

# Lidskjalv: User Interface Framework – Reference Manual

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# 1 Overview of Lidskjalv

Lidskjalv<sup>[1]</sup> 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, Windows 2000, Windows 98, or Windows 95).

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

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.

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



## 2 The Lidskjalv Libraries

The Lidskjalv libraries consists of 15 libraries (fragments):

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

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

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

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

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

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

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

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

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

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

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.

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`.

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

## 2.1 Utilities Libraries

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 Lidskjalv directory tree. It should be noted, that these libraries contains many very useful facilities, but these libraries are not described in this manual. Please refer to the [utilities interface files](#) for details of the very many useful patterns.

## 2.2 Multimedia Libraries

Lidskjalv contains two important libraries for controlling multimedia devices (CD players and QuickTime movies) on the Windows and Macintosh platforms (Unix platform not supported). These facilities are placed in the `multimedia` sub-directory of the Lidskjalv directory tree. Please refer to the [multimedia interface files](#) for details of these useful patterns.

## 2.3 OpenGL Libraries

Lidskjalv contains libraries for making OpenGL graphics. These facilities are placed in the `openGL` sub-directory of the Lidskjalv directory tree. It should, however, be noted that these libraries are not fully developed, and tested, and is included in this release 'as-is'. Please refer to the [OpenGL interface files](#) for details of these useful patterns.

## 3 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.

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` is the root of the hierarchy of interface components in Lidskjalv.
- `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` is a class, defining the facilities for menus, both menus of menubars, menus associated with buttons, and popup menus.
- `window` defines the facilities for defining and manipulation windows.

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` 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).
- Most attributes relate to event handling. `Event` is the superpattern for all event patterns (such as `mouseDown` and `refresh`). These events are invoked by the underlying system as the result of, e.g. user interactions.

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 particular events, defined for that type of `interfaceObject`.

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

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.

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 10–12.

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

## 3.1 Event handling

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.

## 3.2 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` 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` 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.

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 menu 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.

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).

The separator pattern is a special `menuItem` that inserts a vertical line in the menu to separate groups of items.

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` defines the following important attributes:

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

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

### 3.3 Window facilities

`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).
- `type` controls the appearance of the titlebar of the window: `palette`, `dialog` or `normal`.
- `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` 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`.
- `drag` and `resize` are facilities to be used for interactive manipulations of this `windowItem`.

`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).

### 3.4 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.

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.

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`.

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/guienv'
--- program: descriptor ---
guienv
  (# ...
  do ...
  #)

```

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/guienv';
INCLUDE '~beta/guienv/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.

### 3.5 Examples of Use of the guienv Fragment

The demo programs in this manual can be found in the reference demo subdirectory in the guienv directory. The location of the directory is installation-dependent

~beta/guienv/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.

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).

#### Program 1: simplewindow.bet

```

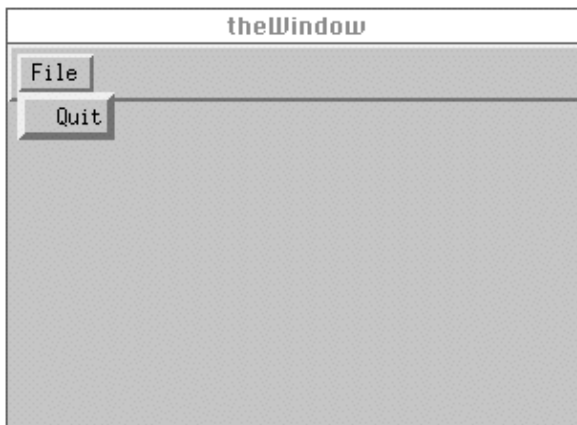
ORIGIN '~beta/guienv/guienv';
(* This demo shows how to create a very simple window and it
 * illustrates the activate/deactivate event.
 *)
--- program: descriptor ---
guienv
(# simpleWindow: @window
  (# eventHandler::
    (# onAboutToClose:: (# do terminate #);
    onActivate::
      (# do 'activate'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

```





```
onMouseUp::
  (#
  do 'onMouseUp ' -> puttext;
  buttonState -> putint;
  (if doubleClick then
    ' doubleclick' -> puttext
  if);
  newLine
  #);
onKeyDown::
  (#
  do 'onKeyDown: ' -> puttext;
  ch -> put;
  newLine
  #)
#)
do theWindow.open
#)
```



## 4 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.
- alertUser, similar to noteUser.
- fileSelectionDialog brings up a standard file selection dialog.
- fileCreationDialog brings up a standard create/save file dialog.

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

### 4.2 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.

#### Program 3: file.bet

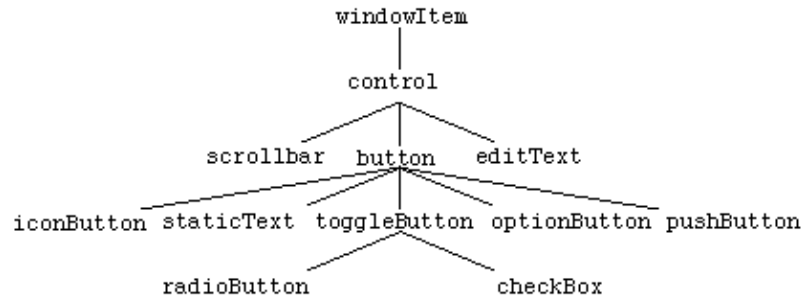
```
ORIGIN '~beta/guienv/guienv';
INCLUDE '~beta/guienv/stddialogs';
(* This demo shows how to use the fileSelectionDialog pattern. The
 * name of the file selected in the dialog is printed on the screen.
 *)
-- program: descriptor --
guienv
(# theWindow: @window
  (# eventHandler::
    (# onAboutToClose::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



# 5 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.).

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

**Paper:**

Used to specify permanent text in the dialog (usually explanatory text).

editText



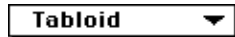
Used to allow the user to enter some text.

pushButton



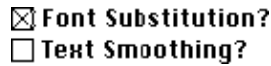
A button is used to specify some actions to be taken.

optionButton



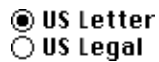
Used to specify a button with associated pop-up menu.

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 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.

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` 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` 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 events: `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` 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` 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` 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.

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` 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` is a kind of `toggleButton` mostly used in a radio button cluster (several `radioButtons` 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` 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` 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.

## 5.1 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/guienv';
INCLUDE '~beta/guienv/controls'
--- program: descriptor ---
```

```

guienv(# pb: @pushButton;
      ...
      do ...
      ... -> pb.label;
      ...
      #)

```

## 5.2 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.

### Program 4: button.bet

```

ORIGIN '~beta/guienv/guienv';
INCLUDE '~beta/guienv/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::
      (#

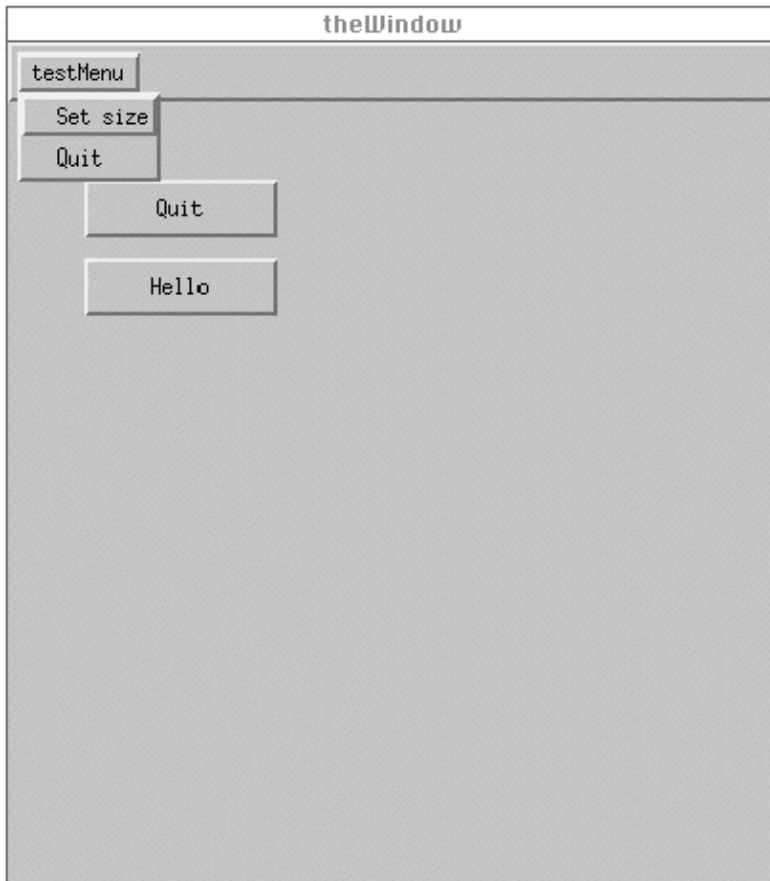
```

```

        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
#)

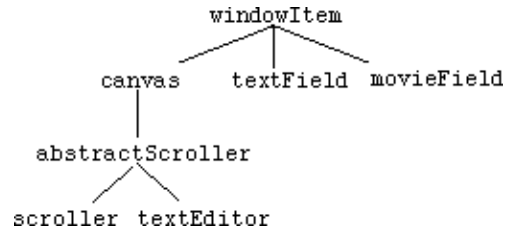
```





## 6 The fields Library

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 windowItems using scrollbars.



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

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

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

```
#) ...
```

## 6.2 Examples of Use of the fields Fragment

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

### Program 5: texteditor.bet

```

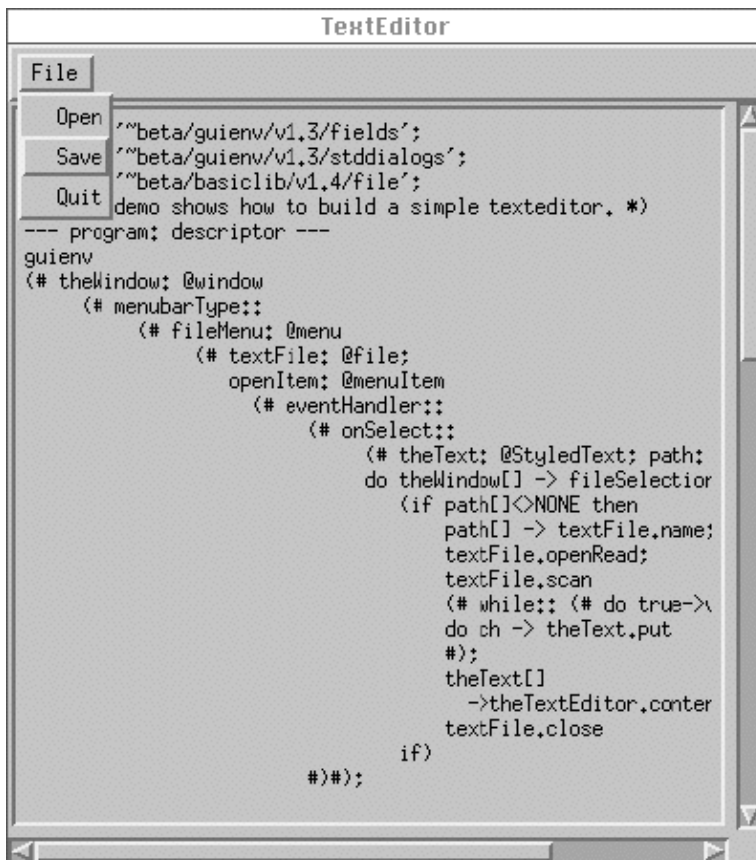
ORIGIN '~beta/guienv/fields';
INCLUDE '~beta/guienv/stddialogs';
INCLUDE '~beta/basiclib/file';
(* This demo shows how to build a simple texteditor. *)
--- program: descriptor ---
guienv
(# theWindow: @window
  (# menubarType::
    (# fileMenu: @menu
      (# textFile: @file;
        openItem: @menuItem
          (# 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
#)

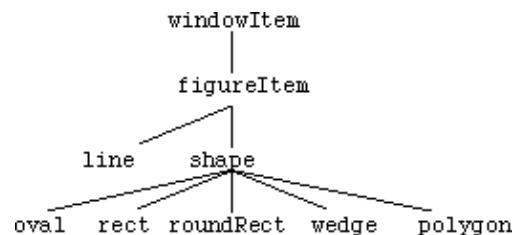
```



## 7 The figureitems Library

The figureitems library is implementing a relative simple vector graphics system, sufficient for many purposes. For more advanced graphics, the Mjølner 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 figureItems to react to user manipulations.



FigureItem is the general superpattern for all vector graphics patterns, implementing the common attributes of all graphics patterns. All figureItems 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 is used for drawing straight lines. The start and end attributes are used for controlling the starting (resp. ending) points of the line.

Shape is the general superpattern for all figureItems 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 are very similar in not defining any additional attributes.

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 defines a 'piece of cake' and defines startAngle and endAngle for controlling the wedge.

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.

### 7.1 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/guienv';
INCLUDE '~beta/guienv/figureitems'
--- program: descriptor ---
guienv(# 1: @line;
    ...
do ...
    ps1 -> l.start;
    ps2 -> l.end;
    ...
```

#)

## 7.2 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.

### Program 6: draw.bet

```

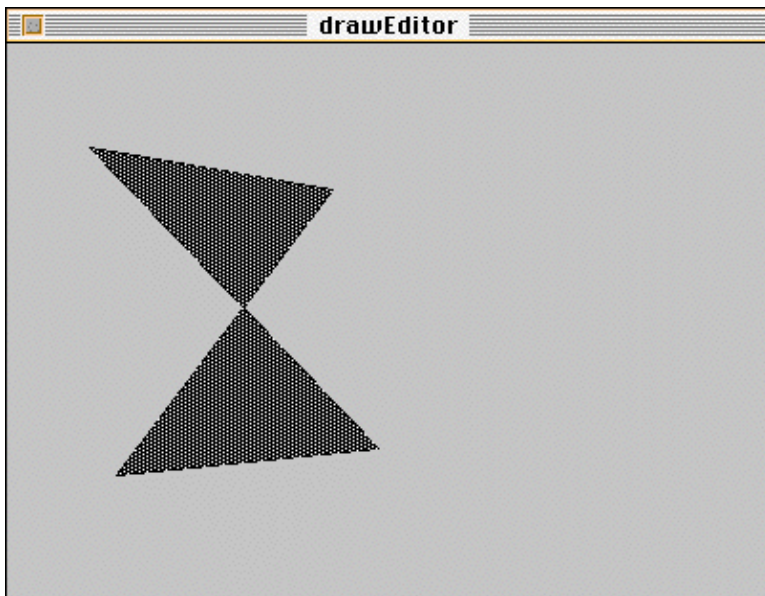
ORIGIN '~beta/guienv/guienv';
INCLUDE '~beta/guienv/figureitems';
(* This demo gives an example of how you can draw lines and polygons
 * with mouse using the figureitems "line" and "polygon". Clicking
 * with the left mouse button defines a node in the polygon/line,
 * clicking with the right mouse 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
#)

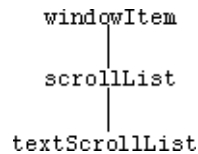
```





## 8 The scrolllists Library

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



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 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.

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

### 8.2 Examples of Use of the scrolllists Fragment

This example illustrates how to use the textscrolllist windowItem.

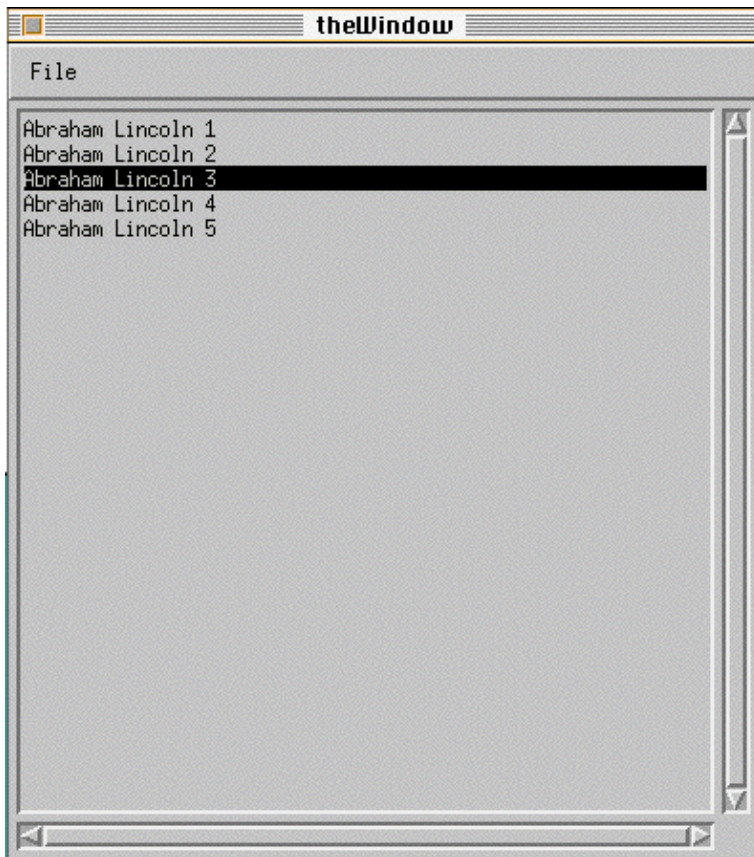
#### Program 7: textscrolllist.bet

```
ORIGIN '~beta/guienv/guienv';
INCLUDE '~beta/guienv/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') -> setttext;
          (noOfItems-3,'Abraham Lincoln 2') -> setttext;
          (noOfItems-2,'Abraham Lincoln 3') -> setttext;
          (noOfItems-1,'Abraham Lincoln 4') -> setttext;
          (noOfItems,'Abraham Lincoln 5') -> setttext
        #)
      #);
    open::
      (#
        do (400,400) -> size;
          theTextScrollList.open;
          theTextScrollList[] -> target
        #)
      #)
    do theWindow.open
  #)

```



## 9 The graphmath Library

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

- point is used for making calculations on 2D positions.
- rectangle is used for making calculations with 2D rectangles
- matrix is used for making calculations with coordinate system transformations.
- region is used for making calculations with 2D regions (i.e. areas in 2D, bounded by a polygon.) Please note that this pattern is not implemented yet.

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

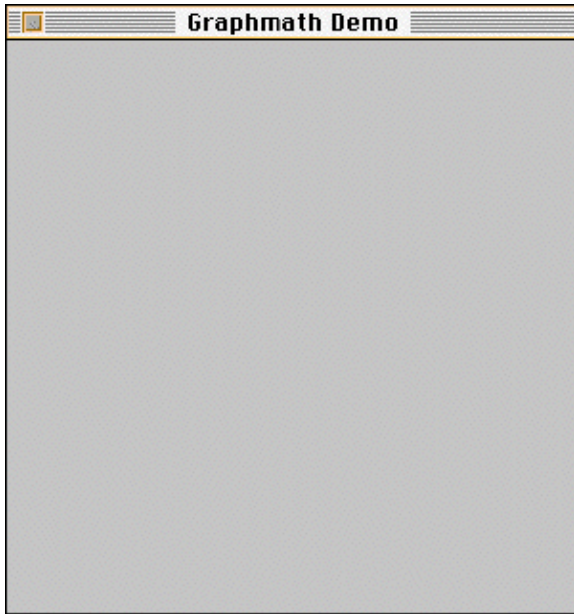
### 9.2 Examples of Use of the graphmath Fragment

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

#### Program 8: containspoint.bet

```
ORIGIN '~beta/guienv/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  
#)
```



# 10 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.

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

## 10.1 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/guienv';
INCLUDE '~beta/guienv/graphics'
--- program: descriptor ---
guienv(# pm: @pixmap;
      ...
      do ...
      ... -> pm.read;
      ...
      #)
```

## 10.2 Examples of Use of the graphics Fragment

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

### Program 9: drawbitmap.bet

```
ORIGIN '~beta/guienv/guienv';
INCLUDE '~beta/guienv/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
(# pm: ^pixmap;
 theWindow: @window
  (# eventhandler::
   (# onAboutToClose:: (# do terminate #) #);
  obj: @windowItem
   (# open::
    (#
     do (50,50) -> position;
     (pm.width,pm.height) -> size
    #);
   eventHandler::
    (# onRefresh::
     (#
      do graphics
      (#
       do (pm[], (0, 0), (0, 0), pm.width,pm.height)
        -> drawRaster
      #)
```

```

        #);
        onMouseDown::
            (# do drag #)
        #)
    #);
    open::
        (#
        do (400,400) -> size;
        obj.open
        #)
    #)
do &ixmap[]->pm[];
'picture' -> pm.read(# error:: (#
                                do THIS(guienv).patterns.black[]->pm[];
                                msg[]->putline;
                                true->continue#)
                                #);
(0xffff,0xffff,0xffff)->pm.transparentcolor;
theWindow.open
#)

```



# 11 The styledtext Library

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.

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

## 11.2 Examples of Use of the styledtext Fragment

No demos, since this extension is not implemented yet.



## 12 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).

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

### 12.2 Examples of Use of the guienvactions Fragment

### 12.3 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.

#### Program 10: keyboardactions.bet

```
ORIGIN '~beta/guienv/guienv';
INCLUDE '~beta/guienv/controls';
INCLUDE '~beta/guienv/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

```



## 13 The controlactions Library

The controlactions library defines the actions related to the events, related to the interfaceObjects, described in the control library.

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

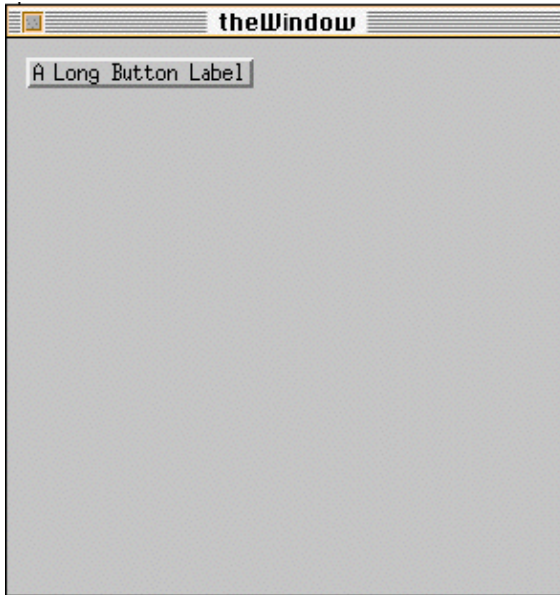
### 13.2 Examples of Use of the controlactions Fragment

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

#### Program 11: buttonactions.bet

```
ORIGIN '~beta/guienv/guienv';
INCLUDE '~beta/guienv/controls';
INCLUDE '~beta/guienv/controlactions';
(* 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
#)
```



# 14 The fieldsactions Library

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

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

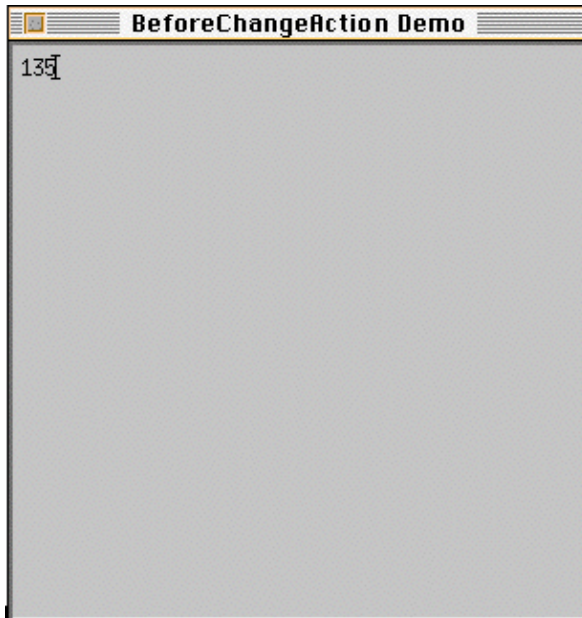
## 14.2 Examples of Use of the fieldsactions Fragment

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

### Program 12: textfieldactions.bet

```
ORIGIN '~beta/guienv/guienv';
INCLUDE '~beta/guienv/fields';
INCLUDE '~beta/guienv/fieldsactions';
INCLUDE '~beta/guienv/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  
#)
```



## 15 The guienvall Library

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.

### 15.1 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/guienvall';  
--- program: descriptor ---  
guienv(# pb: @pushButton;  
    ...  
    do ...  
    ... -> pb.label;  
    ...  
#)
```

## 16 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.

### 16.1 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 (# ... #);
  ...
#)
```



## 17 Appendix A: 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 is installation-dependent

```
~beta/guienv/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:

- `simplewindow.bet`  
This demo shows how to create a very simple window and it illustrates the activate/deactivate event.
- `windowWithStdMenubar.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.
- `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.
- `button.bet`  
This demo shows how to create a window with two pushButtons, and how to give a button a new size on runtime.
- `texteditor.bet`  
This demo shows how to build a simple texteditor.
- `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.
- `textscrolldlist.bet`  
This demo gives a simple example of how to use the `textScrollList` windowitem.
- `containspoint.bet`  
This demo gives an example of how to use the `containsPoint` operation of a rectangle.
- `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.
- `iconbutton.bet`  
This demo shows how to use the `pixmap` 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.
- `keyboardactions.bet`  
This demo shows how to prepend/append actions to `keyDown` events in an `editText` control.
- `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.
- `textfieldactions.bet`  
This is a silly demo that shows how a `beforeChangeAction` can be used to 'eat' every second keystroke in a `textField`.

## 18 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).

### 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

TopLevelShellWidgetClass

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\_RADIOBUTTON 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\_LBUTTONDOWN, WM\_MBUTTONDOWN, WM\_RBUTTONDOWN

mouseUp

buttonRelease

mouseUp

WM\_LBUTTONUP, WM\_MBUTTONUP, WM\_RBUTTONUP

**in menu:**

name

The LabelString of the CascadeButton the menu is connected to

The name of the menu, as it appears in the menubar

The name of the menu, as it appears in 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

pageScrollAmount

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



## 19 References

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*X Toolkit Intrinsic Programming Manual*,  
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[Nye & O'Reilly 90b]

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*X Toolkit Intrinsic Programming Manual, OSF/Motif 1.1 Edition*,  
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O'Reilly & Associates Inc, 1990, ISBN 0-937175-62-5

[Poskanzer]

Jef Poskanzer:  
*Portable BitMap, GrayMap, and PixMap*,  
UNIX Manual Pages.

[Young 90]

Douglas A. Young:  
*The X Window System. Programming and Applications with Xt*,  
OSF/Motif Edition,  
Prentice Hall, 1990, ISBN 0-13-497074-8

## 20.1 Controls Interface

```
ORIGIN 'guienv';
LIB_DEF 'guienvcontrols' '../lib';
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 ...
   #);
 eventHandler::<
   (# onEnabledChanged::< (# ... #);
   #);
 close::< (# do ... #);
 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 according 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 ...; #);
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[] #)
    #);
foregroundColor:
    (# c:@color
    enter c
    do ...
    #);
open::<
    (# create::< (# do ... #)
    do ...
    #);
close::< (# do ... #);
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 ... #);
eventHandler::<

```

```

    (# onMouseDown::<
      (# ... #);
      onRefresh::<
        (# ... #);
      onHiliteChanged::<
        (# ... #);
    #);

    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 ... #);

    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 ... #);
    onMouseDown::< (# ... #);
  #);
  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: ^pixmap;
      enter (# enter theIcon[] do ... #)
      exit (# do ...; exit theIcon[] #)
    #);
  open::<
    (# create::< (# do ... #)
      do ...
    #);
  close::< (# do ... #);
  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 ... #);
    onRefresh:: (# ... #);
  #);
  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 ... #);
  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;
    onMouseUp::<
      (# ... #);
    #);
  state:
    (# theState: @boolean;
    enter (# enter theState do ... #)
    exit (# do ... exit theState #)
    #);
  open::<
    (# create::< (# do ... #)
    do ...
    #);

```

```

    close::< (# do ... #);
    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 ... #);
    private: @...;
#) (* radioButton *);
checkBox: toggleButton
(* this is useful for setting options in dialogs *)
(# <<SLOT checkBoxLib: attributes>>;
  open::<
    (# create::< (# do ... #);
      do ...
    #);
    close::< (# do ... #);
    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 ... #);
    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[] #)
#)

```



## 20.2 Controlsactions Interface

```
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
  #)
```

## 20.3 Fields Interface

```
ORIGIN 'guienv';
LIB_DEF 'guienvfields' '../lib';
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 ...;
    #);
   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>>;
   controlModified: @boolean;
   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 (if controlModified then false->allow; else true->allow if);
       INNER ;
       false->controlModified;

     exit allow
     #);
    onBeforeChange:< beforeChange;
    onFrameChanged:<
      (# do ... #);
    onKeyDown:<
      (# do ... #);
    onMouseDown:<
      (# do ... #);
    onMouseUp:<
      (# do ... #);
    onRefresh:<
      (# do ... #);
    onEnableTarget:<
      (# do ... #);
    onDisableTarget:<
      (# 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 necessary
  *)
  ...;
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 ... #);
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 ... #);
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 ... #);
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 ...;
        #);
    #);
private: @...;
#)

```



## 20.4 Fieldsactions Interface

```
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;
  #)
```

## 20.5 Figureitems Interface

```
ORIGIN 'guienv';
LIB_DEF 'guienvfigureitems' '../lib';
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: ^pixmap;
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 initially pen characteristics of THIS(figureItem) are
* stipple          = patterns.black
* foregroundColor = colors.black
* backgroundColor = colors.white
* size            = 1
*)
(# create::< (# do ... #);
do ...
#);
eventhandler::<
(# onRefresh::<
(# do ...; #);
#);
```

```

    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 ... #);
  #);
  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: ^pixmap;
  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 ... #);
    #);
    private: @...;
    #) (* shape *);
oval: shape
(* the oval is defined by a rectangle *)
(# <<SLOT ovalLib: attributes>>;
  open::< (# do ... #);
  eventhandler::<
    (# onRefresh::<
      (# do ... #);
    #);
  #) (* oval *);
rect: shape
(# <<SLOT rectLib: attributes>>;
  open::< (# do ... #);
  eventhandler::<
    (# onRefresh::<
      (# do ... #);
    #);
  #) (* 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 ... #);
    #);
  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 ... #);
    #);
  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 ... #);
     #);
  private: @...;
#)

```

## 20.6 Graphics Interface

```
ORIGIN 'guienv';
LIB_ITEM '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 canvases.
*
* 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>>;

overrideChildren:<
(* If overrideChildren is furtherbound to return
* TRUE, the drawings will overlay the children
* of THIS(windowItem)
*)
booleanValue;
pen: @
(* defines the basic 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: ^pixmap;
   enter b[] do ...
  #);
  mode:
  (* The transfer mode use specifies how new graphics are
  * mixed with the graphics already in the window
  *)
  (# m: @integer;
   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 ...
    #);
drawSpots:
    (* Draw an Array of points *)
    (# points: [0] ^point;
    enter points
    ...
    #);
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:
  (# p: ^pixmap;
   from,to: @point;
   width,height: @integer;
   enter (p[],from,to,width,height) do ...
  #);
private: @...;
do ...;
#)

```



## 20.7 Graphmath Interface

```
ORIGIN '~beta/basiclib/betaenv';
LIB_DEF 'guienvgraphmath' '../lib';
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 horizontal 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 o'clock, 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[] #)
#)

```

## 20.8 Guienv Interface

```
ORIGIN '~beta/basiclib/betaenv';
LIB_DEF 'guienv' '../lib';
INCLUDE '~beta/containers/list';
INCLUDE 'graphmath';
INCLUDE 'keys';
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
      *)
     (# do INNER #);
   onOpenDocument:<
     (* is called whenever a user opens a document created by this
      * application
      *)
     (# fileName: ^text;
      enter fileName[]
      do INNER
      #);
   onQuit:<
     (* is called when application is going to quit, either
      * because terminate is called or because the system are
      * are going to shut down.
      * If okToQuit is set to false the application will
      * not quit.
      *)
     (# okToQuit: @boolean;
      do true -> okToQuit;
      INNER;
      exit okToQuit
      #);
   terminate:
     (* will terminate the entire application if invoked
      * Terminate calls onQuit and will only quit if
      * onQuit returns true.
      *)
     (# ... #);
   applicationMenubar:
     (* applicationMenubar is used to install a menubar with
      * functionality that is common for all parts for the
      * application.
      *)
     (# theMenubar: ^menubarType
      enter theMenubar[] ... #)
     exit (# ... 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>>;
      ...
      #) (* 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
      *)
      (#
      ...
      #);
    altKey: booleanValue
      (* true if the altkey was the down, when
      * THIS(basicEvent) occurred
      *)
      (#
      ...
      #);
    metaKey: booleanValue
      (* true if the metakey was the down, when
      * THIS(basicEvent) occurred
      *)
      (#
      ...
      #);
    controlKey: booleanValue
      (* true if the controlkey was the down, when
      * THIS(basicEvent) occurred
      *)
      (#
      ...
      #);
    buttonState: integerValue
      (* the number designating the button, which was
      * pressed down, when THIS(basicEvent) occurred
      * - 0 means 'no button'. This value depends
      * on the number of buttons on the mouse -
      * Typically 1, 2 or 3.
      *)
      (#
      ...
      #);
    when: integerValue
      (* the tick count when THIS(basicEvent)
      * occurred. 1 tick = 1/60 sec.
      *)
      (#
      ...
      #);

```



```

globalPosition:
  (* global coordinates of the mouse, when
   * THIS(basicEvent) occurred
   *)
  (# p: @point;
   ...
   exit p
  #);
localPosition:
  (* local coordinates of the mouse, when
   * THIS(basicEvent) occurred - relative to
   * THIS(inteefaceObject)
   *)
  (# p: @point;
   ...
   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 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;
   ...
   exit theChar
  #);
 key:
  (* the specialkey on the keyboard, related to
   * THIS(keyEvent).
   * See keys.bet for descriptions.
   *)
  (# theKey:@int32;
   ...
   exit theKey
  #)
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 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;
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[]
    ...
    #);
appendAction:
    (* Appends the action, so it will be executed after the
    * event is subscribes to.
    *)
    (# theAction: ^action;
    enter theAction[]
    ...
    #);
deleteAction:
    (* Remove the action *)
    (# theAction: ^action;
    enter theAction[]
    ...
    #);
open:<
    (* must be called before any other operation on
    * THIS(interfaceObject).
    *)
    (# create:< (# ... #);
    ...
    #);
close:<
    (* closes THIS(interfaceObject) and dispose all related
    * structures
    *)
    (# ... #);
enableEventType:<
    (* makes THIS(interfaceObject) sensible to the specified
    * type of events
    *)
    (# ev: ##theEventHandler.event
    enter ev##
    ...
    #);
disableEventType:<
    (* makes THIS(interfaceObject) insensible to the
    * specified type of events
    *)
    (# ev: ##theEventHandler.event
    enter ev##
    ...
    #);
interfaceObjectException: exception
    (* abstract superpattern for exceptiosn related to
    * THIS(int).
    *)
    (#
    ...
    #);
notOpenedException: interfaceObjectException
    (# location: ^text
    enter location[]
    ...
    #);
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 menus in the menubar. If
 * the menu is already in the menu bar, nothing happens
 *)
(# theMenu: ^menu;
enter theMenu[]
...
#);
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[]
...
#);
clear:
(* removes all menus from the menu bar when you want to
 * start with new menus
 *)
(# ... #);
appendMenubar:
(* inserts all menus in another menubar after all menus
 * in THIS(menubar). This is the same as calling
 * insertMenubar with NONE as afterMenu.
 *)
(# theMenubar: ^menubartype;
enter theMenubar[]
...
#);
replaceMenubar:
(* replace all menus in theMenubar with all menus in
 * replacementMenubar in THIS(menubar).
 *)
(# theMenubar, replacementMenubar: ^menubartype
enter (theMenubar[], replacementMenubar[])
...
#);
deleteMenubar:
(* deletes all menus in theMenubar from
 * THIS(menubar). The menu titles following the menus in
 * the deleted menubar will move over to fill the vacancy
 *)
(# theMenubar: ^menubartype
enter theMenubar[]
...
#);
scan:
(* iterates over all menus currently inserted in the
 * menubar
 *)
(# current: ^menu;
... #);
open::<
(# create::< (# ... #);

```

```

    ...
    #);
close::<
    (#
    ...
    #);
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[] ... #)
    exit (# ... 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 ... #)
    exit (# ... exit c #)
    #);
specialkey:
    (* Extended version of key.
     * key is the shortcut, if less than 255 used as char.
     * Only one modifier at a time is supported!
     *)
    (# key:@integer; (* from special keys in keys.bet *)
     ctrl,shift,alt:@boolean;
    enter (# enter (key,shift,ctrl,alt) ... #)
    #);
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[] ... #)
    exit (# ... exit t[] #)
    #);

```

```

checked:
  (* when THIS(menuitem) is checked, a check mark is
   * displayed at the left side the menuitem
   *)
  (# checked: @boolean
   enter (# enter checked ... #)
   exit (# ... 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[] ... #)
   exit (# ... exit theMenu[] #)
  #);
position: IntegerValue
  (* the position of THIS(menuitem) in its menu,
   * separator items are counted as well
   *)
  (#
   ...
  #);
eventhandler::<
  (# onStatus:< booleanValue
   (* executed just before THIS(menuitem) is
    * shown. should return true if THIS(menuitem)
    * is enabled. Default is true
    *)
   (# ... #);
  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::< (# ... #);
   ...
  #);
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[]
    ...
   #);
   detach:
   (* the menuitemHandler that is currently attached to
    * THIS(menuitem) is detached, meaning that no action
    * is attached
    *)

