Tutorial GTK+ 2.x para inciantes

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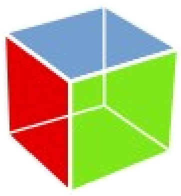
Tutorial GTK+ 2.x para iniciantes

1. Introdução

Esta é uma introdução ao tutorial de programação GTK. O tutorial é feito para a linguagem de programação C. Foi criado e testado no GNU/Linux. O tutorial é direcionado para programadores iniciantes e intermediários.



A GTK+ é uma biblioteca para criação de interfaces gráficas de usuários. Ela foi implementada na linguagem C. Ela é também chamada de kit de ferramentas do GIMP. Originalmente, a biblioteca foi criada enquanto desenvolvia-se o programa de manipulação de imagem GIMP. Desde então, o GTK+ tornou-se um dos mais populares kits de ferramentas para GNU/Linux e BSD Unix. Hoje, muitos dos programas GUI em código aberto do mundo são criados em Qt ou em GTK+. A GTK+ é uma interface de programação de aplicativos orientada a objetos. O sistema orientado a objetos foi criado com o sistema de objeto Glib, que é a base para a biblioteca GTK+. O GObject também permite criar ligação para várias outras linguagens de programação. Ligações de linguagens existem para C++, Python, Perl, Java, C# e outras.
A GTK+ depende das seguintes bibliotecas:

- Glib
- Pango
- ATK
- GDK
- GdkPixbuf
- Cairo

A **Glib** é uma biblioteca de utilidade geral. Fornece vários tipos de dados, utilidades de strings, permite relatório de erros, registro de mensagens, trabalho com threads e outras características de programação úteis. **Pango** é uma biblioteca que habilita internacionalização. **ATK** é um conjunto de ferramentas de acessibilidade. Este conjunto de ferramentas permite uma ajuda física para pessoas desafiadoras que trabalham com computadores. A **GDK** é um envoltório de desenho e funções de janela de baixo nível que permite uma base de sistemas gráficos. No GNU/Linux, GDK varia entre o Servidor X e a biblioteca GTK+. Recentemente, muitas dessas funcionalidades foram atribuídas à biblioteca Cairo. A **GdkPixbuf** é composta por ferramentas que são responsáveis por carregar imagens e por manipular pixel. **Cairo** é uma biblioteca para criação gráfica de vetor 2D. Foi incluída em GTK+ desde a versão 2.8.
Os ambientes de desktop Gnome e o Xfce foram criados usando GTK+. SWT e wxWidgets são as estruturas de programação conhecidas. As aplicações que usam GTK+ incluem Firefox ou Inkscape.

Compilando aplicações GTK+

Para compilar tais aplicações, nós temos que ter em mãos uma ferramenta chamada **pkg-config**. O pgk-config retorna dados sobre bibliotecas instaladas. Se nós quisermos usar uma biblioteca específica, ela permitirá bibliotecas dependentes necessárias e arquivos de cabeçalho, que precisamos. O pkg-config recupera informação sobre pacotes de arquivos especiais.

```
gcc -o simple simple.c `pkg-config --libs --cflags gtk+-2.0`
```

Aqui mostramos como podemos compilar um simples programa. O código fonte consiste em um arquivo, simple.c. Isso não são aspas simples, mas, um acento grave.

```
$ pkg-config --cflags gtk+-2.0
-I/usr/include/gtk-2.0 -I/usr/lib/gtk-2.0/include -I/usr/include/atk-1.0
-I/usr/include/cairo -I/usr/include/pango-1.0 -I/usr/include/glib-2.0
-I/usr/lib/glib-2.0/include -I/usr/include/freetype2 -I/usr/include/libpng12
```

Lista que mostra todos os arquivos de cabeçalhos necessários para programação GTK+.

```
$ pkg-config --libs gtk+-2.0
-lgtk-x11-2.0 -lgdk-x11-2.0 -latk-1.0 -lgdk_pixbuf-2.0 -lm -lpangocairo-1.0
-lfontconfig -lXext -lXrender -lXinerama -lXi -lXrandr
-lXcursor -lXfixes -lpango-1.0 -lcairo -lX11 -lgobject-2.0
-lgmodule-2.0 -ldl -lglib-2.0
```

E a lista com todas as bibliotecas necessárias.

2. Primeiro programa em GTK+

Nesta parte do tutorial, nós iremos criar nosso primeiro programa em GTK+.

Exemplo simples

Iniciaremos com um exemplo muito simples, mostraremos uma janela básica.

```
#include <gtk/gtk.h>

int main( int argc, char *argv[])
{
  GtkWidget *window;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_widget_show(window);

  gtk_main();

  return 0;
}
```

Este exemplo mostrará uma janela básica na tela.

```
gcc -o simple simple.c `pkg-config --libs --cflags gtk+-2.0`
```

Aqui, como compiler o exemplo.

```
gtk_init(&argc, &argv);
```

Aqui nós inicializamos a bibioteca GTK+.

```
window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
```

Nós criamos um widget(engenhoca, quer dizer objetos, componentes de uma janela) **GtkWindow**. O tipo da janela é **GTK_WINDOW_TOPLEVEL**. A janela Toplevel possui uma barra de títulos e uma borda.São gerenciados por um gerenciador de janela.

```
gtk_widget_show(window);
```

Depois de termos criados um widget, iremos mostrá-lo.

```
gtk_main();
```

Este código faz a GTK+ entrar em um laço de repetição. A partir daqui, a aplicação espera que algum evento aconteça.

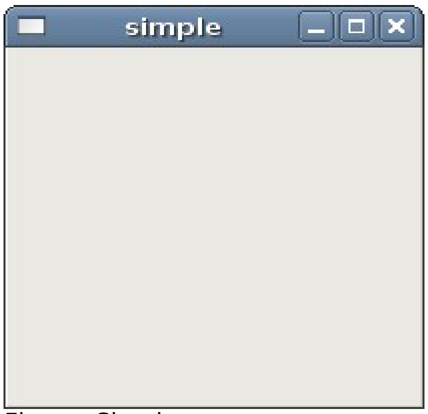


Figura: Simples

Centralizando a janela

Se nós não posicionarmos nossa janela, o gerenciador de janela irá posicioná-la para nós. No próximo exemplo, nós centralizamos a janela.

```
#include <gtk/gtk.h>

int main( int argc, char *argv[])
{
  GtkWidget *window;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_title(GTK_WINDOW(window), "Center");
  gtk_window_set_default_size(GTK_WINDOW(window), 230, 150);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_widget_show(window);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
      G_CALLBACK(gtk_main_quit), NULL);

  gtk_main();

  return 0;
}
```

Em nosso exemplo, nós centralizamos a janela, colocamos um título e um tamanho para ela.

```
gtk_window_set_title(GTK_WINDOW(window), "Center");
```

A função **gtk_window_set_title()** irá setar um título para a janela. Se não setarmos, a GTK+ irá usar o nome do arquivo do código fonte para o título da janela. Por exemplo, se seu programa for 1.c, a janela se chamará 1.

```
 gtk_window_set_default_size(GTK_WINDOW(window), 230, 150);
```

Este código seta o tamanho da janela para 230x150 pixels. Note que estamos falando sobre a área de usuário, excluindo decorações providas pelo gerenciador de janela.

```
gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
```

Este código centraliza a janela.

```
g_signal_connect_swapped(G_OBJECT(window), "destroy",
     G_CALLBACK(gtk_main_quit), NULL);
```

No exemplo anterior, a janela não era completamente fechada quando clicávamos no botão 'x'. Podemos ver isso, se executarmos o exemplo pela linha de comando. A janela não reagia ao sinal de destruição (**destroy** signal,fechamento) por padrão. Vamos explicitar a terminação da aplicação pela conexão do sinal de destruição da função **gtk_main_quit()**.

O aplicativo ícone

No próximo exemplo, mostraremos uma aplicação de ícone. Muitos gerenciadores de janela mostram os ícones no canto esquerdo superior da barra de títulos e também na barra de tarefas.

```
#include <gtk/gtk.h>

GdkPixbuf *create_pixbuf(const gchar * filename)
{
   GdkPixbuf *pixbuf;
   GError *error = NULL;
   pixbuf = gdk_pixbuf_new_from_file(filename, &error);
   if(!pixbuf) {
      fprintf(stderr, "%s\n", error->message);
      g_error_free(error);
   }

   return pixbuf;
}

int main( int argc, char *argv[])
{
  GtkWidget *window;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_title(GTK_WINDOW(window), "icon");
  gtk_window_set_default_size(GTK_WINDOW(window), 230, 150);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_icon(GTK_WINDOW(window), create_pixbuf("web.png"));
  gtk_widget_show(window);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
      G_CALLBACK(gtk_main_quit), NULL);

  gtk_main();

  return 0;
}
```

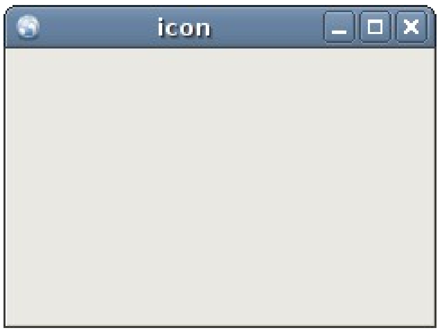
O código mostra o ícone. O arquivo de ícone (no caso web.png) tem que estar no mesmo diretório do executável e os códigos do programa.

```
gtk_window_set_icon(GTK_WINDOW(window), create_pixbuf("web.png"));
```

A função **gtk_window_set_icon()** mostra o ícone de nossa janela. A função **create_pixbuf()** cria um **GdkPixbuf** de um arquivo png.

```
pixbuf = gdk_pixbuf_new_from_file(filename, &error);
```

De acordo com a documentação, a função **gdk_pixbuf_new_from_file()** cria um novo pixbuf para carregar a imagem de um arquivo. O formato de arquivo é detectado automaticamente. Será retornado NULL se algum erro for detectado.



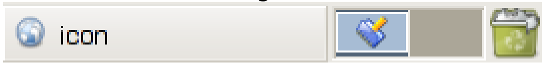


Figura: ícone

Incremento – Decremento

Finalizamos a primeira parte do tutorial com um exemplo, onde temos 3 janelas filhas. 2 botões e uma etiqueta. A etiqueta possui um número inteiro. Os botões irão incrementar ou decrementar o número.

```
#include <gtk/gtk.h>
gint count = 0;
char buf[5];
void increase(GtkWidget *widget, gpointer label)
{
  count++;
  sprintf(buf, "%d", count);
  gtk_label_set_text(label, buf);
}
void decrease(GtkWidget *widget, gpointer label)
{
  count--;
  sprintf(buf, "%d", count);
  gtk_label_set_text(label, buf);
}
int main(int argc, char** argv) {

  GtkWidget *label;
  GtkWidget *window;
  GtkWidget *frame;
  GtkWidget *plus;
  GtkWidget *minus;
  gtk_init(&argc, &argv);
  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 250, 180);
  gtk_window_set_title(GTK_WINDOW(window), "+-");
  frame = gtk_fixed_new();
  gtk_container_add(GTK_CONTAINER(window), frame);
  plus = gtk_button_new_with_label("+");
  gtk_widget_set_size_request(plus, 80, 35);
  gtk_fixed_put(GTK_FIXED(frame), plus, 50, 20);
  minus = gtk_button_new_with_label("-");
  gtk_widget_set_size_request(minus, 80, 35);
  gtk_fixed_put(GTK_FIXED(frame), minus, 50, 80);
  label = gtk_label_new("0");
  gtk_fixed_put(GTK_FIXED(frame), label, 190, 58);
  gtk_widget_show_all(window);
  g_signal_connect(window, "destroy",
      G_CALLBACK (gtk_main_quit), NULL);

  g_signal_connect(plus, "clicked",
      G_CALLBACK(increase), label);

  g_signal_connect(minus, "clicked",
      G_CALLBACK(decrease), label);

  gtk_main();
  return 0;}
```

O código-exemplo incrementa ou decrementa um valor em GtkLabel.

```
g_signal_connect(plus, "clicked",
    G_CALLBACK(increase), label);
```

Nós conectamos a função de rechamada **increase()** para o botão ‘+’. Note que enviamos uma etiqueta como parâmetro para a rechamada (callback). Iremos trabalhar na etiqueta dentro da função de callback.

```
count++;
sprintf(buf, "%d", count);
gtk_label_set_text(label, buf);
```

Dentro da callback increase, nós criamos o contador. Fizemos dados textuais fora do valor do número e atualizamos a etiqueta.

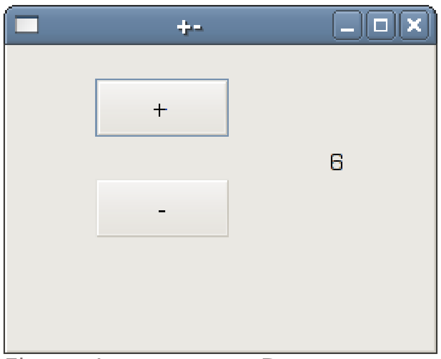


Figura: Incremento – Decremento

Menus e barra de ferramentas em GKT+

Nesta parte do tutorial, trabalharemos com menus e barra de ferramentas.

Uma **barra de ferramentas** é uma das partes mais comuns de uma aplicação GUI. É um grupo de comandos localizado em vários menus. Enquanto que em aplicações de console você tem que lembrar todos aqueles comandos misteriosos, aqui nós temos muitos comandos agrupados em partes lógicas. Existem padrões aceitos que reduzem muito do tempo gasto para aprender uma nova aplicação.

Exemplo simples de menu

Em nosso primeiro exemplo, criaremos uma barra de menu com um menu de arquivo. O menu terá apenas um item de menu. Ao selecionar o item, fechará a aplicação.

```
#include <gtk/gtk.h>
int main( int argc, char *argv[])
{
  GtkWidget *window;
  GtkWidget *vbox;
  GtkWidget *menubar;
  GtkWidget *filemenu;
  GtkWidget *file;
  GtkWidget *quit;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 250, 200);
  gtk_window_set_title(GTK_WINDOW(window), "menu");

  vbox = gtk_vbox_new(FALSE, 0);
  gtk_container_add(GTK_CONTAINER(window), vbox);

  menubar = gtk_menu_bar_new();
  filemenu = gtk_menu_new();

  file = gtk_menu_item_new_with_label("File");
  quit = gtk_menu_item_new_with_label("Quit");

  gtk_menu_item_set_submenu(GTK_MENU_ITEM(file), filemenu);
  gtk_menu_shell_append(GTK_MENU_SHELL(filemenu), quit);
  gtk_menu_shell_append(GTK_MENU_SHELL(menubar), file);
  gtk_box_pack_start(GTK_BOX(vbox), menubar, FALSE, FALSE, 3);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), NULL);

  g_signal_connect(G_OBJECT(quit), "activate",
        G_CALLBACK(gtk_main_quit), NULL);

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

Criar uma barra de menus é um pouco confuso. Nós devemos ter em mente que ambos, barra de menus e menus são derivados de um mesmo widget, chamado **menu shell**. **Itens de menu** são apenas filhos de menus. Eles são também usado para implementar submenus.

```
menubar = gtk_menu_bar_new();
 filemenu = gtk_menu_new();
```

Neste código nós criamos uma barra de menu e um menu.

```
gtk_menu_item_set_submenu(GTK_MENU_ITEM(file), filemenu);
```

Esta linha de código implementa um menu de arquivo. A lógica é que uma barra de menu é um menu shell. Arquivo de menu é também um menu shell. É porque olhamos o menu de arquivo como um submenu ou um subshell.

```
gtk_menu_shell_append(GTK_MENU_SHELL(filemenu), quit);
gtk_menu_shell_append(GTK_MENU_SHELL(menubar), file);
```

Itens de menu são implementados chamando a função **gtk_menu_shell_append()**. Itens de menu são adicionados aos menus shell. Em nosso caso, o menu de sair é adicionado ao menu de arquivo e também o item do menu de arquivo é adicionado à barra de menu.

```
 g_signal_connect(G_OBJECT(quit), "activate",
       G_CALLBACK(gtk_main_quit), NULL);
```

Selecionando o item de menu sair, sairemos da aplicação.

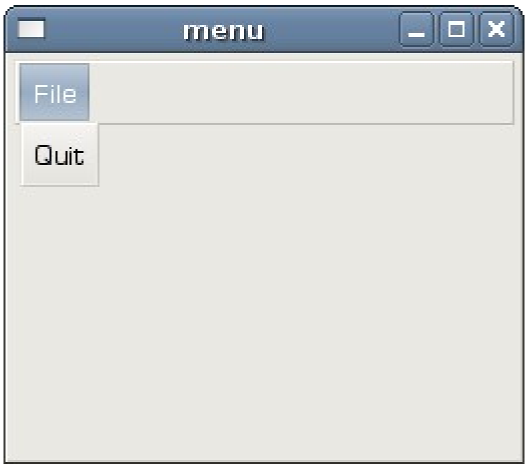


Figura: Menu simples

Imagem de menu, mnemônicos e aceleradores

No próximo exemplo, iremos explorar mais uma funcionalidade que podemos usar em GTK+. **Aceleradores** são atalhos de teclado para ativar menus de itens. **Mnemônicos (que facilmente se grava na memória)** atalhos de teclado para elementos da GUI. Eles são representados por caracteres sublinhados.

```
#include <gtk/gtk.h>
#include <gdk/gdkkeysyms.h>
int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *vbox;
  GtkWidget *menubar;
  GtkWidget *filemenu;
  GtkWidget *file;
  GtkWidget *new;
  GtkWidget *open;
  GtkWidget *quit;

  GtkWidget *sep;
  GtkAccelGroup *accel_group = NULL;
  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 250, 200);
  gtk_window_set_title(GTK_WINDOW(window), "menu");

  vbox = gtk_vbox_new(FALSE, 0);
  gtk_container_add(GTK_CONTAINER(window), vbox);

  menubar = gtk_menu_bar_new();
  filemenu = gtk_menu_new();
  accel_group = gtk_accel_group_new();
  gtk_window_add_accel_group(GTK_WINDOW(window), accel_group);
  file = gtk_menu_item_new_with_mnemonic("_File");
  new = gtk_image_menu_item_new_from_stock(GTK_STOCK_NEW, NULL);
  open = gtk_image_menu_item_new_from_stock(GTK_STOCK_OPEN, NULL);
  sep = gtk_separator_menu_item_new();
  quit = gtk_image_menu_item_new_from_stock(GTK_STOCK_QUIT, accel_group);

  gtk_widget_add_accelerator(quit, "activate", accel_group,
      GDK_q, GDK_CONTROL_MASK, GTK_ACCEL_VISIBLE);
  gtk_menu_item_set_submenu(GTK_MENU_ITEM(file), filemenu);
  gtk_menu_shell_append(GTK_MENU_SHELL(filemenu), new);
  gtk_menu_shell_append(GTK_MENU_SHELL(filemenu), open);
  gtk_menu_shell_append(GTK_MENU_SHELL(filemenu), sep);
  gtk_menu_shell_append(GTK_MENU_SHELL(filemenu), quit);
  gtk_menu_shell_append(GTK_MENU_SHELL(menubar), file);
  gtk_box_pack_start(GTK_BOX(vbox), menubar, FALSE, FALSE, 3);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
      G_CALLBACK(gtk_main_quit), NULL);

  g_signal_connect(G_OBJECT(quit), "activate",
      G_CALLBACK(gtk_main_quit), NULL);
  gtk_widget_show_all(window);
  gtk_main();
  return 0; }
```

O exemplo mostra como adicionar uma imagem ao nosso menu de item. Como setar um acelerador e como usar mnemônicos em nossas aplicações GTK+.

```
accel_group = gtk_accel_group_new();
gtk_window_add_accel_group(GTK_WINDOW(window), accel_group);
...
quit = gtk_image_menu_item_new_from_stock(GTK_STOCK_QUIT, accel_group);
gtk_widget_add_accelerator(quit, "activate", accel_group,
    GDK_q, GDK_CONTROL_MASK, GTK_ACCEL_VISIBLE);
```

Um grupo de acelerador é um grupo de aceleradores de teclado

An accelerator group is a group of keyboard accelerators, tipicamente unido ao nível superior da janela. Aqui criamos um acelerador de teclado Ctrl + q.

```
file = gtk_menu_item_new_with_mnemonic("_File");
```

Para crier um mnemônico temos que chamar a função **gtk_menu_item_new_with_mnemonic()**. Selecionamos o item de menu arquivo ao pressionarz Alt + F.

```
new = gtk_image_menu_item_new_from_stock(GTK_STOCK_NEW, NULL);
open = gtk_image_menu_item_new_from_stock(GTK_STOCK_OPEN, NULL);
```

Aqui criamos duas imagens de itens de menu. Ao setar o segundo parâmetro da função para NULL, automaticamente criamos aceleradores. Fornecemos uma imagem e texto para nosso item de menu por recursos internos do GTK+.

```
sep = gtk_separator_menu_item_new();
```

Itens de menu podem ser separados por um separador horizontal. Isto pode colocar itens de menus em algum grupo lógico.

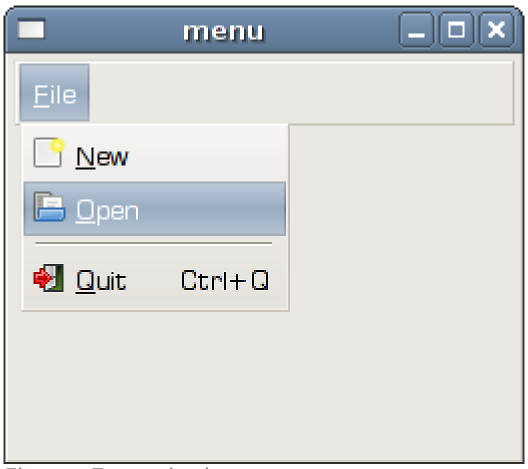


Figura: Exemplo de menu

Item de menu de verificação

Um **GtkCheckMenuItem** é um menu com uma caixa de verificação.

