87
. subpatterns
moveMatrix....88
rotateMatrix....88
scaleMatrix....88
matrix....83
maxChWidth....34
. superpattern
. . integerValue....34
maxSize....25
maxValue....49
maxValue....44
maxValueChanged....49
. superpattern
. . event....49
maxValueChangedAction....115
. superpattern
. . action....115
menu....19
. superpattern
. . interfaceObject....19
menu....5, 6, 127
menuAction....21
menuAction....7
menubar....17
. superpattern
. . interfaceObject....17
menuBar....5, 6, 127
menubarType....13, 24
menubarType....6, 7
menubarVisible....24
menubarVisible....7
menuitem....19
. superpattern
. . interfaceObject....19
menuItem....6, 7, 127
messageDialog....41
. subpatterns
alertUser....42
noteUser....41
. superpattern
. . dialog....41
metaKey....13
. superpattern
. . booleanValue....13
Microsoft Windows....1
minSize....25
mode....95
Motif....1
mouse....35
mouseDovn....5
mouseDown....15
. superpattern
. . mouseEvent....15
mouseDown....128
mouseDownAction....109
. superpattern
. . mouseEventAction....109
mouseDownAction....6
mouseEvent....14
. superpattern
. . basicEvent....14
mouseEventAction....109
. subpatterns
mouseDownAction....109
mouseUpAction....109
. superpattern
. . basicEventAction....109
mouseMove....30
mousePress....30
mouseRelease....30
mouseUp....15
. superpattern
. . mouseEvent....15
mouseUp....128
mouseUpAction....109

. superpattern
. . mouseEventAction.....................109
move 28, 96
move 8
moveMatrix 88
. superpattern
. . matrix...................................... 88
moveTo... 96
moveTo... 93
movie 59
movieField 59
. superpattern
. . windowItem 59
MovieField... 55
mult.. 87
multiple platforms................................127

N

name 19, 34
name 6, 7
name 128
newMenuitem 22
noOfMenuitems.................................... 22
. superpattern
. . integerValue 22
notAndBlend... 37
noteUser.. 41
. superpattern
. . messageDialog.......................... 41
noteUser.. 39
notOpenedError 17
notOpenedException.............................. 17
. superpattern
. . interfaceObjectException 17
notOrBlend... 37
numberOfItems..................................... 78
. superpattern
. . integerValue 78

O

offset.. 86, 89
onAboutToClose.................................... 23
onAboutToClose.....................................7
onActivate 16, 23, 32, 49, 81
onActivate 6, 7
onBeforeChange 60
onBeforeChange 55
onBorderStyleChanged 27
onBorderVisibleChanged......................... 27
onButtonDown 48
onButtonUp 49
onChildFrameChanged........................... 32
onCurrentItemChanged 52
onCurrentItemChanged 45
onDeactivate 16, 23, 32, 49, 81
onDeactivate 6
onDisableTarget 27, 54, 60
onEnabledChanged................................ 26
onEnableTarget 27, 54, 60
onFatherFrameChanged 26
onFatherFrameChanged 7
onFrameChanged26, 32, 49, 50, 54, 60, 65, 72, 74, 81
onFrameChanged.................................... 7
onHiliteChanged......................27, 51, 72, 73
onIconChanged 51
onIdle.......................................12, 15, 60
onIdle.. 6
onKeyDown 15, 54, 60
onKeyDown 6
onLabelChanged...............................50, 52
onLabelChanged....................................44
onMaxValueChanged 49
onMouseDown.........15, 32, 49, 50, 54, 60, 81
onMouseDown....................................... 6
onMouseUp................................15, 32, 60
onMouseUp..6, 7
onOpenDocument..................................12
onPageDown 48
onPageScrollAmountChanged..................49
onPageUp 48
onPageUp 44
onPopUpMenuChanged 52
onPopupMenuChanged...........................45
onPrintDocument...................................12
onRefresh15, 27, 31, 32, 49, 50, 51, 54, 60, 72, 73, 74, 81
onRefresh... 6
onScrollAmountChanged 49
onSelect................................19, 20, 21, 81
onSelect..6, 7
onShowLabelChanged 51
onShowLabelChanged 44
onStartApplication.................................12
onStateChanged 53
onStateChanged 45
onStatus..20, 21
. superpattern
. . booleanValue 20, 21
onStatus... 7
onStyleChanged 31, 50, 52
onStyleChanged 44
onTextChanged 60
onTextChanged 55
onTheCursorChanged 27
onThumbMoved....................................48
onThumbMoved....................................44
onValueChanged 49
onVisibilityChanged............................... 7
onVisibleChanged.................................26
open16, 18, 20, 22, 23, 30, 31, 32, 33, 48, 50, 51, 52, 53, 54, 59, 64, 6
open...5, 128
openMenuitem 22
openPage 31, 33
openPrinter..12
optionButton...52
. superpattern
. . button 52
optionButton.............................43, 45, 128
orBlend..37
oval...73
. superpattern