```

```

        (# ... #);
    eventhandler::<
        (# onStatus::< (# ... #);
         onSelect::< (# ... #);
        #);
    #) (* dynamicMenuItem *);
menuAction:
    (* a menuAction can dynamically 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
         *)
        (# ... #);
        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::< (# ... #);
         ...
         #);
        close::< (# ... #);
    #);
append:
    (* appends the menuItem to THIS(menu) *)
    (# theMenuItem: ^menuItem
     enter theMenuItem[]
     ...
     #);
delete:
    (* deletes the menuItem from THIS(menu) *)
    (# theMenuItem: ^menuItem
     enter theMenuItem[]
     ...
     #);
scan:
    (* iterates over all menuItems in THIS(menu) *)
    (# current: ^menuItem
     ...
     #);
clear:
    (* deletes all menuItems in THIS(menu) *)
    (#
     ...
     #);
noOfMenuItems: integerValue
    (* returns the number of menuItems in THIS(menu) *)
    (# ... #);
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[])
  ...
#);
getMenuItemByNumber:
(* returns a reference to the menuitem at the specified
 * position in the menu
 *)
(# number: @integer;
  theMenuItem: ^menuitem;
  enter number
  ...
  exit theMenuItem[]
#);
enable: (* enable THIS(menu) *)
  (# ... #);
disable: (* disable THIS(menu) *)
  (# ... #);
enabled:< booleanValue
  (* should return true if THIS(menu) is enabled *)
  (# ... #);
open::<
  (* the menu is not automatically inserted in the
   * menubar. You have to do this yourself
   *)
  (# create::< (# ... #);
   ...
  #);
close::< (# ... #);
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::< (# ... #);
   #) (* standardFileMenu *);
  fileMenu:< menu;
  theFileMenu: ^fileMenu;
  standardEditMenu: menu
    (# undoMenuItem: @dynamicMenuItem;
     cutMenuItem: @dynamicMenuItem;
     copyMenuItem: @dynamicMenuItem;
     pasteMenuItem: @dynamicMenuItem;
     clearMenuItem: @dynamicMenuItem;
     open::< (# ... #)
    #) (* standardEditMenu *);
  editMenu:< menu;
  theEditMenu: ^editMenu;
  open::<
    (#

```



```

    ...
    #);
#);
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
    *)
   (# ... #);
  onDeactivate:<<
   (* is send to contents, which takes care of sending
    * the event to all children
    *)
   (# ... #);
#);
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[] ... #)
exit (# ... 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;
type:<
(* The type can be one of the following:
 * windowTypes.normal <- default
 * windowTypes.dialog
 * windowTypes.palette
 *)
integerValue;
resizeable:< booleanValue
(#
do (if type=windowTypes.normal then
true -> value; INNER
if);

```

```

#);
title:
  (* the title of the window is displayed in the windows
  * title-bar if the window has one.
  *)
  (# theTitle: ^text
  enter (# enter theTitle[] ... #)
  exit (# ... 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 ... #)
  exit (# ... exit pt #)
  #);
size:
  (* the size is the size of the inside rectangle of the
  * window
  *)
  (# width, height: @integer;
  enter (# enter (width, height) ... #)
  exit (# ... 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 ... #)
  exit (# ... 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;
  ...
  exit theRectangle
  #);
show:
  (* shows THIS(window) in front of other windows *)
  (# ... #);
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
  *)
  (# ... #);
visible:
  (* The visibility of the window. *)
  (# value: @boolean;
  enter (# enter value ... #)
  exit (# ... exit value #)
  #);
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) ... #)
exit (# ... 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) ... #)
exit (# ... 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[]
...
#);
update:
(* Updates the window by posting a refresh event. If
 * emmediate is true, the refresh event will be processed
 * immediately.
 *)
(# immediate: @boolean;
enter immediate
...
#);
backgroundColor:
(* Sets backgroundcolor of this window *)
(# theColor: @color
enter theColor
...
#);
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 becoming the new
 * target, first "disableTarget" is called for the old
 * target then "enableTarget" is called for the new target
 *)

```

```

(# theTarget: ^windowitem;
enter (# enter theTarget[] ... #)
exit (# ... 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 becoming
  * target in the window
  *)
  (# do INNER #);
onEnableTarget:< enableTarget;
disableTarget: event
  (* is called when THIS(windowitem) was target
  * and another windowitem is becoming 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::< (# ... #);
mouseEnter: event
    (* Is called when the mouse enters THIS(windowitem) *)
    (# do INNER #);
onMouseEnter:< mouseEnter;
mouseLeave: event
    (* Is called when the mouse leaves THIS(windowitem) *)
    (# do INNER #);
onMouseLeave:< mouseLeave;
#);
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 ... #)
    exit (# ... 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
    * onFrameChanged event is called
    *)
    (# pt: @point;
    enter (# enter pt ... #)
    exit (# ... 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)
    ...
    #);
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) ... #)
    exit (# ... exit (width, height) #)

```

```

#);
fitToContents:<
  (* Adjusts the size of THIS(windowItem) to
   * fit the contents
   *)
  (# doneInInner: @boolean;
   ...
  #);
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 ... #)
   exit (# ... exit value #)
  #);
hilite:
  (# value: @boolean;
   enter (# enter value ... #)
   exit (# ... 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 ... #)
   exit (# ... exit value #)
  #);
enable:
  (* enables THIS(windowitem) so it can receive mouse
   * or key events
   *)
  (# ... #);
disable:
  (* disables THIS(windowitem) so it does not receive
   * any mouse or key events
   *)
  (# ... #);
backgroundColor:
  (# theColor: @color;
   enter (# enter theColor ... #)
   exit (# ... exit theColor #)
  #);
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 coming
    *     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[] ... #)
    exit (# ... 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;
...
#);
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
   ...
  #);
open::<
  (* initially a windowitem is visible and active *)
  (# create::< (# ... #);
   enter father[]
   ...
  #);
close::<
  (* no actions are performed at this level *)
  (# ... #);
private: @...;
#); (* windowitem *)
separator: windowitem
  (* a separator is a horizontal 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 coming of of the window.
*)
(# value: @integer;
enter (# enter value ... #)
exit (# ... exit value #)
#);
open::<
  (# create::< (# ... #);
  ...
  #);
close::<
  (# ... #);
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::< (# ... #);
  onDeactivate::< (# ... #);
  onMouseDown::< (# ... #);
  onRefresh::< (# ... #);
  onMouseUp::< (# ... #);
  onFrameChanged::< (# ... #);
  onVisibleChanged::< (# ... #);
  #);
selection: @
  (# add:
  (# theWindowitem: ^windowitem;
  enter theWindowitem[]
  ...
  #);
  set:
  (# theWindowitem: ^windowitem;
  enter theWindowitem[]
  ...
  #);
  remove:
  (# theWindowitem: ^windowitem;
  enter theWindowitem[]
  ...
  #);
  empty: booleanValue
  (#
  ...
  #);
  scan:

```

```

        (# current: ^windowitem;
        ...
        #);
clear:
    (#
    ...
    #);
#);
scan:
    (* Scan operation on the children of THIS(canvas) *)
    (# current: ^windowitem;
    ...
    #);
open::<
    (* The canvas is opened and displayed. *)
    (# create::< (# ... #);
    ...
    #);
close::<
    (* close is called for all the children of
    * THIS(canvas)
    *)
    (# ... #);
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::< (# ... #);
    ...
    #);
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
    *)
    (# ... #);
<<SLOT BifrostAttributes: attributes>>;
private: @...;
#) (* window *);
cursor:
    (* A cursor is the raster attached to the mouse pointer *)
    (# <<SLOT cursorLib: attributes>>;
    private: @...
    #);
pixmap:
    (* Pixmap pattern *)
    (# <<SLOT pixmapLib: attributes>>;
    read:

```

```

(* Reads the specified file into THIS(pixmap).
 * The type of the file are guessed by looking
 * at the extension, or the the first few bytes,
 * or the macintosh file type - all depending
 * on the platform
 *)
(# name: ^text;
 error:< exception
   (# what: ^text;
    enter what[]
    do what[] -> msg.append;
     INNER;
    #);
 enter name[]
 ...
 #);
clear:
 (* Clear the Pixmap with the specified color *)
 (# theColor: @Color;
  enter theColor
  ...
  #);
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)
  ...
  #);
dispose:<
 (* call this to dispose the memory occupied
 * by THIS(pixmap) when completely done with
 * THIS(pixmap)
 *)
 (#
  ...
  #);
width: integerValue
 (* returns the width set by init or by
 * read operations
 *)
 (# ... #);
height: integerValue
 (* returns the height set by init or
 * by read operations
 *)
 (# ... #);
transparent:
 (* Specifies that the "background" of this(pixmap) is
 * transparent.
 * This attribute is automatically set to TRUE
 * If a transparentColor or a mask is specified.
 * If "transparent" is set to FALSE, the transparentColor
 * or mask will be cleared.
 *)
 (# value: @boolean;
  enter (# enter value ... #)
  exit (# ... exit value #)
  #);
transparentColor:
 (* Specify which color in the pixmap should be transparent.
 * This will normally be the background color in the pixmap.
 * When a transparentColor is specified the "transparent"
 * attribute will be set to TRUE.

```

```

    * If the "transparent" is set to FALSE, any transparentColor
    * will be cleared.
    *)
    (# theColor: @color;
    enter (# enter theColor ... #)
    exit (# ... exit theColor #)
    #);
mask:
    (* Specify a mask for this(pixmap). A mask is a one-depth
    * pixmap. Only the pixels in this(pixmap) that has
    * corresponding pixel in the mask with the value 1, will
    * be drawn on the screen, when drawing this(pixmap).
    * If a mask is specified the "transparent" attribute will
    * be set to TRUE. If transparent is set to FALSE, any mask
    * will be cleared.
    *)
    (# theMask: ^pixmap;
    enter (# enter theMask[] ... #)
    exit (# ... exit theMask[] #)
    #);
drawPixmap:
    (* Draw the pixmap "other" on this(pixmap) *)
    (# other: ^pixmap;
    from, to: @point;
    width, height: @integer;
    enter (other[], from, to, width, height)
    ...
    #);
private: @...;
#);
textStyle:
    (* textStyle is font, size and face. You can use this pattern
    * to communicate stylistic 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[] ... #)
        exit (# ... exit theName[] #)
        #);
    size:
        (# value: @integer;
        enter (# enter value ... #)
        exit (# ... exit value #)
        #);
    face:
        (# value: @integer;
        enter (# enter value ... #)
        exit (# ... exit value #)
        #);
    ascent: integerValue
        (* ascent is the maximum amount of pixels a character
        * drawn in THIS(textStyle) will go above the base line
        *)
        (# ... #);
    descent: integerValue
        (* descent is the maximum amount of pixels a character
        * drawn in THIS(textStyle) will go below the base line
        *)
        (# ... #);
    leading: integerValue
        (* leading is the vertical distance between the descent
        * of one line and the ascent of the next line

```

```

    *)
    (# ... #);
lineHeight: integerValue
    (* the line height (in pixels) is determined by adding
    * the ascent, descent, and leading
    *)
    (# ... #);
maxChWidth: integerValue
    (* the greatest distance the pen will move when a
    * character is drawn
    *)
    (# ... #);
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
    ...
    #);
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[]
    ...
    #);
availableSizes:
    (* an INNER is executed for all available sizes in the
    * font of THIS(textStyle)
    *)
    (# thisSize: @integer;
    ...
    #);
private: @...;
#) (* textStyle *);
color:
    (* A Color has three components: red, green and blue. *)
    (# <<SLOT colorLib: attributes>>;
    red,green,blue: @integer;
    enter (red,green,blue)
    exit (red,green,blue)
    #);

timer:
    (# <<SLOT timerLib: attributes>>;
    once:< booleanValue;

    start:
    (# interval: @integer
    enter interval
    ...
    #);
    stop:
    (# ... #);
    action:<
    object;
    private: @...;
    #);

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
    *)
    (# ... #);
  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[] ... #)
    exit (# ... exit txt[] #)
    #);
  clearContents:
    (* call this to empty all contents of the clipboard *)
    (# ... #);
#) (* 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;
    ...
    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.
    *)
    (#
    ...
    #);
  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[] ... #)
    exit (# ... exit theCur[] #)
    #);
#) (* mouse *);

(* These models different properties of the current system
* next 5 patterns was formerly in a systempattern
*)

screenRectangle:
  (* the rectangle of the main screen. *)
  (# theRectangle: @rectangle;
  ...
  exit theRectangle
  #);
screenRgn:
  (* the region defining the screen(s) *)

```

```

    (# rgn: ^region;
    ...
    exit rgn[]
    #);
standardTextStyle:
    (* the textStyle used by the system to draw menutitles
    * etc.
    *)
    @textStyle;
beep:
    (* beeps using the current beep in the system *)
    (# ... #);
guienvWait:
    (* delays the specified number of ticks (1 tick = 1/60
    * sec.)
    *)
    (# ticks: @integer;
    enter ticks
    ...
    #);
transferModes: @
    (# copy: (# exit 0 #);
    invertCopy: (# exit 1 #);
    erase: (# exit 2 #);
    andBlend: (# exit 3 #);
    orBlend: (# exit 4 #);
    xorBlend: (# exit 5 #);
    notAndBlend: (# exit 6 #);
    notOrBlend: (# exit 7 #);
    #);
textFaces: @
    (# <<SLOT textFacesLib: attributes>>;
    plain: (# exit 0 #);
    bold: (# exit 1 #);
    italic: (# exit 2 #);
    #);
patterns: @
    (# black, dkGray, gray, ltGray, white: ^pixmap #);
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 #);
    #);
windowTypes: @
    (# normal: integerValue (# do 0 -> value #);
    dialog: integerValue (# do 1 -> value #);
    palette: integerValue (# do 2 -> value #);
    modelessDialog: integerValue (# do 3 -> value #);
    #);
specKeys:@specialKeys;
private: @...;
trace:
    (* For debugging. If doTrace is true, INNER is called. *)
    (#

```

```

do (if doTrace then INNER if);
#);
doTrace: @Boolean;
(* Additions needed for bifrost *)
bifrostprivate: @...;
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.
   *);
warnStream: ^stream
  (* The stream bifrost warnings are put to. Defaults to
   * screen.
   *);

(* 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;
...
#)

```



## 20.9 Guienvactions Interface

```
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
  #);
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
  #)

```

## 20.10 Guienvall Interface

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

## 20.11 Guienvsystemenv Interface

```
ORIGIN '~beta/basiclib/basicssystemenv';
MDBODY nti      'private/winnt/guienvntssystemenvbody'
      ppcmac    'private/macintosh/guienvsystemenvmac.bet'
      default   'private/X11/guienvxssystemenvbody';

(*
 * 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 basicssystemenv.
 *
 * 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 basicssystemenv.
 *)
[[ (* deliberate empty fragment file *)
---]]
```

## 20.12 Scrolllists Interface

```
ORIGIN 'guienv';
LIB_DEF 'guienvscrolllists' '../lib';

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 "numOfItems"
    *)
   (# 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 "numOfItems"
    *)
   (# 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 "numOfItems"
    *)
   (# 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 "numOfItems"
    *)
   (# 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 "numOfItems"
    *)
   (# numOfItems: @integer;
    enter numOfItems
```

```

do ...
#);
deleteLast:
(* the specified range of items are deleted from the end
 * of THIS(scrollList). The items in the scrollList are indexed
 * from 1 to value returned by "numberOfItems"
 *)
(# 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 #)
#);
multipleSelection:<
(* if multipleSelection is TRUE the user is allowed to select
 * multiple elements in the list at a time.
 *)
booleanValue;
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 ... #);
  onVisibleChanged::<
    (# ... #);
  #);
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 ...; #);
#)

```



## 20.13 Stddialogs Interface

```
ORIGIN 'guienv';
LIB_DEF 'guienvstddialogs' '../lib';

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: @...;
  onClose:< object;
  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 *)
(# ... #)

```

## 20.14 Styledtext Interface

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

## 21.1 Buttonadds Interface

```
ORIGIN '../controls';

INCLUDE '../private/controlsbody'

--- buttonlib: attributes ---
labelHeight:
  (# ts: ^textStyle;
  do style->ts[];
  exit ts.lineHeight
  #);
labelWidth:
  (# ts: ^textStyle;
  do style->ts[];
  exit (label->ts.widthOfText)
  #)
```

## 21.2 ColorConverter Interface

```
ORIGIN '~beta/basiclib/betaenv';
BODY 'private/colorConverterBody'
(*
 * ColorConverter:
 *   This file implements conversion routines between the different
 *   color models. Currently, three color models are supported:
 *   RGB, CMY and HSV.
 *
 *   The implementation of HSVtoRGB and RGBtoHSV routines
 *   are based on the Bifrost implementation (PaintImpl.bet)
 *
 * Usage:
 *   converter: @colorConverter;
 *   ...
 *   RGBcolor->converter.RGBtoHSV->HSVcolor;
 *   ...
 *   HSVcolor->converter.HSVtoRGB->RGBcolor;
 *
 * You can costumize this converter to convert into RGB and HSV
 * color models with different ranges for the dimensions in the
 * color models by further binding the maxRGB, MaxHue, MaxSat, and
 * maxVal virtuale in colorConverter. E.g. to use a 256 RGB cube,
 * declare:
 *
 *   converter: @colorConverter(# maxRGB:: (# do 256->value #);
 *
 * Please note, that due to the duality of the RGB and CMY color models,
 * they use the same MaxRGB constant.
 *)
--- LIB: attributes ---

colorConverter:
  (# (* Contants specifying the range for RGB, hue, saturation and value *)
    MaxRGB:< IntegerValue(# do 65535->value; INNER #);
    MaxHue:< IntegerValue(# do 360->value; INNER #);
    MaxSat:< IntegerValue(# do 32768->value; INNER #); (* (2^15) *)
    MaxVal:< IntegerValue(# do 32768->value; INNER #); (* (2^15) *)

    HSVtoRGB:
      (* Convert h in [0, MaxHue], s in [0, MaxSat], V in [0, MaxVal]
       * to RGB-values in [0, MaxRGB].
       * Adapted from algorithm in
       * "Foley and van Dam: Fundamentals of Interactive Computer Graphics"
       *)
      (# H, S, V: @integer;
        R, G, B: @integer;
        convert: @...
      enter (H, S, V)
      do convert
      exit (r, g, b)
      #);

    RGBtoHSV:
      (* Obtain HSV from RGB *)
      (# R, G, B: @integer;
        H, S, V: @integer;
        convert: @...
      enter (r, g, b)
      do convert
      exit (H, S, V)
      #);

    CMYtoRGB:
      (* convert CMY color to RGB color *)
```

```

    (# C, M, Y: @integer;
     R, G, B: @integer;
     max: (* private *) @integer;
    enter (C, M, Y)
    do maxRGB->max; (max-C, max-M, max-Y)->(R, G, B)
    exit (R, G, B)
    #);
RGBtoCMY:
(* convert RGB color to CMY color *)
(# R, G, B: @integer;
 C, M, Y: @integer;
 max: (* private *) @integer;
 enter (R, G, B)
 do maxRGB->max; (max-R, max-G, max-Y)->(C, M, Y)
 exit (C, M, Y)
 #);
#)

```

## 21.3 ColorDialog Interface

```
ORIGIN '~beta/guienv/guienv';
BODY 'private/colorDialogBody'
-- guienvLib: Attributes --
colorDialog: window
(* this pattern implements a color selection dialog in which you
 * can specify a color interactively in a dialog window. You can
 * specify explicit color values in either RGB or HSV color values,
 * select colors from a set of predefined color names, or you can
 * select the color directly in a HSV color space.
 *
 * Interactively, a color is selected as a custom color value by
 * 'dragging' the color from the 'Color' area down into one of the
 * color spots in the 'Custom' group.
 *)
(# apply:<
  (* this is invoked each time either 'Apply' or 'Close' button
   * are pressed. If the 'Close' button was pressed, 'closing'
   * is 'true'. When invoked, 'c' will contain the selected
   * color value
   *)
  (# c: @color; closing: @boolean
  enter closing
  ...
  #);
setColor:
  (* You can set the custom colors or the selected color by
   * invoking this operation. If 'no'>0, the corresponding custom
   * color will be set. If no=0, then the selected color will be
   * set. In both cases, the new color is expected in 'c'.
   *)
  (# no: @integer; c: @color
  enter (no,c)
  ...
  #);
getColor:
  (* You can get the custom colors or the selected color by
   * invoking this operation. If 'no'>0, the corresponding custom
   * color will be returned in 'c'. If no=0, then the selected
   * color will be returned in 'c'.
   *)
  (# no: @integer; c: @color
  enter no
  ...
  exit c
  #);
open::< (# ... #);
private: @...
#)
```

## 21.4 ColorTable Interface

```
ORIGIN '../guienv';
BODY 'private/colorTableBody'

(* This fragment adds color-table facilities to guienv.
 * A 'colorTable' pattern have been added.
 *
 * colorTable
 * -----
 *
 * This pattern defines facilities for maintaining mappings between
 * textual names of colors, and their numerical representations (in terms
 * of 'color' values). 'colorTable' defines four functions:
 *
 * define: defines the text in 'colorName' to refer to the current
 *         color of 'colorValue'. If 'colorName' is already defined, it
 *         will be redefined to refer to the color of 'colorValue'.
 *
 * lookup: sets the color values of 'colorValue' to the color values
 *         referred to by 'colorName'. If 'colorName' is not defined in the
 *         colortable, 'colorValue' will be set to 'black'
 *
 * loadFile: load the color definitions found in the file 'filename' into
 *           the color table.
 *
 *           If 'overwrite' is bound to 'trueObject'
 *           (i.e. 'overwrite::trueObject'), then the new color definitions
 *           will replace any previously existing color definition with the
 *           same color name.
 *
 *           If 'merge' is not bound to 'trueObject' - i.e. not
 *           'merge::trueObject', then clear the color table.
 *
 *           If 'filename' is empty, or cannot be read, the result will be
 *           that all color definitions will be erased, i.e. a way to clear
 *           all existing color definitions is merely by executing:
 *
 *           ct.loadFile; ('ct' assumed to be an instance of 'colorTable')
 *
 * scan: scans the defined colornames in the color table and their
 *       color values.
 *
 * In multi-fragment guienv programs it can be a problem to
 * reach the single colortable instans. This problem can be
 * solved using the object-pool.
 *
 * Main fragment:
 * ct:@colortable;
 * ...
 * ct[]->objectPool.put;
 *
 * Other fragment:
 * ct:^colortable;
 * ...
 * objectPool.get(# type:<colortable; #)->ct[];
 *
 * see basiclib reference manual p 12&23
 *)

--- guienvlib: attributes ---
colorTable:
  (# <<SLOT colortablelib: attributes>>;
   define:
```



```

(* defines the text in 'colorName' to refer to the current
 * color of 'colorValue'. If 'colorName' is already defined,
 * it will be redefined to refer to the color of 'colorValue'.
 *)
(# colorName: ^text; colorValue: @color
enter (colorName[], colorValue)
...
#);
lookup:
(* sets the color values of 'colorValue' to the color values
 * referred to by 'colorName'. If 'colorName' is not defined
 * in the colortable, 'colorValue' will be set to 'black'
 *)
(# colorName: ^text; colorValue: @color
enter colorName[]
...
exit colorValue
#);
load:
(* reads color definitions from a stream
 * into the color table.
 *
 * If 'overwrite' is bound to 'trueObject'
 * (i.e. 'overwrite::trueObject'), then the new color
 * definitions will replace any previously existing color
 * definition with the same color name.
 *
 * If 'merge' is not bound to 'trueObject' - i.e. not
 * 'merge::trueObject', then clear the color table.
 *)
(# colorstream: ^stream;
  overwrite:< booleanValue;
  merge:< booleanValue;
enter colorstream[]
...
#);
loadFile:
(* load the color definitions found in the file 'filename'
 * into the color table.
 *
 * If 'overwrite' is bound to 'trueObject'
 * (i.e. 'overwrite::trueObject'), then the new color
 * definitions will replace any previously existing color
 * definition with the same color name.
 *
 * If 'merge' is not bound to 'trueObject' - i.e. not
 * 'merge::trueObject', then clear the color table.
 *
 * If 'filename' is empty, or cannot be read, the result will
 * be that all color definitions will be erased, i.e. a way to
 * clear all existing color definitions is merely by executing:
 *
 *      ct.load; ('ct' assumed to be an instance of 'colorTable')
 *)
(# filename: ^text;
  overwrite:< booleanValue;
  merge:< booleanValue;
enter filename[]
...
#);
scan:
(* scans the defined colornames in the color table and their color
 * values.
 *)
(# currentName: ^text; currentColor: @color;
...

```

```
    #);  
    private: @...  
#)
```

## 21.5 CursorTable Interface

```
ORIGIN '../guienv';
BODY 'private/cursorTableBody'

(* This fragment adds cursor-table facilities to guienv.
 * A 'cursorTable' pattern have been added.
 *
 * cursorTable
 * -----
 *
 * This pattern defines facilities for maintaining mappings between
 * textual names of cursors, and their numerical representations (in terms
 * of 'cursor' values). 'cursorTable' defines four functions:
 *
 * define: defines the text in 'cursorName' to refer to the current
 *         cursor of 'cursorValue'. If 'cursorName' is already defined, it
 *         will be redefined to refer to the cursor of 'cursorValue'.
 *
 * lookup: sets the cursor values of 'cursorValue' to the cursor values
 *         referred to by 'cursorName'. If 'cursorName' is not defined in the
 *         cursortable, 'cursorValue' will be set to 'black'
 *
 * loadFile: load the cursor definitions found in the file 'filename' into
 *           the cursor table.
 *
 *           If 'overwrite' is bound to 'trueObject'
 *           (i.e. 'overwrite::trueObject'), then the new cursor definitions
 *           will replace any previously existing cursor definition with the
 *           same cursor name.
 *
 *           If 'merge' is not bound to 'trueObject' - i.e. not
 *           'merge::trueObject', then clear the cursor table.
 *
 *           If 'filename' is empty, or cannot be read, the result will be
 *           that all cursor definitions will be erased, i.e. a way to clear
 *           all existing cursor definitions is merely by executing:
 *
 *           ct.loadFile; ('ct' assumed to be an instance of 'cursorTable')
 *
 * scan: scans the defined cursornames in the cursor table and their
 *       cursor values.
 *
 * In multi-fragment guienv programs it can be a problem to
 * reach the single cursortable instans. This problem can be
 * solved using the object-pool.
 *
 * Main fragment:
 * ct:@cursortable;
 * ...
 * ct[]->objectPool.put;
 *
 * Other fragment:
 * ct:^cursortable;
 * ...
 * objectPool.get(# type:<cursortable; #)->ct[];
 *
 * see basiclib reference manual p 12&23
 *)

---cursorlib: attributes ---
  load:
    (# x11ID:< (# ID: @integer do INNER exit ID #);
     macID:< (# ID: @integer do INNER exit ID #);
```

```

        ntiID:< (# ID: @integer do INNER exit ID #);
        ntiNAME:< (# ID: ^text do INNER exit ID[] #);
        ...
    #);

--- guienvlib: attributes ---
cursorTable:
    (# <<SLOT cursortablelib: attributes>>;
    init:< (* is called automatically to enable automatic load of cursors *)
        (# do INNER init #);
    create:
        (# xllID:< (# ID: @integer do INNER exit ID #);
        macID:< (# ID: @integer do INNER exit ID #);
        ntiID:< (# ID: @integer do INNER exit ID #);
        ntiNAME:< (# ID: ^text do INNER exit ID[] #);
        cursorName: ^text;
        c: ^(*private*)cursor;
        enter cursorName[]
        ...
        #);
    define:
        (* defines the text in 'cursorName' to refer to the current
        * cursor of 'cursorRef'. If 'cursorName' is already defined,
        * it will be redefined to refer to the cursor of 'cursorRef'.
        *)
        (# cursorName: ^text; cursorRef: ^cursor
        enter (cursorName[], cursorRef[])
        ...
        #);
    lookup:
        (* sets 'cursorRef' to refer to the cursor
        * referred to by 'cursorName'. If 'cursorName' is not defined
        * in the cursortable, 'cursorRef' will be set to 'arrow'
        *)
        (# cursorName: ^text; cursorRef: ^cursor
        enter cursorName[]
        ...
        exit cursorRef[]
        #);
    load:
        (* reads cursor definitions from a stream
        * into the cursor table.
        *
        * If 'overwrite' is bound to 'trueObject'
        * (i.e. 'overwrite::trueObject'), then the new cursor
        * definitions will replace any previously existing cursor
        * definition with the same cursor name.
        *
        * If 'merge' is not bound to 'trueObject' - i.e. not
        * 'merge::trueObject', then clear the cursor table.
        *)
        (# cursorstream: ^stream;
        overwrite:< booleanValue;
        merge:< booleanValue;
        enter cursorstream[]
        ...
        #);
    loadFile:
        (* load the cursor definitions found in the file 'filename'
        * into the cursor table.
        *
        * If 'overwrite' is bound to 'trueObject'
        * (i.e. 'overwrite::trueObject'), then the new cursor
        * definitions will replace any previously existing cursor
        * definition with the same cursor name.
        *)

```

```

* If 'merge' is not bound to 'trueObject' - i.e. not
* 'merge::trueObject', then clear the cursor table.
*
* If 'filename' is empty, or cannot be read, the result will
* be that all cursor definitions will be erased, i.e. a way to
* clear all existing cursor definitions is merely by executing:
*
*     ct.load; ('ct' assumed to be an instance of 'cursorTable')
* )
(# filename: ^text;
  overwrite:< booleanValue;
  merge:< booleanValue;
  enter filename[]
  ...
#);
scan:
  (* scans the defined cursornames in the cursor table and their cursor
  * values.
  *)
  (# currentName: ^text; currentCursor: ^cursor;
  ...
  #);
private: @...
#)

```

## 21.6 Decorator Interface

```
ORIGIN '../guienv';
LIB_DEF 'guienvutilsdecorator' '../lib';
BODY 'private/decoratorbody';

-- windowLib: attributes --

decorator: canvas
  (# <<SLOT decoratorLib: attributes>>;
  contentsType:< windowItem;
  contents: @contentsType;
  open::<(#
    ...
  #);
  eventHandler::<
    (# onFrameChanged::<
      (# ... #);
      onChildFrameChanged::<
        (# ... #);
    #);
  private: @...;
  #)
```

## 21.7 Defaultstyle Interface

```
ORIGIN '../guienv';
BODY 'private/defaultstylebody';

-- GUIenvLib: attributes --

defaultStyle:
  (# style: ^textStyle;
   ...
   exit style[]
  #)
```

## 21.8 Designsupport Interface

```
ORIGIN '../guienv';
LIB_DEF 'guienvutilsdesignsup' '../../lib';
BODY 'private/designsupportbody';

-- guienvLib: attributes --

designSetup:
  (#
  ...
  #)
```



## 21.9 Dialogfield Interface

```
ORIGIN '../guienv';
LIB_DEF 'guienvutilsdialogfld' '../../lib';
BODY 'private/dialogfieldbody'
[[
-- INCLUDE '../figureitems'
-- INCLUDE '../fields'

-- WindowLib: Attributes --

DialogField: EditText
  (#
    Selection:
      (# start,end: @Integer;
        enter (# enter (start,end) do ... #)
        exit (# do ... exit (start,end) #)
        #);
    Length:
      (# theLength: @Integer;
        do ...;
        exit theLength
        #);
    MaxChar:
      (# maxCh: @Integer;
        enter (# enter maxCh do ...#)
        exit (# do ... exit maxCh #)
        #);

    EventHandler::<(# beforeChange: event
      (# position,length: @integer;
        allow:@boolean;
        enter (position,length)
        do true -> allow;
        INNER;
        exit allow
        #);
      onBeforeChange:< beforeChange (# do ...;
        #);
      onKeyDown::<
        (# do ...;
        #);
      onEnableTarget::< (# do ...; #);
      #);
    Open::< (# do ... #);
    <<SLOT DialogFieldLib: Attributes>>;
    Private: @...;
  #);

NumberField: DialogField
  (# IntegerContents:
    (# int: @Integer;
      enter (# enter int do ... #)
      exit (# do ... exit int #)
      #);
    EventHandler::<
      (# onBeforeChange::< (# do ...; #);
      #);
  #);

AlphaNumField: DialogField
  (# EventHandler::<
    (# onBeforeChange::< (# do ...; #);
    #);
```

```
#);  
  
LabeledCanvas: Canvas  
  (# Label: @StaticText(# #);  
   Sep: @Separator(# #);  
   Open::< (# do ... #);  
   <<SLOT LabeledCanvasLib: Attributes>>;  
#)
```

## 21.10 Graphicsadds Interface

```
ORIGIN '../graphics';
LIB_ITEM 'guienv';
BODY 'private/graphicsaddsbody';
INCLUDE 'rasteradds';

-- graphicsLib: attributes --
clipRectangle:
  (# r: @rectangle;
   enter r
   ...
  #);
isInClip: booleanValue
  (# r: @rectangle;
   enter r
   ...
  #);
drawIconResource:
  (# r: ^iconResource;
   h,v: @integer;
   enter (r[],h,v)
   ...
  #)
```

## 21.11 Group Interface

```
ORIGIN '../guienv';
LIB_DEF 'guienvutilsgroup' '../../lib';
BODY 'private/groupbody';

-- windowLib: attributes --

group: canvas
  (# <<SLOT groupLib: attributes>>;
  label:
    (# theLabel: ^text;
    enter (# enter theLabel[] ... #)
    exit (# ... exit theLabel[] #)
    #);
  open::<(# create::< (# ... #)
  ...
  #);
  eventHandler::<
    (#
      onRefresh::<
        (# ... #);
    #);
  private: @...;
  #)
```

## 21.12 Guienvadds Interface

```
ORIGIN '../guienv';
LIB_DEF 'guienvadds' '../lib';
BODY 'private/guienvaddsbody';
-- windowItemLib: attributes --

defineRect:
  (* Let the use drag the rectangle.
   * doLeft,doTop,doRight,doBottom specifies which
   * sides of the rectangle should follow the mouse.
   *)
  (# r: @rectangle;
   doLeft,doTop,doRight,doBottom: @boolean;
   enter (r,doLeft,doTop,doRight,doBottom)
   ...
   exit r
  #);
bringToFront:
  (* Bring this(windowItem) to the front of its brothers *)
  (#
   ...
  #);
bringBack:
  (#
   ...
  #);

preferredSize:
  (* If this(windowItem) can accept the suggested width and height
   * these will be returned otherwise some other values are returned.
   *)
  (# suggestedWidth, suggestedHeight: @integer;
   suggest: @boolean;
   preferredWidth, preferredHeight: @integer;
   enter (#
     enter (suggestedWidth, suggestedHeight)
     do true -> suggest;
     #)
   ...
   exit (preferredWidth, preferredHeight)
  #);
drawShadows:
  (# r: @rectangle;
   type: @integer;
   enter (r, type)
   ...
  #);

delegateMouseEvents:
  (# value: @boolean;
   enter value
   ...
  #);

-- windowLib: attributes --

translate:
  (# from, to: ^windowItem;
   p: @point;
   result: @point;
   enter (p, from[], to[])
```

```

...
exit result
#);

launchFile:
(# fileName: ^text;
enter fileName[]
do ...
#);

setWindowIcon:
(# id: @integer;
enter id
...
#);

setWindowIconPixmap:
(# pm:^pixmap
enter pm[]
...
#);

loadWindowIcon:
(# filename: ^text;
enter filename[]
...
#);

setAppIcon:
(# id: @integer;
enter id
...
#);

loadMouseCursor:
(# filename: ^text;
enter filename[]
...
#);

setMouseCursor:
(# symbolConstant: @integer;
enter symbolConstant
...
#)

```

## 21.13 Guienvstuff Interface

```
ORIGIN '../controls';
LIB_DEF 'guienvutilstuff' '../../lib';
BODY 'private/guienvstuffbody';

-- buttonLib: attributes --

center: (# exit 1 #);
left: (# exit 2 #);
right: (# exit 3 #);

alignment:
  (# value: @integer
  enter value
  ...
  #)
```

## 21.14 Heapview Interface

```
ORIGIN '~beta/guienv/guienv';
INCLUDE '~beta/guienv/utils/groupbox';
INCLUDE '../graphics';
INCLUDE '~beta/sysutils/heapinfo';
INCLUDE '~beta/basiclib/numberio';
-- windowLib: Attributes --
heapview: canvas
  (#
    onUpdate:<Object;
    ou:@onUpdate;
    t:@timer
    (#
      action::<(# do
        ou; (* onUpdate; *)
        true->Ioacanvas.drawingarea.update;
        true->aoacanvas.drawingarea.update;
        true->CBFAcanvas.drawingarea.update;
      #);
    #);

  open::<
    (#
      do
        (360,130)->size;
        IOAcanvas.open;
        AOAcanvas.open;
        CBFAcanvas.open;
        50->t.start;
        INNER
    #);

  graphview: groupbox
  (# solution:(# exit 50#);
    priv:@
    (# data:[solution]@integer;
      max:@integer;
    #);

    name:<(# t:^text; do INNER; exit t[] #);
    nm:@name;
    value:<IntegerObject;
    val:@value;
    drawingArea:@canvas
    (# draw:@
      graphics
      (# dx:@real;
        dy:@real;
        imax:@max;
        width,height:@integer;
        mt:@moveto;
        dt:@drawto;
      do this(canvas).size->(width,height);
        (for i:solution-1 repeat
          priv.data[i+1]->priv.data[i];
        for);
        val (*value*) ->priv.data[solution];

        (priv.max,priv.data[solution])->imax->priv.max;

        width/solution->dx;
        priv.max/height->dy;
```



```

(dx,height-priv.data[1]/dy)->mt;
(for i:solution repeat
  (i*dx,height-priv.data[i]/dy)->dt;
for);
#);
eventhandler::
(#
  onrefresh::
    (# cptext:^text;
      do &text[]->cptext[];
      draw;
      nm->cptext.puttext;
      ':'->cptext.put;
      priv.data[solution]->cptext.putint;
      cptext[]->title;
    #);
#);
open::
(# w,h:@integer;
  do father.size->(w,h);
  (w-5,h-10)->size;
  (3,14)->position;
  true->bindleft;
  true->bindright;
  1->priv.max;
#);
#);
open::<
(#
  do name->title;
  drawingArea.open;
  INNER
#);
#);

IOAcanvas: @graphview
(#
  Value::
    (# do 5->getHeapInfo->value; #);
  name::(# do 'IOA'->t[];#);
  open::<
    (#
      do
        (110,120)->size;
        (5,5)->position;
        INNER
      #)
    #);
#);

AOAcanvas: @graphview
(#
  Value::
    (# do 35->getHeapInfo->value;
      value-(36->getHeapInfo)->value;
    #);
  name::(# do 'AOA'->t[];#);
  open::<
    (#
      do
        (110,120)->size;
        (125,5)->position;
        INNER
      #)
    #);
#);

CBFAcanvas: @graphview
(#
  Value::

```

```
(# do 15->getHeapInfo->value; #);  
name::(# do 'CBFA'->t[];#);  
open::<  
  (#  
  do  
    (110,120)->size;  
    (245,5)->position;  
    INNER  
  #)  
#)  
#)
```