```
#include <gtk/gtk.h>
void toggle_statusbar(GtkWidget *widget, gpointer statusbar)
{
  if (gtk_check_menu_item_get_active(GTK_CHECK_MENU_ITEM(widget))) {
    gtk_widget_show(statusbar);
  } else {
    gtk_widget_hide(statusbar);
  }
}

int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *vbox;
  GtkWidget *menubar;
  GtkWidget *viewmenu;
  GtkWidget *view;
  GtkWidget *tog_stat;
  GtkWidget *statusbar;


  gtk_init(&argc, &argv);
  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 250, 200);
  gtk_window_set_title(GTK_WINDOW(window), "view statusbar");

  vbox = gtk_vbox_new(FALSE, 0);
  gtk_container_add(GTK_CONTAINER(window), vbox);

  menubar = gtk_menu_bar_new();
  viewmenu = gtk_menu_new();

  view = gtk_menu_item_new_with_label("View");
  tog_stat = gtk_check_menu_item_new_with_label("View Statusbar");
  gtk_check_menu_item_set_active(GTK_CHECK_MENU_ITEM(tog_stat), TRUE);

  gtk_menu_item_set_submenu(GTK_MENU_ITEM(view), viewmenu);
  gtk_menu_shell_append(GTK_MENU_SHELL(viewmenu), tog_stat);
  gtk_menu_shell_append(GTK_MENU_SHELL(menubar), view);
  gtk_box_pack_start(GTK_BOX(vbox), menubar, FALSE, FALSE, 3);

  statusbar = gtk_statusbar_new();
  gtk_box_pack_end(GTK_BOX(vbox), statusbar, FALSE, TRUE, 1);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), NULL);

  g_signal_connect(G_OBJECT(tog_stat), "activate",
        G_CALLBACK(toggle_statusbar), statusbar);

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

Em nosso código-exemplo mostramos um item de verificação. Se a caixa de verificação está ativada, o widget de barra de status é mostrado.

```
tog_stat = gtk_check_menu_item_new_with_label("View Statusbar");
```

A função de chamada **gtk_check_menu_item_new_with_label()** cria um novo item de verificação.

```
if (gtk_check_menu_item_get_active(GTK_CHECK_MENU_ITEM(widget))) {
  gtk_widget_show(statusbar);
} else {
  gtk_widget_hide(statusbar);
}
```

Se a caixa de verificação no item de menu está ativado, mostramos a barra de status. Senão, a barra de status é escondida.

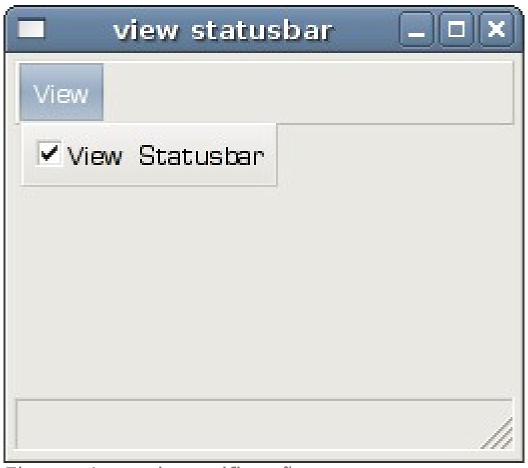


Figura: Item de verificação

Uma barra de ferramentas

Comandos de grupos de menu que podemos usar em aplicação. Barra de ferramentas fornecem um rápido acesso aos commandos mais frequentemente usados.

```
#include <gtk/gtk.h>

int main( int argc, char *argv[])
{
  GtkWidget *window;
  GtkWidget *vbox;
  GtkWidget *toolbar;
  GtkToolItem *new;
  GtkToolItem *open;
  GtkToolItem *save;
  GtkToolItem *sep;
  GtkToolItem *exit;


  gtk_init(&argc, &argv);
  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 250, 200);
  gtk_window_set_title(GTK_WINDOW(window), "toolbar");

  vbox = gtk_vbox_new(FALSE, 0);
  gtk_container_add(GTK_CONTAINER(window), vbox);


  toolbar = gtk_toolbar_new();
  gtk_toolbar_set_style(GTK_TOOLBAR(toolbar), GTK_TOOLBAR_ICONS);

  gtk_container_set_border_width(GTK_CONTAINER(toolbar), 2);

  new = gtk_tool_button_new_from_stock(GTK_STOCK_NEW);
  gtk_toolbar_insert(GTK_TOOLBAR(toolbar), new, -1);
```

```
    open = gtk_tool_button_new_from_stock(GTK_STOCK_OPEN);
    gtk_toolbar_insert(GTK_TOOLBAR(toolbar), open, -1);

    save = gtk_tool_button_new_from_stock(GTK_STOCK_SAVE);
    gtk_toolbar_insert(GTK_TOOLBAR(toolbar), save, -1);

    sep = gtk_separator_tool_item_new();
    gtk_toolbar_insert(GTK_TOOLBAR(toolbar), sep, -1);

    exit = gtk_tool_button_new_from_stock(GTK_STOCK_QUIT);
    gtk_toolbar_insert(GTK_TOOLBAR(toolbar), exit, -1);

    gtk_box_pack_start(GTK_BOX(vbox), toolbar, FALSE, FALSE, 5);

    g_signal_connect(G_OBJECT(exit), "clicked",
          G_CALLBACK(gtk_main_quit), NULL);

    g_signal_connect_swapped(G_OBJECT(window), "destroy",
          G_CALLBACK(gtk_main_quit), NULL);

    gtk_widget_show_all(window);

    gtk_main();
    return 0;
  }
```

O exemplo cria uma simples barra de ferramentas.

```
  toolbar = gtk_toolbar_new();
  gtk_toolbar_set_style(GTK_TOOLBAR(toolbar), GTK_TOOLBAR_ICONS)
```

Criamos uma nova barra de ferramentas. Especificamos que a barra mostra apenas ícones. Sem texto.

```
 new = gtk_tool_button_new_from_stock(GTK_STOCK_NEW);
 gtk_toolbar_insert(GTK_TOOLBAR(toolbar), new, -1);
```

Criamos um botão a partir de um estoque de botões. Os botões da barra de ferramentas sao inseridos na barra através da função de chamada **gtk_toolbar_insert()**.

```
 sep = gtk_separator_tool_item_new();
 gtk_toolbar_insert(GTK_TOOLBAR(toolbar), sep, -1);
```

Aqui inserimos um separados na barra de ferramentas.

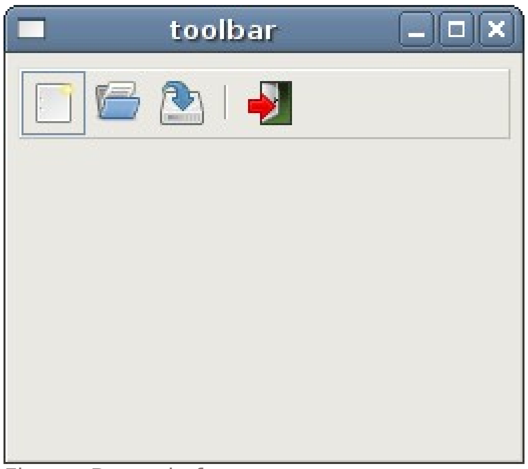


Figura: Barra de ferramentas.

Desfaz refaz

O próximo exemplo demonstra, como podemos desativar botões da barra de ferramentas sobre ela. É uma prática comum em programação GUI. Por exemplo o botão salvar. Se salvamos todas as mudanças de nosso documento em disco, o botão de salvar é inativado na maioria dos editors de texto. Isto é uma forma da aplicação indicar ao usuário que todas as mudanças são salvas.

```
#include <gtk/gtk.h>
#include <string.h>


void undo_redo(GtkWidget *widget,  gpointer item)
{
  static int count = 2;
  const char *name = gtk_widget_get_name(widget);

  if ( strcmp(name, "undo") ) {
    count++;
  } else {
    count--;
  }

  if (count < 0) {
     gtk_widget_set_sensitive(widget, FALSE);
     gtk_widget_set_sensitive(item, TRUE);
  }

  if (count > 5) {
     gtk_widget_set_sensitive(widget, FALSE);
     gtk_widget_set_sensitive(item, TRUE);
  }
}


int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *vbox;

  GtkWidget *toolbar;
  GtkToolItem *undo;
  GtkToolItem *redo;
  GtkToolItem *sep;
```

```
   GtkToolItem *exit;


   gtk_init(&argc, &argv);

   window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
   gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
   gtk_window_set_default_size(GTK_WINDOW(window), 250, 200);
   gtk_window_set_title(GTK_WINDOW(window), "undoredo");

   vbox = gtk_vbox_new(FALSE, 0);
   gtk_container_add(GTK_CONTAINER(window), vbox);


   toolbar = gtk_toolbar_new();
   gtk_toolbar_set_style(GTK_TOOLBAR(toolbar), GTK_TOOLBAR_ICONS);

   gtk_container_set_border_width(GTK_CONTAINER(toolbar), 2);

   undo = gtk_tool_button_new_from_stock(GTK_STOCK_UNDO);
   gtk_widget_set_name(GTK_WIDGET(undo), "undo");
   gtk_toolbar_insert(GTK_TOOLBAR(toolbar), undo, -1);

   redo = gtk_tool_button_new_from_stock(GTK_STOCK_REDO);
   gtk_toolbar_insert(GTK_TOOLBAR(toolbar), redo, -1);

   sep = gtk_separator_tool_item_new();
   gtk_toolbar_insert(GTK_TOOLBAR(toolbar), sep, -1);

   exit = gtk_tool_button_new_from_stock(GTK_STOCK_QUIT);
   gtk_toolbar_insert(GTK_TOOLBAR(toolbar), exit, -1);

   gtk_box_pack_start(GTK_BOX(vbox), toolbar, FALSE, FALSE, 5);


   g_signal_connect(G_OBJECT(undo), "clicked",
         G_CALLBACK(undo_redo), redo);

   g_signal_connect(G_OBJECT(redo), "clicked",
         G_CALLBACK(undo_redo), undo);

   g_signal_connect(G_OBJECT(exit), "clicked",
         G_CALLBACK(gtk_main_quit), NULL);

   g_signal_connect_swapped(G_OBJECT(window), "destroy",
         G_CALLBACK(gtk_main_quit), NULL);

   gtk_widget_show_all(window);

   gtk_main();

   return 0;
 }
```

Nosso exemplo cria botões desfaz e refaz através de recursos preexistente em GTK+. Após diversos cliques, cada um dos botões é inativado. Os botões tornam-se não selecionáveis.

```
 if (count < 0) {
    gtk_widget_set_sensitive(widget, FALSE);
    gtk_widget_set_sensitive(item, TRUE);
 }

 if (count > 5) {
    gtk_widget_set_sensitive(widget, FALSE);
    gtk_widget_set_sensitive(item, TRUE);
```

```
}
```

A função de chamada **gtk_widget_set_sensitive()** é usada para ativar/desativar os botões da barra de ferramentas.

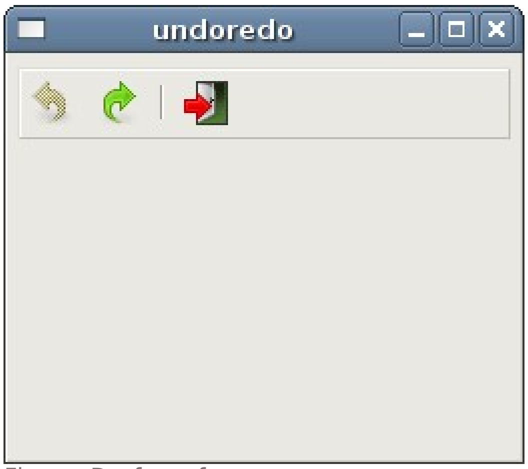


Figura: Desfaz refaz

GTK+ gerenciamento de layout

Nesta parte do tutorial mostraremos como export nossos widgets em janelas ou em diálogos.

Quando projetamos nossa aplicação GUI, decidimos quais e como usaremos e organizaremos nossos widgets na aplicação. Para organizá-los, usamos widgets especializados não visíveis chamados de **layout containers (uma espécie de recipiente)**. Neste capítulo mencionaremos **GtkAlignment**, **GtkFixed**, **GtkVBox** e **GtkTable**.

GtkFixed

O recipiente **GtkFixed** é o lugar em que widgets filhos são fixados com posição e tamanhos próprios. Este recipiente

container places child widgets at fixed positions and with fixed sizes. Este recipiente não executa nenhum gerenciamento de layout. Em muitas aplicações, nós não usamos o GtkFixed. Existem algumas áreas especializadas onde usamos. Por exemplo jogos, aplicações especializadas que trabalham com diagramas, componentes manipuláveis que podem ser movidos (como um gráfico em um aplicativo de planilha), pequenos exemplos educacionais.

```
#include <gtk/gtk.h>

int main( int argc, char *argv[])
{
  GtkWidget *window;
  GtkWidget *fixed;

  GtkWidget *button1;
  GtkWidget *button2;
  GtkWidget *button3;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_title(GTK_WINDOW(window), "GtkFixed");
  gtk_window_set_default_size(GTK_WINDOW(window), 290, 200);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);

  fixed = gtk_fixed_new();
  gtk_container_add(GTK_CONTAINER(window), fixed);

  button1 = gtk_button_new_with_label("Button");
  gtk_fixed_put(GTK_FIXED(fixed), button1, 150, 50);
  gtk_widget_set_size_request(button1, 80, 35);

  button2 = gtk_button_new_with_label("Button");
  gtk_fixed_put(GTK_FIXED(fixed), button2, 15, 15);
  gtk_widget_set_size_request(button2, 80, 35);

  button3 = gtk_button_new_with_label("Button");
  gtk_fixed_put(GTK_FIXED(fixed), button3, 100, 100);
  gtk_widget_set_size_request(button3, 80, 35);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
      G_CALLBACK(gtk_main_quit), NULL);

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

Em nosso exemplo, criamos 3 botões e lugar onde podemos fixar suas coordenadas. Quando redimensionamos a janela da aplicação, os botões mantêm seus tamanhos e posições.

```
fixed = gtk_fixed_new();
```

Aqui um recipiente **GtkFixed** widget é criado.

```
 gtk_fixed_put(GTK_FIXED(fixed), button1, 150, 50);
```

o primeiro botão é colocado usando a função **gtk_fixed_put()** com as coordenadas x=150, y=50.

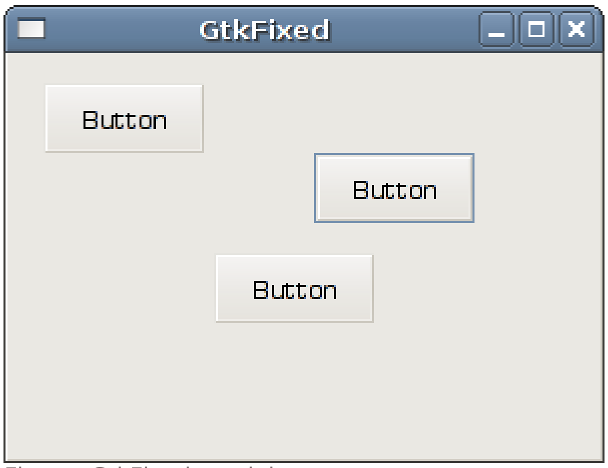


Figura: GtkFixado recipiente

GtkVBox

GtkVBox é uma de recipiente vertical. Ele coloca o que é um widget filho em uma única coluna. **GtkHBox** é muito semelhante só que este coloca os widgets filhos em uma única linha.

```
#include <gtk/gtk.h>


int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *vbox;

  GtkWidget *settings;
  GtkWidget *accounts;
  GtkWidget *loans;
  GtkWidget *cash;
  GtkWidget *debts;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 230, 250);
  gtk_window_set_title(GTK_WINDOW(window), "GtkVBox");
  gtk_container_set_border_width(GTK_CONTAINER(window), 5);

  vbox = gtk_vbox_new(TRUE, 1);
  gtk_container_add(GTK_CONTAINER(window), vbox);

  settings = gtk_button_new_with_label("Settings");
  accounts = gtk_button_new_with_label("Accounts");
  loans = gtk_button_new_with_label("Loans");
  cash = gtk_button_new_with_label("Cash");
  debts = gtk_button_new_with_label("Debts");

  gtk_box_pack_start(GTK_BOX(vbox), settings, TRUE, TRUE, 0);
  gtk_box_pack_start(GTK_BOX(vbox), accounts, TRUE, TRUE, 0);
  gtk_box_pack_start(GTK_BOX(vbox), loans, TRUE, TRUE, 0);
  gtk_box_pack_start(GTK_BOX(vbox), cash, TRUE, TRUE, 0);
  gtk_box_pack_start(GTK_BOX(vbox), debts, TRUE, TRUE, 0);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), G_OBJECT(window));

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

Este exemplo mostra um **GtkVBox** em ação. Ele empacota 5 botões em uma coluna. Se redimensionarmos a janela de nossa aplicação, os widgets filhos serão redimensionados também.

```
vbox = gtk_vbox_new(TRUE, 1);
```

O **GtkVBox** é criado. Setamos o parâmetros homogêneo para TRUE. Isto significa que todos os nossos botões terão o mesmo tamanho. O espaçamento entre widgets é setado para 1 pixel.

```
 gtk_box_pack_start(GTK_BOX(vbox), settings, TRUE, TRUE, 0);
```

Empacotamos um botão de ajuestes no recipiente. Os dois parâmetros são o recipiente e o widget filho. Os próximos três parâmetros são expansão, preenchimento e estofamento. Note que o parâmetro de preenchimento não tem efeito, o de expansão é setado para FALSO. Similarmente, o parâmetro de expansão não tem efeito se criarmos um recipiente com parâmetro homogeneous TRUE.

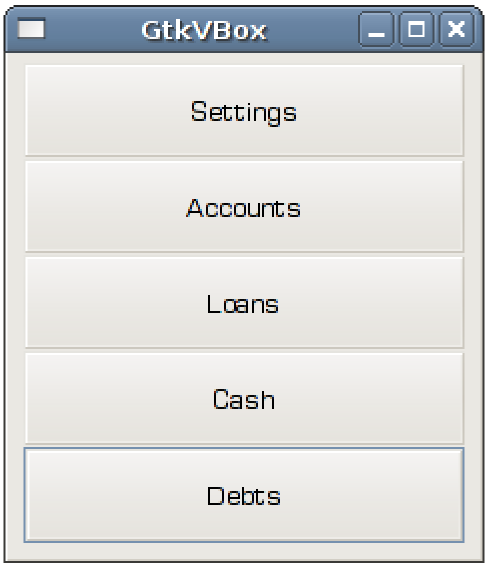


Figure: GtkVBox recipiente

GtkTabela

O widget **GtkTable** arruma widgets em linhas e colunas.

```
#include <gtk/gtk.h>


int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *table;
  GtkWidget *button;

  char *values[16] = { "7", "8", "9", "/",
     "4", "5", "6", "*",
     "1", "2", "3", "-",
     "0", ".", "=", "+"
  };

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 250, 180);
  gtk_window_set_title(GTK_WINDOW(window), "GtkTable");

  gtk_container_set_border_width(GTK_CONTAINER(window), 5);

  table = gtk_table_new(4, 4, TRUE);
  gtk_table_set_row_spacings(GTK_TABLE(table), 2);
  gtk_table_set_col_spacings(GTK_TABLE(table), 2);
  int i = 0;
  int j = 0;
  int pos = 0;

  for( i=0; i < 4; i++) {
    for( j=0; j < 4; j++) {
      button = gtk_button_new_with_label(values[pos]);
      gtk_table_attach_defaults(GTK_TABLE(table), button, j, j+1, i,
i+1 );
      pos++;
    }
  }

  gtk_container_add(GTK_CONTAINER(window), table);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), G_OBJECT(window));

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

Neste exemplo, criamos um set de botões que vemos em calculadoras.

```
table = gtk_table_new(4, 4, TRUE);
```

Criamos um novo **GtkTable** widget com 4 linhas e 4 colunas.

```
gtk_table_set_row_spacings(GTK_TABLE(table), 2);
gtk_table_set_col_spacings(GTK_TABLE(table), 2);
```

Aqui damos um pouco de espaço entre toda linha e toda coluna.

```
for( i=0; i < 4; i++) {
  for( j=0; j < 4; j++) {
    button = gtk_button_new_with_label(values[pos]);
    gtk_table_attach_defaults(GTK_TABLE(table), button, j, j+1, i, i+1 );
    pos++;
  }
}
```

Este código cria 16 botões e lugares para eles no recipiente.

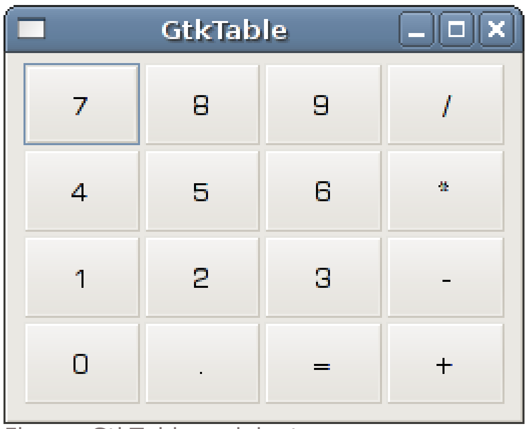


Figure: GtkTable recipiente

GtkAlinhamento

O recipiente **GtkAlignment** controla o alinhamento e o tamanho dos widget filhos.

```
#include <gtk/gtk.h>


int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *ok;
  GtkWidget *close;

  GtkWidget *vbox;
  GtkWidget *hbox;
  GtkWidget *halign;
  GtkWidget *valign;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 350, 200);
  gtk_window_set_title(GTK_WINDOW(window), "GtkAlignment");
  gtk_container_set_border_width(GTK_CONTAINER(window), 10);

  vbox = gtk_vbox_new(FALSE, 5);

  valign = gtk_alignment_new(0, 1, 0, 0);
  gtk_container_add(GTK_CONTAINER(vbox), valign);
  gtk_container_add(GTK_CONTAINER(window), vbox);

  hbox = gtk_hbox_new(TRUE, 3);

  ok = gtk_button_new_with_label("OK");
  gtk_widget_set_size_request(ok, 70, 30);
  gtk_container_add(GTK_CONTAINER(hbox), ok);
  close = gtk_button_new_with_label("Close");
  gtk_container_add(GTK_CONTAINER(hbox), close);

  halign = gtk_alignment_new(1, 0, 0, 0);
  gtk_container_add(GTK_CONTAINER(halign), hbox);

  gtk_box_pack_start(GTK_BOX(vbox), halign, FALSE, FALSE, 0);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), G_OBJECT(window));

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

Neste exemplo, colocamos dois botões no canto inferior direito da janela. Para realizar isso, usamos uma caixa horizontal e outra vertical e 2 recipientes de alinhamento.

```
valign = gtk_alignment_new(0, 1, 0, 0);
```

Isto irá colocar o widget filho no botão.

```
gtk_container_add(GTK_CONTAINER(vbox), valign);
```

Aqui colocamos o widget de alinhamento na caixa vertical.

```
hbox = gtk_hbox_new(TRUE, 3);

ok = gtk_button_new_with_label("OK");
gtk_widget_set_size_request(ok, 70, 30);
gtk_container_add(GTK_CONTAINER(hbox), ok);
close = gtk_button_new_with_label("Close");
gtk_container_add(GTK_CONTAINER(hbox), close);
```

Criamos uma caixa horizontal e colocamos 2 botoões dentro dela.

```
halign = gtk_alignment_new(1, 0, 0, 0);
gtk_container_add(GTK_CONTAINER(halign), hbox);

gtk_box_pack_start(GTK_BOX(vbox), halign, FALSE, FALSE, 0);
```

Isto cria um recipiente de alinhamento que irá colocar o widget filho à direita. Adicionamos a caixa horizontal no recipiente de alinhamento e enpacotamos o recipiente na caixa vertical. Devemos ter em mente que o reservatório de alinhamento tem apenas um Widget filho. É por isso que devemos usar caixas.