. . shape 73
Oval........67
ovalAngle 88

P

pageDown........48
. superpattern
. . event........48
pageDownAction........115
. superpattern
. . action........115
pageScrollAmount........49
pageScrollAmount........129
pageScrollAmountChanged........49
. superpattern
. . event........49
pageScrollAmountChangedAction........115
. superpattern
. . action........115
pageSetUpMenuitem........23
pageUp........48
. superpattern
. . event........48
pageUpAction........115
. superpattern
. . action........115
paste 60
pasteMenuitem........23
patterns........37
pen........71, 95
Pen 67, 93
pixel........101, 102, 103
pixmap 103
. subpatterns
compressedPixmap 103
. superpattern
. . raster........103
pixmap 99
pixmapPrivatePart........103
plain........37
plus........37
point 85
point 83
points 74
points 67
polygon 74
. superpattern
. . shape 74
Polygon 67
popUp 22
popUp 6
popupMenu 52
popUpMenu 45
popUpMenuChanged........52
. superpattern
. . event........52
popUpMenuChangedAction........116
. superpattern
. . action........116
position........20, 24, 27
. superpattern
. . IntegerValue 20
position 7, 8, 129
posToPt........61
prepend 78
prependAction 16
prependAction 6
prevPt 30
print........31, 33
printMenuitem........23
private17, 19, 20, 22, 31, 33, 34, 35, 37, 48, 50, 51, 52,
pToAngle 87
ptToPos........61
pushButton........51
. superpattern
. . button 51
pushButton........ 43, 44, 127
putLayout17, 19, 20, 22, 31, 33, 48, 50, 51, 52, 53, 54,
putPixel........101, 102, 103

Q

quitMenuitem........23

R

radioButton 53
. superpattern
. . toggleButton 53
radioButton 44, 45, 128
raster........ 101
. subpatterns
bitmap........ 102
graymap 102
pixmap........ 103
raster........3, 99
raster image........99
rasterprivatePart........ 102
readFromPBMfile........ 102
readFromPGMfile 103
readFromPPMfile........103, 104
readFromX11file........102, 103
rect........73
. superpattern
. . shape 73
Rect........67
rectangle........85
rectangle........83
red........35
refresh........15
. superpattern
. . basicEvent 15
refresh........5
refresh........ 129
refreshAction........ 109
. superpattern
. . basicEventAction........ 109
refreshAction........6
region 89
region 83
remove 32
removeDisplay........33

replaceMenubar 18
replaceMenubar 6
resize 30
revertMenuitem 22
right 86
rotateMatrix 88
. superpattern
. . matrix 88
roundness 73
roundness 67
roundRect 73
. superpattern
. . shape 73
RoundRect 67

S

saveAsMenuitem 22
saveMenuitem 22
scaleMatrix 88
. superpattern
. . matrix 88
scaleToFit 59
scan 18, 21, 32, 80
scan 6
scanSelection 80
scanText 61
scanTextWithStyle 63
screenRectangle 36
screenRgn 36
scroll 64, 65
scrollAmount 49
scrollAmount 44
scrollAmount 129
scrollAmountChanged 49
. superpattern
. . event 49
scrollAmountChangedAction 115
. superpattern
. . action 115
scrollbar 48
. superpattern
. . control 48
scrollbar 43, 55, 128
Scrollbars 44
scroller 65
. superpattern
. . abstractScroller 65
Scroller 55, 127
scrollIntoView 62, 79
scrollList 78
. subpatterns
textScrollList 81
. superpattern
. . windowItem 78
scrolllist 3, 75, 128
scrolllists 75
select 19, 20, 80
. superpattern
. . event 19, 20, 80
selectAction 110
. superpattern
. . action 110
selection 32, 61, 79
separator 21, 31
. superpattern
. . menuitem..................................21
. . windowitem 21
separatorStyles 37
set32, 62, 86
setFromPoints 86
setFromRectangle 89
setOneFace 63
setOneFont 63
setOneSize 62
setOneStyle 63
setText 81
setText 75
setupDone 38
shadowIn 37
shadowOut 37
shape 72
. subpatterns
oval 73
polygon 74
rect 73
roundRect 73
wedge 74
. superpattern
. . figureItem 72
Shape 67
sharedWindow 33
. superpattern
. . window 33
sharedWindow 5
shiftKey 13
. superpattern
. . booleanValue 13
show 25, 28
show 7, 8, 129
showLabel 51
showLabel 45
showLabelChanged 51
. superpattern
. . event 51
showLabelChangedAction 116
. superpattern
. . action 116
showModal 25
showModal 7
showModal 129
simple 37
singleDashedLine 37
singleLine 37
singleSelection 79
sin_a 89
size 24, 28, 34, 71, 86, 95
size 7, 8, 129
standardEditMenu 23
. superpattern
. . menu 23