## 21.15 Iconname Interface

```
ORIGIN '../controls';
LIB_DEF 'guienvutilsiconname' '../../lib';
BODY 'private/iconnamebody';

-- iconButtonLib: attributes --

iconName:
  (# value: ^text;
  enter (# enter value[] ... #)
  exit (# ... #)
  #)
```

## 21.16 InterfaceObjectAdds Interface

```
ORIGIN '../guienv';
LIB_DEF 'guienvutilsintobjads' '../lib';
BODY 'private/interfaceObjectAddsBody';

-- interfaceObjectLib: attributes --
isOpen:
  (# val:@boolean;
   ...
   exit val
  #)
```

## 21.17 Labelled Interface

```
ORIGIN '~beta/guienv/guienv';
LIB_DEF 'guienvutilslabelled' '../../lib';

INCLUDE '~beta/guienv/utils/group';
INCLUDE '~beta/guienv/utils/private/groupbody';

-- windowLib: attributes --

labelled: group
  (#
    <<SLOT labelledLib:attributes>>;

    contentsType:< windowItem;
    contents: @contentsType;

    labelHeight:
      (# ts: ^textStyle;
        do private.theLabel.style->ts[];
        exit ts.lineHeight+3
        #);

    innerFrame:
      (# p: @Point; fr: @rectangle;
        do (3,labelHeight)->fr.topleft;
          size->p; (3,3)->p.subtract; p->fr.bottomright;
        exit fr
        #);

    open::<(# openContents:<
      (# doneInInner: @Boolean;
        do INNER;
          (if not doneInInner then
            contents.open;
          if);
        #);
      do INNER;
        openContents;
        innerFrame->contents.frame;
        TRUE->contents.bindRight->contents.bindBottom;
      #);
  #)
```

## 21.18 Listview Interface

```
ORIGIN '../scrolllists';
LIB_DEF 'guienvutilslistview' '../lib';
BODY 'private/listviewbody';

-- windowLib: attributes --

listView: textScrollList
(* A textScrollList where each textline in the list corresponds to
 * a unique listItem object.
 *)
(# <<SLOT listViewLib: attributes>>;
 listItem:
(* A listItem object corresponds to a unique line in the List
 * The name if this(listItem) i the text in the corresponding
 * line. When the user selects on item by clicking, onSelect is
 * called.
 *)
(# <<SLOT listItemLib: attributes>>;
 name:
(* The name is the text in the line corresponding to
 * this(listItem).
 *)
(# theName: ^text;
 enter (# enter theName[] ... #)
 exit (# ... exit theName[] #)
 #);
 position: integerValue
(* The the item number of this(listItem) in the range
 * from 1 to numberOfItems.
 *)
(# ... #);
 init:<
(* Inserts this(listItem) in the list before
 * `beforeItem', if `beforeItem' is none this(listItem) is
 * appended. Init *must* be the first operation on this(listItem).
 *)
(# beforeItem: ^listItem;
 enter beforeItem[]
 ...
 #);
 delete:<
(* Delete this(listItem) from this(listView). *)
(# ... #);
 onSelect:<
(* Called when this(listItem) is selected by the user or
 * the programmer. If the user has doubleClicked
 * this(listItem) the `doubleClick' flag is true.
 *)
(# doubleClick: @boolean;
 enter doubleClick
 do INNER;
 #);
 select:
(* Select this(listItem). If singeSelection is true, all
 * other items are deSelected.
 *)
(# ... #);
 deSelect:
(* Call this to deSelect this(listItem). *)
(# ... #);
 private: @...;
```

```
    #);  
    listItems: @list  
    (# element::< listItem #);  
    open::<(# ... #);  
    close::<  
    (# ... #);  
    eventHandler::<  
    (# onMouseUp::<  
    (# ... #);  
    #);  
    private: @...;  
#)
```

## 21.19 Navigationkeys Interface

```
ORIGIN '~beta/basiclib/betaenv';
LIB_DEF 'guienvutilsnvkey' '../../lib';
BODY 'private/navigationkeysbody';
( *
 * COPYRIGHT
 *     Copyright (C) Mjolner Informatics, 1991-96
 *     All rights reserved.
 * )

-- lib: attributes --
leftArrow:
    (# theChar: @char; ... exit theChar #);
rightArrow:
    (# theChar: @char; ... exit theChar #);
upArrow:
    (# theChar: @char; ... exit theChar #);
downArrow:
    (# theChar: @char; ... exit theChar #)
```



## 21.20 Obguienvadds Interface

```
ORIGIN '~beta/guienv/guienv';
LIB_DEF 'guienvutilsobguiadds' '../../lib';
BODY 'private/obguienvaddsbody';
BODY 'private/obrubberbody';
-- windowLib: Attributes --
wriggle:
  (# pos: @Point; reallyWriggle: @boolean (* nobody wants it now *)
  enter reallyWriggle
  do
    bringToFront;
    (if not reallyWriggle then leave wriggle if);
    position->pos;
    (- 10,0)->pos.add;
    pos->position;
    TRUE->update;
    (for i: 10 repeat
      (if i mod 2 = 1 then
        (20-(2*i),0)->pos.add; pos->position; TRUE->update;
      else
        (- 20+(2*i),0)->pos.add; pos->position; TRUE->update;
      if);
    for);

  #);

-- windowItemLib: Attributes --
(* RESIZERELATIVE
 * =====
 *
 * Changes the frame of a child windowItem in response, and relative
 * to, a change in the frame of the father frame, as reported by
 * eventHandler.onFatherFrameChanged *)
resizeRelative:
  (# theEvent: ^theEventHandler.onFatherFrameChanged;
  enter theEvent[]
  do ...
  #);
onFatherFrameResizeRelative: action
  (#
  eventType::
    theEventHandler.fatherFrameChanged;

  do theEvent[]->resizeRelative;
  #);
installResizeRelativeAction:
  (#
  do
    &onFatherFrameResizeRelative[]
    ->appendAction;

  #);
itemPos:
  (* Returns the position of this windowItem in the coordinatsystem
  * of the surrounding window. *)
  (# pos: @Point; ... exit pos #);
FrameDrawer:
  (* If UseRunningOutline is TRUE, FrameDrawer draws a
  * running outline around THIS(windowItem) until kill is called.
  * Otherwise a black outline is drawn and kept refreshed until kill
  * is called.
```

```

*)
  (#
    <<SLOT FrameDrawerLib:Attributes>>;
    kill:
      (# douppdate: @Boolean;
        enter douppdate
        ...
        #);
    fdprivate: @...;
    UseRunningOutline: @Boolean;

    enter UseRunningOutline
    ...
    #);
mydrag:
(* Differs from drag by drawing without clipping the children, and
 * by taking a start point from which mousemoves should be handled
 * relatively. Furthermore, the frame of this windowItem is not set,
 * but the resulting frame is returned. *)
  (# startpos: @Point; newFrame: @rectangle;
    enter startpos
    ...
    exit newFrame
    #);

-- canvasLib: Attributes --
getOutline:
(* Lets the user define a default rectangle by dragging and resizing
 * an outline. When an outline has been defined, done is called.
 * When the rectangle is not being resized, it is presented with an
 * illusion of a running outline.
 *)
  (#
    done:< (# result: @rectangle; enter result do INNER #);
    default: @rectangle;

    enter default
    do ...
    #);
defineRect:
(* Used to resize window rectangles. *)
  (# theRect: @rectangle; followWhenOutside: @Boolean;
    enter (theRect, followWhenOutside)
    do ...
    exit theRect
    #);
simpleDefineRect:
(* Used to define a simple rectangle, starting in the point entered. *)
  (# p: @Point; theRect: @rectangle;
    enter p
    do ...
    exit theRect
    #);
browserDrawRect:
(* Draws (or clears) rectangle. *)
  (# theRect: @rectangle;
    enter theRect
    ...
    #);

-- lib: Attributes --
actionList: List
  (#
    element:: (# action: ##Object #);

```

```

appendAction:
  (# new: ^element; action: ##Object;
  enter action##
  do &element[]->new[]; action##->new.action##; new[]->append;
  #);

#);
actionedMenuItemAction:
  (# paramType:< Object; param: ^paramType; checked: @Boolean;
  enter param[]
  do INNER
  exit checked
  #);
actionedMenuItemOnStatus:
  (# paramType:< Object; param: ^paramType; value: @Boolean
  enter param[]
  do INNER
  exit value
  #);

-- menuLib: Attributes --
actionedMenuItem: menuItem
  (#
  onSelectAction: ##actionedMenuItemAction;
  onStatusAction: ##actionedMenuItemOnStatus;
  paramType:< Object;
  param: ^paramType;
  open::<
    (# itemname: ^Text;
    enter (onSelectAction##,onStatusAction##,param[],itemname[])
    do THIS(actionedMenuItem)[]->append; itemname[]->name; INNER ;
    #);
  eventHandler::<
    (#
    onSelect::<
      (#
      do
        (if onSelectAction## <> none then
          param[]->onSelectAction->checked
          if);
      INNER ;

      #);
    onStatus::<
      (#
      do
        (if onStatusAction## <> none then
          param[]->onStatusAction->value
          if);
      INNER ;

      #);

    #);

#)
#)

```

## 21.21 Pane Interface

```
ORIGIN '../guienv';
LIB_DEF 'guienvutilspane' '../../lib';
BODY 'private/panebody';
--- windowLib:attributes ---
pane: Canvas
(
  *
  * Initialization:
  *   1. Call open.
  *   2. From within INNER open, call appendMember repeatedly until all
  *       initial members have been appended.
  *   3. From within INNER open, call appendsDone.
  *
  * Extension:
  *   1. Call appendMember repeatedly until all new members have
  *       been appended.
  *   2. Call appendsDone.
  *
  * Deletion:
  *   1. Call deleteMember.
  *
  * If the application allows interactive change of the size of the Pane,
  * the members are automatically extended, since correct operation of
  * the pane depends on the assumption that members fill out the
  * pane. DO NOT INTERFERE WITH AUTOMATIC MEMBER RESIZING! E.g., do
  * not bind members, and do not install actions that resize members. This is
  * taken care of by pane.
  *)
(# <<SLOT paneLib:attributes>>;

open::<
  (* verticalStacking: Whether members are stacked vert. or horiz.
  * minsize: Minimal height (or width) of members after interaction.
  * panewidth: Width of the separators between members. Minimum is 2. *)
  (# setDefaults:<
    (* May be used to set default values for verticalStacking,
    * minsize, and panewidth. *)
    (# do INNER #);
    verticalStacking: @Boolean;
    minsize, panewidth: @Integer;
    enter (verticalStacking,minsize,panewidth)
    ...
  #);

appendMember:
  (# member: ^Canvas;
  enter member[]
  ...
  #);

appendsDone: (# ... #);

fixedSize:
  (* Will not respond to automatic resizing in vertical or
  * horizontal direction (depending on the stacking order of
  * this pane
  *)
  (# member: ^Canvas;
  enter member[]
  ...
  #);

deleteMember:
  (# member: ^Canvas;
```

```

enter member[]
...
#);

zoomMember:
  (# member: ^Canvas;
  enter member[]
  ...
  #);

unzoom:
  (#
  ...
  #);

onMemberResize:< IntegerValue
  (* If onMemberResize=paneFixed (default), then dragging a
  * separator will resize both of its surrounding members, and keep the
  * size of the pane fixed.
  * If onMemberResize=paneResizable, then, in addition, dragging a
  * separator with the Shift key down will resize the member immediately
  * before the dragged separator, and keep the rest of the member
  * sizes unchanged. As a result, the pane itself is resized. *)
paneFixed: IntegerValue (# do 0->value #);
paneResizable: IntegerValue (# do 1->value #);

fitToFather:
  (* Changes the size of this pane to fit the size of its
  * father frame.
  * If fitHoriz is TRUE, the pane is fitted horizontally.
  * Default of fitHoriz is verticalStacking.
  * If fitVert is TRUE, the pane is fitted vertically.
  * Default of fitVert is not verticalStacking.
  *)
  (# fitHoriz:< BooleanObject
    (# do ...; INNER #);
    fitVert:< BooleanObject
    (# do ...; INNER #);
  do ...
  #);
fatherFrame:<
  (* Further bind fatherFrame in case "father.frame" is not the
  * frame to be fitted against.
  *)
  (# fr: @rectangle;
  do father.frame->fr; INNER
  exit fr
  #);

dppriv: @...;

eventHandler::<(# onFrameChanged::<
  (* Resizes members to maintain invariant that the pane
  * is filled by its members. *)
  (# do ... #);
#);
#)

```

## 21.22 PromptForArgs Interface

```
ORIGIN 'prompts';
LIB_DEF 'guienvutilspromptarg' '../../lib';
BODY 'private/promptForArgsBody';

--GuienvLib: attributes--

PromptForArgs: PromptForText
  (* Special PromptForText used to read line of arguments *)
  (# <<SLOT PromptForArgsLib: attributes>>;
   argv: [0]^text (* The arguments contained in the string typed by the user *);
   argc: @integer;
   validate::<(#
     do ...
     #);
  #)
```

## 21.23 Prompts Interface

```
ORIGIN '../guienv';
LIB_DEF 'guienvutilsprompt' '../lib';
BODY 'private/promptsbody';

--GuienvLib: attributes--

(* Standard text dialogs for guienv.
 * Known problems:
 * 1. Buttons should be highlighted when invoked via <return>,
 *    <esc> etc.
 * 2. Patterns should be specializations of special dialog pattern,
 *    which would make the window manager treat the prompts as dialogs.
 *)

Prompt: window
(* Dialog with a message text and an OK and Cancel button.
 * When typing <Return> in the text fiels, the OK button
 * is invoked, and when typing <Escape> the cancel button
 * is invoked.
 *)
(# <<SLOT prompt: attributes>>;
menubarVisible:: (# do false -> value #);
type:: (# do windowTypes.dialog->value #);
ok:< Object
    (* Called when the OK button is clicked *);
notok:< Object
    (* Called when the 'No' button is pressed (only promptForBoolean *));
cancel:< object
    (* Called when the Cancel button is clicked *);
extra_hspace:< integerValue
    (* Extra horizontal space to put to the right of the fields *);
extra_vspace:< integerValue
    (* Extra vertical space to put between the fields and the buttons *);
popup:<
    (* Used to pop up the dialog and wait for the text to be typed *)
    (# titleText, msgText: ^text;
    father: ^window;
    enter (father[], titleText[], msgText[])
    ...
    #);
okLabel:< (# value: ^text do 'OK'->value[]; INNER exit value[] #);
notokLabel:<
    (# value: ^text do 'NOT OK'->value[]; INNER exit value[] #);
cancelLabel:<
    (# value: ^text do 'Cancel'->value[]; INNER exit value[] #);
open::< (# ... #);
private: @...;
enter popup
#);

PromptForText: Prompt
(* Prompt with a field to enter a text added. *)
(# <<SLOT promptForTextLib: attributes>>;
usertext: ^text; (* The text entered by user *)
linesInUsertext:< (* number of lines in the text field for user input *)
    integerValue(# do 1->value #);
ok::<
    (# ... #);
validate:< BooleanValue
    (* Called when the OK button is pressed. THIS(Prompt) is only
    * dismissed (and INNER in the ok virtual called) if validate returns
    * true.
```

```

    *)
    (# hiliteOnError: @boolean
      (* Hilite text on error. Default true *);
    ...
    #);
popup::<
  (# defaultText: ^text;
    enter defaultText[]
    ...
    #);
open::< (# ... #);
textprivate: @...;
#);

PromptForInteger: PromptForText
(* Special PromptForText that will only accept integer input *)
(# <<SLOT promptForIntegerLib: attributes>>;
  userinteger: @integer (* The integer typed by the user *);
  validate::<
    (# ... #)
  #);

promptForBoolean: Prompt
(* Special Prompt where the OK buttons has label 'Yes' and
  * there is an extra button with label 'No'.
  *)
(# ok::<
  (# ... #);
  notok::< (* Called when the 'No' button is pressed *)
  (# ... #);
  okLabel::<
  (# do 'Yes'->value[]; INNER #);
  notokLabel::<
  (# do 'No'->value[]; INNER #);
  cancelLabel::<
  (# do 'Cancel'->value[]; INNER #);
  open::<
  (# ... #)
#)

```



## 21.24 Rasteradds Interface

```
ORIGIN '../guienv';
LIB_ITEM 'guienv';
BODY 'private/rasteraddsbody';
(* INCLUDE '../raster'; *)

-- guienvlib: attributes --
iconResource: pixmap
  (# <<SLOT pixmapLib: attributes>>;
   loadById:
     (# id: @integer;
      enter id
      do ...
      #);
  #);

bitmapResource: pixmap
  (# <<SLOT pixmapLib2: attributes>>;
   loadById:
     (# id: @integer;
      success: @boolean;
      enter id
      ...
      exit success
      #);
   loadByName:
     (# name: ^text;
      success: @boolean;
      enter name[]
      ...
      exit success
      #);
  #)
```

## 21.25 Scrolleradds Interface

```
ORIGIN '../fields';
LIB_DEF 'guienvutilsscrolladds' '../../lib';
BODY 'private/scrolleraddsbody';

-- scrollerLib: attributes --

theScroll:
  (# h, v: @integer;
   enter (# enter (h, v) ... #)
   exit (# ... exit (h, v) #)
  #);

scrollIntoView:
  (# theWindowItem: ^windowItem;
   enter theWindowItem[]
   ...
  #);

viewSize:
  (# width, height: @integer;
   ...
   exit (width, height)
  #);

noTabbingToScrollbars:
  (#
  ...
  #);

contentsIsTarget:
  (# value: @boolean;
   enter value
   ...
  #)
```

## 21.26 Simplemenu Interface

```
ORIGIN '../guienv';
LIB_DEF 'guienvutilssimplemenu' '../../lib';
BODY 'private/simplemenubody';
-- MenuBarLib: Attributes --
simplemenu: menu
(* Special menu type with interdependant check marks, some other
 * extra features, and a few code saving patterns, that allow
 * for simple specification of a menu.
 *
 * Example:
 *
 * FileMenu: @simplemenu
 *   (# inew:    @item(# onSelect:: (# do NewFile    #)#);
 *     iopen:   @item(# onSelect:: (# do OpenFile   #)#);
 *     iclose:  @item(# onSelect:: (# do Iconify    #)#);
 *     isave:   @item(# onSelect:: (# do SaveFile   #)#);
 *     isaveas: @item(# onSelect:: (# do SaveFileAs #)#);
 *     iexport: @item(# onSelect:: (# do Export    #)#);
 *     iprint:  @item(# onSelect:: (# do Print     #)#);
 *     iquit:   @item(# onSelect:: (# do Quit      #)#);
 *
 *   open::
 *     (#
 *       do ('New...', 'n') -> inew.newkey; false -> inew.enabled;
 *       ('Open...', 'o') -> iopen.newkey; false -> iopen.enabled;
 *       ('Close', 'w') -> iclose.newkey;
 *       newseparator;
 *       ('Save', 's') -> isave.newkey; false -> isave.enabled;
 *       ('Save As...') -> isaveas.new; false -> isaveas.enabled;
 *       newseparator;
 *       ('Print...', 'p') -> iprint.newkey;
 *       ('Export...', 'e') -> iexport.newkey;
 *       newseparator;
 *       ('Quit', 'q') -> iquit.newkey;
 *     #)
 *   #);
 *
 * ShapeMenu: @simplemenu
 *   (# ievenodd: @radioitem
 *     (# onSelect:: (# do EvenOddRule->SetFillRule #)#);
 *     iwinding: @radioitem
 *       (# onSelect:: (# do WindingRule->SetFillRule #)#);
 *   open::
 *     (#
 *       do 'Even-Odd Fillrule'->ievenodd.new;
 *       'Winding Fillrule'->iwinding.new;
 *     #);
 *   #);
 *)
 (#
 item: menuitem
   (#
     enabled: @boolean
     (* Set to true or false to enable or disable THIS(item) *) ;
     onSelect:< object (* Shortcut for eventhandler.onSelect *) ;
     onStatus:< booleanValue
       (* Shortcut for eventhandler.onStatus *)
       (# do enabled->value; INNER #);
     new: (* Open and append THIS(Item) with label itemtext *)
       (# itemtext: ^text;
         enter itemtext[]
         ...
```

```

    #);
    newkey: new
    (* Also add key equivalent *)
    (# equiv: @char
    enter equiv
    ...
    #);
    eventhandler::< (#
    onSelect::<
    (#
    ...
    #);
    onStatus::< (# ... #);

    #);

    #);
    noOfRadioGroups:< integervalue
    (* The number of independant groups of radioitems.
    * Default 1.
    *) (# ... #);
    radioitem: item
    (* Special item, that is un-checked when another radioitem
    * in the radiogroup indicated by "checkgroup" is selected.
    *)
    (#
    checkgroup: @integer
    (* The group of items THIS(item) is dependant on. default 1. *) ;
    open::< (# ... #);
    onSelect::<
    (#
    ...
    #);

    #);
    toggleitem: item
    (* Special item that is checked every second time it is selected *)
    (# onSelect::< (# ... #)
    #);
    newseparator:
    (* Open and append a separator to THIS(simplemenu) *)
    (# ... #);
    new:
    (* Open THIS(simplemenu) and append it to THIS(MenuBar)
    * with label menutext.
    *)
    (# menutext: ^text;
    enter menutext[]
    ...
    #);
    changechecked:
    (* Explicitly change the checked item to be newitem *)
    (# newitem: ^radioitem
    enter newitem[]
    ...
    #);
    <<SLOT SimpleMenuLib:Attributes>>;
    private: @...;

#)

```

## 21.27 Streamwindow Interface

```
ORIGIN '~beta/guienv/guienv';
LIB_DEF 'guienvutilsstreamwin' '../../lib';
BODY 'private/streamwindowbody';

--GuienvLib: attributes--
streamwindow: window
(* A separate scrolled window, which displays the text put to the
 * stream 'theStream'.
 * theStream buffers output to prevent too frequent
 * updates of the text output.
 * Use flush to ensure everything is displayed in
 * text output.
 * Should only be 'open'-ed once. Call 'show' and 'hide'
 * to make the window visible/invisible.
 *)
(# theStream: @stream<<SLOT StreamWindowStreamBody: MainPart>>;
  close::<(# ... #);
  eventHandler::<
    (#
      onAboutToClose::< (# ... #);
    #);
  open::< (# ... #);
  show: ...;
  flush: ...;
  vanish: (* deletes logfile, if opened *)
    (# ... #);
  logfile: ^text
    (* If specified, logs output to file with that name too *);
  hideOnCloseByUser:@Boolean;
    (* If true then window will be hide when a user "click" on close *);
  saveAs:
    (* Opens a standard file dialog which prompts for a filename.
     * If this dialog is confirmed, the text written to THIS(StreamWindow)
     * is written to the named file.
     *)
    (# dialogtitle: ^text;
      enter dialogtitle[]
      do ...
    #);
  private: @...;
  exit theStream[]
#)
```

## 21.28 TabControl Interface

```
ORIGIN '~beta/guienv/guienv';
LIB_DEF 'guienvutilstabctrl' '../..../lib';
BODY 'private/tabControlBody';
(*
 * COPYRIGHT
 * Copyright (C) Mjolner Informatics, 1997-98
 * All rights reserved.
 *)

-- windowLib: attributes --

tabControl: canvas
  (# <<SLOT tabControlLib: attributes>>;

  resourceAllocationError:< exception
    (# errorMsg: ^text;
     enter errorMsg[]
     do INNER;
     #);

  apiError:< exception
    (# errorMsg: ^text;
     enter errorMsg[]
     do INNER;
     #);

  useError:< exception
    (# errorMsg: ^text;
     enter errorMsg[]
     do INNER;
     #);

  multiLine:<
    (* if multiLine is TRUE the tabControl displays multiple
     * rows of tabs, if necessary, so all tabs are visible at once.
     *)
    booleanValue;

  tab:
    (# label:
      (# theLabel: ^text;
       enter (# enter theLabel[] ... #)
       exit (# ... exit theLabel[] #)
       #);
      icon:
        (# theIcon: ^pixmap;
         enter (# enter theIcon[] ... #)
         exit (# ... exit theIcon[] #)
         #);
      page:
        (# thePage: ^canvas;
         enter (# enter thePage[] ... #)
         exit (# ... exit thePage[] #)
         #);

      open:<(# ... #);

      close:<
        (# ... #);

      select:
        (# ... #);
```

```

onSelect:<
  (* Called when the selection has been changed by the end user *)
  (#
  do INNER onSelect;
  #);

tabPrivate: @...;

#);

tabs: @
  (#
  size: integerValue
  (# ... #);

  scan:
  (# current: ^tab;
  ...
  #);

  tabsPrivate: @...;
  #);

open::<
  (# create::<
  (# ... #);
  ...
  #);

close::<
  (# ... #);

onBeforeSelectionChange:<
  (* Called when the selection is about to change;
  * Assign FALSE to allow to prevent the selection from changing.
  *)
  (# allow: @boolean;
  do TRUE -> allow;
  INNER;
  exit allow
  #);

selection:
  (# theTab: ^tab;
  enter (# enter theTab[] ... #)
  exit (# ... exit theTab[] #)
  #);

eventHandler::<
  (# onMouseUp::<
  (# ... #);
  onMouseDown::<
  (# ... #);
  onFatherFrameChanged::<
  (# ... #);
  onActivate::<
  (# ... #);
  onRefresh::<
  (# ... #);
  #);
private: @...;
#)

```

## 21.29 Tableview Interface

```
ORIGIN '~beta/guienv/guienv';
INCLUDE '~beta/guienv/graphics';
BODY 'private/tableviewbody';
-- windowLib: Attributes --
tableView: canvas
  (#
    <<SLOT tableViewLib:Attributes>>;
    tableItemType:< tableItem;
    abstractColumn: interfaceObject
      (#
        <<SLOT abstractColumnLib:Attributes>>;
        title:
          (# value: ^text;
            enter
              (# enter value[] ... #)
            exit
              (#
                ...
                exit value[]
                #)
              #);
        width:
          (# value: @integer;
            enter (# enter value ... #)
            exit (# ... exit value #)
            #);
        less:< booleanValue
          (#
            left,right: ^tableItemType;
            leftData,rightData: ^text;
            doneInInner: @boolean;

            enter (left[],right[])
              ...
            #);
        open::< (#
          ...
          #);
        close::< (# ... #);
        eventHandler::<
          (#
            drawTitleEvent: event
              (#
                g: ^graphics;
                bounds: ^rectangle;

                enter (g[],bounds[])
                  do INNER ;
                #);
            onDrawTitle:< drawTitleEvent;
            drawItemEvent: event
              (#
                g: ^graphics;
                bounds: ^rectangle;
                theTableItem:
                  ^tableItemType;
                data: ^text;

                enter (g[],bounds[],theTableItem[],data[])
                  do INNER ;
                #);
            onDrawItem:< drawItemEvent;
```



```

        #);
        private: @...;

        #);
appendColumn:
    (#
        theColumn: ^abstractColumn;
        enter theColumn[]
        ...
    #);
insertColumn:
    (# theColumn: ^abstractColumn; after: ^abstractColumn;
        enter (theColumn[],after[])
        ...
    #);
deleteColumn:
    (# theColumn: ^abstractColumn;
        enter theColumn[]
        ...
    #);
horizontalScrollbarVisible:
    (# visible: @boolean;
        enter
            (#
                enter visible
                ...
            #)
        exit
            (#
                ...
                exit visible
            #)
    #);
verticalScrollbarVisible:
    (# visible: @boolean;
        enter
            (#
                enter visible
                ...
            #)
        exit
            (#
                ...
            #)
    #);
changeHiliteColor:
    (# aColor: @Color
        enter aColor
        ...
    #);
columnWithIconType:<
abstractColumn
    (#
        eventHandler:<
            (#
                onDrawTitle:<
                    (# ... #);
                onDrawItem:<
                    (#
                        ...
                    #);
            #);
    #);
    #);

```

```

columnWithIcon: @columnWithIconType;
alignLeft: (# exit 1 #);
alignRight: (# exit 2 #);
column: abstractColumn
  (#
    <<SLOT columnLib:Attributes>>;
    alignment:
      (# value: @integer;
        enter
          (#
            enter value
            ...
          #)
        exit (# ... exit value #)
      #);
    open::<
      (#
        ...
      #);
    close::<
      (#
        ...
      #);
    eventHandler::<
      (#
        onDrawTitle::< (# ... #);
        onDrawItem::<
          (#
            ...
          #);

        #);
    private: @...;

  #);
tableItem: interfaceObject
  (#
    <<SLOT tableItemLib:Attributes>>;
    mainText:
      (# value: ^text;
        enter (# enter value[] ... #)
        exit (# ... exit value[] #)
      #);
    icon:
      (# theIcon: ^pixmap;
        enter (# enter theIcon[] ... #)
        exit
          (#
            ...
            exit theIcon[]
          #)
      #);
    setColumnText:
      (# theColumn: ^abstractColumn; value: ^text;
        enter (theColumn[],value[])
        ...
      #);
    getColumnText:
      (#
        theColumn:
          ^abstractColumn;
          value: ^text;

        enter theColumn[]
        ...
        exit value[]

```

```

#);
textIndent:
  (# value: @integer;
  enter (# enter value ... #)
  exit (# ... exit value #)
  #);
iconIndent:
  (# value: @integer;
  enter (# enter value ... #)
  exit (# ... exit value #)
  #);
selected: booleanValue (# ... #);
eventHandler::<
  (#
  selectEvent: event
    (# do INNER ; #);
  onSelect:< selectEvent
    (# doubleClick: @boolean;
    enter doubleClick
    do INNER
    #);
  deSelectEvent: event
    (# do INNER #);
  onDeSelect:< deSelectEvent
  #);
open::<
  (#
  ...
  #);
close::< (# ... #);
private:
  @...;

#);
append:
  (# theTableItem: ^tableItemType;
  enter theTableItem[]
  ...
  #);
prepend:
  (# theTableItem: ^tableItemType;
  enter theTableItem[]
  ...
  #);
delete:
  (# theTableItem: ^tableItemType;
  enter theTableItem[]
  ...
  #);
insert:
  (#
  theTableItem: ^tableItemType;
  after: ^tableItemType;

  enter (theTableItem[],after[])
  ...
  #);
scan: (# current: ^tableItemType; ... #);
deleteSelection:
  (#
  ...
  #);
selection: @
  (#
  set:
    (# theTableItem: ^tableItemType;

```

```

        enter theTableItem[]
        ...
        #);
    add:
        (#
            theTableItem:
                ^tableItemType;

            enter theTableItem[]
            ...
            #);
    remove:
        (#
            theTableItem:
                ^tableItemType;

            enter theTableItem[]
            ...
            #);
    clear:
        (#
            ...
            #);
    scan:
        (# current: ^tableItemType;
            ...
            #);

#);
theScroll:
    (# x,y: @integer;
        enter
            (#
                enter (x,y)
                ...
                #)
            exit (# ... exit (x,y) #)
        #);
scroll:
    (# dX,dY: @integer;
        enter (dX,dY)
        ...
        #);
maxScroll:
    (# maxX,maxY: @integer;
        ...
        exit (maxX,maxY)
        #);
sortByColumn:
    (# theColumn: ^column;
        enter
            (#
                enter theColumn[]
                ...
                #)
            exit (# ... exit theColumn[] #)
        #);
open::< (# ... #);
close::<
    (# ... #);
eventHandler::<

    (#
        onFrameChanged::< (# ... #);
        onMouseUp::< (# ... #);
    )

```

```
#);  
private:  
  @...;  
  
#)
```

## 21.30 TextFielddadds Interface

```
ORIGIN '../fields';
LIB_DEF 'guienvutilstextfld' '../lib';
MDBODY default 'private/X11/textfielddadds_X11body'
    mac 'private/macintosh/textfielddadds_macbody'
    ppc 'private/macintosh/textfielddadds_macbody'
    ppcmac 'private/macintosh/textfielddadds_macbody'
    nti 'private/winnt/textfielddadds_ntibody'

-- textFieldLib: Attributes --
posToRowCol:
    (# pos: @integer; row,col: @integer;
    indexError:< exception
    (#
    do 'pos out of range in posToRowCol' -> msg.append;
    INNER;
    #);
    enter pos
    do ...;
    exit (row,col)
    #);
rowColToPos:
    (#
    row,col: @integer;
    pos: @integer;
    indexError:< exception
    (#
    do 'Row or col out of range error in rowColToPos' -> msg.append;
    INNER;
    #);
    enter (row,col)
    do ...;
    exit pos
    #);

automaticScrolling:
    (# value: @boolean;
    enter value
    ...
    #);

disableUpdate:
    (# ... #);
enableUpdate:
    (# ... #);
updateLine:
    (* updateLine updates lineNumber in THIS(textField)
    *)
    (# lineNumber: @integer
    enter lineNumber
    ...
    #);
updateRegion:
    (* updateRegion updates the textfield from
    * (0,y1) to (size.x,y2)
    * NB: the coordinates is in pixels
    *)
    (# y1,y2: @integer
    enter (y1,y2)
    ...
    #)
```

## 21.31 Tooltip Interface

```
ORIGIN '~beta/guienv/guienv';
BODY 'private/tooltipBody';

INCLUDE '~beta/guienv/graphmath';

-- windowlib: attributes --
tool:
  (# theWindowItem: ^windowItem;
     theTip: ^text;
     #);

rectTool: tool
  (#
     theRect: ^rectangle; (* Coordinates of the bounding rectangle of the
                           * tool.
                           * The coordinates are relative to the upper-left
                           * corner theWindowItem.
                           * NOT supported on unix.
                           *)
     #);

tooltipControl:
  (#
     <<SLOT GUIENVtooltipLib: attributes>>;

     (* Duration types used in setDelayTime. *)

     AUTOMATIC: (# exit 0 #); (* Automatically calculates the initial,
                              * reshape, and autopopup durations based
                              * on the value of delay. *)

     RESHOW: (# exit 1 #); (* Sets the length of the delay before
                           * subsequent ToolTip windows are displayed
                           * when the cursor is moved from one tool
                           * to another.*)

     AUTOPOP: (# exit 2 #); (* Sets the length of time before the
                            * ToolTip window is hidden if the cursor
                            * remains stationary in the tool's
                            * bounding rectangle after the ToolTip
                            * window has appeared. *)

     INITIAL: (# exit 3 #); (* Sets the length of time that the
                            * cursor must remain stationary within
                            * the bounding rectangle of a tool before
                            * the ToolTip window is displayed. *)

     setDelayTime:
       (# delay: @integer; (* New duration, in milliseconds. *)
          durationType: @integer;
          enter (durationType, delay)
          ...
          #);

     add:
       (# theTool: ^tool;
          enter theTool[]
          ...
          #);
```

```

delete:
  (# theTool: ^tool;
  enter theTool[]
  ...
  #);

open:<(# ... #);

close:<
  (# ... #);

tooltipPriv: @...;
#);

-- windowitemlib:attributes--
addToolTip:
  (# t:^text;
  theTool:^tool;
  tooltip:^tooltipcontrol;
  enter t[]
  ...
  #);
addToolTipExt:
  (# t:^text;
  theTool:^tool;
  theWindow:^window;
  tooltip:^tooltipcontrol;
  enter (theWindow[], t[])
  ...
  #)

```



## 21.32 Treeview Interface

```
ORIGIN '~beta/guienv/guienv';
INCLUDE '~beta/guienv/fields';

BODY 'private/treeviewbody';

--- windowlib: attributes ---
treeview: canvas
  (# <<SLOT treeviewLib: attributes>>;
  selection: ^item;
  item: (* abstract superpattern for elements in the tree *)
    (# <<SLOT treeviewItemLib: attributes>>;
    isFolder:< booleanValue;
    father: ^folder (* the folder in which this(item) is
                     * located - this attribute is only valid,
                     * if this(item) is added to the folder
                     * using addItem
                     *);
    icon:< (* the icon to show for this type of item *)
      (# i: ^guienv.pixmap
      enter i[]
      ...
      #);
    label: ^text (* the text of this item *);
    popupmenu:< (* popup menu on this item *)
      (# m: ^guienv.menu
      enter m[]
      ...
      exit m[]
      #);
    scrollIntoView:
      (# sc: ^scroller
      enter sc[]
      ...
      #);
    select:
      (# ... #);
    deselect:
      (# ... #);
    onIconSelected:< (* invoked when item icon is selected *)
      (# ev: ^eventhandler.mouseevent
      enter ev[]
      ...
      #);
    onSelected:< (* invoked when item is selected *)
      (# ev: ^eventhandler.mouseevent
      enter ev[]
      ...
      #);
    onLabelChanged:<
      (* invoked the label have been edited. newLabel will
      * contain the edited label value.
      *)
      (# newLabel: ^text
      enter newLabel[]
      ...
      #);
    allowLabelEdit:< booleanValue;
    itemPrivate: @...;
  #);
  folder: item
    (# <<SLOT treeviewFolderLib: attributes>>;
    isFolder:: trueObject;
```

```

items: @list(# element:: item #);
addItem:
  (# i: ^item
  enter i[]
  do this(folder)[]->i.father[];
  i[]->items.append;
  INNER
  #);
prependItem:
  (# i: ^item
  enter i[]
  do this(folder)[]->i.father[];
  i[]->items.prepend;
  INNER
  #);
Icon::<(* the icon to show for this folder when open *)
  (# openicon: ^guienv.pixmap
  enter openicon[]
  ...
  #);
onToggleSelected:< (* invoked when toggle icon is selected *)
  (# ... #);
onIconSelected::<(# ... #);
onSelected::<
  (# ... #);
onExpand:< (* invoked when folder is opened *)
  (# ... #);
onCollapse:< (* invoked when folder is closed again *)
  (# ... #);
isExpanded:<
  (# open:@boolean
  ...
  exit open
  #);
folderPrivate: @...;
#);
root:
  (# f: ^folder
  enter (# enter f[] ... #)
  exit (# ... exit f[] #)
  #);
hideRoot:< (* if trueObject then root is not shown *)
  booleanValue;
minSize:< (* Specifies the minimum size of this(treeView) *)
  (# width, height: @integer;
  do INNER;
  exit (width, height)
  #);
changed:
  (# ... #);
eventHandler::<
  (# onRefresh::<
  (# ... #);
  onMouseDown::<
  (# ... #);
  onMouseUp::<
  (# ... #);
  onUpdate:< (* further bind onUpdate and change etc. newheight,
  * to change the size of this treeview
  *)
  (# width,height:@integer;
  newwidth,newheight:@integer;
  updateDoneInInner:@boolean;
  enter (width,height)
  do width->newwidth;
  height->newheight;