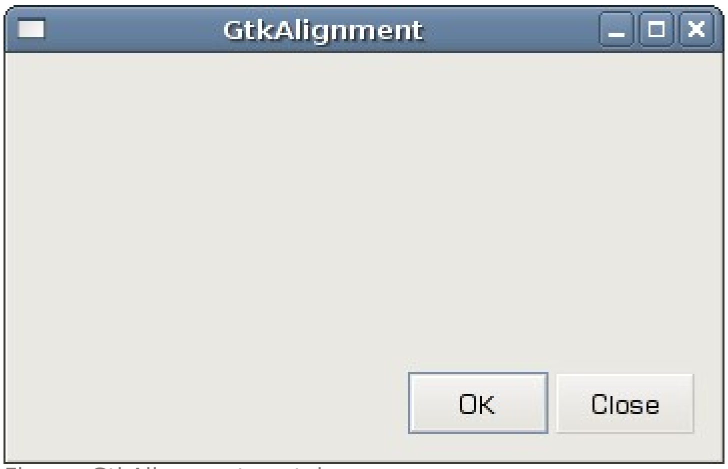


Figure: GtkAlignment container

Janelas

Em seguida vamos criar um exemplo mais avançado. Nós mostramos uma janela, que pode ser encontrado no IDE Jdeveloper.

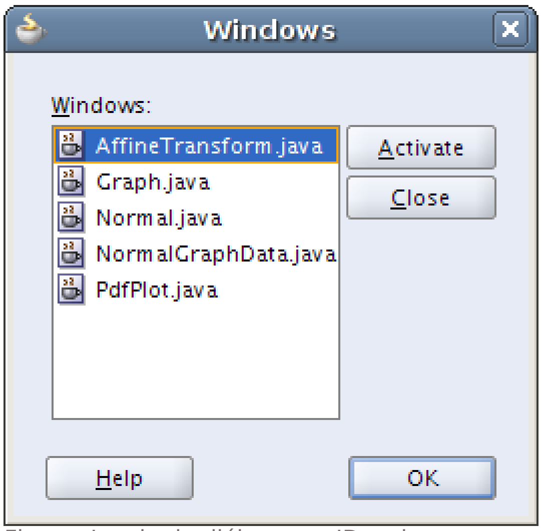


Figure: Janela de diálogo em JDeveloper

O diálogo mostra todas as janelas abertas, ou mais precisamente, guias na aplicação Jdeveloper.

```
#include <gtk/gtk.h>



int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *table;

  GtkWidget *title;
  GtkWidget *activate;
  GtkWidget *halign;
  GtkWidget *halign2;

  GtkWidget *valign;
  GtkWidget *close;
  GtkWidget *wins;

  GtkWidget *help;
  GtkWidget *ok;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_widget_set_size_request (window, 300, 250);
  gtk_window_set_resizable(GTK_WINDOW(window), FALSE);

  gtk_window_set_title(GTK_WINDOW(window), "Windows");

  gtk_container_set_border_width(GTK_CONTAINER(window), 15);

  table = gtk_table_new(8, 4, FALSE);
  gtk_table_set_col_spacings(GTK_TABLE(table), 3);

  title = gtk_label_new("Windows");
  halign = gtk_alignment_new(0, 0, 0, 0);
  gtk_container_add(GTK_CONTAINER(halign), title);
  gtk_table_attach(GTK_TABLE(table), halign, 0, 1, 0, 1,
      GTK_FILL, GTK_FILL, 0, 0);
```

```
    wins = gtk_text_view_new();
    gtk_text_view_set_editable(GTK_TEXT_VIEW(wins), FALSE);
    gtk_text_view_set_cursor_visible(GTK_TEXT_VIEW(wins), FALSE);
    gtk_table_attach(GTK_TABLE(table), wins, 0, 2, 1, 3,
        GTK_FILL | GTK_EXPAND, GTK_FILL | GTK_EXPAND, 1, 1);

    activate = gtk_button_new_with_label("Activate");
    gtk_widget_set_size_request(activate, 50, 30);
    gtk_table_attach(GTK_TABLE(table), activate, 3, 4, 1, 2,
        GTK_FILL, GTK_SHRINK, 1, 1);

    valign = gtk_alignment_new(0, 0, 0, 0);
    close = gtk_button_new_with_label("Close");

    gtk_widget_set_size_request(close, 70, 30);
    gtk_container_add(GTK_CONTAINER(valign), close);
    gtk_table_set_row_spacing(GTK_TABLE(table), 1, 3);
    gtk_table_attach(GTK_TABLE(table), valign, 3, 4, 2, 3,
        GTK_FILL, GTK_FILL | GTK_EXPAND, 1, 1);

    halign2 = gtk_alignment_new(0, 1, 0, 0);
    help = gtk_button_new_with_label("Help");
    gtk_container_add(GTK_CONTAINER(halign2), help);
    gtk_widget_set_size_request(help, 70, 30);
    gtk_table_set_row_spacing(GTK_TABLE(table), 3, 6);
    gtk_table_attach(GTK_TABLE(table), halign2, 0, 1, 4, 5,
        GTK_FILL, GTK_FILL, 0, 0);

    ok = gtk_button_new_with_label("OK");
    gtk_widget_set_size_request(ok, 70, 30);
    gtk_table_attach(GTK_TABLE(table), ok, 3, 4, 4, 5,
        GTK_FILL, GTK_FILL, 0, 0);

    gtk_container_add(GTK_CONTAINER(window), table);

    g_signal_connect_swapped(G_OBJECT(window), "destroy",
          G_CALLBACK(gtk_main_quit), G_OBJECT(window));

    gtk_widget_show_all(window);
    gtk_main();

    return 0;
}
```

Este código mostra como que podemos criar uma janela similar em GTK+.

```
table = gtk_table_new(8, 4, FALSE);
```

Usamos um recipiente de tabela.

```
title = gtk_label_new("Windows");
halign = gtk_alignment_new(0, 0, 0, 0);
gtk_container_add(GTK_CONTAINER(halign), title);
gtk_table_attach(GTK_TABLE(table), halign, 0, 1, 0, 1,
    GTK_FILL, GTK_FILL, 0, 0);
```

Este código cria uma etiqueta que é alinhado para à esquerda. A etiqueta é colocada na primeira linha do recipiente **GtkTable.**

```
wins = gtk_text_view_new();
gtk_text_view_set_editable(GTK_TEXT_VIEW(wins), FALSE);
gtk_text_view_set_cursor_visible(GTK_TEXT_VIEW(wins), FALSE);
gtk_table_attach(GTK_TABLE(table), wins, 0, 2, 1, 3,
    GTK_FILL | GTK_EXPAND, GTK_FILL | GTK_EXPAND, 1, 1);
```

O próximo texto mostra duas linhas e duas colunas. Nós fazemos o widget não editável e escondemos o cursor.

```
 valign = gtk_alignment_new(0, 0, 0, 0);
 close = gtk_button_new_with_label("Close");

 gtk_widget_set_size_request(close, 70, 30);
 gtk_container_add(GTK_CONTAINER(valign), close);
 gtk_table_set_row_spacing(GTK_TABLE(table), 1, 3);
 gtk_table_attach(GTK_TABLE(table), valign, 3, 4, 2, 3,
     GTK_FILL, GTK_FILL | GTK_EXPAND, 1, 1);
```

Nós colocamos o botão de fechar próximo ao widget de texto na quarta coluna. (contamos a partir do zero) Adicionamos o botão ao widget de alinhamento, para que possamos alinhar para o topo.

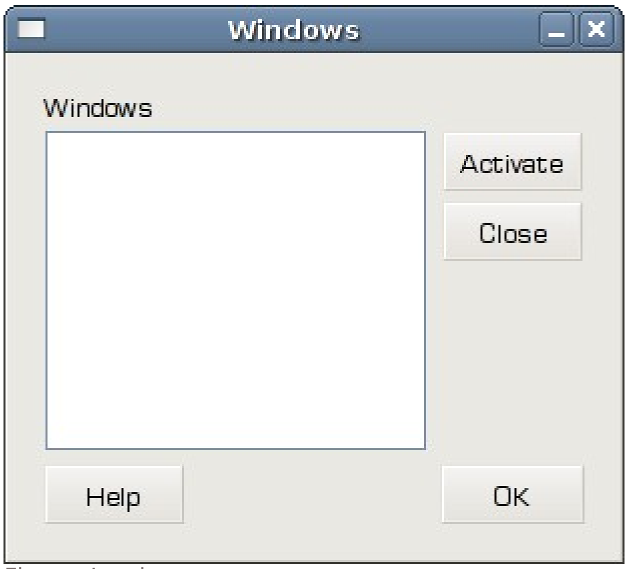


Figure: Janelas

GTK+ eventos e sinais

Nesta parte do tutorial vamos falar sobre o sistema de eventos na biblioteca GTK+.

A biblioteca GTK+ é um sistema orientado a eventos. Todas as aplicações GUI são orientadas a eventos. As aplicações iniciam um loop principal, que verifica continuamente por eventos recém-gerados. Se não existe evento, a aplicação espera e não faz nada. Um GTK+ **evento** é uma mensagem do servidor X. Quando o evento atinge um widget, ele pode reagir a este evento através da emissão de um **sinal**. O programador GTK+ pode ligar uma **callback (chamada)** específica para um sinal. O callback é uma função de manipulador que reage a um sinal.

```
#include <gtk/gtk.h>
void button_clicked(GtkWidget *widget, gpointer data)
{
  g_print("clicked\n");
}

int main( int argc, char *argv[])
{
  GtkWidget *window;
  GtkWidget *fixed;
  GtkWidget *button;

  gtk_init(&argc, &argv);
  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_title(GTK_WINDOW(window), "GtkButton");
  gtk_window_set_default_size(GTK_WINDOW(window), 230, 150);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);

  fixed = gtk_fixed_new();
  gtk_container_add(GTK_CONTAINER(window), fixed);

  button = gtk_button_new_with_label("Click");
  gtk_fixed_put(GTK_FIXED(fixed), button, 50, 50);
  gtk_widget_set_size_request(button, 80, 35);

  g_signal_connect(G_OBJECT(button), "clicked",
      G_CALLBACK(button_clicked), NULL);

  g_signal_connect(G_OBJECT(window), "destroy",
      G_CALLBACK(gtk_main_quit), NULL);

  gtk_widget_show_all(window);

  gtk_main();
  return 0;
}
```

Em nosso aplicação, temos 2 sinais. O sinal **clicked (clicado)** e o **destroy (destruir)**.

```
g_signal_connect(G_OBJECT(button), "clicked",
    G_CALLBACK(button_clicked), NULL);
```

Nós usamos a função **g_signal_connect()** para ligar o sinal clicado para a chamada **button_clicked()**.

```
void button_clicked(GtkWidget *widget, gpointer data)
{
  g_print("clicked\n");
}
```

A chamada irá mostrar o texto "clicked" no console. O primeiro parâmetro da função de chamada é o objeto que emitiu o sinal. Em nosso caso é o botão Click. O Segundo parâmetro é opcional. Nós podemos enviar alguns dados para a chamada. Em nosso caso, nós não enviamos nenhum dado. Enviamos um parâmetro NULL para a função g_signal_connect().

```
g_signal_connect(G_OBJECT(window), "destroy",
     G_CALLBACK(gtk_main_quit), NULL);
```

Se nós pressionarmos o botão x localizado no canto superior direito da barra de título, ou pressionarmos Atl + F4, um sinal **destroy** é emtido. Chamamos a função**gtk_main_quit()**, que irá terminar a aplicação.

Movendo janela

O próximo exemplo mostra como nós reagimos ao mover os eventos de uma janela.

```
#include <gtk/gtk.h>

void frame_callback(GtkWindow *window,
      GdkEvent *event, gpointer data)
{
   int x, y;
   char buf[10];
   x = event->configure.x;
   y = event->configure.y;
   sprintf(buf, "%d, %d", x, y);
   gtk_window_set_title(window, buf);
}


int main(int argc, char *argv[])
{
  GtkWidget *window;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 230, 150);
  gtk_window_set_title(GTK_WINDOW(window), "Simple");
  gtk_widget_add_events(GTK_WIDGET(window), GDK_CONFIGURE);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), G_OBJECT(window));

  g_signal_connect(G_OBJECT(window), "configure-event",
        G_CALLBACK(frame_callback), NULL);

  gtk_widget_show(window);
  gtk_main();

  return 0;
}
```

No exemplo, vamos mostrar a atual posição do canto superior esquerdo da nossa janela na barra de título.

```
gtk_widget_add_events(GTK_WIDGET(window), GDK_CONFIGURE);
```

A máscara de eventos do widget determina que tipo de evento vai receber um elemento específico. Alguns eventos são preconfigurados, outros eventos precisam ser adicionados à máscara de eventos. A **gtk_widget_add_events()** adiciona um tipo de evento **GDK_CONFIGURE** para a máscara. O tipo de evento **GDK_CONFIGURE** conta por todos os tamanhos, posições e ordem dos eventos empilhados.

```
g_signal_connect(G_OBJECT(window), "configure-event",
    G_CALLBACK(frame_callback), NULL);
```

A **configure-event** é emitido para tamanho, posição e pilha de ordem dos eventos.

```
void frame_callback(GtkWindow *window,
    GdkEvent *event, gpointer data)
{
  int x, y;
  char buf[10];
  x = event->configure.x;
  y = event->configure.y;
  sprintf(buf, "%d, %d", x, y);
  gtk_window_set_title(window, buf);
}
```

A função de callback tem três parâmetros. O objeto que emitiu o sinal, **GdkEvent** e os dados opcionais. Nós determinamos a x, y posições e ajustá-lo ao título.

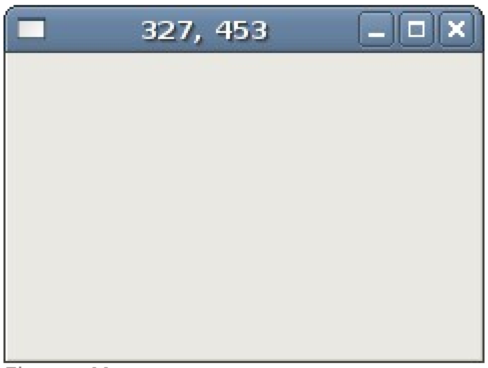


Figure: Mover evento

A entrada de sinal

O próximo exemplo mostra como que reagimos a uma entrada de sinal **(enter)**. A entrada de sinal é emitida quando entramos na área de um widget com o ponteiro do mouse.

```
#include <gtk/gtk.h>


void enter_button(GtkWidget *widget, gpointer data)
{
  GdkColor color;
  color.red = 27000;
  color.green = 30325;
  color.blue = 34181;
  gtk_widget_modify_bg(widget, GTK_STATE_PRELIGHT, &color);
}


int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *fixed;
  GtkWidget *button;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 230, 150);
  gtk_window_set_title(GTK_WINDOW(window), "enter signal");

  fixed = gtk_fixed_new();
  gtk_container_add(GTK_CONTAINER(window), fixed);
  button = gtk_button_new_with_label("Button");
  gtk_widget_set_size_request(button, 80, 35);
  gtk_fixed_put(GTK_FIXED(fixed), button, 50, 50);

  g_signal_connect(G_OBJECT(button), "enter",
      G_CALLBACK(enter_button), NULL);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
      G_CALLBACK(gtk_main_quit), NULL);

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

Nós vamos mudar a cor de fundo do elemento de botão, uma vez que passe um ponteiro do mouse sobre ele.

```
 g_signal_connect(G_OBJECT(button), "enter",
    G_CALLBACK(enter_button), NULL);
```

Nós chamamos a função de usuário **enter_button()** quando a entrada de sinal (**enter** signal) ocorre.

```
 GdkColor color;
color.red = 27000;
color.green = 30325;
color.blue = 34181;
gtk_widget_modify_bg(widget, GTK_STATE_PRELIGHT, &color);
```

Dentro da chamada, mudamos o fundo do botão, chamando a fuunção **gtk_widget_modify_bg()**.

Desligar uma chamada

Nós podemos desligar uma chamada de um sinal. Próximo código demonstra um caso.

```
#include <gtk/gtk.h>


int handler_id;

void button_clicked(GtkWidget *widget, gpointer data)
{
  g_print("clicked\n");
}

void toogle_signal(GtkWidget *widget, gpointer window)
{
  if (gtk_toggle_button_get_active(GTK_TOGGLE_BUTTON(widget))) {
     handler_id = g_signal_connect(G_OBJECT(window), "clicked",
           G_CALLBACK(button_clicked), NULL);
  } else {
     g_signal_handler_disconnect(window, handler_id);
  }
}
```

```
int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *fixed;
  GtkWidget *button;
  GtkWidget *check;


  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 250, 150);
  gtk_window_set_title(GTK_WINDOW(window), "Disconnect");

  fixed = gtk_fixed_new();
  gtk_container_add(GTK_CONTAINER(window), fixed);

  button = gtk_button_new_with_label("Click");
  gtk_widget_set_size_request(button, 80, 30);
  gtk_fixed_put(GTK_FIXED(fixed), button, 30, 50);

  check = gtk_check_button_new_with_label("Connect");
  gtk_toggle_button_set_active(GTK_TOGGLE_BUTTON(check), TRUE);
  gtk_fixed_put(GTK_FIXED(fixed), check, 130, 50);

  handler_id = g_signal_connect(G_OBJECT(button), "clicked",
        G_CALLBACK(button_clicked), NULL);

  g_signal_connect(G_OBJECT(check), "clicked",
        G_CALLBACK(toogle_signal), (gpointer) button);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), NULL);

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

No código exemplo, temos um botão e uma caixa de seleção. A caixa de seleção liga ou desliga uma chamada (callback) de um sinal de clique de botão.

```
handler_id = g_signal_connect(G_OBJECT(button), "clicked",
    G_CALLBACK(button_clicked), NULL);
```

g_signal_connect() retorna um ID do manipulador que identifica a chamada.

```
if (gtk_toggle_button_get_active(GTK_TOGGLE_BUTTON(widget))) {
   handler_id = g_signal_connect(G_OBJECT(window), "clicked",
         G_CALLBACK(button_clicked), NULL);
} else {
   g_signal_handler_disconnect(window, handler_id);
}
```

Este código determina o estado da caixa de seleção. Ele liga a chamada se é clicada ou, caso contrário, desliga.

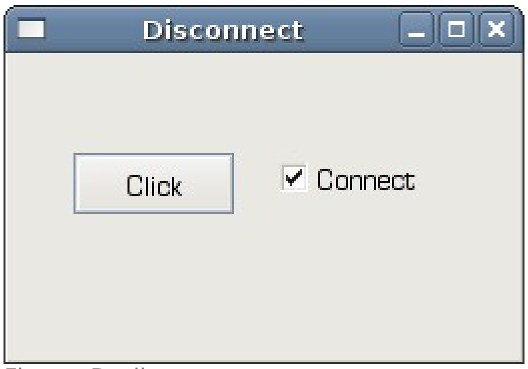


Figure: Desligar

Exemplo de arrasta e solta

No próximo exemplo, mostramos uma interessante característica. Mostraremos uma janela sem bordas e, como podemos arrastar e mover-se como uma janela.

```
#include <gtk/gtk.h>

gboolean on_button_press (GtkWidget* widget,
  GdkEventButton * event, GdkWindowEdge edge)
{
  if (event->type == GDK_BUTTON_PRESS)
  {
    if (event->button == 1) {
      gtk_window_begin_move_drag(GTK_WINDOW(gtk_widget_get_toplevel(widget
)),
          event->button,
        event->x_root,
        event->y_root,
        event->time);
    }
  }

  return FALSE;
}


int main( int argc, char *argv[])
{

  GtkWidget *window;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 230, 150);
  gtk_window_set_title(GTK_WINDOW(window), "Drag & drop");
  gtk_window_set_decorated(GTK_WINDOW (window), FALSE);
  gtk_widget_add_events(window, GDK_BUTTON_PRESS_MASK);

  g_signal_connect(G_OBJECT(window), "button-press-event",
      G_CALLBACK(on_button_press), NULL);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), G_OBJECT(window));
  gtk_widget_show(window);

  gtk_main();

  return 0;
}
```

O exemplo demonstra um arrasta e solta de uma janela sem borda.

```
gtk_window_set_decorated(GTK_WINDOW (window), FALSE);
```

Nós removemos a decoração da janela. Isto significa que a janela não terá bordas e barra de títulos.

```
  g_signal_connect(G_OBJECT(window), "button-press-event",
      G_CALLBACK(on_button_press), NULL);
```

Ligamos a janela ao sinal **button-press-event**.

```
gboolean on_button_press (GtkWidget* widget,
  GdkEventButton * event, GdkWindowEdge edge)
{
  if (event->type == GDK_BUTTON_PRESS)
  {
    if (event->button == 1) {
      gtk_window_begin_move_drag(GTK_WINDOW(gtk_widget_get_toplevel(widget)),
          event->button,
          event->x_root,
          event->y_root,
          event->time);
    }
  }

  return FALSE;
}
```

Dentro de **on_button_press()**, fazemos executar a operação de arrastar e soltar. Checamos se o botão esquerdo do mouse foi pressionado. Então chamamos a função **gtk_window_begin_move_drag().**

Exemplo de temporizador

O próximo código demonstra um exemplo de temporizador. Eles são usados quando temos algumas tarefas de repetição. Poderia ser um relógio, uma contagem regressiva, efeitos visuais e animações.

```
#include <cairo.h>
#include <gtk/gtk.h>
#include <time.h>


static char buffer[256];


static gboolean
on_expose_event(GtkWidget *widget,
    GdkEventExpose *event,
    gpointer data)
{
  cairo_t *cr;

  cr = gdk_cairo_create(widget->window);

  cairo_move_to(cr, 30, 30);
  cairo_show_text(cr, buffer);

  cairo_destroy(cr);

  return FALSE;
}

static gboolean
time_handler(GtkWidget *widget)
{
  if (widget->window == NULL) return FALSE;

  time_t curtime;
  struct tm *loctime;

  curtime = time(NULL);
  loctime = localtime(&curtime);
  strftime(buffer, 256, "%T", loctime);

  gtk_widget_queue_draw(widget);
  return TRUE;
}

int
main (int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *darea;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);

  darea = gtk_drawing_area_new();
  gtk_container_add(GTK_CONTAINER (window), darea);

  g_signal_connect(darea, "expose-event",
      G_CALLBACK(on_expose_event), NULL);
  g_signal_connect(window, "destroy",
      G_CALLBACK(gtk_main_quit), NULL);

  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 170, 100);

  gtk_window_set_title(GTK_WINDOW(window), "timer");
  g_timeout_add(1000, (GSourceFunc) time_handler, (gpointer) window);
  gtk_widget_show_all(window);
  time_handler(window);

  gtk_main();

  return 0;
}
```

Vamos mostrar uma hora local atual na janela. Usamos a biblioteca Cairo 2D.

```
g_signal_connect(darea, "expose-event",


    G_CALLBACK(on_expose_event), NULL);
```

Vamos desenhar o tempo dentro da chamada **on_expose_event()**. A chamada é conectada ao sinal **expose-event**. O sinal é emitido ,quando a janela vai ser redesenhada.

```
 g_timeout_add(1000, (GSourceFunc) time_handler, (gpointer) window);
```

Esta função registra o tempo. A função **time_handler()** é chamada repetidamente em intervalos regulares. Em nosso caso, a cada segundo. A função de temporizador é chamada até que ela retorne FALSE.

```
 time_handler(window);
```

Isto chama a função de temporizador imediatamente. Caso contrário haveria um atraso de segundo.

```
 cairo_t *cr;

cr = gdk_cairo_create(widget->window);

cairo_move_to(cr, 30, 30);
cairo_show_text(cr, buffer);

cairo_destroy(cr);
```

Este código desenha o tempo atual na janela. Para mais informações sobre a biblioteca Cairo 2D, veja: ZetCode's Cairo graphics tutorial.

```
 if (widget->window == NULL) return FALSE;
```

Quando a janela é destruída, pode acontecer que a função do temporizador seja chamada. Esta linha impedirá trabalho sobre widgets já destruídos.

```
 time_t curtime;
struct tm *loctime;

curtime = time(NULL);
loctime = localtime(&curtime);
strftime(buffer, 256, "%T", loctime);
```

Estas linhas determinam a hora local.

```
 gtk_widget_queue_draw(widget);
```

Isto invalidará a área da janela que emitirá o sinal **expose-event.**

GTK+ diólogos

Nesta parte do tutorial de programação em GTK+, introduziremos diálogos.