standardEditMenu.................................. 6
standardFileMenu..................................22
. superpattern
. . menu.......................................22
standardFileMenu.................................. 6
standardMenubar..................................22
. superpattern
. . menubar 22
StandardMenubar 5, 6
start..62, 72
. superpattern
. . integerValue.............................62
start...67
startAngle 74
startAngle 67
state 53
state 45, 129
stateChanged 53
. superpattern
. . event.......................................53
stateChangedAction 116
. superpattern
. . action....................................116
staticText 51
. superpattern
. . button 51
staticText 43, 44, 128
stddialogs... 3, 39
stipple 71, 95
style 29, 31, 50, 53, 81, 96
style...44, 75
styleChanged 31, 50
. superpattern
. . event..................................31, 50
styleChangedAction 110, 115
. superpattern
. . action....................................110
styled text..105
styledText 106
. superpattern
. . text.......................................106
styledtext 3, 105
styleInfo 106
subMenu...20
subMenu.. 7
subtract...85
symDiff 90
system 36
systemTextStyle 36

T

target..26
target..7, 129
teleCursor 34
. superpattern
. . cursor......................................34
terminate..12
text
. subpatterns
styledText 106
textChanged 60
. superpattern
. . event 60
textChangedAction 119
. superpattern
. . action.................................... 119
textContents 35
textEditor...64
. superpattern
. . abstractScroller..........................64
TextEditor.................................... 55, 127
textFaces 37
textField 59
. superpattern
. . windowItem..............................59
TextField..................................... 55, 128
textScrollList..81
. superpattern
. . scrollList 81
TextScrollList................................ 75, 128
textStyle 34
textStyle 129
theAction...20
theButton...54
theCursor...29
theCursor...8
theCursorChanged 27
. superpattern
. . event 27
theCursorChangedAction...................... 110
. superpattern
. . action.................................... 110
theEditMenu...23
theEditMenu...6
theEventhandler 13
theFileMenu 23
theFileMenu 6
theMenubar....................................13, 23
theMenubar..7
theMenuitem 21
theName 19
theta..88
theTeleCursor 34
thumbMoved 48
. superpattern
. . event 48
thumbMovedAction 115
. superpattern
. . action.................................... 115
tile..72
title...24
title...7
toggleButton...52
. subpatterns
checkBox.....................................53
radioButton 53
. superpattern
. . button 52
ToggleButton 45, 128
top..86

topLeft.. 85
trace.. 37
trackMouse... 30
transferMode... 36
transferModes....................................... 36
transformPoint....................................... 88
transformRectangle................................ 88
tx 87
ty 87

U

undoMenuitem...................................... 23
union.. 86, 90
update... 25, 30

V

v 85
value.. 49
value.. 44
valueChanged.. 49
. superpattern
. . event....................................... 49
valueChangedAction............................115
. superpattern
. . action.....................................115
vector graphics...................................... 67
vertical... 31, 49
vertical.. 44
visible.. 28, 29
visibleChanged...................................... 26
. superpattern
. . event....................................... 26
visibleChangedAction...........................110
. superpattern
. . action.....................................110
vr 89

W

wait.. 36
watch.. 37
wedge... 74
. superpattern
. . shape....................................... 74
Wedge... 67
when.. 14
. superpattern
. . integerValue............................. 14
white.. 37
width...101
. superpattern
. . integerValue............................101
width.. 99
widthOfChar... 34
. superpattern
. . integerValue............................. 34
widthOfText... 35
. superpattern
. . integerValue............................. 35
Win32 API..127
window... 23
. superpattern
. . interfaceObject...........................23
window...................................... 5, 7, 127
windowitem..26
. subpatterns
control...48
figureItem....................................71
movieField...................................59
scrollList......................................78
textField......................................59
. superpattern
. . interfaceObject...........................26
windowItem................7, 43, 55, 67, 75, 127
Windows..127
Windows 95.. 1
Windows NT... 1
writeToPBMfile..................................102
writeToPGMfile..................................102
writeToPPMfile............................ 103, 104
writeToX11file............................. 102, 103

X

x 89
X Window System.................................. 1
xorBlend..37
XsystemEnvHandleCallback.....................38
XsystemEnvHandleCallbackP...................38
XsystemEnvPresent...............................38

Y

y 89