```

```
INNER;  
(if not updateDoneInInner then  
  (if (newwidth<>width) or (newheight<>height) then  
    (newwidth,newheight)->size  
  else  
    true->update;  
  if);  
if)  
#)  
#);  
open::<  
  (# ... #);  
treeviewPrivate: @...;  
#)
```

## 21.33 Walkingants Interface

```
ORIGIN '../guienv';
LIB_DEF 'guienvutilsants' '../lib';
BODY 'private/walkingantsbody';

-- GUIenvLib: attributes --

oneWay: (# exit 1 #);
twoWay: (# exit 2 #);

walkingAnts:
(* WalkingsAnts provides a way to highlight an area inside a windowItem.
*
* The walking ants are an animated stippled rectangle.
*
* Interval is the pause in microseconds between each step.
*
* More than one area can be animated at once.
*)
(# <<SLOT walkingAntsLib: attributes>>;

(* Interval is the pause in microseconds
* between each step.
*)
interval: @integer;

(* Style is oneWay or twoWay.
* oneWay: the ants walks clockwise around the edge
* of the area.
* twoWay: the ants alternates between clock
* and counterclock wise.
*)
style: @integer;

(* Size (width and hight) of pen to use *)
pensize: @integer;

init:<(#
...
#);

add:
(* Add an area. *)
(# theRectangle: ^rectangle;
theWindowItem: ^window.windowItem;
enter (theWindowItem[], theRectangle[])
...
#);

delete:
(* Delete an area. *)
(# theRectangle: ^rectangle;
theWindowItem: ^window.windowItem;
enter (theWindowItem[], theRectangle[])
...
#);

clear:
(* Delete all areas *)
(# ... #);

start:
(* Start the animation *)
(#
```

```
    ...  
    #);  
stop:  
    (* Stop the animation *)  
    (# ... #);  
  
private: @...;  
#)
```

## 22.1 Cdplayer Interface

```
ORIGIN '~beta/guienv/guienv';
BODY 'private/cdplayerbody';

-- guienvLib: attributes --

cdPlayer:
  (* This is an interface to controlling the CD player
   * build into the computer.
   *)
  (# <<SLOT cdPlayerLib: attributes>>;
   deviceError:< exception
     (# errMsg: ^text;
      enter errMsg[]
      do INNER deviceError
      #);
   allocationError:< exception
     (# errMsg: ^text;
      enter errMsg[]
      do INNER allocationError
      #);
   open:<(# ... #);
   close:<
     (# ... #);
   cdPresent:
     (* Tells if a cd is present in the cd drawer. *)
     (# isCDPresent: @boolean;
      ...
      exit isCDPresent
      #);
   play:
     (* Play starting at the specified track number. *)
     (# track: @integer;
      enter track
      ...
      #);
   stop:
     (* Stop playing, rewinding to the start of the CD *)
     (#
      ...
      #);
   pause:
     (* Pause playing. *)
     (#
      ...
      #);
   resume:
     (* Resume playing. *)
     (#
      ...
      #);
   duration:
     (* Return the total running time of the current CD in milliseonds. *)
     (# theDuration: @integer;
      ...
      exit theDuration
      #);
   currentTime:
     (* This is the current time in milliseconds. *)
     (# theTime: @integer;
      theTrack:@integer;
      enter (# enter (theTrack,theTime) ... #)
```

```
    exit (# ... exit (theTrack,theTime) #)
    #);
numberOfTracks:
    (* Return the number of tracks on the current CD. *)
    (# tracks: @integer;
    ...
    exit tracks
    #);
private: @...;
#)
```

## 22.2 Movieplayer Interface

```
ORIGIN '~beta/guienv/guienv';

BODY 'private/movieplayerbody';

-- guienvLib: attributes --

movie:
(* A movie represents quicktime movies that can be
 * played in a moviePlayer.
 *)
(# <<SLOT movieLib: attributes>>;
 read:
  (* Read the specified movie file. *)
  (# theFileName: ^text;
   enter theFileName[]
   ...
  #);
 userSelectFile:
  (* Let the user select a movie file in a standard file
   * dialog.
   *)
  (# success: @boolean;
   ...
   exit success
  #);
 duration:
  (* Return the duration of the movie in milliseconds *)
  (# theDuration: @integer;
   ...
   exit theDuration
  #);
 fileName:
  (* The name of the movie file. *)
  (# theFileName: ^text;
   ...
   exit theFileName[]
  #);
 displaySize:
  (* The natural width and height of the movie. *)
  (# width, height: @integer;
   ...
   exit (width, height)
  #);
 private: @...;
#);

-- windowLib: attributes --

moviePlayer: windowitem
(# <<SLOT moviePlayerLib: attributes>>;
 controllerVisible:< (# value: @boolean; do TRUE -> value; INNER exit value#);
  (* Furtherbind controllerVisible to "false -> value"
   * to hide the controller.
   *)
 automaticResize:< (# value: @boolean; do TRUE -> value; INNER exit value#);
  (* Furtherbind automaticResize to "false -> value"
   * to prevent the moviePlayer from resizing automatically
   * based on the natural size of the movie.
   *)
 contents:
```



```

(* The movie that are selected in the moviePlayer. *)
(#
enter (# enter theMovie[] ... #)
exit theMovie[]
#);
read:
(* Read the specified movie file. This is a shortcut for initialising a
* Movie.
*)
(# theFileName: ^text;
enter theFileName[]
...
#);
userSelectFile:
(* Let the user select a movie file in a standard file
* dialog.This is a shortcut for initialising a
* Movie.
*)
(# success: @boolean;
...
exit success
#);

currentTime:
(* The current time is measured in milliseconds *)
(# theTime: @integer;
enter (# enter theTime ... #)
exit (# ... exit theTime #)
#);
currentFrame:
(* The current frame *)
(# theFrame: @integer;
enter (# enter theFrame ... #)
exit (# ... exit theFrame #)
#);

play:
(* Start playing. *)
(# ... #);
stop:
(* Stop playing. *)
(# ... #);
pause:
(* Pause playing. *)
(# ... #);
open::<
(# create::(# ...#);
...
#);
close::<
(#
...
#);
eventHandler::<
(# contentsChanged: event
(# name:^text;
enter name[]
do INNER;
#);
onContentsChanged:< contentsChanged;

onActivate::<
(# ... #);
onDeactivate::<
(# ... #);
onMouseDown::<

```

```
        (# ... #);  
    onRefresh::<  
        (# ... #);  
    #);  
    theMovie: ^movie;  
    private: @...;  
#)
```

## 23.1 OpenGL Interface

```
ORIGIN '~beta/guienv/guienv';
INCLUDE 'openGLlib';
BODY 'private/openGLbody.bet';

--windowlib:attributes--

openGLarea>windowitem
  (#
    Doublebuffer:@boolean; (* True if this windowitem has doublebuffer *)
    glBSwapBuffers:
      ...;
    openGLprivate:@...;
    <<SLOT openGLarealib:attributes>>;
    open::<(#
      create::<
        (#
          ...
          #);
      postcreate:<
        (#
          ...
          #);
    do
      postcreate;
      (200,200)->size;
      INNER open;

    #);
  #)
```

## 23.2 OpenGLlib Interface

```
ORIGIN 'OpenGLlib'
-- lib:attributes --

(* small patterns, for pretty use of repetitions as vectors *)
Vector3d:
(# data:[3]@real;
  copy:(# exit (data[1],data[2],data[3]) #);
enter (data[1],data[2],data[3])
exit @@data[1]
#);

Vector4d:
(# data:[4]@real;
  copy:(# exit (data[1],data[2],data[3],data[4]) #);
enter (data[1],data[2],data[3],data[4])
exit @@data[1]
#);

Vector3i:
(# data:[4]@integer;
  copy:(# exit (data[1],data[2],data[3],data[4]) #);
enter (data[1],data[2],data[3],data[4])
exit @@data[1]
#);

Vector4i:
(# data:[4]@integer;
  copy:(# exit (data[1],data[2],data[3],data[4]) #);
enter (data[1],data[2],data[3],data[4])
exit @@data[1]
#);

glBWireCube: (* Not very usefull, does not generate any normals/texture coords *)
(# size:@real;
  enter size
  do
    GL_LINE_LOOP->glBegin;
    (0,0,0)->glVertex3i;
    (size,0,0)->glVertex3d;
    (size,0,-size)->glVertex3d;
    (0,0,-size)->glVertex3d;
  glEnd;
  GL_LINE_LOOP->glBegin;
  (0,size,0)->glVertex3d;
  (size,size,0)->glVertex3d;
  (size,size,-size)->glVertex3d;
  (0,size,-size)->glVertex3d;
  glEnd;
  GL_LINES->glBegin;
  (0,0,0)->glVertex3i;
  (0,size,0)->glVertex3d;
  (size,0,0)->glVertex3d;
  (size,size,0)->glVertex3d;
  (size,0,-size)->glVertex3d;
  (size,size,-size)->glVertex3d;
  (0,0,-size)->glVertex3d;
  (0,size,-size)->glVertex3d;
  glEnd;
#);
```

```

glBSolidCube: (*NB does not compute vertex normals *)
  (# size:@real;
  enter size
  do
    GL_POLYGON->glBegin; (* bottom *)
    (0,0,0)->glVertex3i;
    (0,0,size)->glVertex3d;
    (size,0,size)->glVertex3d;
    (size,0,0)->glVertex3d;
    glEnd;
    GL_POLYGON->glBegin; (* top *)
    (0,size,0)->glVertex3d;
    (0,size,size)->glVertex3d;
    (size,size,size)->glVertex3d;
    (size,size,0)->glVertex3d;
    glEnd;
    GL_POLYGON->glBegin; (* front *)
    (0,0,size)->glVertex3d;
    (size,0,size)->glVertex3d;
    (size,size,size)->glVertex3d;
    (0,size,size)->glVertex3d;
    glEnd;
    GL_POLYGON->glBegin; (* back *)
    (0,0,0)->glVertex3d;
    (size,0,0)->glVertex3d;
    (size,size,0)->glVertex3d;
    (0,size,0)->glVertex3d;
    glEnd;
    GL_POLYGON->glBegin; (* left *)
    (0,0,0)->glVertex3i;
    (0,0,size)->glVertex3d;
    (0,size,size)->glVertex3d;
    (0,size,0)->glVertex3d;
    glEnd;
    GL_POLYGON->glBegin; (* right *)
    (size,0,0)->glVertex3d;
    (size,0,size)->glVertex3d;
    (size,size,size)->glVertex3d;
    (size,size,0)->glVertex3d;
    glEnd;
  #)

```

## 23.3 OpenGLUlib Interface

```
ORIGIN 'openGLlib';

-- lib: attributes --

(* GLU constants *)

(* GLU Normal vectors *)
GLU_SMOOTH: (# exit 100000 #);
GLU_FLAT: (# exit 100001 #);
GLU_NONE: (# exit 100002 #);

(* GLU Quadric draw styles *)
GLU_POINT: (# exit 100010 #);
GLU_LINE: (# exit 100011 #);
GLU_FILL: (# exit 100012 #);
GLU_SILHOUETTE: (# exit 100013 #);

(* GLU Quadric orientation *)
GLU_OUTSIDE: (# exit 100020 #);
GLU_INSIDE: (# exit 100021 #);

(* GLU Tesselator *)
GLU_BEGIN: (# exit 100100 #);
GLU_VERTEX: (# exit 100101 #);
GLU_END: (# exit 100102 #);
GLU_ERROR: (# exit 100103 #);
GLU_EDGE_FLAG: (# exit 100104 #);

(* GLU Contour types *)
GLU_CW: (# exit 100120 #);
GLU_CCW: (# exit 100121 #);
GLU_INTERIOR: (# exit 100122 #);
GLU_EXTERIOR: (# exit 100123 #);
GLU_UNKNOWN: (# exit 100124 #);

(* GLU Tessellation errors *)
GLU_TESS_ERROR1: (# exit 100151 #);
GLU_TESS_ERROR2: (# exit 100152 #);
GLU_TESS_ERROR3: (# exit 100153 #);
GLU_TESS_ERROR4: (# exit 100154 #);
GLU_TESS_ERROR5: (# exit 100155 #);
GLU_TESS_ERROR6: (# exit 100156 #);
GLU_TESS_ERROR7: (# exit 100157 #);
GLU_TESS_ERROR8: (# exit 100158 #);
GLU_TESS_ERROR9: (# exit 100159 #);

(* NURBS *)
GLU_AUTO_LOAD_MATRIX: (# exit 100200 #);
GLU_CULLING: (# exit 100201 #);
GLU_PARAMETRIC_TOLERANC: (# exit 100202 #);
GLU_SAMPLING_TOLERANCE: (# exit 100203 #);
GLU_DISPLAY_MODE: (# exit 100204 #);
GLU_SAMPLING_METHOD: (# exit 100205 #);
GLU_U_STEP: (# exit 100206 #);
GLU_V_STEP: (# exit 100207 #);
GLU_PATH_LENGTH: (# exit 100215 #);
GLU_PARAMETRIC_ERROR: (# exit 100216 #);
GLU_DOMAIN_DISTANCE: (# exit 100217 #);

GLU_MAP1_TRIM_2: (# exit 100210 #);
GLU_MAP1_TRIM_3: (# exit 100211 #);
```

```

GLU_OUTLINE_POLYGON: (# exit 100240 #);
GLU_OUTLINE_PATCH: (# exit 100241 #);

GLU_NURBS_ERROR1: (# exit 100251 #);
GLU_NURBS_ERROR2: (# exit 100252 #);
GLU_NURBS_ERROR3: (# exit 100253 #);
GLU_NURBS_ERROR4: (# exit 100254 #);
GLU_NURBS_ERROR5: (# exit 100255 #);
GLU_NURBS_ERROR6: (# exit 100256 #);
GLU_NURBS_ERROR7: (# exit 100257 #);
GLU_NURBS_ERROR8: (# exit 100258 #);
GLU_NURBS_ERROR9: (# exit 100259 #);
GLU_NURBS_ERROR10: (# exit 100260 #);
GLU_NURBS_ERROR11: (# exit 100261 #);
GLU_NURBS_ERROR12: (# exit 100262 #);
GLU_NURBS_ERROR13: (# exit 100263 #);
GLU_NURBS_ERROR14: (# exit 100264 #);
GLU_NURBS_ERROR15: (# exit 100265 #);
GLU_NURBS_ERROR16: (# exit 100266 #);
GLU_NURBS_ERROR17: (# exit 100267 #);
GLU_NURBS_ERROR18: (# exit 100268 #);
GLU_NURBS_ERROR19: (# exit 100269 #);
GLU_NURBS_ERROR20: (# exit 100270 #);
GLU_NURBS_ERROR21: (# exit 100271 #);
GLU_NURBS_ERROR22: (# exit 100272 #);
GLU_NURBS_ERROR23: (# exit 100273 #);
GLU_NURBS_ERROR24: (# exit 100274 #);
GLU_NURBS_ERROR25: (# exit 100275 #);
GLU_NURBS_ERROR26: (# exit 100276 #);
GLU_NURBS_ERROR27: (# exit 100277 #);
GLU_NURBS_ERROR28: (# exit 100278 #);
GLU_NURBS_ERROR29: (# exit 100279 #);
GLU_NURBS_ERROR30: (# exit 100280 #);
GLU_NURBS_ERROR31: (# exit 100281 #);
GLU_NURBS_ERROR32: (# exit 100282 #);
GLU_NURBS_ERROR33: (# exit 100283 #);
GLU_NURBS_ERROR34: (# exit 100284 #);
GLU_NURBS_ERROR35: (# exit 100285 #);
GLU_NURBS_ERROR36: (# exit 100286 #);
GLU_NURBS_ERROR37: (# exit 100287 #);

(* GLU Errors *)
GLU_INVALID_ENUM: (# exit 100900 #);
GLU_INVALID_VALUE: (# exit 10090 #);
GLU_OUT_OF_MEMORY: (# exit 10090 #);
GLU_INCOMPATIBLE_GL_VERSION: (# exit 100903 #);

(* GLU 1.1 *)
GLU_VERSION: (# exit 100800 #);
GLU_EXTENSIONS: (# exit 100801 #);

(* Miscellaneous GLU functions *)
gluLookAt: (* wrapped *)
  (# wrapgluLookAt1: External
    (# cx,cy,cz: @real;
      enter (cx,cy,cz)
    #);
  wrapgluLookAt2: External
    (# ux,uy,uz: @real;
      enter (ux,uy,uz)
    #);

  eyex, eyey, eyez: @real;
  centerx, centery, centerz: @real;
  upx, upy, upz: @real;

```

```

enter (eyex,eyey,eyez,centerx,centery,centerz,upx,upy,upz)
do (eyex,eyey,eyez)->wrapset3double;
   (centerx,centery,centerz)->wrapgluLookAt1;
   (upx,upy,upz)->wrapgluLookAt2;
#);

gluOrtho2D: (* wrapped *)
(# wrapgluOrtho2D: External
   (# top: @real;
     enter top
     #);
   left,right,bottom,top: @real;
   enter (left,right,bottom,top)
   do (left,right,bottom)->wrapset3double;
     top->wrapgluOrtho2D;
   #);

gluPerspective: (* wrapped *)
(# wrapgluPerspective: External
   (# zFar: @real
     enter zFar
     #);
   fovy,aspect,zNear,zFar: @real;
   enter (fovy,aspect,zNear,zFar)
   do (fovy,aspect,zNear)->wrapset3double;
     zFar->wrapgluPerspective;
   #);

gluPickMatrix: (* wrapped *)
(# wrapgluPickMatrix: External
   (# height: @real;
     viewp: @integer;
     enter (height,viewp)
     #);
   x,y,width,height: @real;
   viewport: @integer;
   enter (x,y,width,height,viewport)
   do (x,y,width)->wrapset3double;
     (height,viewport)->wrapgluPickMatrix;
   #);

gluProject: (* Wrapped ,not done*)
(# objx,objy,objz: @real;
   modelMatrix,projMatrix,viewport: @integer;
   winx,winy,winz: @integer;
   result: @integer;
   enter (objx,objy,objz,modelMatrix,projMatrix,viewport,winx,winy,winz)
   exit result
   #);

gluUnProject: (* Wrapped ,not done*)
(# winx,winy,winz: @real;
   modelMatrix,projMatrix,viewport: @integer;
   objx,objy,objz: @integer;
   result: @integer;
   enter (winx,winy,winz,modelMatrix,projMatrix,viewport,objx,objy,objz)
   exit result
   #);

gluErrorString: External
(# errorCode: @integer;
   result: [0]@char;
   enter errorCode

```



```

do CallStd;
exit result
#);

(* GLU Mipmapping and image scaling *)

gluScaleImage: External
(# format: @integer;
 widthin,heightin: @integer;
 typein,datain: @integer;
 widthout,heightout: @integer;
 typeout,dataout: @integer;
 result: @integer;
 enter (format,widthin,heightin,typein,datain,widthout,heightout,typeout,dataout)
 do CallStd;
 exit result
 #);

gluBuild1DMipmaps: External
(# target,components,width,format: @integer;
 type,data: @integer;
 result: @integer;
 enter (target,components,width,format,type,data)
 do CallStd;
 exit result
 #);

gluBuild2DMipmaps: External
(# target,components,width,format: @integer;
 type,data: @integer;
 result: @integer;
 enter (target,components,width,format,type,data)
 do CallStd;
 exit result
 #);

(* GLU Quadrics *)

gluNewQuadric: External
(# quadobj: @integer;
 do CallStd;
 exit quadobj
 #);

gluDeleteQuadric: External
(# obj: @integer
 enter obj
 do CallStd;
 #);

gluQuadricDrawStyle: External
(# quadObject: @integer;
 drawStyle: @integer;
 enter (quadObject,drawStyle)
 do CallStd;
 #);

gluQuadricOrientation: External
(# quadObject: @integer;
 orientation: @integer;
 enter (quadObject,orientation)
 do CallStd;
 #);

```

```

gluQuadricNormals: External
  (# quadObject: @integer;
   normals: @integer;
   enter (quadObject, normals)
   do CallStd;
   #);

gluQuadricTexture: External
  (# quadObject: @integer;
   textureCoords: @char; (* GLboolean *)
   enter (quadObject, textureCoords)
   do CallStd;
   #);

(*
gluQuadricCallback: External
  (# qobj: @integer;
   which: @integer;
   void ( *fn)()
   #);
*)

gluCylinder: (* wrapped *)
  (# wrapgluCylinder: External
   (# qobj, slices, stacks: @integer;
    enter (qobj, slices, stacks)
    #);
   qobj: @integer;
   baseRadius, topRadius, height: @real;
   slices, stacks: @integer;
   enter (qobj, baseRadius, topRadius, height, slices, stacks)
   do (baseRadius, topRadius, height)->wrapset3double;
      (qobj, slices, stacks)->wrapgluCylinder;
   #);

gluSphere: External
  (# qobj: @integer;
   radius: @real;
   slices, stacks: @integer;
   enter (qobj, radius, slices, stacks)
   do CallStd;
   #);

gluDisk: External
  (# qobj: @integer;
   innerRadius, outerRadius: @real;
   slices, loops: @integer;
   enter (qobj, innerRadius, outerRadius, slices, loops)
   do CallStd;
   #);

gluPartialDisk: (* wrapped *)
  (# wrapgluPartialDisk: External
   (# sweepangle: @real;
    qobj, slices, loops: @integer;
    enter (sweepangle, qobj, slices, loops)
    #);
   qobj: @integer;
   innerRadius, outerRadius: @real;
   slices, loops: @integer;
   startAngle, sweepAngle: @real;
   enter (qobj, innerRadius, outerRadius, slices, loops, startAngle, sweepAngle)
   do (innerRadius, outerRadius, startAngle)->wrapset3double;

```

```

    (sweepAngle,qobj,slices,loops)->wrapgluPartialDisk;
#);

(* GLU Nurbs *)

gluNewNurbsRenderer: External
  (# nurbsobj: @integer;
  do CallStd;
  exit nurbsobj
  #);

gluDeleteNurbsRenderer: External
  (# nurbsobj: @integer;
  enter nurbsobj
  do CallStd;
  #);

(*
gluLoadSamplingMatrices: External
  (# nobj: @integer;
  GLfloat modelMatrix[16],
  GLfloat projMatrix[16],
  GLint viewport[4]
  #);
*)

gluNurbsProperty: External
  (# nobj: @integer;
  property: @integer;
  value: @real;
  enter (nobj,property,value)
  do
    'wrapgluNurbsProperty'->CallC;
  #);

gluGetNurbsProperty: External
  (# nobj,property: @integer;
  value: @integer; (* GLfloat* *)
  enter (nobj,property,value)
  do CallStd;
  #);

gluBeginCurve: External
  (# nobj: @integer;
  enter nobj
  do CallStd;
  #);

gluEndCurve: External
  (# nobj: @integer;
  enter nobj
  do CallStd;
  #);

gluNurbsCurve: External (* wrapped, not done *)
  (# nobj, nknots: @integer;
  knot: @integer; (* GLfloat* *)
  stride: @integer;
  ctlarray: @integer; (* GLfloat* *)
  order, type: @integer;
  enter (nobj,nknots,knot,stride,ctlarray,order,type)
  #);

```

```

gluBeginSurface: External
  (# nobj: @integer;
   enter nobj
   do CallStd;
   #);

gluEndSurface: External
  (# nobj: @integer;
   enter nobj
   do CallStd;
   #);

gluNurbsSurface: External (* wrapped, not done *)
  (# nobj: @integer;
   sknot_count: @integer;
   sknot: @integer; (*GLfloat * *)
   tknot_count: @integer;
   tknot: @integer; (* GLfloat* *)
   s_stride, t_stride: @integer;
   ctlarray: @integer; (* GLfloat* *)
   sorder, torder, type: @integer;
   enter (nobj,sknot_count,sknot,tknot_count,tknot,s_stride,t_stride,ctlarray,sorder,torder,type)
   #);

gluBeginTrim: External
  (# nobj: @integer;
   enter nobj
   do CallStd;
   #);

gluEndTrim: External
  (# nobj: @integer;
   enter nobj
   do CallStd;
   #);

gluPwlCurve: External (* wrapped, not done *)
  (# nobj, count: @integer;
   array: @integer; (* GLfloat* *)
   stride, type: @integer;
   enter (nobj,count,array,stride,type)
   #);

(*
gluNurbsCallback: External
  (# nobj, which: @integer;
   ( * fn)()
   enter
   #);
*)

(* GLU Polygon tessellation *)

gluNewTess: External
  (# triangulatorObj: @integer;
   do CallStd;
   exit triangulatorObj
   #);

(*
gluTessCallback
*)

gluDeleteTess: External
  (# tobj: @integer;

```

```

    enter tobj
    do CallStd;
    #);

gluBeginPolygon: External
    (#
    tobj: @integer;
    enter tobj
    do CallStd;
    #);

gluEndPolygon: External
    (# tobj: @integer;
    enter tobj
    do CallStd;
    #);

gluNextContour: External
    (# tobj,type: @integer;
    enter (tojb,type)
    do CallStd;
    #);

gluTessVertex: External
    (# tobj: @integer;
      v: @integer; (* GLdouble* *)
      data: @integer; (* void* *)
    enter (tojb,v,data)
    do CallStd;
    #);

(* GLU 1.1 *)

gluGetString: External
    (# name: @integer;
      result: [0]@char;
    enter name
    do CallStd;
    exit result
    #)

```

## 23.4 OpenGLWlib Interface

```
ORIGIN '~beta/guienv/guienv';

--windowitemlib:attributes--

(*----- GLW ----- *)
(* note this is not complete,
 * only intended for internal use,
 * as programs is not platform independent.
 *
 *)

(* Different constants *)

(* pixel types *)
PFD_TYPE_RGBA:(# exit 0 #);
PFD_TYPE_COLORINDEX:(# exit 1 #);

(* layer types *)
PFD_MAIN_PLANE:(# exit 0 #);
PFD_OVERLAY_PLANE:(# exit 1 #);
PFD_UNDERLAY_PLANE:(# exit (-1) #);

(* PIXELFORMATDESCRIPTOR flags *)
PFD_DOUBLEBUFFER:(# exit 0x00000001 #);
PFD_STEREO:(# exit 0x00000002 #);
PFD_DRAW_TO_WINDOW:(# exit 0x00000004 #);
PFD_DRAW_TO_BITMAP:(# exit 0x00000008 #);
PFD_SUPPORT_GDI:(# exit 0x00000010 #);
PFD_SUPPORT_OPENGL:(# exit 0x00000020 #);
PFD_GENERIC_FORMAT:(# exit 0x00000040 #);
PFD_NEED_PALETTE:(# exit 0x00000080 #);
PFD_NEED_SYSTEM_PALETTE:(# exit 0x00000100 #);
PFD_SWAP_EXCHANGE:(# exit 0x00000200 #);
PFD_SWAP_COPY:(# exit 0x00000400 #);
PFD_SWAP_LAYER_BUFFERS:(# exit 0x00000800 #);
PFD_GENERIC_ACCELERATED:(# exit 0x00001000 #);

(* PIXELFORMATDESCRIPTOR flags for use in ChoosePixelFormat only *)
PFD_DEPTH_DONTCARE:(# exit 0x20000000 #);
PFD_DOUBLEBUFFER_DONTCARE:(# exit 0x40000000 #);
PFD_STEREO_DONTCARE:(# exit 0x80000000 #);

SwapBuffers:external
(#
    hdc:@integer; (* HDC* *)
    result:@integer;
    enter hdc
    do CallStd
    exit result
#);

setPixelFormat:external
(#
    hdc:@integer; (* HDC* *)
    result:@integer;
    enter hdc
    exit result
#);

wglCopyContext:external
(#
    source,dest,mask:@integer; (* HGLRC, HGLRC, UINT *)
```

```

enter (source,dest,mask)
#);

wglCreateContext:external
(#
    hdc:@integer; (* HDC *)
    glrc:@integer; (* HGLRC *)
enter hdc
do CallStd
exit glrc
#);

wglCreateLayerContext:external
(#
    hdc,iLayerPlane:@integer; (* HDC, int *)
    glrc:@integer; (* HGLRC *)
enter (hdc,iLayerPlane)
exit glrc
#);

wglDeleteContext:external
(#
    hglrc:@integer; (*HGLRC *)
    result:@integer;
enter hglrc
do CallStd;
exit result
#);

wglGetCurrentContext:external
(#
    hglrc:@integer;
do CallStd;
exit hglrc
#);

wglGetCurrentDC:external
(#
    hdc:@integer;
do CallStd;
exit hdc
#);

(*
* Do we need this ?
*
* wglGetProcAddress:external
* (# (LPCSTR);#);
*)

wglMakeCurrent:external
(#
    hdc,hglrc:@integer; (*HDC, HGLRC*)
    result:@integer;
enter (hdc,hglrc)
do CallStd;
exit result
#);

wglShareLists:external
(#
    hglrc1,hglrc2:@integer; (*HGLRC, HGLRC*)
    result:@integer;
enter (hglrc1,hglrc2)

```

```
do CallStd;  
exit result  
#)
```



## 23.5 OpenGLXlib Interface

```
ORIGIN '~beta/guienv/guienv';

--windowitemlib:attributes--

(*----- GLX ----- *)
(* note this is not complete,
 * only intended for internal use,
 * as programs is not platform independent
 *)

(* -----GLX_CONFIGURATION----- 83 *)
GLX_USE_GL:(# exit 1 #);
GLX_BUFFER_SIZE:(# exit 2 #);
GLX_LEVEL:(# exit 3 #);
GLX_RGBA:(# exit 4 #);
GLX_DOUBLEBUFFER:(# exit 5 #);
GLX_STEREO:(# exit 6 #);
GLX_AUX_BUFFERS:(# exit 7 #);
GLX_RED_SIZE:(# exit 8 #);
GLX_GREEN_SIZE:(# exit 9 #);
GLX_BLUE_SIZE:(# exit 10 #);
GLX_ALPHA_SIZE:(# exit 11 #);
GLX_DEPTH_SIZE:(# exit 12 #);
GLX_STENCIL_SIZE:(# exit 13 #);
GLX_ACCUM_RED_SIZE:(# exit 14 #);
GLX_ACCUM_GREEN_SIZE:(# exit 15 #);
GLX_ACCUM_BLUE_SIZE:(# exit 16 #);
GLX_ACCUM_ALPHA_SIZE:(# exit 17 #);

(* GLX_EXT_visual_info extension *)
GLX_X_VISUAL_TYPE_EXT:(# exit 0x22 #);
GLX_TRANSPARENT_TYPE_EXT:(# exit 0x23 #);
GLX_TRANSPARENT_INDEX_VALUE_EXT:(# exit 0x24 #);
GLX_TRANSPARENT_RED_VALUE_EXT:(# exit 0x25 #);
GLX_TRANSPARENT_GREEN_VALUE_EXT:(# exit 0x26 #);
GLX_TRANSPARENT_BLUE_VALUE_EXT:(# exit 0x27 #);
GLX_TRANSPARENT_ALPHA_VALUE_EXT:(# exit 0x2 #);

(*-----Various functions -----*)

glXChooseVisual:external (* 171 *)
  (# display:@integer;
   screen:@integer;
   attributes:@integer;
   visual:@integer;
   enter (display,screen,attributes)
   exit visual
  #);

glXCopyContext:external
  (# display:@integer;
   src,dst,mask:@integer;
   enter (display,src,dst,mask)
  #);

glXCreateContext:external (* 174 *)
  (# display:@integer;
   visual:@integer; (* found with glXChooseVisual *)
   sharelist:@integer; (* glXcontext *)
   direct:@integer; (* 1 true, 0 false *)
```

```

    context:@integer;
enter (display,visual,sharelist,direct)
exit context
#);

glXCreateGLXPixmap:external
(# display:@integer;
 visual:@integer;
  pixmap, glxpixmap: @integer
enter (display,visual,pixmap)
exit glxpixmap
#);

glXDestroyContext:external
(# display:@integer;
 context:@integer;
enter (display,context)
#);

glXDestroyGLXPixmap:external
(# display:@integer;
 glxpixmap:@integer;
enter (display,glxpixmap)
#);

glXGetClientString:external
(# display:@integer;
 name:@integer;
 string: [0]@char;
enter (display,name)
exit string
#);

glXGetConfig:external
(# display:@integer;
 visual:@integer;
 attrib:@integer;
 value_ptr:@integer;
 status:@integer;
enter (display,visual,attrib,value_ptr)
exit status
#);

glXGetCurrentDisplay:external
(# display:@integer;
exit display
#);

glXGetCurrentDrawable:external
(# drawable:@integer;
exit drawable
#);

glXIsDirect:external
(# display,context:@integer;
 isdirect:@integer
enter (display,context)
exit isdirect
#);

glXMakeCurrent:external (* 179 *)
(# display:@integer;
 drawable:@integer;
 context:@integer;
 result:@integer;
enter(display,drawable,context)

```

```

exit result
#);

glXQueryExtension:external
(# display,errorBase_ptr,eventBase_ptr:@integer;
  has_extension:@boolean
enter (display,errorBase_ptr,eventBase_ptr)
exit has_extension
#);

glXQueryExtensionString:external
(# display,screen:@integer;
  string: [0]@char
enter (display,screen)
exit string
#);

glXQueryServerString:external
(# display,screen,name:@integer;
  string: [0]@char
enter (display,screen,name)
exit string
#);

glXQueryVersion:external
(# display,major_ptr,minor_ptr:@integer;
  status:@boolean
enter (display,major_ptr,minor_ptr)
exit status
#);

glXSwapBuffers:external (* 185 *)
(# display:@integer;
  drawable:@integer;
enter (display,drawable)
#);

glXUseXFont:external
(# font,first,count,listBase:@integer;
enter (font,first,count,listBase)
#);

glXWaitGL:external (* 205 *)
(# #);

glXWaitX:external (* 207 *)
(# #)

```

## 23.6 OpenGLlib Interface

```
ORIGIN '~beta/basiclib/betaenv';
--LIB: attributes--

(* Disclaimer:
 * This is a prelease version of the OpenGL
 * library interface for BETA. It may be
 * changed later, and there is some inconveniences.
 *
 * Fell free to ask questions and come with proposals to
 * support@mjolner.dk
 *
 * OpenGL operates with a large number of types, these
 * are mapped to beta types as follows:
 *
 * |-----|
 * | c-type          | OpenGL          | Beta           | size in bytes |
 * |-----|
 * | void            | GLvoid          |                |                |
 * | unsigned char   | GLboolean       | int8u          | 1              |
 * | signed char     | GLbyte          | int8           | 1              |
 * | short           | GLshort         | int16          | 2              |
 * | int             | GLint           | int32          | 4              |
 * | unsigned char   | GLubyte         | int8u          | 1              |
 * | unsigned char*  | GLubyte*        | [0]@char      | 1              |
 * | unsigned short  | GLushort        | int16u         | 2              |
 * | unsigned int    | GLuint          | int32u         | 4              |
 * | int             | GLsizei         | int32          | 4              |
 * | float           | GLfloat         | real           | 8              |
 * | float           | GLclampf        | real           | 8              |
 * | double          | GLdouble        | real           | 8              |
 * | double          | GLclampd        | real           | 8              |
 * | unsigned int    | GLbitfield      | int32u         | 4              |
 * | unsigned int    | GLenum          | int32u         | 4              |
 * | xxx*            | xxx*            | int32          | 4              |
 * | xxx**           | xxx**           | int32          | 4              |
 * |-----|
 *
 * Original GL-types are shown as comments in patterns.
 *
 * Notice that GLfloat's are mapped to reals. These reals
 * are converted to floats in a c program, just before
 * actually calling the OpenGL routines. This is of
 * course expensive. Use the GLdouble routines when
 * they are available.
 *
 * Also functions that float arrays are expensive
 * because the BETA repetition of reals is copied and
 * and converted to a c-array of floats. In this prelease
 * this is only done when absolutely necessary. That is
 * glVertex3fv is not working, as you can use glVertex3f.
 * But glLightf does converting. Always use repetitions,
 * that is as long as the longest parameter ever. (4 in glLightfv)
 *
 * Functions that return arrays are generally not
 * working. This will be better later.
 *
 * Some funtions are defined equally. eg. glRotatef is the
 * same pattern as glRotated. There is no need for a
 * glRotatef as you can not have any floats in your
 * beta program. So they are defined:
 * glRotated:(# ... #);
 * glRotatef:glRotated(# #);
 * This is done only to ease porting of c-programs.
```

```

*
* logical or '|' is not part of the "highlevel" BETA syntax.
* eg. c:
* glEnable(GL_LIGHTING|GL_CULLFACE);
* in BETA:
* GL_LIGHTING->glEnable;
* GL_CULLFACE->glEnable;
* or
* GL_LIGHTING %Bor GL_CULLFACE -> glEnable;
*)

(*
*
* Enumerations
*
*)

GL_FALSE:                (# exit 0 #);
GL_TRUE:                 (# exit 1 #);

(* Data types *)
GL_BYTE:                 (# exit 0x1400 #);
GL_UNSIGNED_BYTE:       (# exit 0x1401 #);
GL_SHORT:                (# exit 0x1402 #);
GL_UNSIGNED_SHORT:      (# exit 0x1403 #);
GL_INT:                  (# exit 0x1404 #);
GL_UNSIGNED_INT:        (# exit 0x1405 #);
GL_FLOAT:                (# exit 0x1406 #);
GL_DOUBLE:               (# exit 0x140A #);
GL_2_BYTES:              (# exit 0x1407 #);
GL_3_BYTES:              (# exit 0x1408 #);
GL_4_BYTES:              (# exit 0x1409 #);

(* Primitives *)
GL_LINES:                (# exit 0x0001 #);
GL_POINTS:               (# exit 0x0000 #);
GL_LINE_STRIP:           (# exit 0x0003 #);
GL_LINE_LOOP:            (# exit 0x0002 #);
GL_TRIANGLES:           (# exit 0x0004 #);
GL_TRIANGLE_STRIP:       (# exit 0x0005 #);
GL_TRIANGLE_FAN:         (# exit 0x0006 #);
GL_QUADS:                (# exit 0x0007 #);
GL_QUAD_STRIP:           (# exit 0x0008 #);
GL_POLYGON:              (# exit 0x0009 #);
GL_EDGE_FLAG:            (# exit 0x0B43 #);

(* Vertex Arrays *)
GL_VERTEX_ARRAY:         (# exit 0x8074 #);
GL_NORMAL_ARRAY:         (# exit 0x8075 #);
GL_COLOR_ARRAY:          (# exit 0x8076 #);
GL_INDEX_ARRAY:          (# exit 0x8077 #);
GL_TEXTURE_COORD_ARRAY:  (# exit 0x8078 #);
GL_EDGE_FLAG_ARRAY:      (# exit 0x8079 #);
GL_VERTEX_ARRAY_SIZE:    (# exit 0x807A #);
GL_VERTEX_ARRAY_TYPE:    (# exit 0x807B #);
GL_VERTEX_ARRAY_STRIDE:  (# exit 0x807C #);
GL_NORMAL_ARRAY_TYPE:    (# exit 0x807E #);
GL_NORMAL_ARRAY_STRIDE:  (# exit 0x807F #);
GL_COLOR_ARRAY_SIZE:     (# exit 0x8081 #);
GL_COLOR_ARRAY_TYPE:     (# exit 0x8082 #);
GL_COLOR_ARRAY_STRIDE:   (# exit 0x8083 #);
GL_INDEX_ARRAY_TYPE:     (# exit 0x8085 #);
GL_INDEX_ARRAY_STRIDE:   (# exit 0x8086 #);
GL_TEXTURE_COORD_ARRAY_SIZE: (# exit 0x8088 #);
GL_TEXTURE_COORD_ARRAY_TYPE: (# exit 0x8089 #);
GL_TEXTURE_COORD_ARRAY_STRIDE: (# exit 0x808A #);