Janelas de diálogo ou diálogos são uma parte indispensável da maioria dos aplicativos de interface gráfica moderna. Um diálogo é definido como uma conversa entre duas ou mais pessoas. Em uma aplicação de computador uma caixa de diálogo é uma janela que é usada para "conversar" com o aplicativo. Uma caixa de diálogo é usada para entrada de dados, alterar dados, altere as configurações do aplicativo etc. Diálogos são um importante meio de comunicação entre um usuário e um programa de computador.

Diálogos de mensagem

Diálogos de mensagens são diálogos conveniente que oferecem mensagens para o usuário da aplicação. A mensagem é constituída por textos e dados de imagem.

```
#include <gtk/gtk.h>

void show_info(GtkWidget *widget, gpointer window)
{
  GtkWidget *dialog;
  dialog = gtk_message_dialog_new(window,
            GTK_DIALOG_DESTROY_WITH_PARENT,
            GTK_MESSAGE_INFO,
            GTK_BUTTONS_OK,
            "Download Completed", "title");
  gtk_window_set_title(GTK_WINDOW(dialog), "Information");
  gtk_dialog_run(GTK_DIALOG(dialog));
  gtk_widget_destroy(dialog);
}

void show_error(GtkWidget *widget, gpointer window)
{
  GtkWidget *dialog;
  dialog = gtk_message_dialog_new(window,
            GTK_DIALOG_DESTROY_WITH_PARENT,
            GTK_MESSAGE_ERROR,
            GTK_BUTTONS_OK,
            "Error loading file");
  gtk_window_set_title(GTK_WINDOW(dialog), "Error");
  gtk_dialog_run(GTK_DIALOG(dialog));
  gtk_widget_destroy(dialog);
}

void show_question(GtkWidget *widget, gpointer window)
{
  GtkWidget *dialog;
  dialog = gtk_message_dialog_new(window,
            GTK_DIALOG_DESTROY_WITH_PARENT,
            GTK_MESSAGE_QUESTION,
            GTK_BUTTONS_YES_NO,
            "Are you sure to quit?");
  gtk_window_set_title(GTK_WINDOW(dialog), "Question");
  gtk_dialog_run(GTK_DIALOG(dialog));
  gtk_widget_destroy(dialog);
}

void show_warning(GtkWidget *widget, gpointer window)
{
  GtkWidget *dialog;
  dialog = gtk_message_dialog_new(window,
            GTK_DIALOG_DESTROY_WITH_PARENT,
            GTK_MESSAGE_WARNING,
            GTK_BUTTONS_OK,
            "Unallowed operation");
  gtk_window_set_title(GTK_WINDOW(dialog), "Warning");
  gtk_dialog_run(GTK_DIALOG(dialog));
  gtk_widget_destroy(dialog);
}

int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *table;

  GtkWidget *info;
  GtkWidget *warn;
  GtkWidget *que;
  GtkWidget *err;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 220, 150);
  gtk_window_set_title(GTK_WINDOW(window), "Message dialogs");

  table = gtk_table_new(2, 2, TRUE);
  gtk_table_set_row_spacings(GTK_TABLE(table), 2);
  gtk_table_set_col_spacings(GTK_TABLE(table), 2);

  info = gtk_button_new_with_label("Info");
  warn = gtk_button_new_with_label("Warning");
  que = gtk_button_new_with_label("Question");
  err = gtk_button_new_with_label("Error");

  gtk_table_attach(GTK_TABLE(table), info, 0, 1, 0, 1,
      GTK_FILL, GTK_FILL, 3, 3);
  gtk_table_attach(GTK_TABLE(table), warn, 1, 2, 0, 1,
      GTK_FILL, GTK_FILL, 3, 3);
  gtk_table_attach(GTK_TABLE(table), que, 0, 1, 1, 2,
      GTK_FILL, GTK_FILL, 3, 3);
  gtk_table_attach(GTK_TABLE(table), err, 1, 2, 1, 2,
      GTK_FILL, GTK_FILL, 3, 3);

  gtk_container_add(GTK_CONTAINER(window), table);
  gtk_container_set_border_width(GTK_CONTAINER(window), 15);

  g_signal_connect(G_OBJECT(info), "clicked",
        G_CALLBACK(show_info), (gpointer) window);

  g_signal_connect(G_OBJECT(warn), "clicked",
        G_CALLBACK(show_warning), (gpointer) window);

  g_signal_connect(G_OBJECT(que), "clicked",
        G_CALLBACK(show_question), (gpointer) window);

  g_signal_connect(G_OBJECT(err), "clicked",
        G_CALLBACK(show_error), (gpointer) window);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), G_OBJECT(window));

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

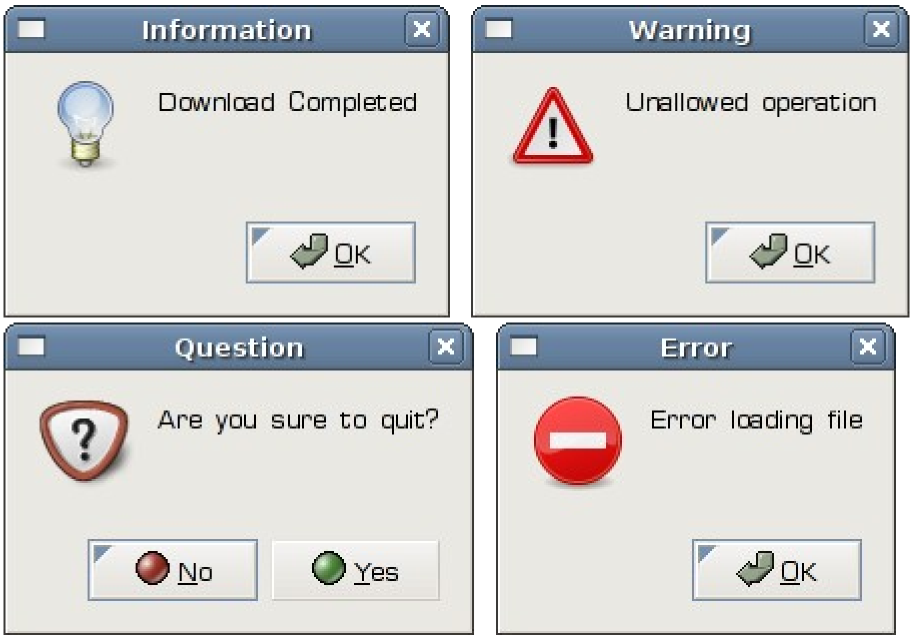
No nosso exemplo, vamos mostrar quatro tipos de janelas de mensagem. Informações, Aviso, perguntas e diálogos de mensagem de erro.

```
 GtkWidget *dialog;
dialog = gtk_message_dialog_new(window,
          GTK_DIALOG_DESTROY_WITH_PARENT,
          GTK_MESSAGE_QUESTION,
          GTK_BUTTONS_YES_NO,
          "Are you sure to quit?");
```

Na função show_question(), mostramos uma janela pop-up de mensagem de diálogo. A mensagem de diálogo é mostrada usando a chamada **gtk_message_dialog_new()**. Os parâmetros da função específica que tipo de mensagem de diálogo criamos. A constante **GTK_MESSAGE_QUESTION** cria tipo de diálogo de pergunta. A constante **GTK_BUTTONS_YES_NO** vai botões 'No' e 'Yes' no diálogo. O último parâmetro é o texto que apresentamos no diálogo.

```
gtk_window_set_title(GTK_WINDOW(dialog), "Warning");
gtk_dialog_run(GTK_DIALOG(dialog));
gtk_widget_destroy(dialog);
```

Aqui vamos definir um título para a mensagem de diálogo. E, finalmente, executá-los. Eles devem ser destruídos manualmente.



GtkAboutDialog

O GtkAboutDialog mostra informação sobre a aplicação. GtkAboutDialog pode mostrar uma logo, o nome da aplicação, versão, copyright, website ou informação de licença. É também possível dar os créditos dos autores, documentação, tradutores e artistas.

```
#include <gtk/gtk.h>


void show_about(GtkWidget *widget, gpointer data)
{

  GdkPixbuf *pixbuf = gdk_pixbuf_new_from_file("battery.png", NULL);

  GtkWidget *dialog = gtk_about_dialog_new();
  gtk_about_dialog_set_name(GTK_ABOUT_DIALOG(dialog), "Battery");
  gtk_about_dialog_set_version(GTK_ABOUT_DIALOG(dialog), "0.9");
  gtk_about_dialog_set_copyright(GTK_ABOUT_DIALOG(dialog),
      "(c) Jan Bodnar");
  gtk_about_dialog_set_comments(GTK_ABOUT_DIALOG(dialog),
     "Battery is a simple tool for battery checking.");
  gtk_about_dialog_set_website(GTK_ABOUT_DIALOG(dialog),
      "http://www.batteryhq.net");
  gtk_about_dialog_set_logo(GTK_ABOUT_DIALOG(dialog), pixbuf);
  g_object_unref(pixbuf), pixbuf = NULL;
  gtk_dialog_run(GTK_DIALOG (dialog));
  gtk_widget_destroy(dialog);
}


int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *about;
  GdkPixbuf *battery;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 220, 150);
  gtk_window_set_title(GTK_WINDOW(window), "Battery");

  gtk_container_set_border_width(GTK_CONTAINER(window), 15);
  gtk_widget_add_events(window, GDK_BUTTON_PRESS_MASK);

  battery = gtk_image_get_pixbuf(GTK_IMAGE(
      gtk_image_new_from_file("battery.png")));

  g_signal_connect(G_OBJECT(window), "button-press-event",
        G_CALLBACK(show_about), (gpointer) window);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), G_OBJECT(window));

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

O exemplo de código usa um GtkAboutDialog com algumas das suas características. Para mostrar o diálogo, clicamos na área cliente da janela.

```
GtkWidget *dialog = gtk_about_dialog_new();
```

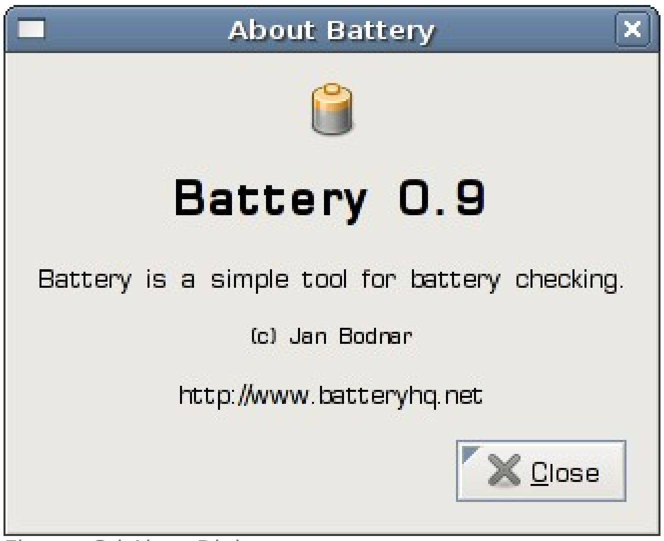
Criamos um novo GtkAboutDialog.

```
gtk_about_dialog_set_name(GTK_ABOUT_DIALOG(dialog), "Battery");
gtk_about_dialog_set_version(GTK_ABOUT_DIALOG(dialog), "0.9");
gtk_about_dialog_set_copyright(GTK_ABOUT_DIALOG(dialog),
     "(c) Jan Bodnar");
```

Estas funções de chamada definem um nome, versão e copyright.

```
GdkPixbuf *pixbuf = gdk_pixbuf_new_from_file("battery.png", NULL);
...
gtk_about_dialog_set_logo(GTK_ABOUT_DIALOG(dialog), pixbuf);
g_object_unref(pixbuf), pixbuf = NULL;
```

Este código cria uma logo.


About Battery

Battery 0.9

Battery is a simple tool for battery checking.

(c) Jan Bodnar

http://www.batteryhq.net

Figure: GtkAboutDialog

GtkFontSelectionDialog

O GtkFontSelectionDialog é um diálogo para selecionar fontes. Tipicamente usado em aplicativos que fazem edição de texto ou formatação.

```
#include <gtk/gtk.h>


void select_font(GtkWidget *widget, gpointer label)
{

  GtkResponseType result;

  GtkWidget *dialog = gtk_font_selection_dialog_new("Select Font");
  result = gtk_dialog_run(GTK_DIALOG(dialog));

  if (result == GTK_RESPONSE_OK || result == GTK_RESPONSE_APPLY)
  {

    PangoFontDescription *font_desc;
    gchar *fontname = gtk_font_selection_dialog_get_font_name(
                            GTK_FONT_SELECTION_DIALOG(dialog));

    font_desc = pango_font_description_from_string(fontname);

    gtk_widget_modify_font(GTK_WIDGET(label), font_desc);

    g_free(fontname);
   }


  gtk_widget_destroy(dialog);
}


int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *label;
  GtkWidget *vbox;

  GtkWidget *toolbar;
  GtkToolItem *font;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 280, 200);
  gtk_window_set_title(GTK_WINDOW(window), "Font Selection Dialog");

  vbox = gtk_vbox_new(FALSE, 0);
  gtk_container_add(GTK_CONTAINER(window), vbox);


  toolbar = gtk_toolbar_new();
  gtk_toolbar_set_style(GTK_TOOLBAR(toolbar), GTK_TOOLBAR_ICONS);

  gtk_container_set_border_width(GTK_CONTAINER(toolbar), 2);

  font = gtk_tool_button_new_from_stock(GTK_STOCK_SELECT_FONT);
  gtk_toolbar_insert(GTK_TOOLBAR(toolbar), font, -1);

  gtk_box_pack_start(GTK_BOX(vbox), toolbar, FALSE, FALSE, 5);

  label = gtk_label_new("ZetCode");
  gtk_label_set_justify(GTK_LABEL(label), GTK_JUSTIFY_CENTER);
  gtk_box_pack_start(GTK_BOX(vbox), label, TRUE, FALSE, 5);


  g_signal_connect(G_OBJECT(font), "clicked",
        G_CALLBACK(select_font), label);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), NULL);

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

In the code example, we put a simple label into the center of the window. We show a font selectin dialog by clicking on the toolbar button.

```
  GtkWidget *dialog = gtk_font_selection_dialog_new("Select Font");

  result = gtk_dialog_run(GTK_DIALOG(dialog));
```

We create and show the **GtkFontSelectionDialog.**

```
if (result == GTK_RESPONSE_OK || result == GTK_RESPONSE_APPLY)

{

  PangoFontDescription *font_desc;

  gchar *fontname = gtk_font_selection_dialog_get_font_name(
                           GTK_FONT_SELECTION_DIALOG(dialog));


  font_desc = pango_font_description_from_string(fontname);


  gtk_widget_modify_font(GTK_WIDGET(label), font_desc);

  g_free(fontname);

 }
```

If the user clicked on the OK or APPLY button, we proceed. We get the selected font name. Than we change the label's font to the selected font name.

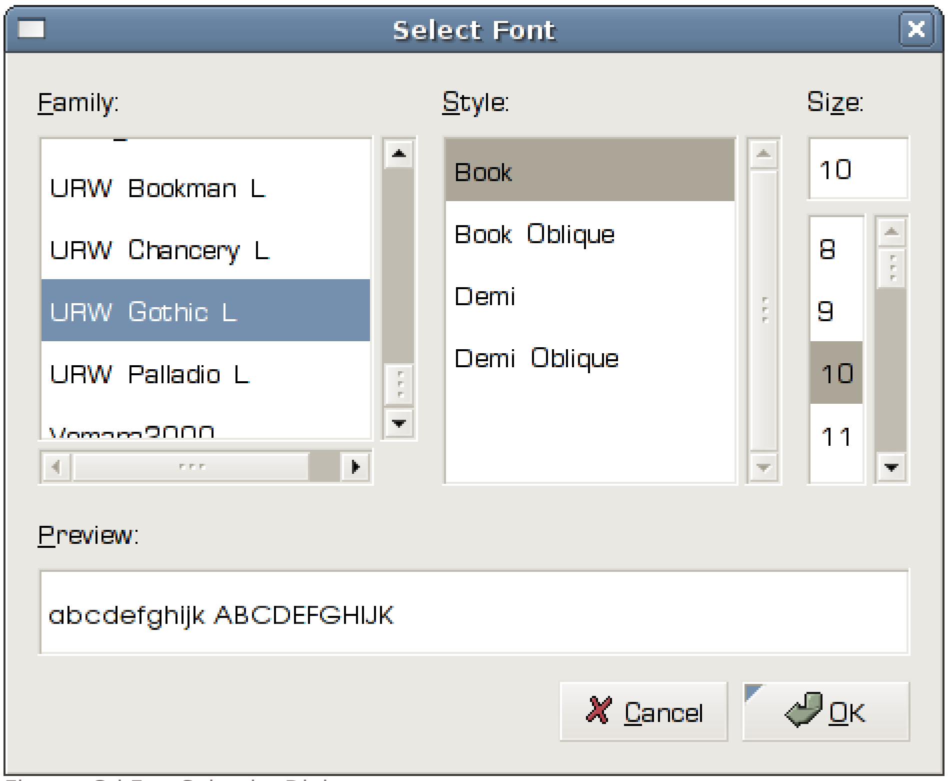


Figure: GtkFontSelectionDialog

GtkColorSelectionDialog

GtkColorSelectionDialog is a dialog for selecting a color.

```
#include <gtk/gtk.h>
```

```
void select_font(GtkWidget *widget, gpointer label)

{



  GtkResponseType result;

  GtkColorSelection *colorsel;



  GtkWidget *dialog = gtk_color_selection_dialog_new("Font Color");

  result = gtk_dialog_run(GTK_DIALOG(dialog));



  if (result == GTK_RESPONSE_OK)

  {



    GdkColor color;



    colorsel = GTK_COLOR_SELECTION(

                   GTK_COLOR_SELECTION_DIALOG(dialog)->colorsel);

    gtk_color_selection_get_current_color(colorsel,

                   &color);



    gtk_widget_modify_fg(GTK_WIDGET(label),

                   GTK_STATE_NORMAL,

                   &color);

  }
  gtk_widget_destroy(dialog);

}




int main( int argc, char *argv[])

{



  GtkWidget *window;

  GtkWidget *widget;

  GtkWidget *label;

  GtkWidget *vbox;



  GtkWidget *toolbar;

  GtkToolItem *font;




  gtk_init(&argc, &argv);



  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);

  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);

  gtk_window_set_default_size(GTK_WINDOW(window), 280, 200);

  gtk_window_set_title(GTK_WINDOW(window), "Color Selection
Dialog");



  vbox = gtk_vbox_new(FALSE, 0);
```

```
gtk_container_add(GTK_CONTAINER(window), vbox);



toolbar = gtk_toolbar_new();

gtk_toolbar_set_style(GTK_TOOLBAR(toolbar), GTK_TOOLBAR_ICONS);


gtk_container_set_border_width(GTK_CONTAINER(toolbar), 2);


font = gtk_tool_button_new_from_stock(GTK_STOCK_SELECT_COLOR);

gtk_toolbar_insert(GTK_TOOLBAR(toolbar), font, -1);


gtk_box_pack_start(GTK_BOX(vbox), toolbar, FALSE, FALSE, 5);


label = gtk_label_new("ZetCode");

gtk_label_set_justify(GTK_LABEL(label), GTK_JUSTIFY_CENTER);

gtk_box_pack_start(GTK_BOX(vbox), label, TRUE, FALSE, 5);



g_signal_connect(G_OBJECT(font), "clicked",

      G_CALLBACK(select_font), label);


g_signal_connect_swapped(G_OBJECT(window), "destroy",

      G_CALLBACK(gtk_main_quit), NULL);


gtk_widget_show_all(window);
```

```


   gtk_main();


   return 0;
 }
```

The example is very similar to the previous one. This time we change the color of the label.

```
GtkWidget *dialog = gtk_color_selection_dialog_new("Font Color");

result = gtk_dialog_run(GTK_DIALOG(dialog));
```

We create and show the **GtkColorSelectionDialog**.

```
if (result == GTK_RESPONSE_OK)

{

  GdkColor color;


  colorsel = GTK_COLOR_SELECTION(

                 GTK_COLOR_SELECTION_DIALOG(dialog)->colorsel);

  gtk_color_selection_get_current_color(colorsel,

                 &color);


  gtk_widget_modify_fg(GTK_WIDGET(label),

                 GTK_STATE_NORMAL,

                 &color);

}
```

If the user pressed OK, we get the color and modify the label's color.

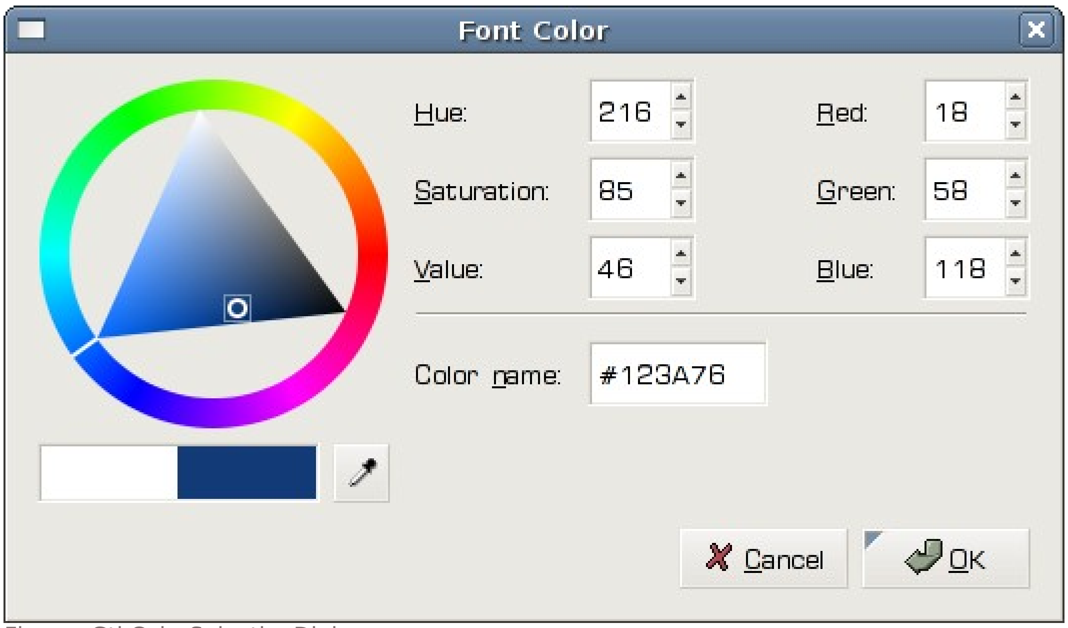


Figure: GtkColorSelectionDialog

GTK+ Widgets

In this part of the GTK+ programming tutorial, we will introduce some GTK+ widgets.

Widgets are basic building blocks of a GUI application. Over the years, several widgets became a standard in all toolkits on all OS platforms. For example a button, a check box or a scroll bar. The GTK+ toolkit's philosophy is to keep the number of widgets at a minimum level. More specialized widgets are created as custom GTK+ widgets.

GtkButton

GtkButton is a simple widget, that is used to trigger an action.

```
#include <gtk/gtk.h>



int main( int argc, char *argv[])

{

  GtkWidget *window;

  GtkWidget *fixed;

  GtkWidget *button;
```

```
gtk_init(&argc, &argv);


window = gtk_window_new(GTK_WINDOW_TOPLEVEL);

gtk_window_set_title(GTK_WINDOW(window), "GtkButton");

gtk_window_set_default_size(GTK_WINDOW(window), 230, 150);

gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);


fixed = gtk_fixed_new();

gtk_container_add(GTK_CONTAINER(window), fixed);


button = gtk_button_new_with_label("Quit");


gtk_fixed_put(GTK_FIXED(fixed), button, 50, 50);

gtk_widget_set_size_request(button, 80, 35);


g_signal_connect(G_OBJECT(button), "clicked",

    G_CALLBACK(gtk_main_quit), G_OBJECT(window));


g_signal_connect_swapped(G_OBJECT(window), "destroy",

    G_CALLBACK(gtk_main_quit), NULL);


gtk_widget_show_all(window);


gtk_main();
```

```
  return 0;

}
```

The example shows a button that is positioned in a fixed container. The application quits, when we click on the button.

```
button = gtk_button_new_with_label("Quit");
```

This code line creates a **GtkButton** with a label.

```
 g_signal_connect(G_OBJECT(button), "clicked",

     G_CALLBACK(gtk_main_quit), G_OBJECT(window));
```

Here we connect a **clicked** signal to the button. The signal will launch the **gtk_main_quit()** function, which terminates the application.

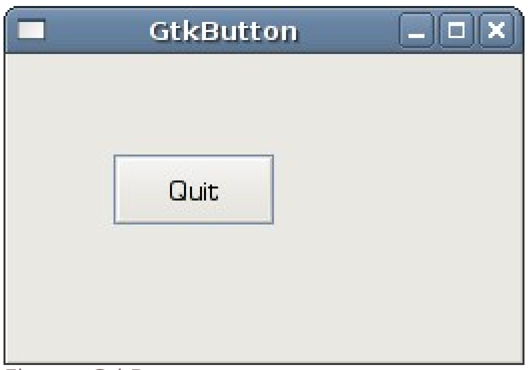


Figure: GtkButton

GtkCheckButton

GtkCheckButton is a widget, that has two states. On and Off. The On state is visualised by a check mark.

```
#include <gtk/gtk.h>




void toggle_title(GtkWidget *widget, gpointer window)

{

  if (gtk_toggle_button_get_active(GTK_TOGGLE_BUTTON(widget))) {
      gtk_window_set_title(window, "GtkCheckButton");

  } else {

      gtk_window_set_title(window, "");

  }

}


int main(int argc, char** argv) {


  GtkWidget *window;

  GtkWidget *frame;

  GtkWidget *check;


  gtk_init(&argc, &argv);


  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);

  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);

  gtk_window_set_default_size(GTK_WINDOW(window), 230, 150);

  gtk_window_set_title(GTK_WINDOW(window), "GtkCheckButton");



  frame = gtk_fixed_new();

  gtk_container_add(GTK_CONTAINER(window), frame);



  check = gtk_check_button_new_with_label("Show title");
```

```
   gtk_toggle_button_set_active(GTK_TOGGLE_BUTTON(check), TRUE);
   GTK_WIDGET_UNSET_FLAGS(check, GTK_CAN_FOCUS);
   gtk_fixed_put(GTK_FIXED(frame), check, 50, 50);

   g_signal_connect_swapped(window, "destroy",
           G_CALLBACK(gtk_main_quit), NULL);

   g_signal_connect(check, "clicked",
           G_CALLBACK(toggle_title), (gpointer) window);

   gtk_widget_show_all(window);

   gtk_main();

   return 0;
 }
```

We will show a title depending on the state of the **GtkCheckButton**.

```
check = gtk_check_button_new_with_label("Show title");
gtk_toggle_button_set_active(GTK_TOGGLE_BUTTON(check), TRUE);
```

The **GtkCheckButton** is created and is marked by default. Because we show a title by default.

```
GTK_WIDGET_UNSET_FLAGS(check, GTK_CAN_FOCUS);
```

This code line disables the focus. I simply didn't like the rectangle over the check button. It does not look good.

```
if (gtk_toggle_button_get_active(GTK_TOGGLE_BUTTON(widget))) {
   gtk_window_set_title(window, "GtkCheckButton");
} else {
    gtk_window_set_title(window, "");

}
```

We show the title of the window, depending on the state of the **GtkCheckButton**.

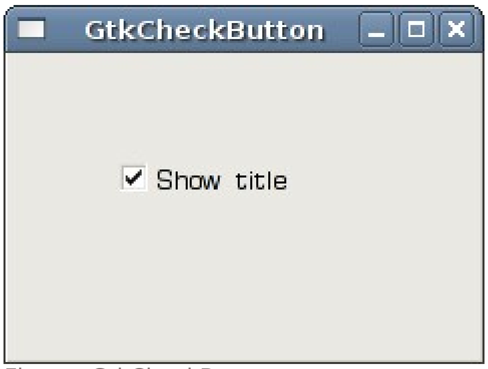


Figure: GtkCheckButton

GtkFrame

GtkFrame is a bin with a decorative frame and optional label

```
#include <gtk/gtk.h>




int main( int argc, char *argv[])

{



  GtkWidget *window;

  GtkWidget *table;



  GtkWidget *frame1;

  GtkWidget *frame2;

  GtkWidget *frame3;

  GtkWidget *frame4;
  gtk_init(&argc, &argv);


  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);

  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);

  gtk_window_set_default_size(GTK_WINDOW(window), 250, 250);

  gtk_window_set_title(GTK_WINDOW(window), "GtkFrame");


  gtk_container_set_border_width(GTK_CONTAINER(window), 10);


  table = gtk_table_new(2, 2, TRUE);

  gtk_table_set_row_spacings(GTK_TABLE(table), 10);

  gtk_table_set_col_spacings(GTK_TABLE(table), 10);

  gtk_container_add(GTK_CONTAINER(window), table);




  frame1 = gtk_frame_new("Shadow In");

  gtk_frame_set_shadow_type(GTK_FRAME(frame1), GTK_SHADOW_IN);

  frame2 = gtk_frame_new("Shadow Out");

  gtk_frame_set_shadow_type(GTK_FRAME(frame2), GTK_SHADOW_OUT);

  frame3 = gtk_frame_new("Shadow Etched In");

  gtk_frame_set_shadow_type(GTK_FRAME(frame3), 
GTK_SHADOW_ETCHED_IN);

  frame4 = gtk_frame_new("Shadow Etched Out");

  gtk_frame_set_shadow_type(GTK_FRAME(frame4), 
GTK_SHADOW_ETCHED_OUT);
```

```
  gtk_table_attach_defaults(GTK_TABLE(table), frame1, 0, 1, 0, 1);
  gtk_table_attach_defaults(GTK_TABLE(table), frame2, 0, 1, 1, 2);
  gtk_table_attach_defaults(GTK_TABLE(table), frame3, 1, 2, 0, 1);
  gtk_table_attach_defaults(GTK_TABLE(table), frame4, 1, 2, 1, 2);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), G_OBJECT(window));

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

The example shows four different frame types. The frames are attached into a table container.

```
frame1 = gtk_frame_new("Shadow In");
gtk_frame_set_shadow_type(GTK_FRAME(frame1), GTK_SHADOW_IN);
```

We create a **GtkFrame** and set it's shadow type.

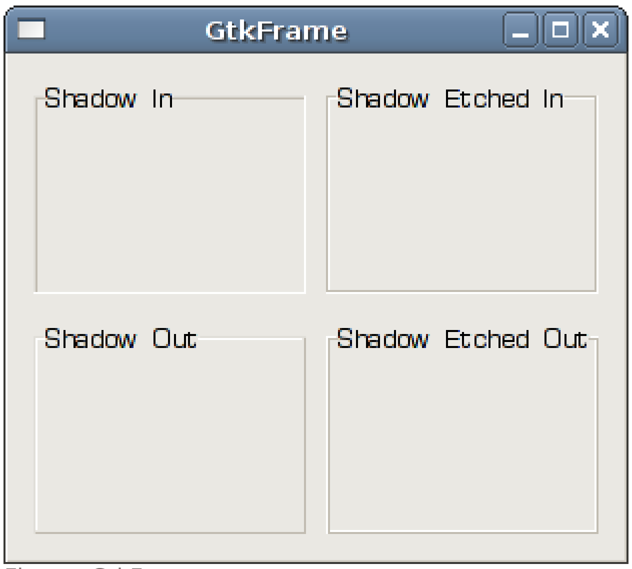


Figure: GtkFrame

GtkLabel

The GtkLabel widget displays text.

```
#include <gtk/gtk.h>


int main( int argc, char *argv[])
{
  GtkWidget *window;
  GtkWidget *label;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_title(GTK_WINDOW(window), "Nymphetamine");
  gtk_window_set_default_size(GTK_WINDOW(window), 350, 400);

  label = gtk_label_new("Cold was my soul\n\
Untold was the pain\n\
I faced when you left me\n\
A rose in the rain....\n\
So I swore to the razor\n\
That never, enchained\n\
Would your dark nails of faith\n\
Be pushed through my veins again\n\
\n\
Bared on your tomb\n\
I'm a prayer for your loneliness\n\
And would you ever soon\n\
Come above onto me?\n\
For once upon a time\n\
On the binds of your lowliness\n\
I could always find the slot for your sacred key ");

  gtk_label_set_justify(GTK_LABEL(label), GTK_JUSTIFY_CENTER);
  gtk_container_add(GTK_CONTAINER(window), label);

  g_signal_connect_swapped(window, "destroy",
      G_CALLBACK (gtk_main_quit), NULL);

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

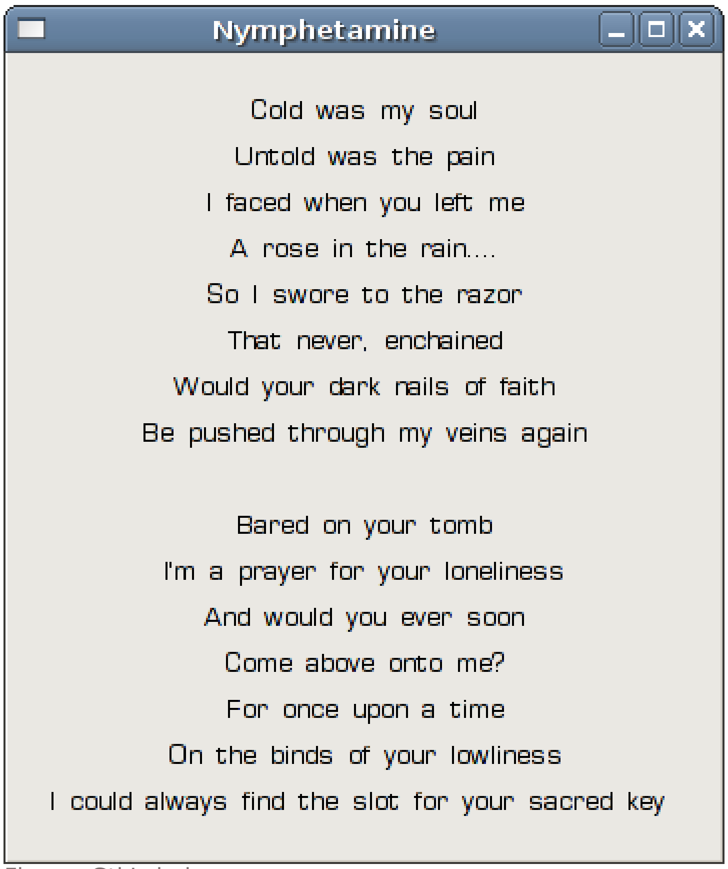
The example shows lyrics of a song.

```
  label = gtk_label_new("Cold was my soul\n\

Untold was the pain\n\

...
```

We create a **GtkLabel** widget. We can create multiline text label by using a new line character. Note the escape character. We use a rather long string and we don't want to put all the text into one line. In such cases, we can use an escape character.

```
 gtk_label_set_justify(GTK_LABEL(label), GTK_JUSTIFY_CENTER);
```

We center our label.



```
Cold was my soul
Untold was the pain
I faced when you left me
A rose in the rain....
So I swore to the razor
That never, enchained
Would your dark nails of faith
Be pushed through my veins again

Bared on your tomb
I'm a prayer for your loneliness
And would you ever soon
Come above onto me?
For once upon a time
On the binds of your lowliness
I could always find the slot for your sacred key
```

Figure: GtkLabel

In GtkLabel we can also use markup language. The next example shows how we can accomplish this.

```
#include <gtk/gtk.h>


int main( int argc, char *argv[])
{
  GtkWidget *window;
  GtkWidget *label;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_title(GTK_WINDOW(window), "markup label");

  char *str = "<b>ZetCode</b>, Knowledge only matters";

  label = gtk_label_new(NULL);
  gtk_label_set_markup(GTK_LABEL(label), str);

  gtk_label_set_justify(GTK_LABEL(label), GTK_JUSTIFY_CENTER);
  gtk_container_add(GTK_CONTAINER(window), label);
  gtk_widget_show(label);

  gtk_window_set_default_size(GTK_WINDOW(window), 300, 100);

  g_signal_connect(window, "destroy",
      G_CALLBACK (gtk_main_quit), NULL);

  gtk_widget_show(window);

  gtk_main();

  return 0;
}
```

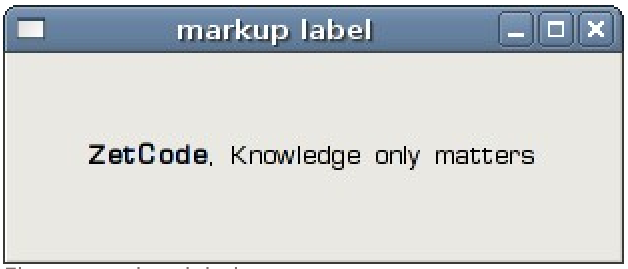
The example shows a portion of text in bold.

```
char *str = "<b>ZetCode</b>, Knowledge only matters";
```

This is the string, we are going to display.

```
 label = gtk_label_new(NULL);

 gtk_label_set_markup(GTK_LABEL(label), str);
```

We create an empty label and set a markup text for it.



ZetCode, Knowledge only matters

Figure: markup label

GTK+ Widgets II

In this part of the GTK+ programming tutorial, we will continue introducing various GTK+ widgets.

GtkComboBox

GtkComboBox is a widget that allows the user to choose from a list of options.

```
#include <gtk/gtk.h>

void combo_selected(GtkWidget *widget, gpointer window)
{
  gchar *text =  gtk_combo_box_get_active_text(GTK_COMBO_BOX(widget));
  gtk_label_set_text(GTK_LABEL(window), text);
  g_free(text);
}


int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *fixed;
  GtkWidget *combo;
  GtkWidget *label;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_title(GTK_WINDOW(window), "GtkCombo");
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 230, 150);

  fixed = gtk_fixed_new();

  combo = gtk_combo_box_new_text();
  gtk_combo_box_append_text(GTK_COMBO_BOX(combo), "Ubuntu");
  gtk_combo_box_append_text(GTK_COMBO_BOX(combo), "Mandriva");
  gtk_combo_box_append_text(GTK_COMBO_BOX(combo), "Fedora");
  gtk_combo_box_append_text(GTK_COMBO_BOX(combo), "Mint");
  gtk_combo_box_append_text(GTK_COMBO_BOX(combo), "Gentoo");
  gtk_combo_box_append_text(GTK_COMBO_BOX(combo), "Debian");

  gtk_fixed_put(GTK_FIXED(fixed), combo, 50, 50);
  gtk_container_add(GTK_CONTAINER(window), fixed);

  label = gtk_label_new("-");
  gtk_fixed_put(GTK_FIXED(fixed), label, 50, 110);

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), G_OBJECT(window));

  g_signal_connect(G_OBJECT(combo), "changed",
        G_CALLBACK(combo_selected), (gpointer) label);

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

The example shows a combo box and a label. The combo box has a list of six options. These are the names of Linux Distros. The label widget shows the selected option from the combo box.

```
combo = gtk_combo_box_new_text();
gtk_combo_box_append_text(GTK_COMBO_BOX(combo), "Ubuntu");
gtk_combo_box_append_text(GTK_COMBO_BOX(combo), "Mandriva");
gtk_combo_box_append_text(GTK_COMBO_BOX(combo), "Fedora");
gtk_combo_box_append_text(GTK_COMBO_BOX(combo), "Mint");
gtk_combo_box_append_text(GTK_COMBO_BOX(combo), "Gentoo");
gtk_combo_box_append_text(GTK_COMBO_BOX(combo), "Debian");
```

We create a **GtkComboBox** and fill it with a list of Linux Distribution names.

```
label = gtk_label_new("-");
```

We also create a label widget.

```
gchar *text =  gtk_combo_box_get_active_text(GTK_COMBO_BOX(widget));
gtk_label_set_text(GTK_LABEL(window), text);
g_free(text);
```

We get the selected text and set the label text to it. The documentation to the combo box says, that **gtk_combo_box_get_active_text()** returns a newly allocated string containing the currently active text. This means, that we must free the memory.

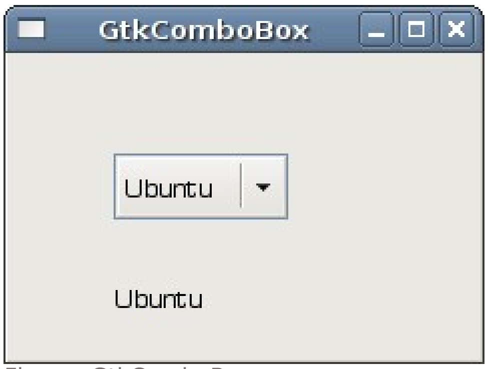


Figure: GtkComboBox

GtkHSeparator

The **GtkHSeparator** is is a horizontal separator. It is a kind of an ornament widget. This widgets serves some design purposes. There is also a sister **GtkVSeparator** widget.

```
#include <gtk/gtk.h>


int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *label1;
  GtkWidget *label2;
  GtkWidget *hseparator;
  GtkWidget *vbox;
  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_title(GTK_WINDOW(window), "GtkHSeparator");
  gtk_window_set_resizable(GTK_WINDOW(window), FALSE);

  gtk_container_set_border_width(GTK_CONTAINER(window), 20);

  label1 = gtk_label_new("Zinc is a moderately reactive, blue gray metal \
that tarnishes in moist air and burns in air with a bright bluish-green 
flame,\
giving off fumes of zinc oxide. It reacts with acids, alkalis and other 
non-metals.\
If not completely pure, zinc reacts with dilute acids to release 
hydrogen.");

  gtk_label_set_line_wrap(GTK_LABEL(label1), TRUE);

  label2 = gtk_label_new("Copper is an essential trace nutrient to all 
high \
plants and animals. In animals, including humans, it is found primarily in 
\
the bloodstream, as a co-factor in various enzymes, and in copper-based 
pigments. \
However, in sufficient amounts, copper can be poisonous and even fatal to 
organisms.");

  gtk_label_set_line_wrap(GTK_LABEL(label2), TRUE);

  vbox = gtk_vbox_new(FALSE, 10);
  gtk_container_add(GTK_CONTAINER(window), vbox);

  hseparator = gtk_hseparator_new();

  gtk_box_pack_start(GTK_BOX(vbox), label1, FALSE, TRUE, 0);
  gtk_box_pack_start(GTK_BOX(vbox), hseparator, FALSE, TRUE, 10);
  gtk_box_pack_start(GTK_BOX(vbox), label2, FALSE, TRUE, 0);


  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), G_OBJECT(window));

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

The code example shows definitions of two chemical elements. They are separated by a horizontal separator. This makes the example more visually appealing.