```

```

GL_EDGE_FLAG_ARRAY_STRIDE:      (# exit 0x808C #);
GL_VERTEX_ARRAY_POINTER:      (# exit 0x808E #);
GL_NORMAL_ARRAY_POINTER:      (# exit 0x808F #);
GL_COLOR_ARRAY_POINTER:       (# exit 0x8090 #);
GL_INDEX_ARRAY_POINTER:       (# exit 0x8091 #);
GL_TEXTURE_COORD_ARRAY_POINTER: (# exit 0x8092 #);
GL_EDGE_FLAG_ARRAY_POINTER:   (# exit 0x8093 #);
GL_V2F:                        (# exit 0x2A20 #);
GL_V3F:                        (# exit 0x2A21 #);
GL_C4UB_V2F:                  (# exit 0x2A22 #);
GL_C4UB_V3F:                  (# exit 0x2A23 #);
GL_C3F_V3F:                   (# exit 0x2A24 #);
GL_N3F_V3F:                   (# exit 0x2A25 #);
GL_C4F_N3F_V3F:              (# exit 0x2A26 #);
GL_T2F_V3F:                   (# exit 0x2A27 #);
GL_T4F_V4F:                   (# exit 0x2A28 #);
GL_T2F_C4UB_V3F:             (# exit 0x2A29 #);
GL_T2F_C3F_V3F:              (# exit 0x2A2A #);
GL_T2F_N3F_V3F:              (# exit 0x2A2B #);
GL_T2F_C4F_N3F_V3F:         (# exit 0x2A2C #);
GL_T4F_C4F_N3F_V4F:         (# exit 0x2A2D #);

(* Matrix Mode *)
GL_MATRIX_MODE:              (# exit 0x0BA0 #);
GL_MODELVIEW:                (# exit 0x1700 #);
GL_PROJECTION:               (# exit 0x1701 #);
GL_TEXTURE:                  (# exit 0x1702 #);

(* Points *)
GL_POINT_SMOOTH:            (# exit 0x0B10 #);
GL_POINT_SIZE:              (# exit 0x0B11 #);
GL_POINT_SIZE_GRANULARITY:  (# exit 0x0B13 #);
GL_POINT_SIZE_RANGE:        (# exit 0x0B12 #);

(* Lines *)
GL_LINE_SMOOTH:             (# exit 0x0B20 #);
GL_LINE_STIPPLE:           (# exit 0x0B24 #);
GL_LINE_STIPPLE_PATTERN:   (# exit 0x0B25 #);
GL_LINE_STIPPLE_REPEAT:    (# exit 0x0B26 #);
GL_LINE_WIDTH:             (# exit 0x0B21 #);
GL_LINE_WIDTH_GRANULARITY: (# exit 0x0B23 #);
GL_LINE_WIDTH_RANGE:       (# exit 0x0B22 #);

(* Polygons *)
GL_POINT:                   (# exit 0x1B00 #);
GL_LINE:                    (# exit 0x1B01 #);
GL_FILL:                   (# exit 0x1B02 #);
GL_CCW:                    (# exit 0x0901 #);
GL_CW:                     (# exit 0x0900 #);
GL_FRONT:                  (# exit 0x0404 #);
GL_BACK:                   (# exit 0x0405 #);
GL_CULL_FACE:              (# exit 0x0B44 #);
GL_CULL_FACE_MODE:         (# exit 0x0B45 #);
GL_POLYGON_SMOOTH:         (# exit 0x0B41 #);
GL_POLYGON_STIPPLE:        (# exit 0x0B42 #);
GL_FRONT_FACE:             (# exit 0x0B46 #);
GL_POLYGON_MODE:           (# exit 0x0B40 #);
GL_POLYGON_OFFSET_FACTOR:  (# exit 0x8038 #);
GL_POLYGON_OFFSET_UNITS:   (# exit 0x2A00 #);
GL_POLYGON_OFFSET_POINT:   (# exit 0x2A01 #);
GL_POLYGON_OFFSET_LINE:    (# exit 0x2A02 #);
GL_POLYGON_OFFSET_FILL:    (# exit 0x8037 #);

(* Display Lists *)
GL_COMPILE:                 (# exit 0x1300 #);
GL_COMPILE_AND_EXECUTE:     (# exit 0x1301 #);

```

```

GL_LIST_BASE:                (# exit 0x0B32 #);
GL_LIST_INDEX:               (# exit 0x0B33 #);
GL_LIST_MODE:                (# exit 0x0B30 #);

(* Depth buffer *)
GL_NEVER:                    (# exit 0x0200 #);
GL_LESS:                     (# exit 0x0201 #);
GL_GEQUAL:                   (# exit 0x0206 #);
GL_LEQUAL:                   (# exit 0x0203 #);
GL_GREATER:                  (# exit 0x0204 #);
GL_NOTEQUAL:                 (# exit 0x0205 #);
GL_EQUAL:                    (# exit 0x0202 #);
GL_ALWAYS:                   (# exit 0x0207 #);
GL_DEPTH_TEST:               (# exit 0x0B71 #);
GL_DEPTH_BITS:               (# exit 0x0D56 #);
GL_DEPTH_CLEAR_VALUE:        (# exit 0x0B73 #);
GL_DEPTH_FUNC:               (# exit 0x0B74 #);
GL_DEPTH_RANGE:              (# exit 0x0B70 #);
GL_DEPTH_WRITEMASK:          (# exit 0x0B72 #);
GL_DEPTH_COMPONENT:          (# exit 0x1902 #);

(* Lighting *)
GL_LIGHTING:                  (# exit 0x0B50 #);
GL_LIGHT0:                    (# exit 0x4000 #);
GL_LIGHT1:                    (# exit 0x4001 #);
GL_LIGHT2:                    (# exit 0x4002 #);
GL_LIGHT3:                    (# exit 0x4003 #);
GL_LIGHT4:                    (# exit 0x4004 #);
GL_LIGHT5:                    (# exit 0x4005 #);
GL_LIGHT6:                    (# exit 0x4006 #);
GL_LIGHT7:                    (# exit 0x4007 #);
GL_SPOT_EXPONENT:             (# exit 0x1205 #);
GL_SPOT_CUTOFF:               (# exit 0x1206 #);
GL_CONSTANT_ATTENUATION:      (# exit 0x1207 #);
GL_LINEAR_ATTENUATION:        (# exit 0x1208 #);
GL_QUADRATIC_ATTENUATION:     (# exit 0x1209 #);
GL_AMBIENT:                   (# exit 0x1200 #);
GL_DIFFUSE:                   (# exit 0x1201 #);
GL_SPECULAR:                  (# exit 0x1202 #);
GL_SHININESS:                 (# exit 0x1601 #);
GL_EMISSION:                  (# exit 0x1600 #);
GL_POSITION:                  (# exit 0x1203 #);
GL_SPOT_DIRECTION:            (# exit 0x1204 #);
GL_AMBIENT_AND_DIFFUSE:       (# exit 0x1602 #);
GL_COLOR_INDEXES:             (# exit 0x1603 #);
GL_LIGHT_MODEL_TWO_SIDE:      (# exit 0x0B52 #);
GL_LIGHT_MODEL_LOCAL_VIEWER:  (# exit 0x0B51 #);
GL_LIGHT_MODEL_AMBIENT:       (# exit 0x0B53 #);
GL_FRONT_AND_BACK:            (# exit 0x0408 #);
GL_SHADE_MODEL:                (# exit 0x0B54 #);
GL_FLAT:                       (# exit 0x1D00 #);
GL_SMOOTH:                    (# exit 0x1D01 #);
GL_COLOR_MATERIAL:            (# exit 0x0B57 #);
GL_COLOR_MATERIAL_FACE:       (# exit 0x0B55 #);
GL_COLOR_MATERIAL_PARAMETER:  (# exit 0x0B56 #);
GL_NORMALIZE:                 (# exit 0x0BA1 #);

(* User clipping planes *)
GL_CLIP_PLANE0:               (# exit 0x3000 #);
GL_CLIP_PLANE1:               (# exit 0x3001 #);
GL_CLIP_PLANE2:               (# exit 0x3002 #);
GL_CLIP_PLANE3:               (# exit 0x3003 #);
GL_CLIP_PLANE4:               (# exit 0x3004 #);
GL_CLIP_PLANE5:               (# exit 0x3005 #);

(* Accumulation buffer *)

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GL_ACCUM_RED_BITS:          (# exit 0x0D58 #);
GL_ACCUM_GREEN_BITS:       (# exit 0x0D59 #);
GL_ACCUM_BLUE_BITS:        (# exit 0x0D5A #);
GL_ACCUM_ALPHA_BITS:       (# exit 0x0D5B #);
GL_ACCUM_CLEAR_VALUE:      (# exit 0x0B80 #);
GL_ACCUM:                   (# exit 0x0100 #);
GL_ADD:                      (# exit 0x0104 #);
GL_LOAD:                     (# exit 0x0101 #);
GL_MULT:                     (# exit 0x0103 #);
GL_RETURN:                   (# exit 0x0102 #);

(* Alpha testing *)
GL_ALPHA_TEST:              (# exit 0x0BC0 #);
GL_ALPHA_TEST_REF:         (# exit 0x0BC2 #);
GL_ALPHA_TEST_FUNC:        (# exit 0x0BC1 #);

(* Blending *)
GL_BLEND:                   (# exit 0x0BE2 #);
GL_BLEND_SRC:               (# exit 0x0BE1 #);
GL_BLEND_DST:               (# exit 0x0BE0 #);
GL_ZERO:                    (# exit 0 #);
GL_ONE:                     (# exit 1 #);
GL_SRC_COLOR:               (# exit 0x0300 #);
GL_ONE_MINUS_SRC_COLOR:     (# exit 0x0301 #);
GL_DST_COLOR:               (# exit 0x0306 #);
GL_ONE_MINUS_DST_COLOR:    (# exit 0x0307 #);
GL_SRC_ALPHA:               (# exit 0x0302 #);
GL_ONE_MINUS_SRC_ALPHA:     (# exit 0x0303 #);
GL_DST_ALPHA:               (# exit 0x0304 #);
GL_ONE_MINUS_DST_ALPHA:    (# exit 0x0305 #);
GL_SRC_ALPHA_SATURATE:     (# exit 0x0308 #);
GL_CONSTANT_COLOR:         (# exit 0x8001 #);
GL_ONE_MINUS_CONSTANT_COLOR: (# exit 0x8002 #);
GL_CONSTANT_ALPHA:         (# exit 0x8003 #);
GL_ONE_MINUS_CONSTANT_ALPHA: (# exit 0x8004 #);

(* Render Mode *)
GL_FEEDBACK:                (# exit 0x1C01 #);
GL_RENDER:                  (# exit 0x1C00 #);
GL_SELECT:                  (# exit 0x1C02 #);

(* Feedback *)
GL_2D:                      (# exit 0x0600 #);
GL_3D:                      (# exit 0x0601 #);
GL_3D_COLOR:                (# exit 0x0602 #);
GL_3D_COLOR_TEXTURE:        (# exit 0x0603 #);
GL_4D_COLOR_TEXTURE:        (# exit 0x0604 #);
GL_POINT_TOKEN:             (# exit 0x0701 #);
GL_LINE_TOKEN:              (# exit 0x0702 #);
GL_LINE_RESET_TOKEN:        (# exit 0x0707 #);
GL_POLYGON_TOKEN:           (# exit 0x0703 #);
GL_BITMAP_TOKEN:            (# exit 0x0704 #);
GL_DRAW_PIXEL_TOKEN:        (# exit 0x0705 #);
GL_COPY_PIXEL_TOKEN:        (# exit 0x0706 #);
GL_PASS_THROUGH_TOKEN:      (# exit 0x0700 #);
GL_FEEDBACK_BUFFER_POINTER:  (# exit 0x0DF0 #);
GL_FEEDBACK_BUFFER_SIZE:    (# exit 0x0DF1 #);
GL_FEEDBACK_BUFFER_TYPE:    (# exit 0x0DF2 #);

(* Fog *)
GL_FOG:                     (# exit 0x0B60 #);
GL_FOG_MODE:                 (# exit 0x0B65 #);
GL_FOG_DENSITY:              (# exit 0x0B62 #);
GL_FOG_COLOR:                (# exit 0x0B66 #);
GL_FOG_INDEX:                (# exit 0x0B61 #);

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GL_FOG_START:          (# exit 0x0B63 #);
GL_FOG_END:           (# exit 0x0B64 #);
GL_LINEAR:            (# exit 0x2601 #);
GL_EXP:               (# exit 0x0800 #);
GL_EXP2:              (# exit 0x0801 #);

(* Logic Ops *)
GL_LOGIC_OP:          (# exit 0x0BF1 #);
GL_INDEX_LOGIC_OP:   (# exit 0x0BF1 #);
GL_COLOR_LOGIC_OP:   (# exit 0x0BF2 #);
GL_LOGIC_OP_MODE:    (# exit 0x0BF0 #);
GL_CLEAR:            (# exit 0x1500 #);
GL_SET:              (# exit 0x150F #);
GL_COPY:             (# exit 0x1503 #);
GL_COPY_INVERTED:    (# exit 0x150C #);
GL_NOOP:             (# exit 0x1505 #);
GL_INVERT:           (# exit 0x150A #);
GL_AND:              (# exit 0x1501 #);
GL_NAND:             (# exit 0x150E #);
GL_OR:               (# exit 0x1507 #);
GL_NOR:              (# exit 0x1508 #);
GL_XOR:              (# exit 0x1506 #);
GL_EQUIV:            (# exit 0x1509 #);
GL_AND_REVERSE:      (# exit 0x1502 #);
GL_AND_INVERTED:    (# exit 0x1504 #);
GL_OR_REVERSE:       (# exit 0x150B #);
GL_OR_INVERTED:     (# exit 0x150D #);

(* Stencil *)
GL_STENCIL_TEST:      (# exit 0x0B90 #);
GL_STENCIL_WRITEMASK: (# exit 0x0B98 #);
GL_STENCIL_BITS:      (# exit 0x0D57 #);
GL_STENCIL_FUNC:      (# exit 0x0B92 #);
GL_STENCIL_VALUE_MASK: (# exit 0x0B93 #);
GL_STENCIL_REF:       (# exit 0x0B97 #);
GL_STENCIL_FAIL:      (# exit 0x0B94 #);
GL_STENCIL_PASS_DEPTH_PASS: (# exit 0x0B96 #);
GL_STENCIL_PASS_DEPTH_FAIL: (# exit 0x0B95 #);
GL_STENCIL_CLEAR_VALUE: (# exit 0x0B91 #);
GL_STENCIL_INDEX:     (# exit 0x1901 #);
GL_KEEP:              (# exit 0x1E00 #);
GL_REPLACE:           (# exit 0x1E01 #);
GL_INCR:              (# exit 0x1E02 #);
GL_DECR:              (# exit 0x1E03 #);

(* Buffers, Pixel Drawing/Reading *)
GL_NONE:              (# exit 0 #);
GL_LEFT:              (# exit 0x0406 #);
GL_RIGHT:             (# exit 0x0407 #);

(*GL_FRONT:          (# exit 0x0404 #); *)
(*GL_BACK:           (# exit 0x0405 #); *)
(*GL_FRONT_AND_BACK: (# exit 0x0408 #); *)

GL_FRONT_LEFT:        (# exit 0x0400 #);
GL_FRONT_RIGHT:       (# exit 0x0401 #);
GL_BACK_LEFT:         (# exit 0x0402 #);
GL_BACK_RIGHT:        (# exit 0x0403 #);
GL_AUX0:              (# exit 0x0409 #);
GL_AUX1:              (# exit 0x040A #);
GL_AUX2:              (# exit 0x040B #);
GL_AUX3:              (# exit 0x040C #);
GL_COLOR_INDEX:       (# exit 0x1900 #);
GL_RED:               (# exit 0x1903 #);
GL_GREEN:             (# exit 0x1904 #);
GL_BLUE:              (# exit 0x1905 #);
GL_ALPHA:             (# exit 0x1906 #);

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GL_LUMINANCE:                (# exit 0x1909 #);
GL_LUMINANCE_ALPHA:         (# exit 0x190A #);
GL_ALPHA_BITS:              (# exit 0x0D55 #);
GL_RED_BITS:                (# exit 0x0D52 #);
GL_GREEN_BITS:              (# exit 0x0D53 #);
GL_BLUE_BITS:               (# exit 0x0D54 #);
GL_INDEX_BITS:              (# exit 0x0D51 #);
GL_SUBPIXEL_BITS:          (# exit 0x0D50 #);
GL_AUX_BUFFERS:             (# exit 0x0C00 #);
GL_READ_BUFFER:             (# exit 0x0C02 #);
GL_DRAW_BUFFER:             (# exit 0x0C01 #);
GL_DOUBLEBUFFER:           (# exit 0x0C32 #);
GL_STEREO:                  (# exit 0x0C33 #);
GL_BITMAP:                  (# exit 0x1A00 #);
GL_COLOR:                   (# exit 0x1800 #);
GL_DEPTH:                   (# exit 0x1801 #);
GL_STENCIL:                  (# exit 0x1802 #);
GL_DITHER:                  (# exit 0x0BD0 #);
GL_RGB:                      (# exit 0x1907 #);
GL_RGBA:                    (# exit 0x1908 #);

(* Implementation limits *)
GL_MAX_LIST_NESTING:        (# exit 0x0B31 #);
GL_MAX_ATTRIB_STACK_DEPTH: (# exit 0x0D35 #);
GL_MAX_MODELVIEW_STACK_DEPTH: (# exit 0x0D36 #);
GL_MAX_NAME_STACK_DEPTH:   (# exit 0x0D37 #);
GL_MAX_PROJECTION_STACK_DEPTH: (# exit 0x0D38 #);
GL_MAX_TEXTURE_STACK_DEPTH: (# exit 0x0D39 #);
GL_MAX_EVAL_ORDER:         (# exit 0x0D30 #);
GL_MAX_LIGHTS:             (# exit 0x0D31 #);
GL_MAX_CLIP_PLANES:        (# exit 0x0D32 #);
GL_MAX_TEXTURE_SIZE:       (# exit 0x0D33 #);
GL_MAX_PIXEL_MAP_TABLE:    (# exit 0x0D34 #);
GL_MAX_VIEWPORT_DIMS:      (# exit 0x0D3A #);
GL_MAX_CLIENT_ATTRIB_STACK_DEPTH: (# exit 0x0D3B #);

(* Gets *)
GL_ATTRIB_STACK_DEPTH:      (# exit 0x0BB0 #);
GL_CLIENT_ATTRIB_STACK_DEPTH: (# exit 0x0BB1 #);
GL_COLOR_CLEAR_VALUE:       (# exit 0x0C22 #);
GL_COLOR_WRITEMASK:         (# exit 0x0C23 #);
GL_CURRENT_INDEX:           (# exit 0x0B01 #);
GL_CURRENT_COLOR:           (# exit 0x0B00 #);
GL_CURRENT_NORMAL:          (# exit 0x0B02 #);
GL_CURRENT_RASTER_COLOR:    (# exit 0x0B04 #);
GL_CURRENT_RASTER_DISTANCE: (# exit 0x0B09 #);
GL_CURRENT_RASTER_INDEX:    (# exit 0x0B05 #);
GL_CURRENT_RASTER_POSITION: (# exit 0x0B07 #);
GL_CURRENT_RASTER_TEXTURE_COORDS: (# exit 0x0B06 #);
GL_CURRENT_RASTER_POSITION_VALID: (# exit 0x0B08 #);
GL_CURRENT_TEXTURE_COORDS:  (# exit 0x0B03 #);
GL_INDEX_CLEAR_VALUE:       (# exit 0x0C20 #);
GL_INDEX_MODE:              (# exit 0x0C30 #);
GL_INDEX_WRITEMASK:         (# exit 0x0C21 #);
GL_MODELVIEW_MATRIX:        (# exit 0x0BA6 #);
GL_MODELVIEW_STACK_DEPTH:   (# exit 0x0BA3 #);
GL_NAME_STACK_DEPTH:        (# exit 0x0D70 #);
GL_PROJECTION_MATRIX:       (# exit 0x0BA7 #);
GL_PROJECTION_STACK_DEPTH:  (# exit 0x0BA4 #);
GL_RENDER_MODE:             (# exit 0x0C40 #);
GL_RGBA_MODE:               (# exit 0x0C31 #);
GL_TEXTURE_MATRIX:          (# exit 0x0BA8 #);
GL_TEXTURE_STACK_DEPTH:     (# exit 0x0BA5 #);
GL_VIEWPORT:                (# exit 0x0BA2 #);

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(* Evaluators *)
GL_AUTO_NORMAL:          (# exit 0x0D80 #);
GL_MAP1_COLOR_4:         (# exit 0x0D90 #);
GL_MAP1_GRID_DOMAIN:    (# exit 0x0DD0 #);
GL_MAP1_GRID_SEGMENTS:  (# exit 0x0DD1 #);
GL_MAP1_INDEX:          (# exit 0x0D91 #);
GL_MAP1_NORMAL:         (# exit 0x0D92 #);
GL_MAP1_TEXTURE_COORD_1: (# exit 0x0D93 #);
GL_MAP1_TEXTURE_COORD_2: (# exit 0x0D94 #);
GL_MAP1_TEXTURE_COORD_3: (# exit 0x0D95 #);
GL_MAP1_TEXTURE_COORD_4: (# exit 0x0D96 #);
GL_MAP1_VERTEX_3:       (# exit 0x0D97 #);
GL_MAP1_VERTEX_4:       (# exit 0x0D98 #);
GL_MAP2_COLOR_4:        (# exit 0x0DB0 #);
GL_MAP2_GRID_DOMAIN:    (# exit 0x0DD2 #);
GL_MAP2_GRID_SEGMENTS:  (# exit 0x0DD3 #);
GL_MAP2_INDEX:          (# exit 0x0DB1 #);
GL_MAP2_NORMAL:         (# exit 0x0DB2 #);
GL_MAP2_TEXTURE_COORD_1: (# exit 0x0DB3 #);
GL_MAP2_TEXTURE_COORD_2: (# exit 0x0DB4 #);
GL_MAP2_TEXTURE_COORD_3: (# exit 0x0DB5 #);
GL_MAP2_TEXTURE_COORD_4: (# exit 0x0DB6 #);
GL_MAP2_VERTEX_3:       (# exit 0x0DB7 #);
GL_MAP2_VERTEX_4:       (# exit 0x0DB8 #);
GL_COEFF:                (# exit 0x0A00 #);
GL_DOMAIN:               (# exit 0x0A02 #);
GL_ORDER:                (# exit 0x0A01 #);

(* Hints *)
GL_FOG_HINT:             (# exit 0x0C54 #);
GL_LINE_SMOOTH_HINT:    (# exit 0x0C52 #);
GL_PERSPECTIVE_CORRECTION_HINT: (# exit 0x0C50 #);
GL_POINT_SMOOTH_HINT:   (# exit 0x0C51 #);
GL_POLYGON_SMOOTH_HINT: (# exit 0x0C53 #);
GL_DONT_CARE:           (# exit 0x1100 #);
GL_FASTEST:             (# exit 0x1101 #);
GL_NICEST:              (# exit 0x1102 #);

(* Scissor box *)
GL_SCISSOR_TEST:        (# exit 0x0C11 #);
GL_SCISSOR_BOX:         (# exit 0x0C10 #);

(* Pixel Mode / Transfer *)
GL_MAP_COLOR:           (# exit 0x0D10 #);
GL_MAP_STENCIL:         (# exit 0x0D11 #);
GL_INDEX_SHIFT:         (# exit 0x0D12 #);
GL_INDEX_OFFSET:        (# exit 0x0D13 #);
GL_RED_SCALE:           (# exit 0x0D14 #);
GL_RED_BIAS:            (# exit 0x0D15 #);
GL_GREEN_SCALE:         (# exit 0x0D18 #);
GL_GREEN_BIAS:          (# exit 0x0D19 #);
GL_BLUE_SCALE:          (# exit 0x0D1A #);
GL_BLUE_BIAS:           (# exit 0x0D1B #);
GL_ALPHA_SCALE:         (# exit 0x0D1C #);
GL_ALPHA_BIAS:          (# exit 0x0D1D #);
GL_DEPTH_SCALE:         (# exit 0x0D1E #);
GL_DEPTH_BIAS:          (# exit 0x0D1F #);
GL_PIXEL_MAP_S_TO_S_SIZE: (# exit 0x0CB1 #);
GL_PIXEL_MAP_I_TO_I_SIZE: (# exit 0x0CB0 #);
GL_PIXEL_MAP_I_TO_R_SIZE: (# exit 0x0CB2 #);
GL_PIXEL_MAP_I_TO_G_SIZE: (# exit 0x0CB3 #);
GL_PIXEL_MAP_I_TO_B_SIZE: (# exit 0x0CB4 #);
GL_PIXEL_MAP_I_TO_A_SIZE: (# exit 0x0CB5 #);
GL_PIXEL_MAP_R_TO_R_SIZE: (# exit 0x0CB6 #);
GL_PIXEL_MAP_G_TO_G_SIZE: (# exit 0x0CB7 #);
GL_PIXEL_MAP_B_TO_B_SIZE: (# exit 0x0CB8 #);

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GL_PIXEL_MAP_A_TO_A_SIZE:      (# exit 0x0CB9 #);
GL_PIXEL_MAP_S_TO_S:          (# exit 0x0C71 #);
GL_PIXEL_MAP_I_TO_I:          (# exit 0x0C70 #);
GL_PIXEL_MAP_I_TO_R:          (# exit 0x0C72 #);
GL_PIXEL_MAP_I_TO_G:          (# exit 0x0C73 #);
GL_PIXEL_MAP_I_TO_B:          (# exit 0x0C74 #);
GL_PIXEL_MAP_I_TO_A:          (# exit 0x0C75 #);
GL_PIXEL_MAP_R_TO_R:          (# exit 0x0C76 #);
GL_PIXEL_MAP_G_TO_G:          (# exit 0x0C77 #);
GL_PIXEL_MAP_B_TO_B:          (# exit 0x0C78 #);
GL_PIXEL_MAP_A_TO_A:          (# exit 0x0C79 #);
GL_PACK_ALIGNMENT:            (# exit 0x0D05 #);
GL_PACK_LSB_FIRST:            (# exit 0x0D01 #);
GL_PACK_ROW_LENGTH:           (# exit 0x0D02 #);
GL_PACK_SKIP_PIXELS:          (# exit 0x0D04 #);
GL_PACK_SKIP_ROWS:            (# exit 0x0D03 #);
GL_PACK_SWAP_BYTES:           (# exit 0x0D00 #);
GL_UNPACK_ALIGNMENT:          (# exit 0x0CF5 #);
GL_UNPACK_LSB_FIRST:          (# exit 0x0CF1 #);
GL_UNPACK_ROW_LENGTH:         (# exit 0x0CF2 #);
GL_UNPACK_SKIP_PIXELS:        (# exit 0x0CF4 #);
GL_UNPACK_SKIP_ROWS:          (# exit 0x0CF3 #);
GL_UNPACK_SWAP_BYTES:         (# exit 0x0CF0 #);
GL_ZOOM_X:                     (# exit 0x0D16 #);
GL_ZOOM_Y:                     (# exit 0x0D17 #);

(* Texture mapping *)
GL_TEXTURE_ENV:                (# exit 0x2300 #);
GL_TEXTURE_ENV_MODE:           (# exit 0x2200 #);
GL_TEXTURE_1D:                 (# exit 0x0DE0 #);
GL_TEXTURE_2D:                 (# exit 0x0DE1 #);
GL_TEXTURE_WRAP_S:             (# exit 0x2802 #);
GL_TEXTURE_WRAP_T:             (# exit 0x2803 #);
GL_TEXTURE_MAG_FILTER:         (# exit 0x2800 #);
GL_TEXTURE_MIN_FILTER:         (# exit 0x2801 #);
GL_TEXTURE_ENV_COLOR:         (# exit 0x2201 #);
GL_TEXTURE_GEN_S:              (# exit 0x0C60 #);
GL_TEXTURE_GEN_T:              (# exit 0x0C61 #);
GL_TEXTURE_GEN_MODE:           (# exit 0x2500 #);
GL_TEXTURE_BORDER_COLOR:       (# exit 0x1004 #);
GL_TEXTURE_WIDTH:              (# exit 0x1000 #);
GL_TEXTURE_HEIGHT:             (# exit 0x1001 #);
GL_TEXTURE_BORDER:             (# exit 0x1005 #);
GL_TEXTURE_COMPONENTS:         (# exit 0x1003 #);
GL_TEXTURE_RED_SIZE:           (# exit 0x805C #);
GL_TEXTURE_GREEN_SIZE:         (# exit 0x805D #);
GL_TEXTURE_BLUE_SIZE:          (# exit 0x805E #);
GL_TEXTURE_ALPHA_SIZE:         (# exit 0x805F #);
GL_TEXTURE_LUMINANCE_SIZE:     (# exit 0x8060 #);
GL_TEXTURE_INTENSITY_SIZE:     (# exit 0x8061 #);
GL_NEAREST_MIPMAP_NEAREST:     (# exit 0x2700 #);
GL_NEAREST_MIPMAP_LINEAR:      (# exit 0x2702 #);
GL_LINEAR_MIPMAP_NEAREST:      (# exit 0x2701 #);
GL_LINEAR_MIPMAP_LINEAR:       (# exit 0x2703 #);
GL_OBJECT_LINEAR:              (# exit 0x2401 #);
GL_OBJECT_PLANE:               (# exit 0x2501 #);
GL_EYE_LINEAR:                 (# exit 0x2400 #);
GL_EYE_PLANE:                  (# exit 0x2502 #);
GL_SPHERE_MAP:                 (# exit 0x2402 #);
GL_DECAL:                      (# exit 0x2101 #);
GL_MODULATE:                   (# exit 0x2100 #);
GL_NEAREST:                    (# exit 0x2600 #);
GL_REPEAT:                     (# exit 0x2901 #);
GL_CLAMP:                      (# exit 0x2900 #);
GL_S:                          (# exit 0x2000 #);
GL_T:                          (# exit 0x2001 #);

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GL_R:                (# exit 0x2002 #);
GL_Q:                (# exit 0x2003 #);
GL_TEXTURE_GEN_R:    (# exit 0x0C62 #);
GL_TEXTURE_GEN_Q:    (# exit 0x0C63 #);

GL_PROXY_TEXTURE_1D: (# exit 0x8063 #);
GL_PROXY_TEXTURE_2D: (# exit 0x8064 #);
GL_TEXTURE_PRIORITY: (# exit 0x8066 #);
GL_TEXTURE_RESIDENT: (# exit 0x8067 #);
GL_TEXTURE_BINDING_1D: (# exit 0x8068 #);
GL_TEXTURE_BINDING_2D: (# exit 0x8069 #);

(* Internal texture formats *)
GL_ALPHA4:           (# exit 0x803B #);
GL_ALPHA8:           (# exit 0x803C #);
GL_ALPHA12:          (# exit 0x803D #);
GL_ALPHA16:          (# exit 0x803E #);
GL_LUMINANCE4:       (# exit 0x803F #);
GL_LUMINANCE8:       (# exit 0x8040 #);
GL_LUMINANCE12:      (# exit 0x8041 #);
GL_LUMINANCE16:      (# exit 0x8042 #);
GL_LUMINANCE4_ALPHA4: (# exit 0x8043 #);
GL_LUMINANCE6_ALPHA2: (# exit 0x8044 #);
GL_LUMINANCE8_ALPHA8: (# exit 0x8045 #);
GL_LUMINANCE12_ALPHA4: (# exit 0x8046 #);
GL_LUMINANCE12_ALPHA12: (# exit 0x8047 #);
GL_LUMINANCE16_ALPHA16: (# exit 0x8048 #);
GL_INTENSITY:        (# exit 0x8049 #);
GL_INTENSITY4:       (# exit 0x804A #);
GL_INTENSITY8:       (# exit 0x804B #);
GL_INTENSITY12:      (# exit 0x804C #);
GL_INTENSITY16:      (# exit 0x804D #);
GL_R3_G3_B2:         (# exit 0x2A10 #);
GL_RGB4:              (# exit 0x804F #);
GL_RGB5:              (# exit 0x8050 #);
GL_RGB8:              (# exit 0x8051 #);
GL_RGB10:             (# exit 0x8052 #);
GL_RGB12:             (# exit 0x8053 #);
GL_RGB16:             (# exit 0x8054 #);
GL_RGBA2:             (# exit 0x8055 #);
GL_RGBA4:             (# exit 0x8056 #);
GL_RGB5_A1:           (# exit 0x8057 #);
GL_RGBA8:             (# exit 0x8058 #);
GL_RGB10_A2:          (# exit 0x8059 #);
GL_RGBA12:            (# exit 0x805A #);
GL_RGBA16:            (# exit 0x805B #);

(* Utility *)
GL_VENDOR:            (# exit 0x1F00 #);
GL_RENDERER:          (# exit 0x1F01 #);
GL_VERSION:           (# exit 0x1F02 #);
GL_EXTENSIONS:        (# exit 0x1F03 #);

(* Errors *)
GL_INVALID_VALUE:     (# exit 0x0501 #);
GL_INVALID_ENUM:      (# exit 0x0500 #);
GL_INVALID_OPERATION: (# exit 0x0502 #);
GL_STACK_OVERFLOW:    (# exit 0x0503 #);
GL_STACK_UNDERFLOW:   (# exit 0x0504 #);
GL_OUT_OF_MEMORY:     (# exit 0x0505 #);

(*
 * 1.0 Extensions
 *)
(* GL_EXT_blend_minmax and GL_EXT_blend_color *)
GL_CONSTANT_COLOR_EXT: (# exit 0x8001 #);

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GL_ONE_MINUS_CONSTANT_COLOR_EXT: (# exit 0x8002 #);
GL_CONSTANT_ALPHA_EXT:          (# exit 0x8003 #);
GL_ONE_MINUS_CONSTANT_ALPHA_EXT: (# exit 0x8004 #);
GL_BLEND_EQUATION_EXT:          (# exit 0x8009 #);
GL_MIN_EXT:                      (# exit 0x8007 #);
GL_MAX_EXT:                      (# exit 0x8008 #);
GL_FUNC_ADD_EXT:                 (# exit 0x8006 #);
GL_FUNC_SUBTRACT_EXT:           (# exit 0x800A #);
GL_FUNC_REVERSE_SUBTRACT_EXT:   (# exit 0x800B #);
GL_BLEND_COLOR_EXT:             (# exit 0x8005 #);

(* GL_EXT_polygon_offset *)
GL_POLYGON_OFFSET_EXT:          (# exit 0x8037 #);
GL_POLYGON_OFFSET_FACTOR_EXT:   (# exit 0x8038 #);
GL_POLYGON_OFFSET_BIAS_EXT:     (# exit 0x8039 #);

(* GL_EXT_vertex_array *)
GL_VERTEX_ARRAY_EXT:            (# exit 0x8074 #);
GL_NORMAL_ARRAY_EXT:            (# exit 0x8075 #);
GL_COLOR_ARRAY_EXT:             (# exit 0x8076 #);
GL_INDEX_ARRAY_EXT:             (# exit 0x8077 #);
GL_TEXTURE_COORD_ARRAY_EXT:     (# exit 0x8078 #);
GL_EDGE_FLAG_ARRAY_EXT:        (# exit 0x8079 #);
GL_VERTEX_ARRAY_SIZE_EXT:       (# exit 0x807A #);
GL_VERTEX_ARRAY_TYPE_EXT:       (# exit 0x807B #);
GL_VERTEX_ARRAY_STRIDE_EXT:     (# exit 0x807C #);
GL_VERTEX_ARRAY_COUNT_EXT:      (# exit 0x807D #);
GL_NORMAL_ARRAY_TYPE_EXT:       (# exit 0x807E #);
GL_NORMAL_ARRAY_STRIDE_EXT:     (# exit 0x807F #);
GL_NORMAL_ARRAY_COUNT_EXT:      (# exit 0x8080 #);
GL_COLOR_ARRAY_SIZE_EXT:        (# exit 0x8081 #);
GL_COLOR_ARRAY_TYPE_EXT:        (# exit 0x8082 #);
GL_COLOR_ARRAY_STRIDE_EXT:      (# exit 0x8083 #);
GL_COLOR_ARRAY_COUNT_EXT:       (# exit 0x8084 #);
GL_INDEX_ARRAY_TYPE_EXT:        (# exit 0x8085 #);
GL_INDEX_ARRAY_STRIDE_EXT:      (# exit 0x8086 #);
GL_INDEX_ARRAY_COUNT_EXT:       (# exit 0x8087 #);
GL_TEXTURE_COORD_ARRAY_SIZE_EXT: (# exit 0x8088 #);
GL_TEXTURE_COORD_ARRAY_TYPE_EXT: (# exit 0x8089 #);
GL_TEXTURE_COORD_ARRAY_STRIDE_EXT: (# exit 0x808A #);
GL_TEXTURE_COORD_ARRAY_COUNT_EXT: (# exit 0x808B #);
GL_EDGE_FLAG_ARRAY_STRIDE_EXT:  (# exit 0x808C #);
GL_EDGE_FLAG_ARRAY_COUNT_EXT:   (# exit 0x808D #);
GL_VERTEX_ARRAY_POINTER_EXT:    (# exit 0x808E #);
GL_NORMAL_ARRAY_POINTER_EXT:    (# exit 0x808F #);
GL_COLOR_ARRAY_POINTER_EXT:     (# exit 0x8090 #);
GL_INDEX_ARRAY_POINTER_EXT:     (# exit 0x8091 #);
GL_TEXTURE_COORD_ARRAY_POINTER_EXT: (# exit 0x8092 #);
GL_EDGE_FLAG_ARRAY_POINTER_EXT: (# exit 0x8093 #);

(* GL_EXT_texture_object *)
GL_TEXTURE_PRIORITY_EXT:        (# exit 0x8066 #);
GL_TEXTURE_RESIDENT_EXT:        (# exit 0x8067 #);
GL_TEXTURE_1D_BINDING_EXT:      (# exit 0x8068 #);
GL_TEXTURE_2D_BINDING_EXT:      (# exit 0x8069 #);

(* GL_EXT_texture3D *)
GL_PACK_SKIP_IMAGES_EXT:        (# exit 0x806B #);
GL_PACK_IMAGE_HEIGHT_EXT:       (# exit 0x806C #);
GL_UNPACK_SKIP_IMAGES_EXT:      (# exit 0x806D #);
GL_UNPACK_IMAGE_HEIGHT_EXT:     (# exit 0x806E #);
GL_TEXTURE_3D_EXT:              (# exit 0x806F #);
GL_PROXY_TEXTURE_3D_EXT:        (# exit 0x8070 #);
GL_TEXTURE_DEPTH_EXT:           (# exit 0x8071 #);
GL_TEXTURE_WRAP_R_EXT:          (# exit 0x8072 #);
GL_MAX_3D_TEXTURE_SIZE_EXT:     (# exit 0x8073 #);

```

```

GL_TEXTURE_3D_BINDING_EXT:          (# exit 0x806A #);

(* GL_EXT_paletted_texture *)
GL_TABLE_TOO_LARGE_EXT:            (# exit 0x8031 #);
GL_COLOR_TABLE_FORMAT_EXT:          (# exit 0x80D8 #);
GL_COLOR_TABLE_WIDTH_EXT:           (# exit 0x80D9 #);
GL_COLOR_TABLE_RED_SIZE_EXT:        (# exit 0x80DA #);
GL_COLOR_TABLE_GREEN_SIZE_EXT:      (# exit 0x80DB #);
GL_COLOR_TABLE_BLUE_SIZE_EXT:       (# exit 0x80DC #);
GL_COLOR_TABLE_ALPHA_SIZE_EXT:      (# exit 0x80DD #);
GL_COLOR_TABLE_LUMINANCE_SIZE_EXT:  (# exit 0x80DE #);
GL_COLOR_TABLE_INTENSITY_SIZE_EXT:  (# exit 0x80DF #);
GL_TEXTURE_INDEX_SIZE_EXT:          (# exit 0x80E1 #); (*XXX right value??*)
GL_COLOR_INDEX1_EXT:                (# exit 0x80E2 #);
GL_COLOR_INDEX2_EXT:                (# exit 0x80E3 #);
GL_COLOR_INDEX4_EXT:                (# exit 0x80E4 #);
GL_COLOR_INDEX8_EXT:                (# exit 0x80E5 #);
GL_COLOR_INDEX12_EXT:               (# exit 0x80E6 #);
GL_COLOR_INDEX16_EXT:               (# exit 0x80E7 #);

(* GL_EXT_shared_texture_palette *)
GL_SHARED_TEXTURE_PALETTE_EXT:      (# exit 0x81FB #);

(* GL_EXT_point_parameters *)
GL_POINT_SIZE_MIN_EXT:              (# exit 0x8126 #);
GL_POINT_SIZE_MAX_EXT:              (# exit 0x8127 #);
GL_POINT_FADE_THRESHOLD_SIZE_EXT:   (# exit 0x8128 #);
GL_DISTANCE_ATTENUATION_EXT:        (# exit 0x8129 #);

(* GL_NO_ERROR must be zero *)
GL_NO_ERROR: (# exit 0 #);

GL_CURRENT_BIT:                     (# exit 0x00000001 #);
GL_POINT_BIT:                       (# exit 0x00000002 #);
GL_LINE_BIT:                         (# exit 0x00000004 #);
GL_POLYGON_BIT:                     (# exit 0x00000008 #);
GL_POLYGON_STIPPLE_BIT:             (# exit 0x00000010 #);
GL_PIXEL_MODE_BIT:                  (# exit 0x00000020 #);
GL_LIGHTING_BIT:                    (# exit 0x00000040 #);
GL_FOG_BIT:                         (# exit 0x00000080 #);
GL_DEPTH_BUFFER_BIT:                (# exit 0x00000100 #);
GL_ACCUM_BUFFER_BIT:                (# exit 0x00000200 #);
GL_STENCIL_BUFFER_BIT:              (# exit 0x00000400 #);
GL_VIEWPORT_BIT:                    (# exit 0x00000800 #);
GL_TRANSFORM_BIT:                   (# exit 0x00001000 #);
GL_ENABLE_BIT:                      (# exit 0x00002000 #);
GL_COLOR_BUFFER_BIT:                (# exit 0x00004000 #);
GL_HINT_BIT:                        (# exit 0x00008000 #);
GL_EVAL_BIT:                        (# exit 0x00010000 #);
GL_LIST_BIT:                        (# exit 0x00020000 #);
GL_TEXTURE_BIT:                     (# exit 0x00040000 #);
GL_SCISSOR_BIT:                     (# exit 0x00080000 #);
GL_ALL_ATTRIB_BITS:                 (# exit 0x000fffff #);

GL_CLIENT_PIXEL_STORE_BIT:          (# exit 0x00000001 #);
GL_CLIENT_VERTEX_ARRAY_BIT:         (# exit 0x00000002 #);
GL_CLIENT_ALL_ATTRIB_BITS:          (# exit 0x0000ffff #);

(*
 * Miscellaneous
 *)

```

```

glClearColor: External (* Wrapped *)
  (# c: @real (* GLfloat *)
  enter (c)
  do 'wrapglClearColor'-->CallC;
  #);

glClearColor: (* Wrapped *)
  (#
  wrapglClearColorfirst: External
    (# red,green: @real;
    enter (red,green)
    #);
  wrapglClearColorsecond: External
    (# blue,alpha: @real;
    enter (blue,alpha)
    #);
  red: @real (* GLclampf *);
  green: @real (* GLclampf *);
  blue: @real (* GLclampf *);
  alpha: @real (* GLclampf *)
  enter (red, green, blue, alpha)
  do (red,green)-->wrapglClearColorfirst;
    (blue,alpha)-->wrapglClearColorsecond;
  #);

glClear: External
  (# mask: @int32u (* GLbitfield *)
  enter (mask)
  do callStd
  #);

glIndexMask: External
  (# mask: @int32u (* GLuint *)
  enter (mask)
  do callStd
  #);

glColorMask: External
  (# red: @int8u (* GLboolean *);
  green: @int8u (* GLboolean *);
  blue: @int8u (* GLboolean *);
  alpha: @int8u (* GLboolean *)
  enter (red, green, blue, alpha)
  do callStd
  #);

glAlphaFunc: External
  (# func: @int32u (* GLenum *);
  ref: @real (* GLclampf *)
  enter (func, ref)
  do callStd
  #);

glBlendFunc: External
  (# sfactor: @int32u (* GLenum *);
  dfactor: @int32u (* GLenum *)
  enter (sfactor, dfactor)
  do callStd
  #);

glLogicOp: External
  (# opcode: @int32u (* GLenum *)
  enter (opcode)
  do callStd
  #);

```



```

glCullFace: External
  (# mode: @int32u (* GLenum *);
  enter (mode)
  do callStd
  #);

glFrontFace: External
  (# mode: @int32u (* GLenum *);
  enter (mode)
  do callStd
  #);

glPointSize: External
  (# size: @real (* GLfloat *);
  enter (size)
  do 'wrapglPointSize'->CallC;
  #);

glLineWidth: External
  (# width: @real (* GLfloat *);
  enter (width)
  do 'wrapglLineWidth'->CallC;
  #);

glLineStipple: External
  (# factor: @int32 (* GLint *);
  pattern: @int16u (* GLushort *);
  enter (factor, pattern)
  do callStd
  #);

glPolygonMode: External
  (# face: @int32u (* GLenum *);
  mode: @int32u (* GLenum *);
  enter (face, mode)
  do callStd
  #);

glPolygonOffset: External (* removed in gl1.2?*)
  (# factor: @real (* GLfloat *);
  units: @real (* GLfloat *);
  enter (factor, units)
  do 'wrapglPolygonOffset'->CallC;
  #);

glPolygonStipple: External
  (# mask: @int8u (* GLubyte* *);
  enter (mask)
  do callStd
  #);

glGetPolygonStipple: External
  (# mask: @int8u (* GLubyte* *);
  enter (mask)
  do callStd
  #);

glEdgeFlag: External
  (# flag: @int8u (* GLboolean *);
  enter (flag)
  do callStd
  #);

glEdgeFlagv: External
  (# flag: @int32 (* GLboolean* *);
  enter (flag)

```

```

do callStd
#);

glScissor: External
(# x: @int32 (* GLint *);
 y: @int32 (* GLint *);
 width: @int32 (* GLsizei *);
 height: @int32 (* GLsizei *);
 enter (x, y, width, height)
 do callStd
#);

glClipPlane: External
(# plane: @int32u (* GLenum *);
 equation: @int32 (* GLdouble* *);
 enter (plane, equation)
 do callStd
#);

glGetClipPlane: External
(# plane: @int32u (* GLenum *);
 equation: @int32 (* GLdouble* *);
 enter (plane, equation)
 do callStd
#);

glDrawBuffer: External
(# mode: @int32u (* GLenum *);
 enter (mode)
 do callStd
#);

glReadBuffer: External
(# mode: @int32u (* GLenum *);
 enter (mode)
 do callStd
#);

glEnable: External
(# cap: @int32u (* GLenum *);
 enter (cap)
 do callStd
#);

glDisable: External
(# cap: @int32u (* GLenum *);
 enter (cap)
 do callStd
#);

glIsEnabled: External
(# cap: @int32u (* GLenum *);
 result: @int8u (* GLboolean *);
 enter cap
 do callStd
 exit result
#);

glEnableClientState: External
(# cap: @int32u (* GLenum *);
 enter (cap)
 do callStd
#);

```

```

glDisableClientState: External
  (# cap: @int32u (* GLenum *))
  enter (cap)
  do callStd
  #);

glGetBooleanv: External
  (# pname: @int32u (* GLenum *);
   params: @int32 (* GLboolean* *));
  enter (pname, params)
  do callStd
  #);

glGetDoublev: External
  (# pname: @int32u (* GLenum *);
   params: @int32 (* GLdouble* *));
  enter (pname, params)
  do callStd
  #);

glGetFloatv: External
  (# pname: @int32u (* GLenum *);
   params: @int32 (* GLfloat* *));
  enter (pname, params)
  do callStd
  #);

glGetIntegerv: External
  (# pname: @int32u (* GLenum *);
   params: @int32 (* GLint* *));
  enter (pname, params)
  do callStd
  #);

glPushAttrib: External
  (# mask: @int32u (* GLbitfield *));
  enter (mask)
  do callStd
  #);

glPopAttrib: External
  (#
  do callStd
  #);

glPushClientAttrib: External
  (# mask: @int32u (* GLbitfield *));
  enter (mask)
  do callStd
  #);

glPopClientAttrib: External
  (#
  do callStd
  #);

glRenderMode: External
  (# mode: @int32u (* GLenum *);
   result: @int32 (* GLint *));
  enter mode
  do callStd;
  exit result
  #);

```

```

glGetError: External
  (# error: @int32u (* GLenum *);
  do callStd;
  exit error
  #);

glGetString: External
  (# name: @int32 (* GLubyte* *);
   result: [0]@char (* GLubyte* *);
  enter name
  do callStd;
  exit result
  #);

glFinish: External
  (#
  do callStd;
  #);

glFlush: External
  (#
  do callStd;
  #);

glHint: External
  (# target: @int32u (* GLenum *);
   mode: @int32u (* GLenum *);
  enter (target, mode)
  do callStd;
  #);

(*
 * Depth Buffer
 *)

glClearDepth: External
  (# depth: @real (* GLclampd *);
  enter (depth)
  do callStd;
  #);

glDepthFunc: External
  (# func: @int32u (* GLenum *);
  enter (func)
  do callStd;
  #);

glDepthMask: External
  (# flag: @int8u (* GLboolean *);
  enter (flag)
  do callStd;
  #);

glDepthRange: External
  (# near_val: @real (* GLclampd *);
   far_val: @real (* GLclampd *);
  enter (near_val, far_val)
  do callStd;
  #);

(*
 * Accumulation Buffer

```

```

*)

glClearAccum: (* Wrapped *)
  (# wrapglClearAccumfirst: External
    (# red,green: @real;
      enter(red,green)
      #);
    wrapglClearAccumsecond: External
      (# blue,alpha: @real;
        enter (blue,alpha)
        #);
    red: @real (* GLfloat *);
    green: @real (* GLfloat *);
    blue: @real (* GLfloat *);
    alpha: @real (* GLfloat *);
    enter (red, green, blue, alpha)
    do (red,green)->wrapglClearAccumfirst;
      (blue,alpha)->wrapglClearAccumsecond;
    #);

glAccum: External (* wrapped *)
  (# op: @int32u (* GLenum *);
    value: @real (* GLfloat *);
    enter (op, value)
    do 'wrapglAccum'->CallC;
    #);

(*
 * Transformation
 *)

glMatrixMode: External
  (# mode: @int32u (* GLenum *);
    enter (mode)
    do callStd;
    #);

glOrtho: (* Wrapped *)
  (# wrapglOrthofirst: External
    (# left,right,bottom: @real;
      enter (left,right,bottom)
      #);
    wrapglOrthosecond: External
      (# top,near,far: @real;
        enter (top,near,far)
        #);
    left: @real (* GLdouble *);
    right: @real (* GLdouble *);
    bottom: @real (* GLdouble *);
    top: @real (* GLdouble *);
    near_val: @real (* GLdouble *);
    far_val: @real (* GLdouble *);
    enter (left, right, bottom, top, near_val, far_val)
    do
      (left,right,bottom)->wrapglOrthofirst;
      (top,near_val,far_val)->wrapglOrthosecond;
    #);

glFrustum: (* Wrapped *)
  (# wrapglFrustumfirst: External
    (# left,right,bottom: @real;
      enter (left,right,bottom)
      #);
    wrapglFrustumsecond: External

```

```

    (# top,near,far: @real;
    enter (top,near,far)
    #);
left: @real (* GLdouble *);
right: @real (* GLdouble *);
bottom: @real (* GLdouble *);
top: @real (* GLdouble *);
near_val: @real (* GLdouble *);
far_val: @real (* GLdouble *);
enter (left, right, bottom, top, near_val, far_val)
do
    (left,right,bottom)->wrapglFrustumfirst;
    (top,near_val,far_val)->wrapglFrustumsecond;
#);

glViewport: External
    (# x: @int32 (* GLint *);
    y: @int32 (* GLint *);
    width: @int32 (* GLsizei *);
    height: @int32 (* GLsizei *);
    enter (x, y, width, height)
    do callStd
    #);

glPushMatrix: External
    (#
    do callStd;
    #);

glPopMatrix: External
    (#
    do callStd;
    #);

glLoadIdentity: External
    (#
    do callStd;
    #);

glLoadMatrixd: External
    (# m: @int32 (* GLdouble* *);
    enter (m)
    do callStd;
    #);

glLoadMatrixf: External
    (# m: @int32 (* GLfloat* *);
    enter (m)
    do callStd;
    #);

glMultMatrixd: External
    (# m: @int32 (* GLdouble* *);
    enter (m)
    do callStd;
    #);

glMultMatrixf: External
    (# m: @int32 (* GLfloat* *);
    enter (m)
    do callStd;
    #);

glRotated: (* Wrapped *)
    (# wrapglRotatedfirst: External
    (# angle,x: @real

```

```

    enter (angle,x)
    #);
wrapglRotatedsecond: External
    (# y,z: @real;
    enter (y,z)
    #);
    angle: @real (* GLdouble *);
    x: @real (* GLdouble *);
    y: @real (* GLdouble *);
    z: @real (* GLdouble *);
    enter (angle, x, y, z)
    do (angle,x)->wrapglRotatedfirst;
        (y,z)->wrapglRotatedsecond;
    #);

glRotatef:glRotated(# #);

glScaled: External
    (# x: @real (* GLdouble *);
    y: @real (* GLdouble *);
    z: @real (* GLdouble *);
    enter (x, y, z)
    do callStd;
    #);

glScalef:glScaled(# #);

glTranslated: External
    (# x: @real (* GLdouble *);
    y: @real (* GLdouble *);
    z: @real (* GLdouble *);
    enter (x, y, z)
    do callStd;
    #);

glTranslatef:glTranslated(# #);

(*
 * Display Lists
 *)

glIsList: External
    (# list: @int32 (* GLuint *);
    result: @int8u (* GLboolean *);
    enter list
    do callStd;
    exit result
    #);

glDeleteLists: External
    (# list: @int32 (* GLuint *);
    range: @int32 (* GLsizei *);
    enter (list, range)
    do callStd;
    #);

glGenLists: External
    (# range: @int32 (* GLsizei *);
    result: @int32u (* GLuint *);
    enter range
    do callStd;
    exit result
    #);

glNewList: External
    (# list: @int32 (* GLuint *);

```

```

    mode: @int32u (* GLenum *);
    enter (list, mode)
    do callStd;
    #);

glEndList: External
    (#
    do callStd;
    #);

glCallList: External
    (# list: @int32 (* GLuint *);
    enter (list)
    do callStd;
    #);

glCallLists: External
    (# n: @int32 (* GLsizei *);
    type: @int32u (* GLenum *);
    lists: @int32 (* GLvoid* *);
    enter (n, type, lists)
    do callStd;
    #);

glListBase: External
    (# base: @int32u (* GLuint *);
    enter (base)
    do callStd;
    #);

(*
 * Drawing Functions
 *)

glBegin: External
    (# mode: @int32u (* GLenum *);
    enter (mode)
    do callStd;
    #);

glEnd: External
    (#
    do callStd;
    #);

glVertex2d: External
    (# x: @real (* GLdouble *);
    y: @real (* GLdouble *);
    enter (x, y)
    do callStd;
    #);

glVertex2f:glVertex2d(# #);

glVertex2i: External
    (# x: @int32 (* GLint *);
    y: @int32 (* GLint *);
    enter (x, y)
    do callStd;
    #);

glVertex2s: External
    (# x: @int16 (* GLshort *);

```



```

        y: @int16 (* GLshort *);
    enter (x, y)
    do callStd;
    #);

glVertex3d: External
    (# x: @real (* GLdouble *);
     y: @real (* GLdouble *);
     z: @real (* GLdouble *);
    enter (x, y, z)
    do callStd;
    #);

glVertex3f:glVertex3d(# #);

glVertex3i: External
    (# x: @int32 (* GLint *);
     y: @int32 (* GLint *);
     z: @int32 (* GLint *);
    enter (x, y, z)
    do callStd;
    #);

glVertex3s: External
    (# x: @int16 (* GLshort *);
     y: @int16 (* GLshort *);
     z: @int16 (* GLshort *);
    enter (x, y, z)
    do callStd;
    #);

glVertex4d,glVertex4f:
    (# wrapglVertex4d: External
     (# w: @real;
      enter (w)
      #);
     x: @real (* GLdouble *);
     y: @real (* GLdouble *);
     z: @real (* GLdouble *);
     w: @real (* GLdouble *);
    enter (x, y, z, w)
    do (x,y,z)->wrapset3double;
       (w)->wrapglVertex4d;
    #);

glVertex4i: External
    (# x: @int32 (* GLint *);
     y: @int32 (* GLint *);
     z: @int32 (* GLint *);
     w: @int32 (* GLint *);
    enter (x, y, z, w)
    do callStd;
    #);

glVertex4s: External
    (# x: @int16 (* GLshort *);
     y: @int16 (* GLshort *);
     z: @int16 (* GLshort *);
     w: @int16 (* GLshort *);
    enter (x, y, z, w)
    do callStd;
    #);

glVertex2dv: External
    (# v: @int32 (* GLdouble* *)
     enter (v)

```

```

do callStd;
#);

glVertex2fv: External
(# v: @int32 (* GLfloat* *)
enter (v)
do callStd;
#);

glVertex2iv: External
(# v: @int32 (* GLint* *)
enter (v)
do callStd;
#);

glVertex2sv: External
(# v: @int32 (* GLshort* *)
enter (v)
do callStd;
#);

glVertex3dv: External
(# v: @int32 (* GLdouble* *)
enter (v)
do callStd;
#);

glVertex3fv: External
(# v: @int32 (* GLfloat* *)
enter (v)
do callStd;
#);

glVertex3iv: External
(# v: @int32 (* GLint* *)
enter (v)
do callStd;
#);

glVertex3sv: External
(# v: @int32 (* GLshort* *)
enter (v)
do callStd;
#);

glVertex4dv: External
(# v: @int32 (* GLdouble* *)
enter (v)
do callStd;
#);

glVertex4fv: External
(# v: @int32 (* GLfloat* *)
enter (v)
do callStd;
#);

glVertex4iv: External
(# v: @int32 (* GLint* *)
enter (v)
do callStd;
#);

glVertex4sv: External
(# v: @int32 (* GLshort* *)
enter (v)

```

```

do callStd;
#);

glNormal3b: External
(# nx: @int8 (* GLbyte *);
 ny: @int8 (* GLbyte *);
  nz: @int8 (* GLbyte *);
 enter (nx, ny, nz)
 do callStd;
#);

glNormal3d: External
(# nx: @real (* GLdouble *);
  ny: @real (* GLdouble *);
  nz: @real (* GLdouble *);
 enter (nx, ny, nz)
 do callStd;
#);

glNormal3f: glNormal3d(# #);

glNormal3i: External
(# nx: @int32 (* GLint *);
  ny: @int32 (* GLint *);
  nz: @int32 (* GLint *);
 enter (nx, ny, nz)
 do callStd;
#);

glNormal3s: External
(# nx: @int16 (* GLshort *);
  ny: @int16 (* GLshort *);
  nz: @int16 (* GLshort *);
 enter (nx, ny, nz)
 do callStd;
#);

glNormal3bv: External
(# v: @int32 (* GLbyte* *)
 enter (v)
 do callStd;
#);

glNormal3dv: External
(# v: @int32 (* GLdouble* *)
 enter (v)
 do callStd;
#);

glNormal3fv: External
(# v: @int32 (* GLfloat* *)
 enter (v)
 do callStd;
#);

glNormal3iv: External
(# v: @int32 (* GLint* *)
 enter (v)
 do callStd;
#);

glNormal3sv: External
(# v: @int32 (* GLshort* *)
 enter (v)
 do callStd;

```

```

#);

glIndexd: External
  (# c: @real (* GLdouble *);
  enter (c)
  do callStd;
  #);

glIndexf: glIndexd(# #);

glIndexi: External
  (# c: @int32 (* GLint *);
  enter (c)
  do callStd;
  #);

glIndexs: External
  (# c: @int16 (* GLshort *);
  enter (c)
  do callStd;
  #);

glIndexub: External
  (# c: @int8u (* GLubyte *);
  enter (c)
  do callStd;
  #);

glIndexdv: External
  (# c: @int32 (* GLdouble* *);
  enter (c)
  do callStd;
  #);

glIndexfv: External
  (# c: @int32 (* GLfloat* *);
  enter (c)
  do callStd;
  #);

glIndexiv: External
  (# c: @int32 (* GLint* *);
  enter (c)
  do callStd;
  #);

glIndexsv: External
  (# c: @int32 (* GLshort* *);
  enter (c)
  do callStd;
  #);

glIndexubv: External
  (# c: @int32 (* GLubyte* *);
  enter (c)
  do callStd;
  #); (* 1.1 *)

glColor3b: External
  (# red: @int8 (* GLbyte *);
   green: @int8 (* GLbyte *);
   blue: @int8 (* GLbyte *);
  enter (red, green, blue)
  do callStd;
  #);

```

```

glColor3d: External
  (# red: @real (* GLdouble *);
   green: @real (* GLdouble *);
   blue: @real (* GLdouble *);
  enter (red, green, blue)
  do callStd;
  #);

glColor3f: glColor3d(# #);

glColor3i: External
  (# red: @int32 (* GLint *);
   green: @int32 (* GLint *);
   blue: @int32 (* GLint *);
  enter (red, green, blue)
  do callStd;
  #);

glColor3s: External
  (# red: @int16 (* GLshort *);
   green: @int16 (* GLshort *);
   blue: @int16 (* GLshort *);
  enter (red, green, blue)
  do callStd;
  #);

glColor3ub: External
  (# red: @int8u (* GLubyte *);
   green: @int8u (* GLubyte *);
   blue: @int8u (* GLubyte *);
  enter (red, green, blue)
  do callStd;
  #);

glColor3ui: External
  (# red: @int32 (* GLuint *);
   green: @int32 (* GLuint *);
   blue: @int32 (* GLuint *);
  enter (red, green, blue)
  do callStd;
  #);

glColor3us: External
  (# red: @int16u (* GLushort *);
   green: @int16u (* GLushort *);
   blue: @int16u (* GLushort *);
  enter (red, green, blue)
  do callStd;
  #);

glColor4b: External
  (# red: @int8 (* GLbyte *);
   green: @int8 (* GLbyte *);
   blue: @int8 (* GLbyte *);
   alpha: @int8 (* GLbyte *);
  enter (red, green, blue, alpha)
  do callStd;
  #);

glColor4d:
  (# wrapglColor4d: External
   (# alpha: @real;
    enter alpha
    #);
   red: @real (* GLdouble *);

```

```

    green: @real (* GLdouble *);
    blue: @real (* GLdouble *);
    alpha: @real (* GLdouble *);
    enter (red, green, blue, alpha)
    do (red,green,blue)->wrapset3double;
    alpha->wrapglColor4d;
    #);

glColor4f: glColor4d(# #);

glColor4i: External
  (# red: @int32 (* GLint *);
   green: @int32 (* GLint *);
   blue: @int32 (* GLint *);
   alpha: @int32 (* GLint *);
   enter (red, green, blue, alpha)
   do callStd;
   #);

glColor4s: External
  (# red: @int16 (* GLshort *);
   green: @int16 (* GLshort *);;
   blue: @int16 (* GLshort *);
   alpha: @int16 (* GLshort *);
   enter (red, green, blue, alpha)
   do callStd;
   #);

glColor4ub: External
  (# red: @int8u (* GLubyte *);
   green: @int8u (* GLubyte *);;
   blue: @int8u (* GLubyte *);
   alpha: @int8u (* GLubyte *);
   enter (red, green, blue, alpha)
   do callStd;
   #);

glColor4ui: External
  (# red: @int32 (* GLuint *);
   green: @int32 (* GLuint *);
   blue: @int32 (* GLuint *);
   alpha: @int32 (* GLuint *);
   enter (red, green, blue, alpha)
   do callStd;
   #);

glColor4us: External
  (# red: @int16u (* GLushort *);
   green: @int16u (* GLushort *);;
   blue: @int16u (* GLushort *);
   alpha: @int16u (* GLushort *);
   enter (red, green, blue, alpha)
   do callStd;
   #);

glColor3bv: External
  (# v: @int32 (* GLbyte* *)
   enter (v)
   do callStd;
   #);

glColor3dv: External
  (# v: @int32 (* GLdouble* *)
   enter (v)
   do callStd;
   #);

```

```
glColor3fv: External
  (# v: @int32 (* GLfloat* *)
  enter (v)
  do callStd;
  #);
```

```
glColor3iv: External
  (# v: @int32 (* GLint* *)
  enter (v)
  do callStd;
  #);
```

```
glColor3sv: External
  (# v: @int32 (* GLshort* *)
  enter (v)
  do callStd;
  #);
```

```
glColor3ubv: External
  (# v: @int8u (* GLubyte* *)
  enter (v)
  do callStd;
  #);
```

```
glColor3uiv: External
  (# v: @int32 (* GLuint* *)
  enter (v)
  do callStd;
  #);
```

```
glColor3usv: External
  (# v: @int32 (* GLushort* *)
  enter (v)
  do callStd;
  #);
```

```
glColor4bv: External
  (# v: @int32 (* GLbyte* *)
  enter (v)
  do callStd;
  #);
```

```
glColor4dv: External
  (# v: @int32 (* GLdouble* *)
  enter (v)
  do callStd;
  #);
```

```
glColor4fv: External
  (# v: @int32 (* GLfloat* *)
  enter (v)
  #);
```

```
glColor4iv: External
  (# v: @int32 (* GLint* *)
  enter (v)
  do callStd;
  #);
```

```
glColor4sv: External
  (# v: @int32 (* GLshort* *)
  enter (v)
  do callStd;
  #);
```

```

glColor4ubv: External
  (# v: @int8u (* GLubyte* *)
  enter (v)
  do callStd;
  #);

glColor4uiv: External
  (# v: @int32 (* GLuint* *)
  enter (v)
  do callStd;
  #);

glColor4usv: External
  (# v: @int32 (* GLushort* *)
  enter (v)
  do callStd;
  #);

glTexCoord1d: External
  (# s: @real (* GLdouble *)
  enter (s)
  do callStd;
  #);

glTexCoord1f: External (* Wrapped *)
  (# s: @real (* GLfloat *)
  enter (s)
  do 'wrapglTexCoord1f' -> CallC;
  #);

glTexCoord1i: External
  (# s: @int32 (* GLint *)
  enter (s)
  do callStd;
  #);

glTexCoord1s: External
  (# s: @int16 (* GLshort *)
  enter (s)
  do callStd;
  #);

glTexCoord2d: External
  (# s: @real (* GLdouble *);
   t: @real (* GLdouble *);
  enter (s, t)
  do callStd;
  #);

glTexCoord2f: glTexCoord2d(# #);

glTexCoord2i: External
  (# s: @int32 (* GLint *);
   t: @int32 (* GLint *);
  enter (s, t)
  do callStd;
  #);

glTexCoord2s: External
  (# s: @int16 (* GLshort *);
   t: @int16 (* GLshort *);
  enter (s, t)
  do callStd;
  #);

```



```

glTexCoord3d: External
  (# s: @real (* GLdouble *);
   t: @real (* GLdouble *);
   r: @real (* GLdouble *);
  enter (s, t, r)
  do callStd;
  #);

glTexCoord3f: glTexCoord3d(# #);

glTexCoord3i: External
  (# s: @int32 (* GLint *);
   t: @int32 (* GLint *);
   r: @int32 (* GLint *);
  enter (s, t, r)
  do callStd;
  #);

glTexCoord3s: External
  (# s: @int16 (* GLshort *);
   t: @int16 (* GLshort *);
   r: @int16 (* GLshort *);
  enter (s, t, r)
  do callStd;
  #);

glTexCoord4d: (*Wrapped*)
  (# wrapglTexCoord4d: External
   (# q: @real;
    enter q
    #);
   s: @real (* GLdouble *);
   t: @real (* GLdouble *);
   r: @real (* GLdouble *);
   q: @real (* GLdouble *);
  enter (s, t, r, q)
  do (s,t,r)->wrapset3double;
     (q)->wrapglTexCoord4d;
  #);

glTexCoord4f: glTexCoord4d(# #);

glTexCoord4i: External
  (# s: @int32 (* GLint *);
   t: @int32 (* GLint *);
   r: @int32 (* GLint *);
   q: @int32 (* GLint *);
  enter (s, t, r, q)
  do callStd;
  #);

glTexCoord4s: External
  (# s: @int16 (* GLshort *);
   t: @int16 (* GLshort *);
   r: @int16 (* GLshort *);
   q: @int16 (* GLshort *);
  enter (s, t, r, q)
  do callStd;
  #);

glTexCoord1dv: External
  (# v: @int32 (* GLdouble* *)
  enter (v)
  do callStd;
  #);

```

```
glTexCoord1fv: External
  (# v: @int32 (* GLfloat* *)
  enter (v)
  do callStd;
  #);
```

```
glTexCoord1iv: External
  (# v: @int32 (* GLint* *)
  enter (v)
  do callStd;
  #);
```

```
glTexCoord1sv: External
  (# v: @int32 (* GLshort* *)
  enter (v)
  do callStd;
  #);
```

```
glTexCoord2dv: External
  (# v: @int32 (* GLdouble* *)
  enter (v)
  do callStd;
  #);
```

```
glTexCoord2fv: External
  (# v: @int32 (* GLfloat* *)
  enter (v)
  do callStd;
  #);
```

```
glTexCoord2iv: External
  (# v: @int32 (* GLint* *)
  enter (v)
  do callStd;
  #);
```

```
glTexCoord2sv: External
  (# v: @int32 (* GLshort* *)
  enter (v)
  do callStd;
  #);
```

```
glTexCoord3dv: External
  (# v: @int32 (* GLdouble* *)
  enter (v)
  do callStd;
  #);
```

```
glTexCoord3fv: External
  (# v: @int32 (* GLfloat* *)
  enter (v)
  do callStd;
  #);
```

```
glTexCoord3iv: External
  (# v: @int32 (* GLint* *)
  enter (v)
  do callStd;
  #);
```

```
glTexCoord3sv: External
  (# v: @int32 (* GLshort* *)
  enter (v)
  do callStd;
  #);
```

```

glTexCoord4dv: External
  (# v: @int32 (* GLdouble* *)
  enter (v)
  do callStd;
  #);

glTexCoord4fv: External
  (# v: @int32 (* GLfloat* *)
  enter (v)
  do callStd;
  #);

glTexCoord4iv: External
  (# v: @int32 (* GLint* *)
  enter (v)
  do callStd;
  #);

glTexCoord4sv: External
  (# v: @int32 (* GLshort* *)
  enter (v)
  do callStd;
  #);

glRasterPos2d: External
  (# x: @real (* GLdouble *);
   y: @real (* GLdouble *);
  enter (x, y)
  do callStd;
  #);

glRasterPos2f: glRasterPos2d(# #);

glRasterPos2i: External
  (# x: @int32 (* GLint *);
   y: @int32 (* GLint *);
  enter (x, y)
  do callStd;
  #);

glRasterPos2s: External
  (# x: @int16 (* GLshort *);
   y: @int16 (* GLshort *);
  enter (x, y)
  do callStd;
  #);

glRasterPos3d: External
  (# x: @real (* GLdouble *);
   y: @real (* GLdouble *);
   z: @real (* GLdouble *);
  enter (x, y, z)
  do callStd;
  #);

glRasterPos3f: glRasterPos3d(# #);

glRasterPos3i: External
  (# x: @int32 (* GLint *);
   y: @int32 (* GLint *);
   z: @int32 (* GLint *);
  enter (x, y, z)
  do callStd;
  #);

```

```

glRasterPos3s: External
  (# x: @int16 (* GLshort *);
   y: @int16 (* GLshort *);
   z: @int16 (* GLshort *);
  enter (x, y, z)
  do callStd;
  #);

glRasterPos4d: (* wrapped *)
  (# wrapglRasterPos4d: External
   (# w: @real;
    enter w
    #);
   x: @real (* GLdouble *);
   y: @real (* GLdouble *);
   z: @real (* GLdouble *);
   w: @real (* GLdouble *);
  enter (x, y, z, w)
  do (x,y,z)->wrapset3double;
     (w)->wrapglRasterPos4d;
  #);

glRasterPos4f: glRasterPos4d(# #);

glRasterPos4i: External
  (# x: @int32 (* GLint *);
   y: @int32 (* GLint *);
   z: @int32 (* GLint *);
   w: @int32 (* GLint *);
  enter (x, y, z, w)
  do callStd;
  #);

glRasterPos4s: External
  (# x: @int16 (* GLshort *);
   y: @int16 (* GLshort *);
   z: @int16 (* GLshort *);
   w: @int16 (* GLshort *);
  enter (x, y, z, w)
  do callStd;
  #);

glRasterPos2dv: External
  (# v: @int32 (* GLdouble* *)
  enter (v)
  do callStd;
  #);

glRasterPos2fv: External
  (# v: @int32 (* GLfloat* *)
  enter (v)
  do callStd;
  #);

glRasterPos2iv: External
  (# v: @int32 (* GLint* *)
  enter (v)
  do callStd;
  #);

glRasterPos2sv: External
  (# v: @int32 (* GLshort* *)
  enter (v)
  do callStd;
  #);

```

```

glRasterPos3dv: External
  (# v: @int32 (* GLdouble* *)
  enter (v)
  do callStd;
  #);

glRasterPos3fv: External
  (# v: @int32 (* GLfloat* *)
  enter (v)
  do callStd;
  #);

glRasterPos3iv: External
  (# v: @int32 (* GLint* *)
  enter (v)
  do callStd;
  #);

glRasterPos3sv: External
  (# v: @int32 (* GLshort* *)
  enter (v)
  do callStd;
  #);

glRasterPos4dv: External
  (# v: @int32 (* GLdouble* *)
  enter (v)
  do callStd;
  #);

glRasterPos4fv: External
  (# v: @int32 (* GLfloat* *)
  enter (v)
  do callStd;
  #);

glRasterPos4iv: External
  (# v: @int32 (* GLint* *)
  enter (v)
  do callStd;
  #);

glRasterPos4sv: External
  (# v: @int32 (* GLshort* *)
  enter (v)
  do callStd;
  #);

glRectd: (* wrapped *)
  (# wrapglRectd: External
  (# y2: @real;
  enter y2
  #);
  x1: @real (* GLdouble *);
  y1: @real (* GLdouble *);
  x2: @real (* GLdouble *);
  y2: @real (* GLdouble *);
  enter (x1, y1, x2, y2)
  do (x1,y1,x2)->wrapset3double;
  y2->wrapglRectd;
  #);

glRectf: glRectd(# #);

glRecti: External