```
   label1 = gtk_label_new("Zinc is a moderately reactive, blue gray metal \
that tarnishes in moist air and burns in air with a bright bluish-green 
flame,\
giving off fumes of zinc oxide. It reacts with acids, alkalis and other non-
metals.\
If not completely pure, zinc reacts with dilute acids to release hydrogen.");
```

We create the first label, the definition of the Zinc element.

```
 gtk_label_set_line_wrap(GTK_LABEL(label2), TRUE);
```

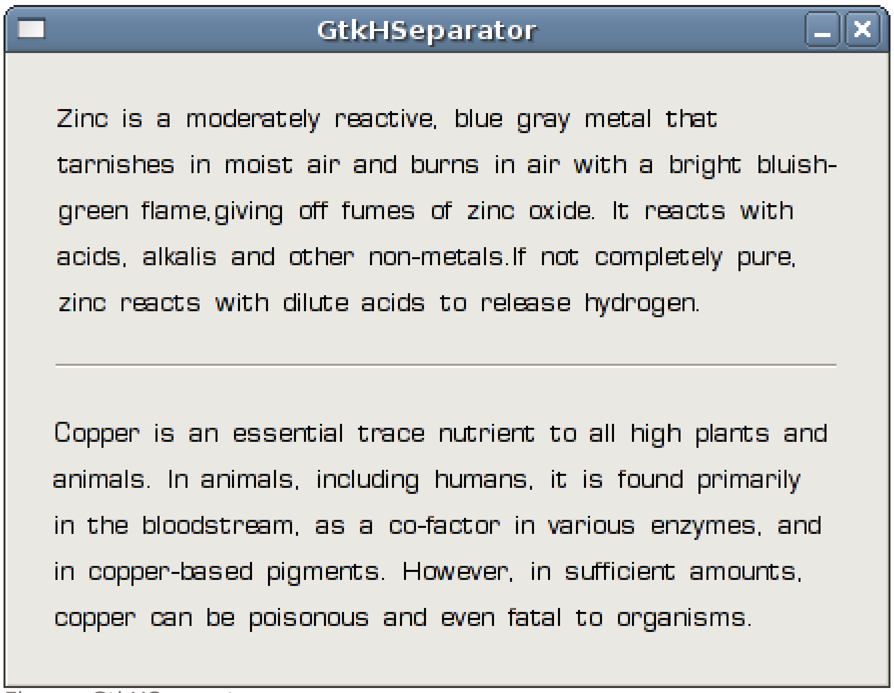
We wrap the text.

```
hseparator = gtk_hseparator_new();
```

We create a horizontal separator.

```
gtk_box_pack_start(GTK_BOX(vbox), label1, FALSE, TRUE, 0);
gtk_box_pack_start(GTK_BOX(vbox), hseparator, FALSE, TRUE, 10);
gtk_box_pack_start(GTK_BOX(vbox), label2, FALSE, TRUE, 0);
```

We place the separator between the labels.



Zinc is a moderately reactive, blue gray metal that tarnishes in moist air and burns in air with a bright bluish-green flame,giving off fumes of zinc oxide. It reacts with acids, alkalis and other non-metals.If not completely pure, zinc reacts with dilute acids to release hydrogen.

Copper is an essential trace nutrient to all high plants and animals. In animals, including humans, it is found primarily in the bloodstream, as a co-factor in various enzymes, and in copper-based pigments. However, in sufficient amounts, copper can be poisonous and even fatal to organisms.

Figure: GtkHSeparator

GtkEntry

GtkEntry is a single line text entry field. This widget is used to enter textual data.

```
#include <gtk/gtk.h>


int main(int argc, char *argv[]) {

  GtkWidget *window;
  GtkWidget *table;

  GtkWidget *label1;
  GtkWidget *label2;
  GtkWidget *label3;

  GtkWidget *entry1;
  GtkWidget *entry2;
  GtkWidget *entry3;
  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_title(GTK_WINDOW(window), "GtkEntry");
  gtk_container_set_border_width(GTK_CONTAINER(window), 10);

  table = gtk_table_new(3, 2, FALSE);
  gtk_container_add(GTK_CONTAINER(window), table);

  label1 = gtk_label_new("Name");
  label2 = gtk_label_new("Age");
  label3 = gtk_label_new("Occupation");


  gtk_table_attach(GTK_TABLE(table), label1, 0, 1, 0, 1,
      GTK_FILL | GTK_SHRINK, GTK_FILL | GTK_SHRINK, 5, 5);
  gtk_table_attach(GTK_TABLE(table), label2, 0, 1, 1, 2,
      GTK_FILL | GTK_SHRINK, GTK_FILL | GTK_SHRINK, 5, 5);
  gtk_table_attach(GTK_TABLE(table), label3, 0, 1, 2, 3,
      GTK_FILL | GTK_SHRINK, GTK_FILL | GTK_SHRINK, 5, 5);

  entry1 = gtk_entry_new();
  entry2 = gtk_entry_new();
  entry3 = gtk_entry_new();

  gtk_table_attach(GTK_TABLE(table), entry1, 1, 2, 0, 1,
      GTK_FILL | GTK_SHRINK, GTK_FILL | GTK_SHRINK, 5, 5);
  gtk_table_attach(GTK_TABLE(table), entry2, 1, 2, 1, 2,
      GTK_FILL | GTK_SHRINK, GTK_FILL | GTK_SHRINK, 5, 5);
  gtk_table_attach(GTK_TABLE(table), entry3, 1, 2, 2, 3,
      GTK_FILL | GTK_SHRINK, GTK_FILL | GTK_SHRINK, 5, 5);

  gtk_widget_show(table);

  gtk_widget_show(label1);
  gtk_widget_show(label2);
  gtk_widget_show(label3);

  gtk_widget_show(entry1);
  gtk_widget_show(entry2);
  gtk_widget_show(entry3);

  gtk_widget_show(window);

  g_signal_connect(window, "destroy",
      G_CALLBACK(gtk_main_quit), NULL);

  gtk_main();

  return 0;
}
```

In our example we show three text entries and three labels.

```
table = gtk_table_new(3, 2, FALSE);
gtk_container_add(GTK_CONTAINER(window), table);
```

To organize our widgets, we use the table container widget.

```
entry1 = gtk_entry_new();
entry2 = gtk_entry_new();
entry3 = gtk_entry_new();
```

Here we create three text entries.

```
gtk_table_attach(GTK_TABLE(table), entry1, 1, 2, 0, 1,
    GTK_FILL | GTK_SHRINK, GTK_FILL | GTK_SHRINK, 5, 5);
gtk_table_attach(GTK_TABLE(table), entry2, 1, 2, 1, 2,
    GTK_FILL | GTK_SHRINK, GTK_FILL | GTK_SHRINK, 5, 5);
gtk_table_attach(GTK_TABLE(table), entry3, 1, 2, 2, 3,
    GTK_FILL | GTK_SHRINK, GTK_FILL | GTK_SHRINK, 5, 5);
```

We attacht the widgets to the table widget.

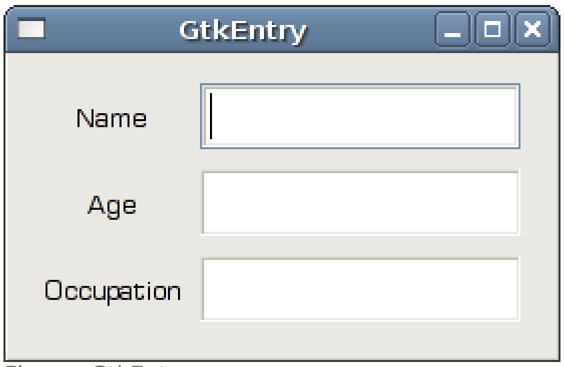


Figure: GtkEntry

GtkImage

GtkImage is a widget used to display an image.

```
#include <gtk/gtk.h>


int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *image;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 230, 150);
  gtk_window_set_title(GTK_WINDOW(window), "Red Rock");
  gtk_window_set_resizable(GTK_WINDOW(window), FALSE);

  gtk_container_set_border_width(GTK_CONTAINER(window), 2);

  image = gtk_image_new_from_file("redrock.png");
  gtk_container_add(GTK_CONTAINER(window), image);


  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), G_OBJECT(window));

  gtk_widget_show_all(window);

  gtk_main();
  return 0;
}
```

In our example we show an image of a castle. The castle is called Red Rock and is situated in the western part of Slovakia. You can download the picture here.

```
gtk_container_set_border_width(GTK_CONTAINER(window), 2);
```

We put a small 2px border around the picture.

```
image = gtk_image_new_from_file("redrock.png");

gtk_container_add(GTK_CONTAINER(window), image);
```

We load an image from the file and add it into the container.

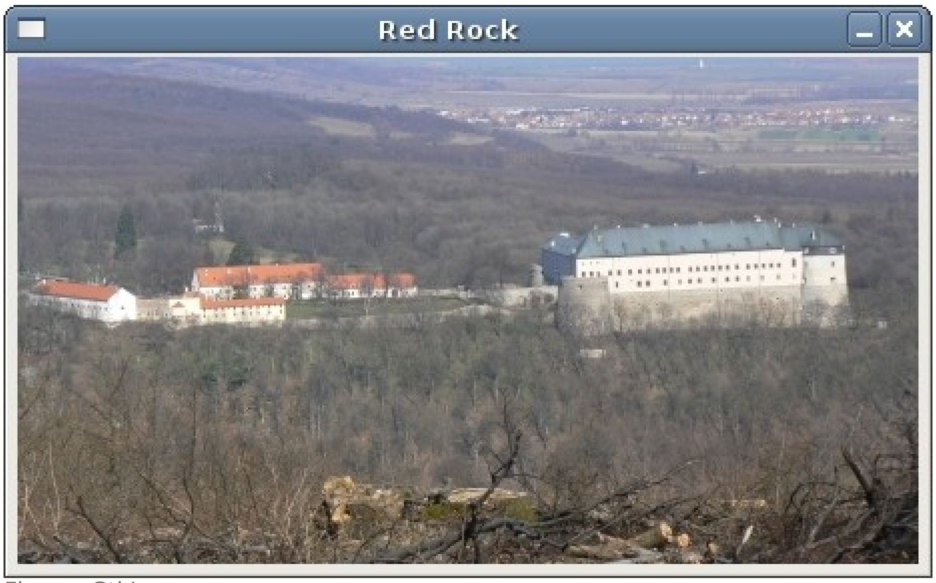


Figure: GtkImage

GtkStatusbar

GtkStatusbar displays status information. It is placed at the bottom of the application window.

```
#include <gtk/gtk.h>


void button_pressed(GtkWidget *widget, gpointer window)
{
   gchar *str;
   str = g_strdup_printf("Button %s clicked",
         gtk_button_get_label(GTK_BUTTON(widget)));

   gtk_statusbar_push(GTK_STATUSBAR(window),
         gtk_statusbar_get_context_id(GTK_STATUSBAR(window), str), str);
   g_free(str);
}

int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *fixed;
  GtkWidget *button1;
  GtkWidget *button2;
  GtkWidget *statusbar;
  GtkWidget *vbox;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 280, 150);
  gtk_window_set_title(GTK_WINDOW(window), "GtkStatusbar");

  vbox = gtk_vbox_new(FALSE, 2);

  fixed = gtk_fixed_new();
  gtk_container_add(GTK_CONTAINER(window), vbox);

  gtk_box_pack_start(GTK_BOX(vbox), fixed, TRUE, TRUE, 1);

  button1 = gtk_button_new_with_label("OK");
  gtk_widget_set_size_request(button1, 80, 30 );
  button2 = gtk_button_new_with_label("Apply");
  gtk_widget_set_size_request(button2, 80, 30 );

  gtk_fixed_put(GTK_FIXED(fixed), button1, 50, 50);
  gtk_fixed_put(GTK_FIXED(fixed), button2, 150, 50);


  statusbar = gtk_statusbar_new();
  gtk_box_pack_start(GTK_BOX(vbox), statusbar, FALSE, TRUE, 1);

  g_signal_connect(G_OBJECT(button1), "clicked",
           G_CALLBACK(button_pressed), G_OBJECT(statusbar));

  g_signal_connect(G_OBJECT(button2), "clicked",
           G_CALLBACK(button_pressed), G_OBJECT(statusbar));

  g_signal_connect_swapped(G_OBJECT(window), "destroy",
        G_CALLBACK(gtk_main_quit), G_OBJECT(window));

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

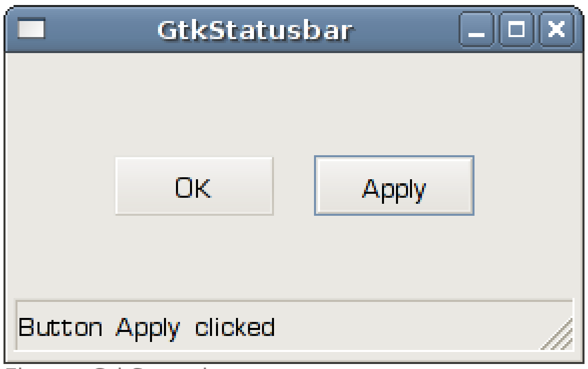
In our code example we show two buttons and a statusbar. If we click on the button, a message is displayed in the statusbar. It says, which button we have pressed.

```
gchar *str;
str = g_strdup_printf("Button %s clicked",
      gtk_button_get_label(GTK_BUTTON(widget)));
```

We create a message.

```
gtk_statusbar_push(GTK_STATUSBAR(window),
     gtk_statusbar_get_context_id(GTK_STATUSBAR(window), str), str);
```

We show the message in the statusbar.



Button Apply clicked

Figure: GtkStatusbar

GtkIconView

The GtkIconView is a widget which displays a list of icons in a grid.

```
#include <gtk/gtk.h>
#include <assert.h>

enum
{
  COL_DISPLAY_NAME,
  COL_PIXBUF,
  NUM_COLS
};


GtkTreeModel * init_model(void)
{
  GtkListStore *list_store;
  GdkPixbuf *p1, *p2, *p3, *p4;
  GtkTreeIter iter;
  GError *err = NULL;


  p1 = gdk_pixbuf_new_from_file("ubuntu.png", &err);
  p2 = gdk_pixbuf_new_from_file("gnumeric.png", &err);
  p3 = gdk_pixbuf_new_from_file("blender.png", &err);
  p4 = gdk_pixbuf_new_from_file("inkscape.png", &err);

  assert(err==NULL);

  list_store = gtk_list_store_new(NUM_COLS,
      G_TYPE_STRING, GDK_TYPE_PIXBUF);

  int i = 0;
  for (i; i < 50; i++) {
    gtk_list_store_append(list_store, &iter);
    gtk_list_store_set(list_store, &iter, COL_DISPLAY_NAME,
        "ubuntu", COL_PIXBUF, p1, -1);
    gtk_list_store_append(list_store, &iter);
    gtk_list_store_set(list_store, &iter, COL_DISPLAY_NAME,
        "gnumeric", COL_PIXBUF, p2, -1);
    gtk_list_store_append(list_store, &iter);
    gtk_list_store_set(list_store, &iter, COL_DISPLAY_NAME,
        "blender", COL_PIXBUF, p3, -1);
    gtk_list_store_append(list_store, &iter);
    gtk_list_store_set(list_store, &iter, COL_DISPLAY_NAME,
        "inkscape", COL_PIXBUF, p4, -1);
  }

  return GTK_TREE_MODEL(list_store);
}

int main (int argc, char *argv[])
{
  GtkWidget *window;
  GtkWidget *icon_view;
  GtkWidget *sw;

  gtk_init (&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);

  gtk_window_set_title(GTK_WINDOW (window), "Icon View");
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_container_set_border_width(GTK_CONTAINER(window), 10);
  gtk_widget_set_size_request(window, 350, 330);

  sw = gtk_scrolled_window_new(NULL, NULL);
  gtk_container_add(GTK_CONTAINER (window), sw);
  gtk_scrolled_window_set_policy(GTK_SCROLLED_WINDOW(sw),
      GTK_POLICY_AUTOMATIC, GTK_POLICY_AUTOMATIC);
  gtk_scrolled_window_set_shadow_type(GTK_SCROLLED_WINDOW(sw),
      GTK_SHADOW_IN);

  icon_view = gtk_icon_view_new_with_model(init_model());
  gtk_container_add(GTK_CONTAINER(sw), icon_view);

  gtk_icon_view_set_text_column(GTK_ICON_VIEW(icon_view),
      COL_DISPLAY_NAME);
  gtk_icon_view_set_pixbuf_column(GTK_ICON_VIEW(icon_view),
      COL_PIXBUF);
  gtk_icon_view_set_selection_mode(GTK_ICON_VIEW(icon_view),
      GTK_SELECTION_MULTIPLE);

  g_signal_connect(window, "destroy", G_CALLBACK(gtk_main_quit), NULL);

  gtk_widget_show_all(window);

  gtk_main();

  return 0;
}
```

The example will display 200 icons. The icons represent four prominent open source projects.

```
p1 = gdk_pixbuf_new_from_file("ubuntu.png", &err);
p2 = gdk_pixbuf_new_from_file("gnumeric.png", &err);
p3 = gdk_pixbuf_new_from_file("blender.png", &err);
p4 = gdk_pixbuf_new_from_file("inkscape.png", &err);
```

We load 4 icons from the disk.

```
list_store = gtk_list_store_new(NUM_COLS,
    G_TYPE_STRING, GDK_TYPE_PIXBUF);
```

We will store textual and pixbuf data.

```
gtk_list_store_append(list_store, &iter);
```

```
gtk_list_store_set(list_store, &iter, COL_DISPLAY_NAME,
    "ubuntu", COL_PIXBUF, p1, -1);
```

This code adds a new icon to the icon view.

```
 icon_view = gtk_icon_view_new_with_model(init_model());
gtk_container_add(GTK_CONTAINER(sw), icon_view);

gtk_icon_view_set_text_column(GTK_ICON_VIEW(icon_view),
    COL_DISPLAY_NAME);
gtk_icon_view_set_pixbuf_column(GTK_ICON_VIEW(icon_view),
    COL_PIXBUF);
```

We create a **GtkIconView** widget and set an icon and it's name to the icon view.

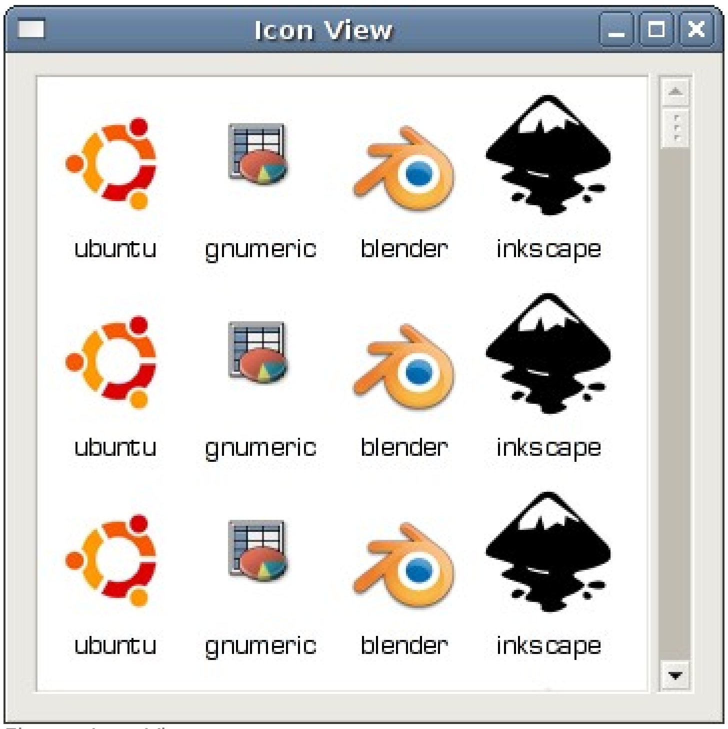


Figure: Icon View

GtkTreeView Widget

In this part of the GTK+ programming tutorial, we will work with a GtkTreeView widget.

GtkTreeView widget is a complex widget which can be used to display lists and trees. The widget can have one or multiple columns. The GtkTreeView widget has a MVC (Model View Controller) design architecture. This means, that the data is separated from the view.

There are several other objects that are used with the GtkTreeView widget. The **GtkCellRenderer** determines, how the data is going to be displayed in the **GtkTreeViewColumn**. The **GtkListStore** and the **GtkTreeStore** represent the model. They handle data, that are displayed in the GtkTreeView widget. **GtkTreeIter** is a structure used to refer to a row in the GtkTreeView. **GtkTreeSelection** is a an object that handles selections.