```

```

    (# x1: @int32 (* GLint *);
     y1: @int32 (* GLint *);
     x2: @int32 (* GLint *);
     y2: @int32 (* GLint *);
    enter (x1, y1, x2, y2)
    do callStd;
    #);

glRects: External
    (# x1: @int16 (* GLshort *);
     y1: @int16 (* GLshort *);
     x2: @int16 (* GLshort *);
     y2: @int16 (* GLshort *);
    enter (x1, y1, x2, y2)
    do callStd;
    #);

glRectdv: External
    (# v1: @int32 (* GLdouble* *); v2: @int32 (* GLdouble* *)
    enter (v1, v2)
    do callStd;
    #);

glRectfv: External
    (# v1: @int32 (* GLfloat* *); v2: @int32 (* GLfloat* *)
    enter (v1, v2)
    do callStd;
    #);

glRectiv: External
    (# v1: @int32 (* GLint* *); v2: @int32 (* GLint* *)
    enter (v1, v2)
    do callStd;
    #);

glRectsv: External
    (# v1: @int32 (* GLshort* *); v2: @int32 (* GLshort* *)
    enter (v1,v2)
    #);

(*
 * Vertex Arrays (1.1)
 *)

glVertexPointer: External
    (# size: @int32 (* GLint *);
     type: @int32u (* GLenum *);
     stride: @int32 (* GLsizei *);
     ptr: @int32 (* GLvoid* *);
    enter (size, type, stride, ptr)
    do callStd;
    #);

glNormalPointer: External
    (# type: @int32u (* GLenum *);
     stride: @int32 (* GLsizei *);
     ptr: @int32 (* GLvoid* *);
    enter (type, stride, ptr)
    do callStd;
    #);

glColorPointer: External
    (# size: @int32 (* GLint *);
     type: @int32u (* GLenum *);

```

```

        stride: @int32 (* GLsizei *);
        ptr: @int32 (* GLvoid* *);
    enter (size, type, stride, ptr)
    do callStd;
    #);

glIndexPointer: External
    (# type: @int32u (* GLenum *);
        stride: @int32 (* GLsizei *);
        ptr: @int32 (* GLvoid* *);
    enter (type, stride, ptr)
    do callStd;
    #);

glTexCoordPointer: External
    (# size: @int32 (* GLint *);
        type: @int32u (* GLenum *);
        stride: @int32 (* GLsizei *);
        ptr: @int32 (* GLvoid* *);
    enter (size, type, stride, ptr)
    do callStd;
    #);

glEdgeFlagPointer: External
    (# stride: @int32 (* GLsizei *);
        ptr: @int32 (* GLboolean* *);
    enter (stride, ptr)
    do callStd;
    #);

glGetPointerv: External
    (# pname: @int32u (* GLenum *);
        params: @int32 (* void** *);
    enter (pname, params)
    do callStd;
    #);

glArrayElement: External
    (# i: @int32 (* GLint *);
    enter (i)
    do callStd;
    #);

glDrawArrays: External
    (# mode: @int32u (* GLenum *);
        first: @int32 (* GLint *);
        count: @int32 (* GLsizei *);
    enter (mode, first, count)
    do callStd;
    #);

glDrawElements: External
    (# mode: @int32u (* GLenum *);
        count: @int32 (* GLsizei *);
        type: @int32u (* GLenum *);
        indices: @int32 (* GLvoid* *);
    enter (mode, count, type, indices)
    do callStd;
    #);

glInterleavedArrays: External
    (# format: @int32u (* GLenum *);
        stride: @int32 (* GLsizei *);
        pointer: @int32 (* GLvoid* *);
    enter (format, stride, pointer)
    do callStd;

```

```

#);

(*
 * Lighting
 *)

glShadeModel: External
  (# mode: @int32u (* GLenum *);
   enter (mode)
   do callStd;
  #);

glLightf: External (* Wrapped *)
  (# light: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   param: @real (* GLfloat *);
   enter (light, pname, param)
   do 'wrapglLightf'->CallC;
  #);

glLighti: External
  (# light: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   param: @int32 (* GLint *);
   enter (light, pname, param)
   do callStd;
  #);

glLightfv: External
  (# light: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   params: @int32 (* GLfloat* *);
   enter (light, pname, params)
   do 'wrapglLightfv'->CallC;
  #);

glLightiv: External
  (# light: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   params: @int32 (* GLint* *);
   enter (light, pname, params)
   do callStd;
  #);

glGetLightfv: External
  (# light: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   params: @int32 (* GLfloat* *);
   enter (light, pname, params)
   do callStd;
  #);

glGetLightiv: External
  (# light: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   params: @int32 (* GLint* *);
   enter (light, pname, params)
   do callStd;
  #);

glLightModelf: External (* wrapped *)
  (# pname: @int32u (* GLenum *);
   param: @real (* GLfloat *);
   enter (pname, param)
   do 'wrapglLightModelf'->CallC;

```



```

#);

glLightModeli: External
(# pname: @int32u (* GLenum *);
 param: @int32 (* GLint *);
 enter (pname, param)
 do callStd;
#);

glLightModelfv: External
(# pname: @int32u (* GLenum *);
 params: @int32 (* GLfloat* *);
 enter (pname, params)
 do 'wrapglLightModelfv'->CallC;
#);

glLightModeliv: External
(# pname: @int32u (* GLenum *);
 params: @int32 (* GLint* *);
 enter (pname, params)
 do callStd;
#);

glMaterialf: External (* wrapped *)
(# face: @int32u (* GLenum *);
 pname: @int32u (* GLenum *);
 param: @real (* GLfloat *);
 enter (face, pname, param)
 do 'wrapglMaterialf'->CallC;
#);

glMateriali: External
(# face: @int32u (* GLenum *);
 pname: @int32u (* GLenum *);
 param: @int32 (* GLint *);
 enter (face, pname, param)
 do callStd;
#);

glMaterialfv: External
(# face: @int32u (* GLenum *);
 pname: @int32u (* GLenum *);
 params: @int32 (* GLfloat* *);
 enter (face, pname, params)
 do 'wrapglMaterialfv'->CallC;
#);

glMaterialiv: External
(# face: @int32u (* GLenum *);;
 pname: @int32u (* GLenum *);;
 params: @int32 (* GLint* *);
 enter (face, pname, params)
 do callStd;
#);

glGetMaterialfv: External
(# face: @int32u (* GLenum *);
 pname: @int32u (* GLenum *);
 params: @int32 (* GLfloat* *);
 enter (face, pname, params)
 do callStd;
#);

glGetMaterialiv: External
(# face: @int32u (* GLenum *);
 pname: @int32u (* GLenum *);

```

```

    params: @int32 (* GLint* *);
    enter (face, pname, params)
    do callStd;
    #);

glColorMaterial: External
    (# face: @int32u (* GLenum *);
     mode: @int32u (* GLenum *);
    enter (face, mode)
    do callStd;
    #);

(*
 * Raster functions
 *)

glPixelZoom: External (* wrapped *)
    (# xfactor: @real (* GLfloat *);
     yfactor: @real (* GLfloat *);
    enter (xfactor, yfactor)
    do 'wrapglPixelZoom'->CallC;
    #);

glPixelStoref: External (* wrapped *)
    (# pname: @int32u (* GLenum *);
     param: @real (* GLfloat *);
    enter (pname, param)
    do 'wrapglPixelStoref'->CallC;
    #);

glPixelStorei: External
    (# pname: @int32u (* GLenum *);
     param: @int32 (* GLint *);
    enter (pname, param)
    do callStd;
    #);

glPixelTransferf: External (* wrapped *)
    (# pname: @int32u (* GLenum *);
     param: @real (* GLfloat *);
    enter (pname, param)
    do 'wrapglPixelTransferf'->CallC;
    #);

glPixelTransferi: External
    (# pname: @int32u (* GLenum *); param: @int32 (* GLint *)
    enter (pname, param)
    do callStd;
    #);

glPixelMapfv: External
    (# map: @int32u (* GLenum *);
     mapsize: @int32 (* GLint *);
     values: @int32 (* GLfloat* *)
    enter (map, mapsize, values)
    do callStd;
    #);

glPixelMapuiv: External
    (# map: @int32u (* GLenum *);
     mapsize: @int32 (* GLint *);
     values: @int32 (* GLuint* *)
    enter (map, mapsize, values)

```

```

do callStd;
#);

glPixelMapusv: External
(# map: @int32u (* GLenum *);
 mapsize: @int32 (* GLint *);
 values: @int32 (* GLushort* *);
 enter (map, mapsize, values)
 do callStd;
#);

glGetPixelMapfv: External
(# map: @int32u (* GLenum *);
 values: @int32 (* GLfloat* *);
 enter (map, values)
 do callStd;
#);

glGetPixelMapuiv: External
(# map, values: @int32 (* GLuint* *);
 enter (map, values)
 do callStd;
#);

glGetPixelMapusv: External
(# map: @int32u (* GLenum *);
 values: @int32 (* GLushort* *);
 enter (map, values)
 do callStd;
#);

glBitmap: (* wrapped *)
(# wrapglBitmap: External
 (# width,height: @int32;
  ymove: @real;
  bitmap: @int32;
  enter (width,height,ymove,bitmap)
  #);

 width: @int32 (* GLsizei *);
 height: @int32 (* GLsizei *);;
 xorig: @real (* GLfloat *);
 yorig: @real (* GLfloat *);;
 xmove: @real (* GLfloat *);
 ymove: @real (* GLfloat *);;
 bitmap: @int32 (* GLubyte* *);
 enter (width, height, xorig, yorig, xmove, ymove, bitmap)
 do (xorig,yorig,xmove)->wrapset3double;
 (width,height,ymove,bitmap)->wrapglBitmap;
#);

glReadPixels: External
(# x: @int32 (* GLint *);
 y: @int32 (* GLint *);;
 width: @int32 (* GLsizei *);
 height: @int32 (* GLsizei *);;
 format: @int32u (* GLenum *);
 type: @int32u (* GLenum *);;
 pixels: @int32 (* GLvoid* *);
 enter (x, y, width, height, format, type, pixels)
 do callStd;
#);

glDrawPixels: External
(# width: @int32 (* GLsizei *);
 height: @int32 (* GLsizei *);;

```

```

    format: @int32u (* GLenum *);
    type: @int32u (* GLenum *);
    pixels: @int32 (* GLvoid* *)
enter (width, height, format, type, pixels)
do callStd;
#);

glCopyPixels: External
(# x: @int32 (* GLint *);
 y: @int32 (* GLint *);
 width: @int32 (* GLsizei *);
 height: @int32 (* GLsizei *);
 type: @int32u (* GLenum *);
enter (x, y, width, height, type)
do callStd;
#);

(*
 * Stenciling
 *)

glStencilFunc: External
(# func: @int32u (* GLenum *);
 ref: @int32 (* GLint *);
 mask: @int32 (* GLuint *);
enter (func, ref, mask)
do callStd;
#);

glStencilMask: External
(# mask: @int32 (* GLuint *);
enter (mask)
do callStd;
#);

glStencilOp: External
(# fail: @int32u (* GLenum *);
 zfail: @int32u (* GLenum *);
 zpass: @int32u (* GLenum *);
enter (fail, zfail, zpass)
do callStd;
#);

glClearStencil: External
(# s: @int32 (* GLint *);
enter (s)
do callStd;
#);

(*
 * Texture mapping
 *)

glTexGend: External
(# coord: @int32u (* GLenum *);
 pname: @int32u (* GLenum *);
 param: @real (* GLdouble *);
enter (coord, pname, param)
do callStd;
#);

glTexGenf: glTexGend(# #);

```

```

glTexGeni: External
  (# coord: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   param: @int32 (* GLint *);
  enter (coord, pname, param)
  do callStd;
  #);

glTexGendv: External
  (# coord: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   params: @int32 (* GLdouble* *);
  enter (coord, pname, params)
  do callStd;
  #);

glTexGenfv: glTexGendv(# #);

glTexGeniv: External
  (# coord: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   params: @int32 (* GLint* *);
  enter (coord, pname, params)
  do callStd;
  #);

glGetTexGendv: External
  (# coord: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   params: @int32 (* GLdouble* *);
  enter (coord, pname, params)
  do callStd;
  #);

glGetTexGenfv: glGetTexGendv(# #);

glGetTexGeniv: External
  (# coord: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   params: @int32 (* GLint* *);
  enter (coord, pname, params)
  do callStd;
  #);

glTexEnvf: External (* wrapped *)
  (# target: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   param: @real (* GLfloat *);
  enter (target, pname, param)
  do 'wrapglTexEnvf' -> CallC;
  #);

glTexEnvi: External
  (# target: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   param: @int32 (* GLint *);
  enter (target, pname, param)
  do callStd;
  #);

glTexEnvfv: External
  (# target: @int32u (* GLenum *);
   pname: @int32u (* GLenum *);
   params: @int32 (* GLfloat* *);

```

```

enter (target, pname, params)
do callStd;
#);

glTexEnviv: External
(# target: @int32u (* GLenum *);
  pname: @int32u (* GLenum *);
  params: @int32 (* GLint* *);
enter (target, pname, params)
do callStd;
#);

glGetTexEnvfv: External
(# target: @int32u (* GLenum *);
  pname: @int32u (* GLenum *);
  params: @int32 (* GLfloat* *);
enter (target, pname, params)
do callStd;
#);

glGetTexEnviv: External
(# target: @int32u (* GLenum *);
  pname: @int32u (* GLenum *);
  params: @int32 (* GLint* *);
enter (target, pname, params)
do callStd;
#);

glTexParameterf: External (* wrapped *)
(# target: @int32u (* GLenum *);
  pname: @int32u (* GLenum *);
  param: @real (* GLfloat *);
enter (target, pname, param)
do 'wrapglTexParameterf'->CallC;
#);

glTexParameteri: External
(# target: @int32u (* GLenum *);
  pname: @int32u (* GLenum *);
  param: @int32 (* GLint *);
enter (target, pname, param)
do callStd;
#);

glTexParameterfv: External
(# target: @int32u (* GLenum *); pname: @int32u (* GLenum *);
  params: @int32 (* GLfloat* *);
enter (target, pname, params)
do callStd;
#);

glTexParameteriv: External
(# target: @int32u (* GLenum *);
  pname: @int32u (* GLenum *);
  params: @int32 (* GLint* *);
enter (target, pname, params)
do callStd;
#);

glGetTexParameterfv: External
(# target: @int32u (* GLenum *);
  pname: @int32u (* GLenum *); params: @int32 (* GLfloat* *);
enter (target, pname, params)
do callStd;
#);

```

```

glGetTexParameteriv: External
  (# target: @int32u (* GLenum *);
   pname: @int32u (* GLenum *); params: @int32 (* GLint* *)
  enter (target, pname, params)
  do callStd;
  #);

glGetTexLevelParameterfv: External
  (# target: @int32u (* GLenum *); level: @int32 (* GLint *);
   pname: @int32u (* GLenum *); params: @int32 (* GLfloat* *)
  enter (target, level, pname, params)
  do callStd;
  #);

glGetTexLevelParameteriv: External
  (# target: @int32u (* GLenum *); level: @int32 (* GLint *);
   pname: @int32u (* GLenum *); params: @int32 (* GLint* *)
  enter (target, level, pname, params)
  do callStd;
  #);

glTexImage1D: External
  (# target: @int32u (* GLenum *);
   level: @int32 (* GLint *);
   internalFormat: @int32 (* GLint *);
   width: @int32 (* GLsizei *);
   border: @int32 (* GLint *);
   format: @int32u (* GLenum *);
   type: @int32u (* GLenum *);
   pixels: @int32 (* GLvoid* *)
  enter (target, level, internalFormat, width, border, format, type, pixels)
  do callStd;
  #);

glTexImage2D: External
  (# target: @int32u (* GLenum *);
   level: @int32 (* GLint *);
   internalFormat: @int32 (* GLint *);
   width: @int32 (* GLsizei *);
   height: @int32 (* GLsizei *);
   border: @int32 (* GLint *);
   format: @int32u (* GLenum *);
   type: @int32u (* GLenum *);
   pixels: @int32 (* GLvoid* *)
  enter (target, level, internalFormat, width, height, border, format, type, pixels)
  do callStd;
  #);

glGetTexImage: External
  (# target: @int32u (* GLenum *);
   level: @int32 (* GLint *);
   format: @int32u (* GLenum *);
   type: @int32u (* GLenum *);
   pixels: @int32 (* GLvoid* *)
  enter (target, level, format, type, pixels)
  do callStd;
  #);

(* 1.1 functions *)

glGenTextures: External
  (# n: @int32 (* GLsizei *);
   textures: @int32 (* GLuint* *)

```

```

enter (n, textures)
do callStd;
#);

glDeleteTextures: External
(# n: @int32 (* GLsizei *);
 textures: @int32 (* GLuint* *);
enter (n, textures)
do callStd;
#);

glBindTexture: External
(# target: @int32u (* GLenum *);
 texture: @int32 (* GLuint *);
enter (target, texture)
do callStd;
#);

glPrioritizeTextures: External
(# n: @int32 (* GLsizei *);
 textures: @int32 (* GLuint* *);
 priorities: @int32 (* GLclampf* *);
enter (n, textures, priorities)
do callStd;
#);

glAreTexturesResident: External
(# n: @int32 (* GLsizei *);
 textures: @int32 (* GLuint* *);
 residences: @int32 (* GLboolean* *);
 result: @int8u (* GLboolean *);
enter (n, textures, residences)
do callStd;
exit result
#);

glIsTexture: External
(# texture: @int32 (* GLuint *);
 result: @int8u (* GLboolean *);
enter texture
do callStd;
exit result
#);

glTexSubImage1D: External
(# target: @int32u (* GLenum *);
 level: @int32 (* GLint *);
 xoffset: @int32 (* GLint *);
 width: @int32 (* GLsizei *);
 format: @int32u (* GLenum *);
 type: @int32u (* GLenum *);
 pixels: @int32 (* GLvoid* *);
enter (target, level, xoffset, width, format, type, pixels)
do callStd;
#);

glTexSubImage2D: External
(# target: @int32u (* GLenum *);
 level: @int32 (* GLint *);
 xoffset: @int32 (* GLint *);
 yoffset: @int32 (* GLint *);
 width: @int32 (* GLsizei *);
 height: @int32 (* GLsizei *);
 format: @int32u (* GLenum *);

```



```

    type: @int32u (* GLenum *);
    pixels: @int32 (* GLvoid* *);
enter (target, level, xoffset, yoffset, width, height, format, type, pixels)
do callStd;
#);

```

```

glCopyTexImage1D: External
(# target: @int32u (* GLenum *);
 level: @int32 (* GLint *);
 internalformat: @int32u (* GLenum *));
 x: @int32 (* GLint *);
 y: @int32 (* GLint *);
 width: @int32 (* GLsizei *);
 border: @int32 (* GLint *);
enter (target, level, internalformat, x, y, width, border)
do callStd;
#);

```

```

glCopyTexImage2D: External
(# target: @int32u (* GLenum *);
 level: @int32 (* GLint *);
 internalformat: @int32u (* GLenum *));
 x: @int32 (* GLint *);
 y: @int32 (* GLint *);
 width: @int32 (* GLsizei *);
 height: @int32 (* GLsizei *);
 border: @int32 (* GLint *);
enter (target, level, internalformat, x, y, width, height, border)
do callStd;
#);

```

```

glCopyTexSubImage1D: External
(# target: @int32u (* GLenum *);
 level: @int32 (* GLint *);
 xoffset: @int32 (* GLint *);
 x: @int32 (* GLint *));
 y: @int32 (* GLint *);
 width: @int32 (* GLsizei *);
enter (target, level, xoffset, x, y, width)
do callStd;
#);

```

```

glCopyTexSubImage2D: External
(# target: @int32u (* GLenum *);
 level: @int32 (* GLint *);
 xoffset: @int32 (* GLint *);
 yoffset: @int32 (* GLint *);
 x: @int32 (* GLint *);
 y: @int32 (* GLint *);
 width: @int32 (* GLsizei *);
 height: @int32 (* GLsizei *);
enter (target, level, xoffset, yoffset, x, y, width, height)
do callStd;
#);

```

```

(*
 * Evaluators
 *)

```

```

glMapId: External
  (# target: @int32u (* GLenum *);
   u1: @real (* GLdouble *);
   u2: @real (* GLdouble *);
   stride: @int32 (* GLint *);
   order: @int32 (* GLint *);
   points: @int32 (* GLdouble* *);
  enter (target, u1, u2, stride, order, points)
  do callStd;
  #);

glMap1f: External
  (# target: @int32u (* GLenum *);
   u1: @real (* GLfloat *);
   u2: @real (* GLfloat *);
   stride: @int32 (* GLint *);
   order: @int32 (* GLint *);
   points: @int32 (* GLfloat* *);
  enter (target, u1, u2, stride, order, points)
  do callStd;
  #);

glMap2d: (* wrapped *)
  (# wrapglMap2d: External
   (# v2: @real;
    target: @int32u;
    ustride: @int32;
    uorder: @int32;
    vstride: @int32;
    vorder: @int32;
    points: @int32;
    enter (v2, target, ustride, uorder, vstride, vorder, points)
    #);
   target: @int32u (* GLenum *);
   u1: @real (* GLdouble *);
   u2: @real (* GLdouble *);
   ustride: @int32 (* GLint *);
   uorder: @int32 (* GLint *);
   v1: @real (* GLdouble *);
   v2: @real (* GLdouble *);
   vstride: @int32 (* GLint *);
   vorder: @int32 (* GLint *);
   points: @int32 (* GLdouble* *);
  enter (target, u1, u2, ustride, uorder, v1, v2, vstride, vorder, points)
  do (u1, u2, v1)->wrapset3double;
   (v2, target, ustride, uorder, vstride, vorder, points)->wrapglMap2d;
  #);

glMap2f: glMap2d(# #);

glGetMapdv: External
  (# target: @int32u (* GLenum *);
   query: @int32u (* GLenum *);
   v: @int32 (* GLdouble* *);
  enter (target, query, v)
  do callStd;
  #);

glGetMapfv: External
  (# target: @int32u (* GLenum *);
   query: @int32u (* GLenum *);
   v: @int32 (* GLfloat* *);
  enter (target, query, v)
  do callStd;
  #);

```

```

glGetMapiv: External
  (# target: @int32u (* GLenum *);
   query: @int32u (* GLenum *);
   v: @int32 (* GLint* *);
  enter (target, query, v)
  do callStd;
  #);

glEvalCoord1d: External
  (# u: @real (* GLdouble *);
  enter (u)
  do callStd;
  #);

glEvalCoord1f: glEvalCoord1d(# #);

glEvalCoord1dv: External
  (# u: @int32 (* GLdouble* *);
  enter (u)
  do callStd;
  #);

glEvalCoord1fv: glEvalCoord1dv(# #);

glEvalCoord2d: External
  (# u: @real (* GLdouble *);
   v: @real (* GLdouble *);
  enter (u, v)
  do callStd;
  #);

glEvalCoord2f: glEvalCoord2d(# #);

glEvalCoord2dv: External
  (# u: @int32 (* GLdouble* *);
  enter (u)
  do callStd;
  #);

glEvalCoord2fv: glEvalCoord2dv(# #);;

glMapGrid1d: External
  (# un: @int32 (* GLint *);
   u1: @real (* GLdouble *);
   u2: @real (* GLdouble *);
  enter (un, u1, u2)
  do callStd;
  #);

glMapGrid1f: glMapGrid1d(# #);

glMapGrid2d: (*Wrapped*)
  (# wrapglMapGrid2d: External
   (# v2: @real;
    un: @int32;
    vn: @int32;
    enter(v2,un,vn)
    #);

   un: @int32 (* GLint *);
   u1: @real (* GLdouble *);
   u2: @real (* GLdouble *);
   vn: @int32 (* GLint *);
   v1: @real (* GLdouble *);
   v2: @real (* GLdouble *);
   enter (un, u1, u2, vn, v1, v2)

```

```

do (u1,u2,v1)->wrapset3double;
    (v2,un,vn)->wrapglMapGrid2d;
#);

glMapGrid2f: glMapGrid2d(# #);

glEvalPoint1: External
(# i: @int32 (* GLint *);
 enter (i)
 do callStd;
#);

glEvalPoint2: External
(# i: @int32 (* GLint *);
  j: @int32 (* GLint *);
 enter (i, j)
 do callStd;
#);

glEvalMesh1: External
(# mode: @int32u (* GLenum *);
  i1: @int32 (* GLint *);
  i2: @int32 (* GLint *);
 enter (mode, i1, i2)
 do callStd;
#);

glEvalMesh2: External
(# mode: @int32u (* GLenum *);
  i1: @int32 (* GLint *);
  i2: @int32 (* GLint *);
  j1: @int32 (* GLint *);
  j2: @int32 (* GLint *);
 enter (mode, i1, i2, j1, j2)
 do callStd;
#);

(*
 * Fog
 *)

glFogf: External (* wrapped *)
(# pname: @int32u (* GLenum *);
  param: @real (* GLfloat *);
 enter (pname, param)
 do 'wrapglFogf'->CallC;
#);

glFogi: External
(# pname: @int32u (* GLenum *);
  param: @int32 (* GLint *);
 enter (pname, param)
 do callStd;
#);

glFogfv: External
(# pname: @int32u (* GLenum *);
  params: @int32 (* GLfloat* *);
 enter (pname, params)
 do callStd;
#);

glFogiv: External
(# pname: @int32u (* GLenum *);

```

```

    params: @int32 (* GLint* *);
    enter (pname, params)
    do callStd;
    #);

(*
 * Selection and Feedback
 *)

glFeedbackBuffer: External
  (# size: @int32 (* GLsizei *);
   type: @int32u (* GLenum *);
   buffer: @int32 (* GLfloat* *);
   enter (size, type, buffer)
   do callStd;
   #);

glPassThrough: External (* wrapped *)
  (# token: @real (* GLfloat *);
   enter (token)
   do 'wrapglPassThrough'->CallC;
   #);

glSelectBuffer: External
  (# size: @int32 (* GLsizei *);
   buffer: @int32 (* GLuint* *);
   enter (size, buffer)
   do callStd;
   #);

glInitNames: External
  (#
   do callStd;
  #);

glLoadName: External
  (# name: @int32 (* GLuint *);
   enter (name)
   do callStd;
   #);

glPushName: External
  (# name: @int32 (* GLuint *);
   enter (name)
   do callStd;
   #);

glPopName: External
  (#
   do callStd;
  #);

(*
 * 1.0 Extensions
 *)

(* GL_EXT_blend_minmax *)
glBlendEquationEXT: External
  (# mode: @int32u (* GLenum *);
   enter (mode)
   do callStd;
   #);

```

```

(* GL_EXT_blend_color *)
glBlendColorEXT: (* Wrapped *)
  (# wrapglBlendColorEXT: External
    (# alpha: @real;
      enter alpha
      #);
    red: @real (* GLclampf *);
    green: @real (* GLclampf *);
    blue: @real (* GLclampf *);
    alpha: @real (* GLclampf *);
    enter (red, green, blue, alpha)
    do (red,green,blue)->wrapset3double;
      (* alpha->wrapglBlendColorEXT;
        * not supported on all platforms
        *)
    #);

(* GL_EXT_polygon_offset *)
(* Don't work *)
glPolygonOffsetEXT: External (* Wrapped *)
  (# factor: @real (* GLfloat *);
    bias: @real (* GLfloat *);
    enter (factor, bias)
    do (* 'wrapglPolygonOffsetEXT'->CallC; *)
    #);

(* GL_EXT_vertex_array *)

glVertexPointerEXT: External
  (# size: @int32 (* GLint *);
    type: @int32u (* GLenum *);
    stride: @int32 (* GLsizei *);
    count: @int32 (* GLsizei *);
    ptr: @int32 (* GLvoid* *);
    enter (size, type, stride, count, ptr)
    do callStd;
    #);

glNormalPointerEXT: External
  (# type: @int32u (* GLenum *);
    stride: @int32 (* GLsizei *);
    count: @int32 (* GLsizei *);
    ptr: @int32 (* GLvoid* *);
    enter (type, stride, count, ptr)
    do callStd;
    #);

glColorPointerEXT: External
  (# size: @int32 (* GLint *);
    type: @int32u (* GLenum *);
    stride: @int32 (* GLsizei *);
    count: @int32 (* GLsizei *);
    ptr: @int32 (* GLvoid* *);
    enter (size, type, stride, count, ptr)
    do callStd;
    #);

glIndexPointerEXT: External
  (# type: @int32u (* GLenum *);

```

```

        stride: @int32 (* GLsizei *);
        count: @int32 (* GLsizei *);
        ptr: @int32 (* GLvoid* *);
    enter (type, stride, count, ptr)
    do callStd;
    #);

glTexCoordPointerEXT: External
    (# size: @int32 (* GLint *);
     type: @int32u (* GLenum *);
     stride: @int32 (* GLsizei *);
     count: @int32 (* GLsizei *);
     ptr: @int32 (* GLvoid* *);
    enter (size, type, stride, count, ptr)
    do callStd;
    #);

glEdgeFlagPointerEXT: External
    (# stride: @int32 (* GLsizei *);
     count: @int32 (* GLsizei *);
     ptr: @int32 (* GLboolean* *);
    enter (stride, count, ptr)
    do callStd;
    #);

glGetPointervEXT: External
    (# pname: @int32u (* GLenum *);
     params: @int32 (* void** *);
    enter (pname, params)
    do callStd;
    #);

glArrayElementEXT: External
    (# i: @int32 (* GLint *);
    enter (i)
    do callStd;
    #);

glDrawArraysEXT: External
    (# mode: @int32u (* GLenum *);
     first: @int32 (* GLint *);
     count: @int32 (* GLsizei *);
    enter (mode, first, count)
    do callStd;
    #);

(* GL_EXT_texture_object *)

glGenTexturesEXT: External
    (# n: @int32 (* GLsizei *);
     textures: @int32 (* GLuint* *);
    enter (n, textures)
    do callStd;
    #);

glDeleteTexturesEXT: External
    (# n: @int32 (* GLsizei *);
     textures: @int32 (* GLuint* *);
    enter (n, textures)
    do callStd;
    #);

glBindTextureEXT: External
    (# target: @int32u (* GLenum *);

```

```

    texture: @int32 (* GLuint *);
enter (target, texture)
do callStd;
#);

glPrioritizeTexturesEXT: External
(# n: @int32 (* GLsizei *);
  textures: @int32 (* GLuint* *);
  priorities: @int32 (* GLclampf* *);
enter (n, priorities)
do callStd;
#);

glAreTexturesResidentEXT: External
(# n: @int32 (* GLsizei *);
  textures: @int32 (* GLuint* *);
  residences: @int32 (* GLboolean* *);
  result: @int8u (* GLboolean *);
enter (n, textures, residences)
do callStd;
exit result
#);

glIsTextureEXT: External
(# texture: @int32 (* GLuint *);
  result: @int8u (* GLboolean *);
enter (texture)
do callStd;
exit (result)
#);

(* GL_EXT_texture3D *)

glTexImage3DEXT: External
(# target: @int32u (* GLenum *);
  level: @int32 (* GLint *);
  internalFormat: @int32u (* GLenum *);
  width: @int32 (* GLsizei *);
  height: @int32 (* GLsizei *);
  depth: @int32 (* GLsizei *);
  border: @int32 (* GLint *);
  format: @int32u (* GLenum *);
  type: @int32u (* GLenum *);
  pixels: @int32 (* GLvoid* *);
enter (target, level, internalFormat, width, height, depth, border, format, type, pixels)
do callStd;
#);

glTexSubImage3DEXT: External
(# target: @int32u (* GLenum *);
  level: @int32 (* GLint *);
  xoffset: @int32 (* GLint *);
  yoffset: @int32 (* GLint *);
  zoffset: @int32 (* GLint *);
  width: @int32 (* GLsizei *);
  height: @int32 (* GLsizei *);
  depth: @int32 (* GLsizei *);
  format: @int32u (* GLenum *);
  type: @int32u (* GLenum *);
  pixels: @int32 (* GLvoid* *);
enter (target, level, xoffset, yoffset, zoffset, width, height, depth, format, type, pixels)
do callStd;
#);

glCopyTexSubImage3DEXT: External

```



```

(# target: @int32u (* GEnum *);
 level: @int32 (* GLint *);
 xoffset: @int32 (* GLint *);
 yoffset: @int32 (* GLint *);
 zoffset: @int32 (* GLint *);
 x: @int32 (* GLint *);
 y: @int32 (* GLint *);
 width: @int32 (* GLsizei *);
 height: @int32 (* GLsizei *);
enter (target, level, xoffset, yoffset, zoffset, x, y, width, height)
do callStd;
#);

(* EXT_color_table *)

glColorTableEXT: External
(# target: @int32u (* GEnum *);
 internalformat: @int32u (* GEnum *);
 width: @int32 (* GLsizei *);
 format: @int32u (* GEnum *);
 type: @int32u (* GEnum *);
 table: @int32 (* GLvoid* *);
enter (target, internalformat, width, format, type, table)
do callStd;
#);

glColorSubTableEXT: External
(# target: @int32u (* GEnum *);
 start: @int32 (* GLsizei *);
 count: @int32 (* GLsizei *);
 format: @int32u (* GEnum *);
 type: @int32u (* GEnum *);
 data: @int32 (* GLvoid* *);
enter (target, start, count, format, type, data)
do callStd;
#);

glGetColorTableEXT: External
(# target: @int32u (* GEnum *);
 format: @int32u (* GEnum *);
 type: @int32u (* GEnum *);
 table: @int32 (* GLvoid* *);
enter (target, format, type, table)
do callStd;
#);

glGetColorTableParameterfvEXT: External
(# target: @int32u (* GEnum *);
 pname: @int32u (* GEnum *);
 params: @int32 (* GLfloat* *);
enter (target, pname, params)
do callStd;
#);

glGetColorTableParameterivEXT: External
(# target: @int32u (* GEnum *);
 pname: @int32u (* GEnum *);
 params: @int32 (* GLint* *);
enter (target, pname, params)
do callStd;
#);

```

```

(* GL_EXT_point_parameters *)

glPointParameterfEXT: External (* wrapped *)
  (# pname: @int32u (* GLenum *);
   param: @real (* GLfloat *);
   enter (pname, param)
   do (* 'wrapglPointParameterfEXT'->CallC; *)
   #);

glPointParameterfvEXT: External
  (# pname: @int32u (* GLenum *);
   params: @int32 (* GLfloat* *);
   enter (pname, params)
   do callStd;
   #);

(* wrapper function *)
wrapset3double: External
  (# d1,d2,d3: @real;
   enter(d1,d2,d3)
   #)

```

# Index

The entries in the alphabetic index consists of selected words and symbols from the body files of this manual – these are in **bold** font – as well as the identifiers defined in the public interfaces of the libraries – set in regular font.

In the manual, the entries, which can be found in the index are typeset like this. This can help localizing the identifier, when the link from the index is followed – especially in the case where the browser does not scroll the line to the top, e.g. because there is less than a page of text left. In the small table of letters and symbols below, each entry links directly to the section of the index containing entries starting with the corresponding letter or symbol.

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GL_LIGHT4	glHint	heightout
GL_LIGHT5	mode	result
GL_LIGHT6	target	typein
GL_LIGHT7	glIndexd	typeout
GL_LIGHT_MODEL_AMBIENT	c	widthin
GL_LIGHT_MODEL_LOCAL_VIEWER	glIndexdv	widthout
GL_LIGHT_MODEL_TWO_SIDE	c	gluSphere
GL_LIGHTING	glIndexf	qobj
GL_LIGHTING_BIT	glIndexfv	radius
GL_LINE	c	slices
GL_LINE_BIT	glIndexi	stacks
GL_LINE_LOOP	c	gluTessVertex
GL_LINE_RESET_TOKEN	glIndexiv	data
GL_LINE_SMOOTH	c	tobj
GL_LINE_SMOOTH_HINT	glIndexMask	v
GL_LINE_STIPPLE	mask	gluUnProject
GL_LINE_STIPPLE_PATTERN	glIndexPointer	modelMatrix
GL_LINE_STIPPLE_REPEAT	ptr	objx
GL_LINE_STRIP	stride	objy
GL_LINE_TOKEN	type	objz
GL_LINE_WIDTH	glIndexPointerEXT	projMatrix
GL_LINE_WIDTH_GRANULARITY	count	result
GL_LINE_WIDTH_RANGE	ptr	viewport
GL_LINEAR	stride	winx
GL_LINEAR_ATTENUATION	type	winy
GL_LINEAR_MIPMAP_LINEAR	glIndexs	winz
GL_LINEAR_MIPMAP_NEAREST	c	glVertex2d
GL_LINES	glIndexsv	x
GL_LIST_BASE	c	y
GL_LIST_BIT	glIndexub	glVertex2dv

GL_LIST_INDEX	c	v
GL_LIST_MODE	glIndexubv	glVertex2f
GL_LOAD	c	glVertex2fv
GL_LOGIC_OP	glInitNames	v
GL_LOGIC_OP_MODE	glInterleavedArrays	glVertex2i
GL_LUMINANCE	format	x
GL_LUMINANCE12	pointer	y
GL_LUMINANCE12_ALPHA12	stride	glVertex2iv
GL_LUMINANCE12_ALPHA4	glIsEnabled	v
GL_LUMINANCE16	cap	glVertex2s
GL_LUMINANCE16_ALPHA16	result	x
GL_LUMINANCE4	glIsList	y
GL_LUMINANCE4_ALPHA4	list	glVertex2sv
GL_LUMINANCE6_ALPHA2	result	v
GL_LUMINANCE8	glIsTexture	glVertex3d
GL_LUMINANCE8_ALPHA8	result	x
GL_LUMINANCE_ALPHA	texture	y
GL_MAP1_COLOR_4	glIsTextureEXT	z
GL_MAP1_GRID_DOMAIN	result	glVertex3dv
GL_MAP1_GRID_SEGMENTS	texture	v
GL_MAP1_INDEX	glLightf	glVertex3f
GL_MAP1_NORMAL	light	glVertex3fv
GL_MAP1_TEXTURE_COORD_1	param	v
GL_MAP1_TEXTURE_COORD_2	pname	glVertex3i
GL_MAP1_TEXTURE_COORD_3	glLightfv	x
GL_MAP1_TEXTURE_COORD_4	light	y
GL_MAP1_VERTEX_3	params	z
GL_MAP1_VERTEX_4	pname	glVertex3iv
GL_MAP2_COLOR_4	glLighti	v
GL_MAP2_GRID_DOMAIN	light	glVertex3s
GL_MAP2_GRID_SEGMENTS	param	x
GL_MAP2_INDEX	pname	y
GL_MAP2_NORMAL	glLightiv	z
GL_MAP2_TEXTURE_COORD_1	light	glVertex3sv
GL_MAP2_TEXTURE_COORD_2	params	v
GL_MAP2_TEXTURE_COORD_3	pname	glVertex4d
GL_MAP2_TEXTURE_COORD_4	glLightModelf	glVertex4dv
GL_MAP2_VERTEX_3	param	v
GL_MAP2_VERTEX_4	pname	glVertex4f
GL_MAP_COLOR	glLightModelfv	glVertex4fv
GL_MAP_STENCIL	params	v
GL_MATRIX_MODE	pname	glVertex4i
GL_MAX_3D_TEXTURE_SIZE_EXT	glLightModeli	w
GL_MAX_ATTRIB_STACK_DEPTH	param	x
GL_MAX_CLIENT_ATTRIB_STACK_DEPTH	pname	y
GL_MAX_CLIP_PLANES	glLightModeliv	z
GL_MAX_EVAL_ORDER	params	glVertex4iv
GL_MAX_EXT	pname	v
GL_MAX_LIGHTS	glLineStipple	glVertex4s
GL_MAX_LIST_NESTING	factor	w
GL_MAX_MODELVIEW_STACK_DEPTH	pattern	x
GL_MAX_NAME_STACK_DEPTH	glLineWidth	y
GL_MAX_PIXEL_MAP_TABLE	width	z
GL_MAX_PROJECTION_STACK_DEPTH	glDisable	glVertex4sv
GL_MAX_TEXTURE_SIZE	base	v

GL_MAX_TEXTURE_STACK_DEPTH	GLuint	glVertexAttrib	glVertexAttrib
GL_MAX_VIEWPORT_DIMS	GLuint	glLoadMatrixd	ptr
GL_MIN_EXT	m		size
GL_MODELVIEW	GLuint	glLoadMatrixf	stride
GL_MODELVIEW_MATRIX	m		type
GL_MODELVIEW_STACK_DEPTH	GLuint	glLoadName	glVertexAttribEXT
GL_MODULATE	name		count
GL_MULT	glLogicOp		ptr
GL_N3F_V3F	opcode		size
GL_NAME_STACK_DEPTH	glMap1d		stride
GL_NAND	order		type
GL_NEAREST	points		glViewport
GL_NEAREST_MIPMAP_LINEAR	stride		height
GL_NEAREST_MIPMAP_NEAREST	target		width
GL_NEVER	u1		x
GL_NICEST	u2		y
GL_NO_ERROR	glMap1f		GLX_ACCUM_ALPHA_SIZE
GL_NONE	order		GLX_ACCUM_BLUE_SIZE
GL_NOOP	points		GLX_ACCUM_GREEN_SIZE
GL_NOR	stride		GLX_ACCUM_RED_SIZE
GL_NORMAL_ARRAY	target		GLX_ALPHA_SIZE
GL_NORMAL_ARRAY_COUNT_EXT	u1		GLX_AUX_BUFFERS
GL_NORMAL_ARRAY_EXT	u2		GLX_BLUE_SIZE
GL_NORMAL_ARRAY_POINTER	glMap2d		GLX_BUFFER_SIZE
GL_NORMAL_ARRAY_POINTER_EXT	points		GLX_DEPTH_SIZE
GL_NORMAL_ARRAY_STRIDE	target		GLX_DOUBLEBUFFER
GL_NORMAL_ARRAY_STRIDE_EXT	u1		GLX_GREEN_SIZE
GL_NORMAL_ARRAY_TYPE	u2		GLX_LEVEL
GL_NORMAL_ARRAY_TYPE_EXT	uorder		GLX_RED_SIZE
GL_NORMALIZE	ustride		GLX_RGBA
GL_NOTEQUAL	v1		GLX_STENCIL_SIZE
GL_OBJECT_LINEAR	v2		GLX_STEREO
GL_OBJECT_PLANE	vorder		GLX_TRANSPARENT_ALPHA_VALUE
GL_ONE	vstride		GLX_TRANSPARENT_BLUE_VALUE
GL_ONE_MINUS_CONSTANT_ALPHA	wrapglMap2d		GLX_TRANSPARENT_GREEN_VALUE
GL_ONE_MINUS_CONSTANT_ALPHA_EXT	glMap2f		GLX_TRANSPARENT_INDEX_VALUE
GL_ONE_MINUS_CONSTANT_COLOR	glMapGrid1d		GLX_TRANSPARENT_RED_VALUE
GL_ONE_MINUS_CONSTANT_COLOR_EXT	GLMapf		GLX_TRANSPARENT_TYPE_EXT
GL_ONE_MINUS_DST_ALPHA	u2		GLX_USE_GL
GL_ONE_MINUS_DST_COLOR	un		GLX_X_VISUAL_TYPE_EXT
GL_ONE_MINUS_SRC_ALPHA	glMapGrid1f		glXChooseVisual
GL_ONE_MINUS_SRC_COLOR	glMapGrid2d		attributes
GL_OR	u1		display
GL_OR_INVERTED	u2		screen
GL_OR_REVERSE	un		visual
GL_ORDER	v1		glXCopyContext
GL_OUT_OF_MEMORY	v2		display
GL_PACK_ALIGNMENT	vn		dst
GL_PACK_IMAGE_HEIGHT_EXT	wrapglMapGrid2d		mask
GL_PACK_LSB_FIRST	glMapGrid2f		src
GL_PACK_ROW_LENGTH	glMaterialf		glXCreateContext
GL_PACK_SKIP_IMAGES_EXT	face		context
GL_PACK_SKIP_PIXELS	param		direct
GL_PACK_SKIP_ROWS	pname		display
GL_PACK_SWAP_BYTES	glMaterialfv		sharelist

GL_PASS_THROUGH_TOKEN	face	visual
GL_PERSPECTIVE_CORRECTION_HINT	params	glXCreateGLXPixmap
GL_PIXEL_MAP_A_TO_A	pname	display
GL_PIXEL_MAP_A_TO_A_SIZE	glMateriali	glxpixmap
GL_PIXEL_MAP_B_TO_B	face	pixmap
GL_PIXEL_MAP_B_TO_B_SIZE	param	visual
GL_PIXEL_MAP_G_TO_G	pname	glXDestroyContext
GL_PIXEL_MAP_G_TO_G_SIZE	EglMaterialiv	context
GL_PIXEL_MAP_I_TO_A	face	display
GL_PIXEL_MAP_I_TO_A_SIZE	params	glXDestroyGLXPixmap
GL_PIXEL_MAP_I_TO_B	pname	display
GL_PIXEL_MAP_I_TO_B_SIZE	glMatrixMode	glxpixmap
GL_PIXEL_MAP_I_TO_G	mode	glXGetClientString
GL_PIXEL_MAP_I_TO_G_SIZE	glMultMatrixd	display
GL_PIXEL_MAP_I_TO_I	m	name
GL_PIXEL_MAP_I_TO_I_SIZE	glMultMatrixf	string
GL_PIXEL_MAP_I_TO_R	m	glXGetConfig
GL_PIXEL_MAP_I_TO_R_SIZE	glNewList	attrib
GL_PIXEL_MAP_R_TO_R	list	display
GL_PIXEL_MAP_R_TO_R_SIZE	mode	status
GL_PIXEL_MAP_S_TO_S	glNormal3b	value_ptr
GL_PIXEL_MAP_S_TO_S_SIZE	nx	visual
GL_PIXEL_MODE_BIT	ny	glXGetCurrentDisplay
GL_POINT	nz	display
GL_POINT_BIT	glNormal3bv	glXGetCurrentDrawable
GL_POINT_FADE_THRESHOLD_SIZE	v_EXT	drawable
GL_POINT_SIZE	glNormal3d	glXIsDirect
GL_POINT_SIZE_GRANULARITY	nx	context
GL_POINT_SIZE_MAX_EXT	ny	display
GL_POINT_SIZE_MIN_EXT	nz	isdirect
GL_POINT_SIZE_RANGE	glNormal3dv	glXMakeCurrent
GL_POINT_SMOOTH	v	context
GL_POINT_SMOOTH_HINT	glNormal3f	display
GL_POINT_TOKEN	glNormal3fv	drawable
GL_POINTS	v	result
GL_POLYGON	glNormal3i	glxpixmap [2]
GL_POLYGON_BIT	nx	glXQueryExtension
GL_POLYGON_MODE	ny	display
GL_POLYGON_OFFSET_BIAS_EXT	nz	errorBase_ptr
GL_POLYGON_OFFSET_EXT	glNormal3iv	eventBase_ptr
GL_POLYGON_OFFSET_FACTOR	v	has_extension
GL_POLYGON_OFFSET_FACTOR_EXT	glNormal3s	glXQueryExtensionString
GL_POLYGON_OFFSET_FILL	nx	display
GL_POLYGON_OFFSET_LINE	ny	screen
GL_POLYGON_OFFSET_POINT	nz	string
GL_POLYGON_OFFSET_UNITS	glNormal3sv	glXQueryServerString
GL_POLYGON_SMOOTH	v	display
GL_POLYGON_SMOOTH_HINT	glNormalPointer	name
GL_POLYGON_STIPPLE	ptr	screen
GL_POLYGON_STIPPLE_BIT	stride	string
GL_POLYGON_TOKEN	type	glXQueryVersion
GL_POSITION	glNormalPointerEXT	display
GL_PROJECTION	count	major_ptr
GL_PROJECTION_MATRIX	ptr	minor_ptr
GL_PROJECTION_STACK_DEPTH	stride	status

GL_PROXY_TEXTURE_1D	type	glXSwapBuffers
GL_PROXY_TEXTURE_2D	global [2]	display
GL_PROXY_TEXTURE_3D_EXT	globalPosition [2]	drawable
GL_Q	globalToLocal	glXUseXFont
GL_QUAD_STRIP	glOrtho	count
GL_QUADRATIC_ATTENUATION	bottom	first
GL_QUADS	far_val	font
GL_R	left	listBase
GL_R3_G3_B2	near_val	glXWaitGL
GL_READ_BUFFER	right	glXWaitX
GL_RED	top	<b>graphics [2] [3]</b>
GL_RED_BIAS	wrapglOrthofirst	draw
GL_RED_BITS	wrapglOrthosecond	drawLine
GL_RED_SCALE	glPassThrough	drawOval
GL_RENDER	token	drawPolygon
GL_RENDER_MODE	glPixelMapfv	drawRaster
GL_RENDERER	map	drawRect
GL_REPEAT	mapsize	drawRoundRect
GL_REPLACE	values	drawSlice
GL_RETURN	glPixelMapuiv	drawSpot
GL_RGB	map	drawSpots
GL_RGB10	mapsize	drawText
GL_RGB10_A2	values	drawTo
GL_RGB12	glPixelMapusv	fillOval
GL_RGB16	map	fillPolygon
GL_RGBA	mapsize	fillRect
GL_RGBA4	values	fillRoundRect
GL_RGBA5_A1	glPixelStoref	fillSlice
GL_RGBA8	param	move
GL_RGBA	pname	moveTo
GL_RGBA12	glPixelStorei	overrideChildren
GL_RGBA16	param	pen
GL_RGBA2	pname	background-color
GL_RGBA4	glPixelTransferf	foregroundColor
GL_RGBA8	param	mode
GL_RGBA_MODE	pname	size
GL_RIGHT	glPixelTransferi	stipple
GL_S	param	private
GL_SCISSOR_BIT	pname	style
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GL_SHADE_MODEL	param	[10] [11] [12] [13] [14] [15] [16] [17]
GL_SHARED_TEXTURE_PALETTE_EXT	pname	group
GL_SHININESS	glPointParameterfvEXT	eventHandler
GL_SHORT	params	label
GL_SMOOTH	pname	open
GL_SPECULAR	glPointSize	private
GL_SPHERE_MAP	size	<b>guienv [2] [3]</b>
GL_SPOT_CUTOFF	glPolygonMode	GUIenv
GL_SPOT_DIRECTION	face	applicationMenuBar
GL_SPOT_EXPONENT	mode	theMenuBar
GL_SRC_ALPHA	glPolygonOffset	beep
GL_SRC_ALPHA_SATURATE	factor	bifrostprivate

GL_SRC_COLOR	units	borderStyles
GL_STACK_OVERFLOW	glPolygonOffsetEXT	etchedIn
GL_STACK_UNDERFLOW	bias	etchedOut
GL_STENCIL	factor	shadowIn
GL_STENCIL_BITS	glPolygonStipple	shadowOut
GL_STENCIL_BUFFER_BIT	mask	simple
GL_STENCIL_CLEAR_VALUE	glPopAttrib	clipboard
GL_STENCIL_FAIL	glPopClientAttrib	clearContents
GL_STENCIL_FUNC	glPopMatrix	hasText
GL_STENCIL_INDEX	glPopName	textContents
GL_STENCIL_PASS_DEPTH_FAIL	glPrioritizeTextures	color
GL_STENCIL_PASS_DEPTH_PASS	n	blue
GL_STENCIL_REF	priorities	green
GL_STENCIL_TEST	textures	red
GL_STENCIL_VALUE_MASK	glPrioritizeTexturesEXT	cursor
GL_STENCIL_WRITEMASK	n	private
GL_STEREO	priorities	cursors
GL_SUBPIXEL_BITS	textures	arrow
GL_T	glPushAttrib	cross
GL_T2F_C3F_V3F	mask	iBeam
GL_T2F_C4F_N3F_V3F	glPushClientAttrib	plus
GL_T2F_C4UB_V3F	mask	watch
GL_T2F_N3F_V3F	glPushMatrix	displaywarnings
GL_T2F_V3F	glPushName	doSetup
GL_T4F_C4F_N3F_V4F	name	doTrace
GL_T4F_V4F	glRasterPos2d	guienvWait
GL_TABLE_TOO_LARGE_EXT	x	ticks
GL_TEXTURE	y	interfaceObject
GL_TEXTURE_1D	glRasterPos2dv	action
GL_TEXTURE_1D_BINDING_EXT	v	appendAction
GL_TEXTURE_2D	glRasterPos2f	close
GL_TEXTURE_2D_BINDING_EXT	glRasterPos2fv	deleteAction
GL_TEXTURE_3D_BINDING_EXT	v	disableEventType
GL_TEXTURE_3D_EXT	glRasterPos2i	enableEventType
GL_TEXTURE_ALPHA_SIZE	x	eventhandler
GL_TEXTURE_BINDING_1D	y	activate
GL_TEXTURE_BINDING_2D	glRasterPos2iv	basicEvent
GL_TEXTURE_BIT	v	altKey
GL_TEXTURE_BLUE_SIZE	glRasterPos2s	buttonState
GL_TEXTURE_BORDER	x	controlKey
GL_TEXTURE_BORDER_COLOR	y	globalPosition
GL_TEXTURE_COMPONENTS	glRasterPos2sv	localPosition
GL_TEXTURE_COORD_ARRAY	v	metaKey
GL_TEXTURE_COORD_ARRAY_BINDING_EXT	glRasterPos2t	shiftKey
GL_TEXTURE_COORD_ARRAY_EXT	x	when
GL_TEXTURE_COORD_ARRAY_POINTER	y	deactivate
GL_TEXTURE_COORD_ARRAY_POINTER_EXT	v	event
GL_TEXTURE_COORD_ARRAY_SIZE	glRasterPos3dv	keyDown
GL_TEXTURE_COORD_ARRAY_SIZE_EXT	v	keyEvent
GL_TEXTURE_COORD_ARRAY_STRIDE	glRasterPos3f	ch
GL_TEXTURE_COORD_ARRAY_STRIDE_EXT	glRasterPos3fv	key
GL_TEXTURE_COORD_ARRAY_TYPE	glRasterPos3i	mouseDown
GL_TEXTURE_COORD_ARRAY_TYPE_EXT	glRasterPos3s	delay
GL_TEXTURE_DEPTH_EXT	x	mouseEvent
GL_TEXTURE_ENV	y	doubleClick



GL_TEXTURE_ENV_COLOR	z	mouseUp
GL_TEXTURE_ENV_MODE	glRasterPos3iv	onActivate
GL_TEXTURE_GEN_MODE	v	onDeactivate
GL_TEXTURE_GEN_Q	glRasterPos3s	onKeyDown
GL_TEXTURE_GEN_R	x	onMouseDown
GL_TEXTURE_GEN_S	y	onMouseUp
GL_TEXTURE_GEN_T	z	onRefresh
GL_TEXTURE_GREEN_SIZE	glRasterPos3sv	refresh
GL_TEXTURE_HEIGHT	v	interfaceObjectException
GL_TEXTURE_INDEX_SIZE_EXT	glRasterPos4d	notOpenedError
GL_TEXTURE_INTENSITY_SIZE	w	notOpenedException
GL_TEXTURE_LUMINANCE_SIZE	wrapglRasterPos4d	open
GL_TEXTURE_MAG_FILTER	x	prependAction
GL_TEXTURE_MATRIX	y	private
GL_TEXTURE_MIN_FILTER	z	theEventHandler
GL_TEXTURE_PRIORITY	glRasterPos4dv	menu
GL_TEXTURE_PRIORITY_EXT	v	append
GL_TEXTURE_RED_SIZE	glRasterPos4f	clear
GL_TEXTURE_RESIDENT	glRasterPos4fv	close
GL_TEXTURE_RESIDENT_EXT	v	delete
GL_TEXTURE_STACK_DEPTH	glRasterPos4i	disable
GL_TEXTURE_WIDTH	w	dynamicMenuItem
GL_TEXTURE_WRAP_R_EXT	x	attach
GL_TEXTURE_WRAP_S	y	detach
GL_TEXTURE_WRAP_T	z	eventhandler
GL_TRANSFORM_BIT	glRasterPos4iv	onSelect
GL_TRIANGLE_FAN	v	onStatus
GL_TRIANGLE_STRIP	glRasterPos4s	theAction
GL_TRIANGLES	w	enable
GL_TRUE	x	enabled
GL_UNPACK_ALIGNMENT	y	eventhandler
GL_UNPACK_IMAGE_HEIGHT_EXT	z	onSelect
GL_UNPACK_LSB_FIRST	glRasterPos4sv	select
GL_UNPACK_ROW_LENGTH	v	getMenuItemByNumber
GL_UNPACK_SKIP_IMAGES_EXT	glRect [2]	menuAction
GL_UNPACK_SKIP_PIXELS	glReadBuffer	onSelect
GL_UNPACK_SKIP_ROWS	mode	onStatus
GL_UNPACK_SWAP_BYTES	glReadPixels	theMenuItem
GL_UNSIGNED_BYTE	format	menuItem
GL_UNSIGNED_INT	height	checked
GL_UNSIGNED_SHORT	pixels	eventhandler
GL_V2F	type	onSelect
GL_V3F	width	onStatus
GL_VENDOR	x	select
GL_VERSION	y	key
GL_VERTEX_ARRAY	glRectd	name
GL_VERTEX_ARRAY_COUNT_EXT	wrapglRectd	open
GL_VERTEX_ARRAY_EXT	x1	position
GL_VERTEX_ARRAY_POINTER	x2	private
GL_VERTEX_ARRAY_POINTER_EXT	y1	specialkey
GL_VERTEX_ARRAY_SIZE	y2	subMenu
GL_VERTEX_ARRAY_SIZE_EXT	glRectdv	name
GL_VERTEX_ARRAY_STRIDE	v1	theName
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GL_VERTEX_ARRAY_TYPE	glRectf	open

GL_VERTEX_ARRAY_TYPE_EXT	glRectfv	popUp
GL_VIEWPORT	v1	private
GL_VIEWPORT_BIT	v2	scan
GL_XOR	glRecti	separator
GL_ZERO	x1	menubar
GL_ZOOM_X	x2	append
GL_ZOOM_Y	y1	appendMenubar
glAccum	y2	clear
op	glRectiv	close
value	v1	delete
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func	glRects	open
ref	x1	private
glAreTexturesResident	x2	replaceMenubar
n	y1	scan
residences	y2	menubarType
result	glRectsv	mouse
textures	v1	busyCursor
glAreTexturesResidentEXT	v2	buttonState
n	glRenderMode	globalPosition
residences	mode	onOpenDocument
result	result	fileName
textures	glRotated	onQuit
glArrayElement	angle	okToQuit
i	wrapglRotatedfirst	onStartApplication
glArrayElementEXT	wrapglRotatedsecond	patterns
i	x	black
glBegin	y	dkGray
mode	z	gray
glBindTexture	glRotatef	ltGray
target	glScaled	white
texture	x	pixmap
glBindTextureEXT	y	clear
target	z	dispose
texture	glScalef	drawPixmap
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bitmap	height	init
height	width	mask
width	x	private
wrapglBitmap	y	read
xmove	glSelectBuffer	transparent
xorig	buffer	transparentColor
ymove	size	width
yorig	glShadeModel	private
glBlendColorEXT	mode	screenRectangle
alpha	glStencilFunc	theRectangle
blue	func	screenRgn
green	mask	rgn
red	ref	separatorStyles
wrapglBlendColorEXT	glStencilMask	doubleDashedLine
glBlendEquationEXT	mask	doubleLine
mode	glStencilOp	etchedIn
glBlendFunc	fail	etchedOut
dfactor	zfail	singleDashedLine
sfactor	zpass	singleLine

glBSolidCube	glTexCoord1d	setupDone
size	s	specKeys
glBSwapBuffers	glTexCoord1dv	standardMenuBar
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glCallList	s	open
list	glTexCoord1fv	standardEditMenu
glCallLists	v	clearMenuItem
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n	s	cutMenuItem
type	glTexCoord1iv	open
glClear	v	pasteMenuItem
mask	glTexCoord1s	undoMenuItem
glClearAccum	s	standardFileMenu
alpha	glTexCoord1sv	closeMenuItem
blue	v	newMenuItem
green	glTexCoord2d	open
red	s	openMenuItem
wrapglClearAccumfirst	t	pageSetUpMenuItem
wrapglClearAccumsecond	glTexCoord2dv	printMenuItem
glClearColor	v	quitMenuItem
alpha	glTexCoord2f	revertMenuItem
blue	glTexCoord2fv	saveAsMenuItem
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wrapglClearColorfirst	s	theFileMenu
wrapglClearColorsecond	t	standardTextStyle
glClearDepth	glTexCoord2iv	terminate
depth	v	textFaces
glClearIndex	glTexCoord2s	bold
c	s	italic
glClearStencil	t	plain
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glClipPlane	v	ascent
equation	glTexCoord3d	availableSizes
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glColor3b	s	face
blue	t	leading
green	glTexCoord3dv	lineHeight
red	v	maxChWidth
glColor3bv	glTexCoord3f	name
v	glTexCoord3fv	private
glColor3d	v	size
blue	glTexCoord3i	widthOfChar
green	r	widthOfText
red	s	timer
glColor3dv	t	action
v	glTexCoord3iv	once
glColor3f	v	private
glColor3fv	glTexCoord3s	start
v	r	stop
glColor3i	s	trace
blue	t	transferModes
green	glTexCoord3sv	andBlend
red	v	copy

glColor3iv	glTexCoord4d	erase
v	q	invertCopy
glColor3s	r	notAndBlend
blue	s	notOrBlend
green	t	orBlend
red	wrapglTexCoord4d	xorBlend
glColor3sv	glTexCoord4dv	warnStream
v	v	window
glColor3ub	glTexCoord4f	backgroundColor
blue	glTexCoord4fv	bringBack
green	v	bringBehind
red	glTexCoord4i	bringToFront
glColor3ubv	q	canvas
v	r	close
glColor3ui	s	eventhandler
blue	t	childFrameChanged
green	glTexCoord4iv	onActivate
red	v	onChildFrameChanged
glColor3uiv	glTexCoord4s	onDeactivate
v	q	onFrameChanged
glColor3us	r	onMouseDown
blue	s	onMouseUp
green	t	onRefresh
red	glTexCoord4sv	onVisibleChanged
glColor3usv	v	open
v	glTexCoordPointer	private
glColor4b	ptr	scan
alpha	size	selection
blue	stride	add
green	type	clear
red	glTexCoordPointerEXT	empty
glColor4bv	count	remove
v	ptr	scan
glColor4d	size	set
alpha	stride	close
blue	type	contents
green	glTexEnvf	eventhandler
red	param	aboutToClose
wrapglColor4d	pname	onAboutToClose
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v	glTexEnvfv	onDeactivate
glColor4f	params	frame
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v	target	global
glColor4i	glTexEnvi	local
alpha	param	hide
blue	pname	insideRectangle
green	target	localToGlobal
red	glTexEnviv	global
glColor4iv	params	local
v	pname	maxSize
glColor4s	target	menubarType
alpha	glTexGend	menubarVisible
blue	coord	minSize
green	param	open

red	pname	position
glColor4sv	glTexGendv	private
v	coord	resizeable
glColor4ub	params	separator
alpha	pname	close
blue	glTexGenf	eventhandler
green	glTexGenfv	onRefresh
red	glTexGeni	onStyleChanged
glColor4ubv	coord	styleChanged
v	param	open
glColor4ui	pname	private
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blue	coord	vertical
green	params	show
red	pname	showModal
glColor4uiv	glTexImage1D	size
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glColor4us	format	theMenubar
alpha	internalFormat	title
blue	level	type
green	pixels	update
red	target	visible
glColor4usv	type	windowitem
v	width	background-color
glColorMask	glTexImage2D	bindBottom
alpha	border	bindLeft
blue	format	bindRight
green	height	bindTop
red	internalFormat	border
glColorMaterial	level	style
face	pixels	visible
mode	target	close
glColorPointer	type	cursorType
ptr	width	disable
size	glTexImage3D	drag
stride	border	enable
type	depth	enabled
glColorPointerEXT	format	eventhandler
count	height	borderStyleChanged
ptr	internalFormat	borderVisibleChanged
size	level	disableTarget
stride	pixels	enabledChanged
type	target	enableTarget
glColorSubTableEXT	type	fatherFrameChanged
count	width	frameChanged
data	glTexParameterf	hiliteChanged
format	param	mouseEnter
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target	target	onBorderStyleChanged
type	glTexParameterfv	onBorderVisibleChanged
glColorTableEXT	params	onDisableTarget
format	pname	onEnabledChanged
internalformat	target	onEnableTarget
table	glTexParameterf	onFatherFrameChanged
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x	glTexSubImage1D	theCursorChanged
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target	width	hilite
width	xoffset	insideRectangle
x	glTexSubImage2D	move
y	format	open
glCopyTexImage2D	height	position
border	level	private
height	pixels	resize
internalformat	target	show
level	type	size
target	width	theCursor
width	xoffset	trackMouse
x	yoffset	curPt
y	glTexSubImage3D	mouseMove
glCopyTexSubImage1D	depth	mousePress
level	format	mouseRelease
target	height	prevPt
width	level	update
x	pixels	visible
xoffset	target	windowTypes
y	type	dialog
glCopyTexSubImage2D	width	modelessDialog
height	xoffset	normal
level	yoffset	palette
target	zoffset	XsystemEnvHandleCallback
width	glTranslated	XsystemEnvHandleCallbackP
x	x	cb
xoffset	y	XsystemEnvPresent
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height	GLU_BEGIN	guienvWait

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h [2] [3]	onUpdate	<b>hide [2] [3] [4]</b>
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mapsize [2] [3]	<b>menubarVisible</b> [2] [3]	read
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tx	mouseEvent	open
ty	mouseEventAction	pause
MaxChar	mouseLeave	play
maxChWidth	mouseMove	private
MaxHue	mousePress	read
MaxRGB	mouseRelease	stop
MaxSat	mouseUp	theMovie
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MaxVal	moveMatrix	mult
maxValue	itx	multiLine
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new	noTabbingToScrollbars	IntegerContents
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newseparator	notok [2]	nurbsobj [2]
nknots	notokLabel [2]	nx [2] [3] [4]
nobj [2] [3] [4] [5] [6] [7] [8] [9] [10] [11]	notOpenedError	ny [2] [3] [4]
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offset [2]	onPopUpMenuChanged	currentItem
ok [2] [3]	onQuit	eventhandler
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<b>onAboutToClose</b> [2]	<b>onSelect</b> [2] [3] [4] [5] [6] [7]	onLabelChanged
<b>onActivate</b> [2] [3] [4] [5] [6] [7]	onSelectAction	onPopUpMenuChanged
onBeforeChange	onShowLabelChanged	onRefresh
onBeforeSelectionChange	onStartApplication	onStyleChanged
onBorderStyleChanged	onStateChanged	popUpMenuChanged
onBorderVisibleChanged	<b>onStatus</b> [2] [3] [4]	open
onButtonDown	onStatusAction	popupMenu
onButtonUp	onStyleChanged [2] [3]	private
once	onTextChanged	orBlend
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<b>onDeactivate</b> [2] [3] [4] [5] [6]	onUpdate	ou
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 notok  
 notokLabel  
 ok  
 okLabel  
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PFD_SUPPORT_GDI	prepend [2]	open
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[10] [11]	union	resizeRelative
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rect	bounds	rgn
eventhandler	containsPoint	right [2] [3] [4] [5]
onRefresh	containsRectangle	rightArrow
open	difference	theChar
rectangle	dispose	root
bottom	empty	rotateMatrix
bottomRight	inset	theta
containsPoint	intersection	roundness
inset	isEmpty	roundRect
intersection	isEqual	eventhandler
isEmpty	offset	onRefresh
isEqual	private	open
left	setFromRectangle	private
offset	symDiff	roundness
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right	remove	rowColToPos
set	<b>replaceMenuBar</b> [2]	col
setFromPoints	RESHOW	indexError
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s [2] [3] [4] [5] [6] [7] [8] [9]	onSelect	new
[10] [11] [12] [13] [14]	onVisibleChanged	newseparator

s_stride	select	noOfRadioGroups
saveAs	getItemRectangle	private
saveAsMenuItem	insert	radioitem
saveMenuItem	itemHeight	toggleitem
scaleMatrix	multipleSelection	sin_a [2]
scaleToFit	numberOfItems	singleDashedLine
<b>scan</b> [2] [3] [4] [5] [6] [7] [8] [9]	open	singleLine
[10]	prepend	<b>size</b> [2] [3] [4] [5] [6] [7] [8] [9]
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scroll [2] [3] [4]	first	source
scrollAmount	has	specialkey
scrollAmountChanged	last	specKeys
scrollAmountChangedAction	scrollIntoView	src
scrollbar	select	stacks [2]
close	<b>scrollists</b>	<b>standardEditMenu</b> [2]
eventhandler	select [2] [3] [4]	<b>standardFileMenu</b> [2]
buttonDown	selectAction [2]	<b>StandardMenuBar</b>
buttonUp	selection [2]	<b>standardMenuBar</b>
maxValueChanged	Selection	standardMenuBar
onActivate	selection [2] [3] [4]	standardTextStyle
onButtonDown	Sep	start [2] [3] [4] [5]
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onDeactivate	separatorStyles	startpos
onFrameChanged	set [2] [3]	state
onMaxValueChanged	setAppIcon	stateChanged
onMouseDown	id	stateChangedAction
onPageDown	setColor	staticText
onPageScrollAmountChanged	setDelayTime	close
onPageUp	setFromPoints	eventhandler
onRefresh	setFromRectangle	onRefresh
onScrollAmountChanged	setMouseCursor	open
onThumbMoved	symbolConstant	private
onValueChanged	setOneFace	status [2]
pageDown	setOneFont	<b>stddialogs</b> [2]
pageScrollAmountChanged	setOneSize	stipple [2]
pageUp	setOneStyle	stop [2] [3] [4]
scrollAmountChanged	setPixelFormat	streamwindow
thumbMoved	hdc	close
valueChanged	result	eventHandler
length	<b>setText</b> [2]	flush
maxValue	setupDone	hideOnCloseByUser
open	setWindowIcon	logfilename
pageScrollAmount	id	open
private	setWindowIconPixmap	private
scrollAmount	pm	saveAs
value	sfactor	show
vertical	shadowIn	theStream
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scrollList	<b>show</b> [2] [3] [4] [5]	subtract
append	showLabel	suggest
close	showLabelChanged	suggestedHeight
delete	showLabelChangedAction	suggestedWidth
deleteFirst	<b>showModal</b> [2]	SwapBuffers
deleteLast	simple	hdc
eventhandler	simpleDefineRect	result
onActivate	p	sweepAngle
onDeactivate	theRect	symbolConstant
onFrameChanged	simplemenu	symDiff
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[10] [11] [12]	eventhandler	tile
t_stride	beforeChange	timer
tab	onBeforeChange	<b>title</b> [2]
tabControl	onDisableTarget	tknot
apiError	onEnableTarget	tknot_count
close	onFrameChanged	to
eventHandler	onKeyDown	tobj [2] [3] [4] [5]
multiLine	onMouseDown	toggleButton
onBeforeSelectionChange	onMouseUp	close
open	onRefresh	eventhandler
private	onTextChanged	onMouseUp
resourceAllocationError	textChanged	onStateChanged
selection	getChar	stateChanged
tab	insert	open
tabs	isOneStyle	private
useError	length	state
table [2]	margin	toggleitem
tableItem	open	token
tableItemType	paste	tool
tableView	postToPt	theTip
abstractColumn	private	theWindowItem
alignLeft	ptToPos	tooltipc [2]
alignRight	scanText	tooltipControl
append	scanTextWithStyle	add
appendColumn	selection	AUTOMATIC
changeHiliteColor	contents	AUTOPOP
close	end	close
column	get	delete

columnWithIcon	scrollIntoView	INITIAL
columnWithIconType	set	open
delete	start	RESHOW
deleteColumn	setOneFace	setDelayTime
deleteSelection	setOneFont	tooltipPriv
eventHandler	setOneSize	tooltipPriv
horizontalScrollbarVisible	setOneStyle	top [2] [3] [4]
insert	textprivate	topLeft
insertColumn	<b>TextScrollList</b>	topRadius
maxScroll	textScrollList	torder
open	close	trace
prepend	getText	trackMouse
private	open	transferModes
scan	setText	transformPoint
scroll	style	transformRectangle
selection	textStyle	translate
sortByColumn	texture [2] [3] [4]	from
tableItem	textureCoords	p
tableItemType	textures [2] [3] [4] [5] [6] [7] [8]	result
theScroll	theAction	to
verticalScrollbarVisible	theButton	transparent
tabs	theChar [2] [3] [4]	transparentColor
<b>target</b> [2] [3] [4] [5] [6] [7] [8]	<b>theCursor</b> [2]	treeview
[10] [11] [12] [13] [14] [15]	<b>theCursorChangeAction</b> [2]	changed
[16] [17] [18] [19]	<b>theCursorChangeAction</b>	eventHandler
[20] [21] [22] [23] [24] [25]	<b>theEditor</b> [2]	folder
[26] [27] [28] [29]	<b>theEditor</b> [2]	hideRoot
[30] [31] [32] [33] [34] [35]	<b>theEvent</b>	item
[36] [37] [38] [39]	<b>theEvent</b>	minSize
[40] [41] [42] [43] [44]	<b>theEvent</b>	open
terminate	theEventHandler	root
textChanged	<b>theFileMenu</b> [2]	selection
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textContent	theMenuItem	treeviewPrivate
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close	theName	ts [2]
contentsType	theRect [2] [3] [4]	twoWay
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private	theScroll	ty
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unzoom	y2	ustride
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## V

v [2] [3] [4] [5] [6] [7] [8] [9]	valueChangedAction	vertical [2]
[10] [11] [12] [13] [14] [15]	value [1] [2] [3] [4] [5] [6]	verticalScrollbarVisible
[20] [21] [22] [23] [24] [25]	valueh [27] [28] [29]	viewport [2] [3]
[30] [31] [32] [33] [34] [35]	valuev [36] [37] [38] [39]	viewSize
[40] [41] [42] [43] [44] [45]	valuev [46] [47] [48] [49]	height
[50] [51] [52] [53] [54] [55]	valuev [56] [57] [58] [59]	width
[60] [61] [62] [63] [64] [65]	valuev [66] [67] [68] [69]	visible [2] [3]
v1 [2] [3] [4] [5] [6]	copy	visibleChanged
v2 [2] [3] [4] [5] [6]	data	visibleChangedAction
val	Vector4d	visual [2] [3] [4]
validate [2] [3]	copy	vn
value [2] [3] [4] [5] [6] [7] [8] [9]	data	vorder
[10]	Vector4i	vr
value_ptr	copy	vstride
valueChanged	data	

## W

w [2] [3] [4] [5] [6]	hgirc	wrapglClearAccumsecond
walkingAnts	result	wrapglClearColorfirst
add	wglGetCurrentContext	wrapglClearColorsecond
clear	hgirc	wrapglColor4d
delete	wglGetCurrentDC	wrapglFrustumfirst
init	hdc	wrapglFrustumsecond
interval	wglMakeCurrent	wrapglMap2d
pensize	hdc	wrapglMapGrid2d
private	hgirc	wrapglOrthofirst
start	result	wrapglOrthosecond
stop	wglShareLists	wrapglRasterPos4d
style	hgirc1	wrapglRectd
warnStream	hgirc2	wrapglRotatedfirst
watch	result	wrapglRotatedsecond
wedge	when	wrapglTexCoord4d
endAngle	white	wrapgluCylinder
eventhandler	width [2] [3] [4] [5] [6] [7] [8]	wrapgluLookAt1
onRefresh	[10] [11] [12] [13] [14] [15]	wrapgluLookAt2 [19]
open	[20] [21] [22] [23] [24]	wrapgluOrtho2D
private	widthin	wrapgluPartialDisk
startAngle	widthOfChar	wrapgluPerspective
wglCopyContext	widthOfText	wrapgluPickMatrix
dest	without	wrapglVertex4d
mask	<b>window [2] [3]</b>	wrapset3double
source	<b>windowItem [2] [3]</b>	d1
wglCreateContext	windowitem	d2
hgirc	windowTypes	d3
hdc	winx [2]	wriggle

wglCreateLayerContext	winy [2]	for
glrc	winz [2]	pos
hdc	wrapglBitmap	reallyWriggle
iLayerPlane	wrapglBlendColorEXT	
wglDeleteContext	wrapglClearAccumfirst	

## X

x [2] [3] [4] [5] [6] [7] [8] [9]	x11ID	xorBlend
[10] [11] [12] [13] [14] [15]	x216 [17] [18] [19]	xorig
[20] [21] [22] [23] [24] [25]	x26 [27] [28] [29]	XsystemEnvHandleCallback
[30] [31] [32] [33]	xmove	XsystemEnvHandleCallbackP
x1 [2] [3]	xoffset [2] [3] [4] [5] [6]	XsystemEnvPresent

## Y

y [2] [3] [4] [5] [6] [7] [8] [9]	y1 [2] [3] [4]	yoffset [2] [3] [4]
[10] [11] [12] [13] [14] [15]	y216 [17] [18] [19]	yorig
[20] [21] [22] [23] [24] [25]	y26 [27] [28] [29]	
[30] [31] [32] [33]	ymove	

## Z

z [2] [3] [4] [5] [6] [7] [8] [9]	zFar	zoomMember
[10] [11] [12] [13] [14] [15]	zNear	zpass
zfail	zoffset [2]	