Simple List View

The first example will show a simple list view. We will display textual data.

```
#include <gtk/gtk.h>


enum

{

  LIST_ITEM = 0,

  N_COLUMNS

};


static void

init_list(GtkWidget *list)

{


  GtkCellRenderer *renderer;

  GtkTreeViewColumn *column;

  GtkListStore *store;


  renderer = gtk_cell_renderer_text_new();

  column = gtk_tree_view_column_new_with_attributes("List Items",

          renderer, "text", LIST_ITEM, NULL);

  gtk_tree_view_append_column(GTK_TREE_VIEW(list), column);


  store = gtk_list_store_new(N_COLUMNS, G_TYPE_STRING);


  gtk_tree_view_set_model(GTK_TREE_VIEW(list),
      GTK_TREE_MODEL(store));


  g_object_unref(store);

}


static void

add_to_list(GtkWidget *list, const gchar *str)

{

  GtkListStore *store;

  GtkTreeIter iter;


  store = GTK_LIST_STORE(gtk_tree_view_get_model

      (GTK_TREE_VIEW(list)));


  gtk_list_store_append(store, &iter);

  gtk_list_store_set(store, &iter, LIST_ITEM, str, -1);

}




void  on_changed(GtkWidget *widget, gpointer label)

{

  GtkTreeIter iter;

  GtkTreeModel *model;

  char *value;
  if (gtk_tree_selection_get_selected(

      GTK_TREE_SELECTION(widget), &model, &iter)) {


    gtk_tree_model_get(model, &iter, LIST_ITEM, &value,  -1);

    gtk_label_set_text(GTK_LABEL(label), value);

    g_free(value);

  }


}


int main (int argc, char *argv[])

{


  GtkWidget *window;

  GtkWidget *list;


  GtkWidget *vbox;

  GtkWidget *label;

  GtkTreeSelection *selection;


  gtk_init(&argc, &argv);




  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
```

```
gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);

gtk_container_set_border_width(GTK_CONTAINER(window), 10);

gtk_widget_set_size_request(window, 270, 250);

gtk_window_set_title(GTK_WINDOW(window), "List View");


list = gtk_tree_view_new();

gtk_tree_view_set_headers_visible(GTK_TREE_VIEW(list), FALSE);


vbox = gtk_vbox_new(FALSE, 0);


gtk_box_pack_start(GTK_BOX(vbox), list, TRUE, TRUE, 5);


label = gtk_label_new("");

gtk_label_set_justify(GTK_LABEL(label), GTK_JUSTIFY_CENTER);

gtk_box_pack_start(GTK_BOX(vbox), label, FALSE, FALSE, 5);


gtk_container_add(GTK_CONTAINER(window), vbox);


init_list(list);

add_to_list(list, "Aliens");

add_to_list(list, "Leon");

add_to_list(list, "Capote");

add_to_list(list, "Saving private Ryan");

add_to_list(list, "Der Untergang");
```

```
  selection = gtk_tree_view_get_selection(GTK_TREE_VIEW(list));

  g_signal_connect(selection, "changed",
      G_CALLBACK(on_changed), label);

  g_signal_connect(G_OBJECT (window), "destroy",
      G_CALLBACK(gtk_main_quit), NULL);

  gtk_widget_show_all(window);

  gtk_main ();

  return 0;
}
```

In our code example, we will show 5 items in the GtkTreeView. We will have only one column and the header of the column will be hidden. We will place a **GtkVBox** into the window. This box will have two widgets. A **GtkTreeView** and a **GtkLabel**.

```
  list = gtk_tree_view_new();

  gtk_tree_view_set_headers_visible(GTK_TREE_VIEW(list), FALSE);
```

The **GtkTreeView** is created and the columns are hidden.

```
  label = gtk_label_new("");

  gtk_label_set_justify(GTK_LABEL(label), GTK_JUSTIFY_CENTER);

  gtk_box_pack_start(GTK_BOX(vbox), label, FALSE, FALSE, 5);
```

The **GtkLabel** is created, centered and placed below the **GtkTreeView**

```
 init_list(list);
```

This function initializes the list.

```
renderer = gtk_cell_renderer_text_new();

column = gtk_tree_view_column_new_with_attributes("List Items",

        renderer, "text", LIST_ITEM, NULL);

gtk_tree_view_append_column(GTK_TREE_VIEW(list), column);
```

Inside that function, we create and append one single column.

```
store = gtk_list_store_new(N_COLUMNS, G_TYPE_STRING);



gtk_tree_view_set_model(GTK_TREE_VIEW(list),

    GTK_TREE_MODEL(store));
```

We create a **GtkListStore** (a model) and set it to the list.

```
g_object_unref(store);
```

The model is destroyed automatically with the view.

```
add_to_list(list, "Aliens");
```

This user function adds an option to the list.

```
store = GTK_LIST_STORE(gtk_tree_view_get_model

    (GTK_TREE_VIEW(list)));



gtk_list_store_append(store, &iter);

gtk_list_store_set(store, &iter, LIST_ITEM, str, -1);
```

Inside the **add_to_list()** function, we get the model using the **gtk_tree_view_get_model()** function call. We append a new row and set a value to the row, which is reference by an **GtkTreeIter** object.

```
selection = gtk_tree_view_get_selection(GTK_TREE_VIEW(list));
```

The **GtkTreeSelection** need not to be created explicitly. It is automatically created with the **GtkTreeView** widget. The reference to the widget is obtained using the **gtk_tree_view_get_selection()** function call.

```
g_signal_connect(selection, "changed",

    G_CALLBACK(on_changed), label);
```

Upon change signal of the **GtkTreeSelection**, we call the **on_changed()** handler.

```
gtk_tree_model_get(model, &iter, LIST_ITEM, &value,  -1);

gtk_label_set_text(GTK_LABEL(label), value);
```

Inside the handler function, we get the value of the cell in the row referenced by the iter object.

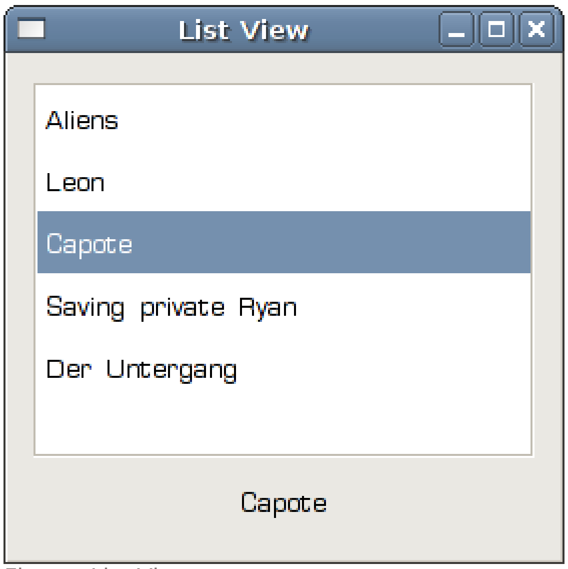


Figure: List View

Advanced List View

The second example will add additional functionality to the previous one. We will be able to add and remove items from the list view.

```
#include <gtk/gtk.h>



enum

{

  LIST_ITEM = 0,

  N_COLUMNS

};



GtkWidget *list;
```

```
static void
append_item(GtkWidget *widget, gpointer entry)
{
  GtkListStore *store;
  GtkTreeIter  iter;

  const char *str = gtk_entry_get_text(entry);

  store = GTK_LIST_STORE(gtk_tree_view_get_model(
       GTK_TREE_VIEW(list)));

  gtk_list_store_append(store, &iter);
  gtk_list_store_set(store, &iter, LIST_ITEM, str, -1);
}

static void
remove_item(GtkWidget *widget, gpointer selection)
{
  GtkListStore *store;
  GtkTreeModel *model;
  GtkTreeIter  iter;


  store = GTK_LIST_STORE(gtk_tree_view_get_model(
      GTK_TREE_VIEW (list)));

  model = gtk_tree_view_get_model (GTK_TREE_VIEW (list));


  if (gtk_tree_model_get_iter_first(model, &iter) == FALSE)

      return;


  if
(gtk_tree_selection_get_selected(GTK_TREE_SELECTION(selection),

      &model, &iter)) {

    gtk_list_store_remove(store, &iter);

  }

}


static void

remove_all(GtkWidget *widget, gpointer selection)

{

  GtkListStore *store;

  GtkTreeModel *model;

  GtkTreeIter  iter;



  store = GTK_LIST_STORE(gtk_tree_view_get_model(

      GTK_TREE_VIEW (list)));

  model = gtk_tree_view_get_model (GTK_TREE_VIEW (list));
  if (gtk_tree_model_get_iter_first(model, &iter) == FALSE)

      return;

  gtk_list_store_clear(store);

}


static void

init_list(GtkWidget *list)

{


  GtkCellRenderer    *renderer;

  GtkTreeViewColumn  *column;

  GtkListStore       *store;


  renderer = gtk_cell_renderer_text_new();

  column = gtk_tree_view_column_new_with_attributes("List Item",

          renderer, "text", LIST_ITEM, NULL);

  gtk_tree_view_append_column(GTK_TREE_VIEW (list), column);


  store = gtk_list_store_new (N_COLUMNS, G_TYPE_STRING);


  gtk_tree_view_set_model(GTK_TREE_VIEW (list),

      GTK_TREE_MODEL(store));


  g_object_unref(store);

}
```

```
int main (int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *sw;

  GtkWidget *remove;
  GtkWidget *add;
  GtkWidget *removeAll;
  GtkWidget *entry;

  GtkWidget *vbox;
  GtkWidget *hbox;

  GtkTreeSelection *selection;

  gtk_init(&argc, &argv);


  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  sw = gtk_scrolled_window_new(NULL, NULL);
  list = gtk_tree_view_new();
```

```
gtk_window_set_title (GTK_WINDOW (window), "List View");

gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);

gtk_container_set_border_width (GTK_CONTAINER (window), 10);

gtk_widget_set_size_request (window, 370, 270);


gtk_scrolled_window_set_policy (GTK_SCROLLED_WINDOW(sw),

          GTK_POLICY_AUTOMATIC, GTK_POLICY_AUTOMATIC);


gtk_scrolled_window_set_shadow_type (GTK_SCROLLED_WINDOW(sw),

          GTK_SHADOW_ETCHED_IN);


gtk_tree_view_set_headers_visible (GTK_TREE_VIEW (list), FALSE);


vbox = gtk_vbox_new(FALSE, 0);


gtk_box_pack_start(GTK_BOX(vbox), sw, TRUE, TRUE, 5);


hbox = gtk_hbox_new(TRUE, 5);


add = gtk_button_new_with_label("Add");

remove = gtk_button_new_with_label("Remove");

removeAll = gtk_button_new_with_label("Remove All");

entry = gtk_entry_new();


gtk_box_pack_start(GTK_BOX(hbox), add, FALSE, TRUE, 3);
```

```
  gtk_box_pack_start(GTK_BOX(hbox), entry, FALSE, TRUE, 3);

  gtk_box_pack_start(GTK_BOX(hbox), remove, FALSE, TRUE, 3);

  gtk_box_pack_start(GTK_BOX(hbox), removeAll, FALSE, TRUE, 3);


  gtk_box_pack_start(GTK_BOX(vbox), hbox, FALSE, TRUE, 3);


  gtk_container_add(GTK_CONTAINER (sw), list);

  gtk_container_add(GTK_CONTAINER (window), vbox);


  init_list(list);


  selection  = gtk_tree_view_get_selection(GTK_TREE_VIEW(list));


  g_signal_connect(G_OBJECT(add), "clicked",

          G_CALLBACK(append_item), entry);


  g_signal_connect(G_OBJECT(remove), "clicked",

          G_CALLBACK(remove_item), selection);


  g_signal_connect(G_OBJECT(removeAll), "clicked",

          G_CALLBACK(remove_all), selection);


  g_signal_connect (G_OBJECT (window), "destroy",

          G_CALLBACK(gtk_main_quit), NULL);
  gtk_widget_show_all(window);


  gtk_main ();


  return 0;
}
```

Instead of a label, we create three buttons and one text entry. We will be able to add a new option dynamically and remove the currently selected option or remove all list items.

```
sw = gtk_scrolled_window_new(NULL, NULL);

...


gtk_scrolled_window_set_policy (GTK_SCROLLED_WINDOW(sw),

          GTK_POLICY_AUTOMATIC, GTK_POLICY_AUTOMATIC);


gtk_scrolled_window_set_shadow_type (GTK_SCROLLED_WINDOW(sw),

          GTK_SHADOW_ETCHED_IN);


...

gtk_box_pack_start(GTK_BOX(vbox), sw, TRUE, TRUE, 5);

...

gtk_container_add(GTK_CONTAINER (sw), list);
```

The **GtkTreeView** is placed inside the scrolled window.

```
if (gtk_tree_selection_get_selected(GTK_TREE_SELECTION(selection),

    &model, &iter)) {

  gtk_list_store_remove(store, &iter);

}
```

The **gtk_list_store_remove()** function removes an item from the list.

```
gtk_list_store_clear(store);
```

The **gtk_list_store_clear()** will remove all items from the list.

```
if (gtk_tree_model_get_iter_first(model, &iter) == FALSE)

    return;
```

This code checks if there is some item left in the list. Obviosly, we can remove items only if there is at least one left in the list.

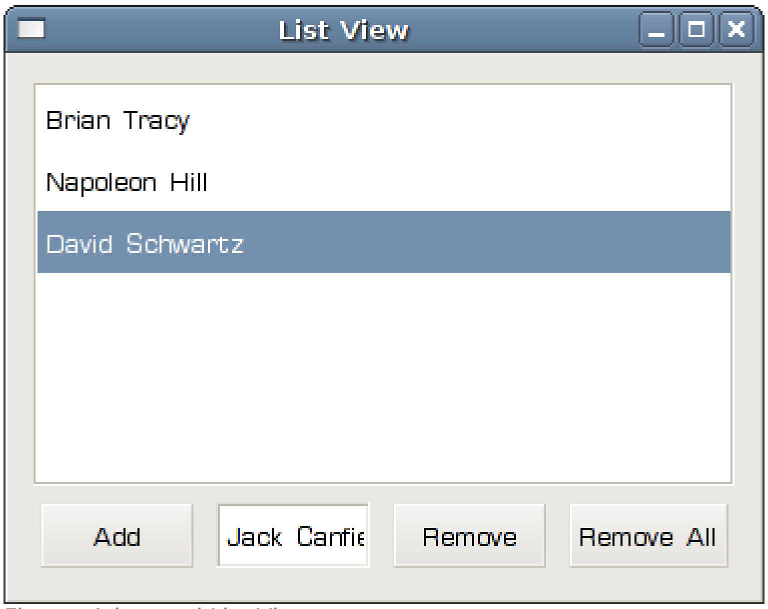


Figure: Advanced List View

Tree View

Next we will use the **GtkTreeView** widget to display hierarchical data. In the previous two examples, we used the list view, now we are going to use tree view.

```
#include <gtk/gtk.h>



enum

{

  COLUMN = 0,

  NUM_COLS
```

```
} ;


void  on_changed(GtkWidget *widget, gpointer statusbar)
{
  GtkTreeIter iter;
  GtkTreeModel *model;
  char *value;



  if (gtk_tree_selection_get_selected(
      GTK_TREE_SELECTION(widget), &model, &iter)) {

    gtk_tree_model_get(model, &iter, COLUMN, &value,  -1);
    gtk_statusbar_push(GTK_STATUSBAR(statusbar),
        gtk_statusbar_get_context_id(GTK_STATUSBAR(statusbar),
            value), value);
    g_free(value);
  }
}



static GtkTreeModel *
create_and_fill_model (void)
{
  GtkTreeStore *treestore;
```

```
GtkTreeIter toplevel, child;


treestore = gtk_tree_store_new(NUM_COLS,

                G_TYPE_STRING);


gtk_tree_store_append(treestore, &toplevel, NULL);

gtk_tree_store_set(treestore, &toplevel,

                   COLUMN, "Scripting languages",

                   -1);


gtk_tree_store_append(treestore, &child, &toplevel);

gtk_tree_store_set(treestore, &child,

                   COLUMN, "Python",

                   -1);

gtk_tree_store_append(treestore, &child, &toplevel);

gtk_tree_store_set(treestore, &child,

                   COLUMN, "Perl",

                   -1);

gtk_tree_store_append(treestore, &child, &toplevel);

gtk_tree_store_set(treestore, &child,

                   COLUMN, "PHP",

                   -1);


gtk_tree_store_append(treestore, &toplevel, NULL);

gtk_tree_store_set(treestore, &toplevel,
                   COLUMN, "Compiled languages",

                   -1);


  gtk_tree_store_append(treestore, &child, &toplevel);

  gtk_tree_store_set(treestore, &child,

                   COLUMN, "C",

                   -1);


  gtk_tree_store_append(treestore, &child, &toplevel);

  gtk_tree_store_set(treestore, &child,

                   COLUMN, "C++",

                   -1);


  gtk_tree_store_append(treestore, &child, &toplevel);

  gtk_tree_store_set(treestore, &child,

                   COLUMN, "Java",

                   -1);


  return GTK_TREE_MODEL(treestore);

}




static GtkWidget *

create_view_and_model (void)
```

```
{

  GtkTreeViewColumn *col;

  GtkCellRenderer *renderer;

  GtkWidget *view;

  GtkTreeModel *model;


  view = gtk_tree_view_new();


  col = gtk_tree_view_column_new();

  gtk_tree_view_column_set_title(col, "Programming languages");

  gtk_tree_view_append_column(GTK_TREE_VIEW(view), col);


  renderer = gtk_cell_renderer_text_new();

  gtk_tree_view_column_pack_start(col, renderer, TRUE);

  gtk_tree_view_column_add_attribute(col, renderer,

      "text", COLUMN);


  model = create_and_fill_model();

  gtk_tree_view_set_model(GTK_TREE_VIEW(view), model);

  g_object_unref(model);


  return view;

}
```

```
int

main (int argc, char **argv)

{

  GtkWidget *window;

  GtkWidget *view;

  GtkTreeSelection *selection;

  GtkWidget *vbox;

  GtkWidget *statusbar;


  gtk_init(&argc, &argv);


  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);

  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);

  gtk_window_set_title(GTK_WINDOW(window), "Tree View");

  gtk_widget_set_size_request (window, 350, 300);




  vbox = gtk_vbox_new(FALSE, 2);

  gtk_container_add(GTK_CONTAINER(window), vbox);




  view = create_view_and_model();

  selection = gtk_tree_view_get_selection(GTK_TREE_VIEW(view));


  gtk_box_pack_start(GTK_BOX(vbox), view, TRUE, TRUE, 1);
  statusbar = gtk_statusbar_new();

  gtk_box_pack_start(GTK_BOX(vbox), statusbar, FALSE, TRUE, 1);


  g_signal_connect(selection, "changed",

      G_CALLBACK(on_changed), statusbar);


  g_signal_connect (G_OBJECT (window), "destroy",

          G_CALLBACK(gtk_main_quit), NULL);


  gtk_widget_show_all(window);


  gtk_main();


  return 0;

}
```

In our example, we divide programming languages into two groups. Scripting languages and compiled languages. The language categories serve as toplevel nodes for their list of items. The currently selected node or item is shown in the statusbar.

The steps to create a tree view are very similar to creating a list view.

```
GtkTreeStore *treestore;
```

Here we use a different model. A **GtkTreeStore**.

```
treestore = gtk_tree_store_new(NUM_COLS,

                G_TYPE_STRING);
```

We create a **GtkTreeStore** with only one column.

```
gtk_tree_store_append(treestore, &toplevel, NULL);

gtk_tree_store_set(treestore, &toplevel,
                   COLUMN, "Scripting languages",

                   -1);
```

This creates a toplevel node.

```
gtk_tree_store_append(treestore, &child, &toplevel);

gtk_tree_store_set(treestore, &child,

                     COLUMN, "Python",

                     -1);
```

This code creates a child item.

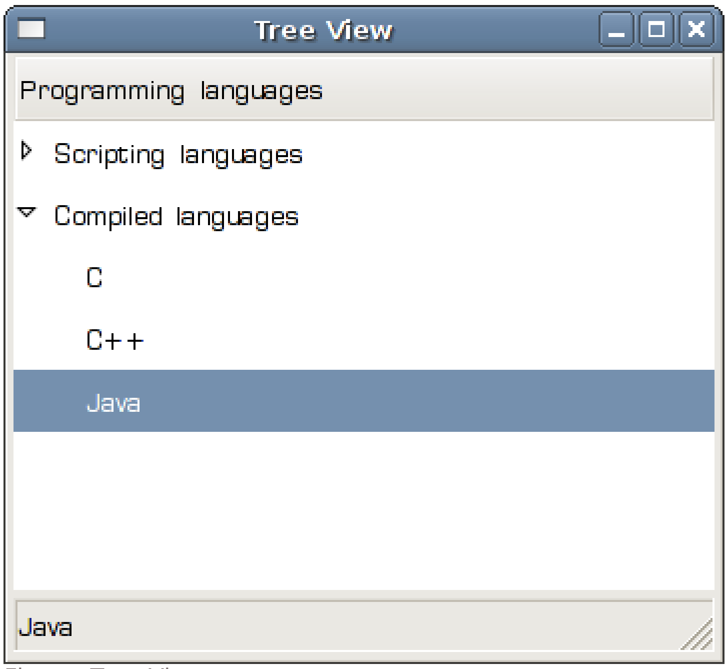


Figure: Tree View

GtkTexView Widget

In this part of the GTK+ programming tutorial, we will work with a GtkTexView widget.

GtkTexView widget is used for displaying and editing multiline text. GtkTexView widget has also the MVC design. The GtkTextView represents the view component and **GtkTexBuffer** represents the model component. The GtkTexBuffer is used to manipulate the text data. **GtkTextTag** is an attribute that can be applied to the text. The **GtkTextIter** represents a position between two characters in the text. All manipulation with the text is done using text iterators.

Simple example

In our first example, we show some of the GtkTexView's functionality. We show how to apply various text tags to the text data in the GtkTextView.

```
#include <gtk/gtk.h>



int main( int argc, char *argv[])

{


  GtkWidget *window;

  GtkWidget *view;

  GtkWidget *vbox;


  GtkTextBuffer *buffer;

  GtkTextIter start, end;

  GtkTextIter iter;


  gtk_init(&argc, &argv);


  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);

  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);

  gtk_window_set_default_size(GTK_WINDOW(window), 250, 200);

  gtk_window_set_title(GTK_WINDOW(window), "TextView");

  gtk_container_set_border_width(GTK_CONTAINER(window), 5);

  GTK_WINDOW(window)->allow_shrink = TRUE;


  vbox = gtk_vbox_new(FALSE, 0);

  view = gtk_text_view_new();
```

```
gtk_box_pack_start(GTK_BOX(vbox), view, TRUE, TRUE, 0);


buffer = gtk_text_view_get_buffer(GTK_TEXT_VIEW(view));


gtk_text_buffer_create_tag(buffer, "gap",
      "pixels_above_lines", 30, NULL);


gtk_text_buffer_create_tag(buffer, "lmarg",
    "left_margin", 5, NULL);
gtk_text_buffer_create_tag(buffer, "blue_fg",
    "foreground", "blue", NULL);
gtk_text_buffer_create_tag(buffer, "gray_bg",
    "background", "gray", NULL);
gtk_text_buffer_create_tag(buffer, "italic",
    "style", PANGO_STYLE_ITALIC, NULL);
gtk_text_buffer_create_tag(buffer, "bold",
    "weight", PANGO_WEIGHT_BOLD, NULL);


gtk_text_buffer_get_iter_at_offset(buffer, &iter, 0);


gtk_text_buffer_insert(buffer, &iter, "Plain text\n", -1);
gtk_text_buffer_insert_with_tags_by_name(buffer, &iter,
      "Colored Text\n", -1, "blue_fg", "lmarg",  NULL);
gtk_text_buffer_insert_with_tags_by_name (buffer, &iter,
        "Text with colored background\n", -1, "lmarg", "gray_bg",
NULL);


  gtk_text_buffer_insert_with_tags_by_name (buffer, &iter,

        "Text in italics\n", -1, "italic", "lmarg",  NULL);


  gtk_text_buffer_insert_with_tags_by_name (buffer, &iter,

        "Bold text\n", -1, "bold", "lmarg",  NULL);


  gtk_container_add(GTK_CONTAINER(window), vbox);


  g_signal_connect_swapped(G_OBJECT(window), "destroy",

        G_CALLBACK(gtk_main_quit), G_OBJECT(window));


  gtk_widget_show_all(window);


  gtk_main();


  return 0;

}
```

The example shows some text with different **GtkTextTags** applied.

```
view = gtk_text_view_new();
```

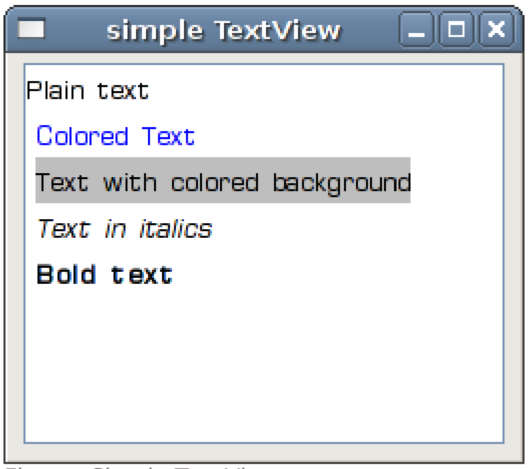
The **GtkTextView** is created.

```
gtk_text_buffer_create_tag(buffer, "blue_fg",

    "foreground", "blue", NULL);
```

This is an example of a **GtkTextTag**. The tag changes the color of the text to blue.

```
gtk_text_buffer_insert_with_tags_by_name(buffer, &iter,

      "Colored Text\n", -1, "blue_fg", "lmarg",  NULL);
```

This code inserts some text with a specific **blue_fg** text tag.



Plain text
Colored Text
Text with colored background
Text in italics
Bold text

Figure: Simple TextView

Lines and Columns

The following example will display the current line and column of the text cursor.

```
#include <gtk/gtk.h>


update_statusbar(GtkTextBuffer *buffer,

    GtkStatusbar  *statusbar)

{

  gchar *msg;

  gint row, col;

  GtkTextIter iter;


  gtk_statusbar_pop(statusbar, 0);


  gtk_text_buffer_get_iter_at_mark(buffer,
      &iter, gtk_text_buffer_get_insert(buffer));


  row = gtk_text_iter_get_line(&iter);

  col = gtk_text_iter_get_line_offset(&iter);


  msg = g_strdup_printf("Col %d Ln %d", col+1, row+1);


  gtk_statusbar_push(statusbar, 0, msg);


  g_free(msg);

}


static void

mark_set_callback(GtkTextBuffer *buffer,

    const GtkTextIter *new_location, GtkTextMark *mark,

    gpointer data)

{

  update_statusbar(buffer, GTK_STATUSBAR(data));

}




int main( int argc, char *argv[])

{


  GtkWidget *window;
  GtkWidget *vbox;


  GtkWidget *toolbar;

  GtkWidget *view;

  GtkWidget *statusbar;

  GtkToolItem *exit;

  GtkTextBuffer *buffer;


  gtk_init(&argc, &argv);


  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);

  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);

  gtk_window_set_default_size(GTK_WINDOW(window), 250, 200);

  gtk_window_set_title(GTK_WINDOW(window), "lines & cols");


  vbox = gtk_vbox_new(FALSE, 0);

  gtk_container_add(GTK_CONTAINER(window), vbox);


  toolbar = gtk_toolbar_new();

  gtk_toolbar_set_style(GTK_TOOLBAR(toolbar), GTK_TOOLBAR_ICONS);


  exit = gtk_tool_button_new_from_stock(GTK_STOCK_QUIT);

  gtk_toolbar_insert(GTK_TOOLBAR(toolbar), exit, -1);


  gtk_box_pack_start(GTK_BOX(vbox), toolbar, FALSE, FALSE, 5);
```

```
view = gtk_text_view_new();

gtk_box_pack_start(GTK_BOX(vbox), view, TRUE, TRUE, 0);

gtk_widget_grab_focus(view);


buffer = gtk_text_view_get_buffer(GTK_TEXT_VIEW(view));


statusbar = gtk_statusbar_new();

gtk_box_pack_start(GTK_BOX(vbox), statusbar, FALSE, FALSE, 0);


g_signal_connect(G_OBJECT(exit), "clicked",

      G_CALLBACK(gtk_main_quit), NULL);


g_signal_connect(buffer, "changed",

      G_CALLBACK(update_statusbar), statusbar);


g_signal_connect_object(buffer, "mark_set",

      G_CALLBACK(mark_set_callback), statusbar, 0);


g_signal_connect_swapped(G_OBJECT(window), "destroy",

      G_CALLBACK(gtk_main_quit), NULL);


gtk_widget_show_all(window);


update_statusbar(buffer, GTK_STATUSBAR (statusbar));
```

```
  gtk_main();


  return 0;
}
```

In this code example, we show the current position of the text cursor in the statusbar.

```
view = gtk_text_view_new();
```

The **GtkTextView** widget is created.

```
g_signal_connect(buffer, "changed",

      G_CALLBACK(update_statusbar), statusbar);
```

When we change the text, we call the **update_statusbar()** handler.

```
g_signal_connect_object(buffer, "mark_set",

      G_CALLBACK(mark_set_callback), statusbar, 0);
```

The **mark_set** signal is emitted, when the cursor moves.

```
gtk_statusbar_pop(statusbar, 0);
```

This code line clears any previous message from the statusbar.

```
gtk_text_buffer_get_iter_at_mark(buffer,

    &iter, gtk_text_buffer_get_insert(buffer));



row = gtk_text_iter_get_line(&iter);

col = gtk_text_iter_get_line_offset(&iter);
```

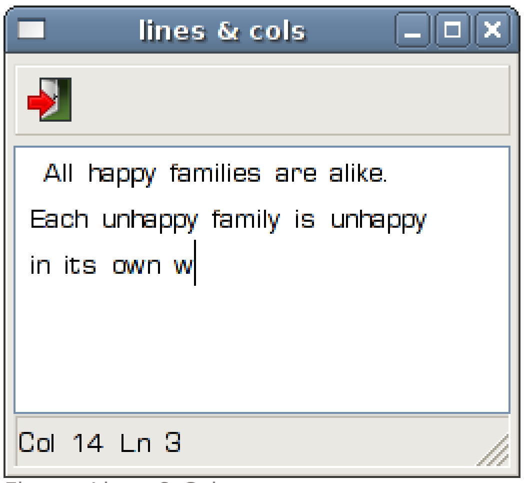
These lines determine the current line/row and column.

```
msg = g_strdup_printf("Col %d Ln %d", col+1, row+1);
```

This code builds the text to be displayed on the statusbar.

```
gtk_statusbar_push(statusbar, 0, msg);
```

We show the text on the statusbar.



All happy families are alike.
Each unhappy family is unhappy
in its own w

Col 14 Ln 3

Figure: Lines & Columns

Search & Highlight

In the next example, we will do some searching in the **GtkTextBuffer**. We will highlight some text patterns in the text buffer.

```
#include <gtk/gtk.h>

#include <gdk/gdkkeysyms.h>








gboolean key_pressed(GtkWidget * window,

    GdkEventKey* event, GtkTextBuffer *buffer) {



  GtkTextIter start_sel, end_sel;

  GtkTextIter start_find, end_find;

  GtkTextIter start_match, end_match;

  gboolean selected;

  gchar *text;
  if ((event->type == GDK_KEY_PRESS) &&

     (event->state & GDK_CONTROL_MASK)) {



    switch (event->keyval)

    {

      case GDK_m :

        selected = gtk_text_buffer_get_selection_bounds(buffer,

            &start_sel, &end_sel);

      if (selected) {

        gtk_text_buffer_get_start_iter(buffer, &start_find);

        gtk_text_buffer_get_end_iter(buffer, &end_find);



        gtk_text_buffer_remove_tag_by_name(buffer, "gray_bg",

            &start_find, &end_find);

        text = (char *) gtk_text_buffer_get_text(buffer,
&start_sel,

            &end_sel, FALSE);



        while ( gtk_text_iter_forward_search(&start_find, text,

                GTK_TEXT_SEARCH_TEXT_ONLY |

                GTK_TEXT_SEARCH_VISIBLE_ONLY,

                &start_match, &end_match, NULL) ) {
```

```
          gtk_text_buffer_apply_tag_by_name(buffer, "gray_bg",
              &start_match, &end_match);
          int offset = gtk_text_iter_get_offset(&end_match);
          gtk_text_buffer_get_iter_at_offset(buffer,
              &start_find, offset);
        }

        g_free(text);
      }

      break;

      case GDK_r:
        gtk_text_buffer_get_start_iter(buffer, &start_find);
        gtk_text_buffer_get_end_iter(buffer, &end_find);

        gtk_text_buffer_remove_tag_by_name(buffer, "gray_bg",
            &start_find, &end_find);
      break;
    }
  }

  return FALSE;
}
```

```
int main( int argc, char *argv[])
{

  GtkWidget *window;
  GtkWidget *view;
  GtkWidget *vbox;

  GtkTextBuffer *buffer;
  GtkTextIter start, end;
  GtkTextIter iter;

  gtk_init(&argc, &argv);

  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);
  gtk_window_set_default_size(GTK_WINDOW(window), 250, 200);
  gtk_window_set_title(GTK_WINDOW(window), "Search & Highlight");
  gtk_container_set_border_width(GTK_CONTAINER(window), 5);
  GTK_WINDOW(window)->allow_shrink = TRUE;

  vbox = gtk_vbox_new(FALSE, 0);
  view = gtk_text_view_new();
  gtk_widget_add_events(view, GDK_BUTTON_PRESS_MASK);
  gtk_box_pack_start(GTK_BOX(vbox), view, TRUE, TRUE, 0);
  buffer = gtk_text_view_get_buffer(GTK_TEXT_VIEW(view));

  gtk_text_buffer_create_tag(buffer, "gray_bg",

      "background", "gray", NULL);

  gtk_container_add(GTK_CONTAINER(window), vbox);



  g_signal_connect_swapped(G_OBJECT(window), "destroy",

        G_CALLBACK(gtk_main_quit), G_OBJECT(window));



  g_signal_connect(G_OBJECT(window), "key-press-event",

        G_CALLBACK(key_pressed), buffer);



  gtk_widget_show_all(window);



  gtk_main();



  return 0;

}
```

In our code example we use keyboard shortcuts. The Ctrl + M shortcut highlights the all occurences of currently selected text. The Ctrl + R removes the highlights from the text.

```
gtk_text_buffer_create_tag(buffer, "gray_bg",

    "background", "gray", NULL);
```

This is the **GtkTextTag** that we use in our example. The tag makes the background of the text gray.

```
selected = gtk_text_buffer_get_selection_bounds(buffer,

    &start_sel, &end_sel);
```

Here we get the start and end positions of the selected text.

```
gtk_text_buffer_get_start_iter(buffer, &start_find);

gtk_text_buffer_get_end_iter(buffer, &end_find);
```

We get the first and last position in the text buffer.

```
gtk_text_buffer_remove_tag_by_name(buffer, "gray_bg",

    &start_find, &end_find);
```

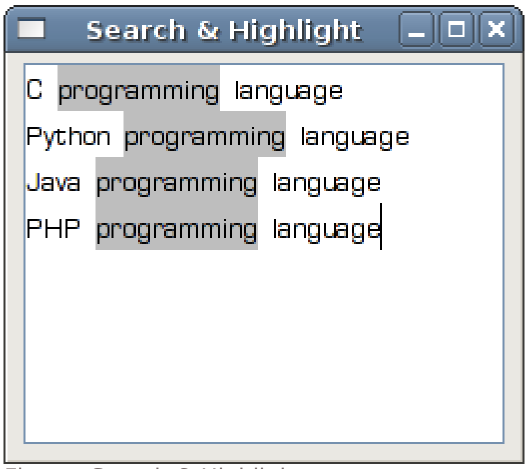
We remove any previous text tag.

```
text = (char *) gtk_text_buffer_get_text(buffer, &start_sel,

    &end_sel, FALSE);
```

We obtain the selected text. It is the text, we are going to search for.

```
while ( gtk_text_iter_forward_search(&start_find, text,

        GTK_TEXT_SEARCH_TEXT_ONLY |

        GTK_TEXT_SEARCH_VISIBLE_ONLY,

        &start_match, &end_match, NULL) ) {


  gtk_text_buffer_apply_tag_by_name(buffer, "gray_bg",

      &start_match, &end_match);

  int offset = gtk_text_iter_get_offset(&end_match);

  gtk_text_buffer_get_iter_at_offset(buffer,

      &start_find, offset);

}
```

This code searches for all occurences of our selected text. If we find any match, we apply the text tag. After the match, the ending point of the word becomes the starting point for the next search.



```
C programming language
Python programming language
Java programming language
PHP programming language
```

Figure: Search & Highlight

Custom GTK+ widget

In this part of the GTK+ programming tutorial, we will create a custom GTK+ widget, where we will use the Cairo graphics library.

CPU widget

In the next example we will create a CPU widget.

```
/* cpu.h */


#ifndef __CPU_H

#define __CPU_H


#include <gtk/gtk.h>

#include <cairo.h>


G_BEGIN_DECLS
```

```
#define GTK_CPU(obj) GTK_CHECK_CAST(obj, gtk_cpu_get_type (),
GtkCpu)

#define GTK_CPU_CLASS(klass) GTK_CHECK_CLASS_CAST(klass,
gtk_cpu_get_type(), GtkCpuClass)

#define GTK_IS_CPU(obj) GTK_CHECK_TYPE(obj, gtk_cpu_get_type())




typedef struct _GtkCpu GtkCpu;

typedef struct _GtkCpuClass GtkCpuClass;




struct _GtkCpu {

  GtkWidget widget;


  gint sel;

};


struct _GtkCpuClass {

  GtkWidgetClass parent_class;

};




GtkType gtk_cpu_get_type(void);

void gtk_cpu_set_sel(GtkCpu *cpu, gint sel);

GtkWidget * gtk_cpu_new();
```

```
G_END_DECLS


#endif /* __CPU_H */

/* cpu.c */


#include "cpu.h"




static void gtk_cpu_class_init(GtkCpuClass *klass);

static void gtk_cpu_init(GtkCpu *cpu);

static void gtk_cpu_size_request(GtkWidget *widget,

    GtkRequisition *requisition);

static void gtk_cpu_size_allocate(GtkWidget *widget,

    GtkAllocation *allocation);

static void gtk_cpu_realize(GtkWidget *widget);

static gboolean gtk_cpu_expose(GtkWidget *widget,

    GdkEventExpose *event);

static void gtk_cpu_paint(GtkWidget *widget);

static void gtk_cpu_destroy(GtkObject *object);




GtkType

gtk_cpu_get_type(void)

{
  static GtkType gtk_cpu_type = 0;



  if (!gtk_cpu_type) {
      static const GtkTypeInfo gtk_cpu_info = {
          "GtkCpu",
          sizeof(GtkCpu),
          sizeof(GtkCpuClass),
          (GtkClassInitFunc) gtk_cpu_class_init,
          (GtkObjectInitFunc) gtk_cpu_init,
          NULL,
          NULL,
          (GtkClassInitFunc) NULL
      };
      gtk_cpu_type = gtk_type_unique(GTK_TYPE_WIDGET, &gtk_cpu_info);
  }



  return gtk_cpu_type;
}

void
gtk_cpu_set_state(GtkCpu *cpu, gint num)
{
   cpu->sel = num;
   gtk_cpu_paint(GTK_WIDGET(cpu));
}



GtkWidget * gtk_cpu_new()
{
   return GTK_WIDGET(gtk_type_new(gtk_cpu_get_type()));
}



static void
gtk_cpu_class_init(GtkCpuClass *klass)
{
  GtkWidgetClass *widget_class;
  GtkObjectClass *object_class;



  widget_class = (GtkWidgetClass *) klass;
  object_class = (GtkObjectClass *) klass;

  widget_class->realize = gtk_cpu_realize;
  widget_class->size_request = gtk_cpu_size_request;
  widget_class->size_allocate = gtk_cpu_size_allocate;
  widget_class->expose_event = gtk_cpu_expose;
  object_class->destroy = gtk_cpu_destroy;

}




static void

gtk_cpu_init(GtkCpu *cpu)

{

   cpu->sel = 0;

}




static void

gtk_cpu_size_request(GtkWidget *widget,

    GtkRequisition *requisition)

{

  g_return_if_fail(widget != NULL);

  g_return_if_fail(GTK_IS_CPU(widget));

  g_return_if_fail(requisition != NULL);


  requisition->width = 80;

  requisition->height = 100;

}




static void
```

```
gtk_cpu_size_allocate(GtkWidget *widget,

    GtkAllocation *allocation)

{

  g_return_if_fail(widget != NULL);

  g_return_if_fail(GTK_IS_CPU(widget));

  g_return_if_fail(allocation != NULL);



  widget->allocation = *allocation;



  if (GTK_WIDGET_REALIZED(widget)) {

     gdk_window_move_resize(

         widget->window,

         allocation->x, allocation->y,

         allocation->width, allocation->height

     );

   }

}




static void

gtk_cpu_realize(GtkWidget *widget)

{

  GdkWindowAttr attributes;

  guint attributes_mask;
  g_return_if_fail(widget != NULL);

  g_return_if_fail(GTK_IS_CPU(widget));



  GTK_WIDGET_SET_FLAGS(widget, GTK_REALIZED);



  attributes.window_type = GDK_WINDOW_CHILD;

  attributes.x = widget->allocation.x;

  attributes.y = widget->allocation.y;

  attributes.width = 80;

  attributes.height = 100;



  attributes.wclass = GDK_INPUT_OUTPUT;

  attributes.event_mask = gtk_widget_get_events(widget) |
GDK_EXPOSURE_MASK;



  attributes_mask = GDK_WA_X | GDK_WA_Y;



  widget->window = gdk_window_new(

     gtk_widget_get_parent_window (widget),

     & attributes, attributes_mask

  );



  gdk_window_set_user_data(widget->window, widget);



  widget->style = gtk_style_attach(widget->style, widget->window);
  gtk_style_set_background(widget->style, widget->window,
GTK_STATE_NORMAL);

}




static gboolean

gtk_cpu_expose(GtkWidget *widget,

    GdkEventExpose *event)

{

  g_return_val_if_fail(widget != NULL, FALSE);

  g_return_val_if_fail(GTK_IS_CPU(widget), FALSE);

  g_return_val_if_fail(event != NULL, FALSE);


  gtk_cpu_paint(widget);


  return FALSE;

}




static void

gtk_cpu_paint(GtkWidget *widget)

{

  cairo_t *cr;


  cr = gdk_cairo_create(widget->window);
  cairo_translate(cr, 0, 7);


  cairo_set_source_rgb(cr, 0, 0, 0);

  cairo_paint(cr);


  gint pos = GTK_CPU(widget)->sel;

  gint rect = pos / 5;


  cairo_set_source_rgb(cr, 0.2, 0.4, 0);


  gint i;

  for ( i = 1; i <= 20; i++) {

      if (i > 20 - rect) {

          cairo_set_source_rgb(cr, 0.6, 1.0, 0);

      } else {

          cairo_set_source_rgb(cr, 0.2, 0.4, 0);

      }

      cairo_rectangle(cr, 8, i*4, 30, 3);

      cairo_rectangle(cr, 42, i*4, 30, 3);

      cairo_fill(cr);

  }


  cairo_destroy(cr);

}
```

```
static void
gtk_cpu_destroy(GtkObject *object)
{
  GtkCpu *cpu;
  GtkCpuClass *klass;

  g_return_if_fail(object != NULL);
  g_return_if_fail(GTK_IS_CPU(object));

  cpu = GTK_CPU(object);

  klass = gtk_type_class(gtk_widget_get_type());

  if (GTK_OBJECT_CLASS(klass)->destroy) {
     (* GTK_OBJECT_CLASS(klass)->destroy) (object);
  }
}
/* main.c */

#include "cpu.h"


static void set_value(GtkWidget * widget, gpointer data)
```

```
{
  GdkRegion *region;


  GtkRange *range = (GtkRange *) widget;
  GtkWidget *cpu = (GtkWidget *) data;
  GTK_CPU(cpu)->sel = gtk_range_get_value(range);


  region = gdk_drawable_get_clip_region(cpu->window);
  gdk_window_invalidate_region(cpu->window, region, TRUE);
  gdk_window_process_updates(cpu->window, TRUE);
}



int main (int argc, char ** argv)
{
  GtkWidget *window;
  GtkWidget *cpu;
  GtkWidget *fixed;
  GtkWidget *scale;


  gtk_init(&argc, &argv);



  window = gtk_window_new(GTK_WINDOW_TOPLEVEL);
  gtk_window_set_title(GTK_WINDOW(window), "CPU widget");
  gtk_window_set_position(GTK_WINDOW(window), GTK_WIN_POS_CENTER);

  gtk_window_set_default_size(GTK_WINDOW(window), 200, 180);




  g_signal_connect(G_OBJECT(window), "destroy",

       G_CALLBACK(gtk_main_quit), NULL);


  fixed = gtk_fixed_new();

  gtk_container_add(GTK_CONTAINER(window), fixed);


  cpu = gtk_cpu_new();

  gtk_fixed_put(GTK_FIXED(fixed), cpu, 30, 40);




  scale = gtk_vscale_new_with_range(0.0, 100.0, 1.0);

  gtk_range_set_inverted(GTK_RANGE(scale), TRUE);

  gtk_scale_set_value_pos(GTK_SCALE(scale), GTK_POS_TOP);

  gtk_widget_set_size_request(scale, 50, 120);

  gtk_fixed_put(GTK_FIXED(fixed), scale, 130, 20);


  g_signal_connect(G_OBJECT(scale), "value_changed",
G_CALLBACK(set_value), (gpointer) cpu);


  gtk_widget_show(cpu);

  gtk_widget_show(fixed);
  gtk_widget_show_all(window);

  gtk_main();



  return 0;

}
```

The CPU widget is a **GtkWidget**, on which we draw with Cairo API. We draw a black background and 40 small rectangles. The rectangles are drawn in two colors. Dark green and bright green color. The **GtkVScale** widget controls the number of the bright green rectangles drawn on the widget.

The example might look difficult at the first sight. But it is not that difficult after all. Most of the code is boilerplate, it always repeats, when we create a new widget.

The drawing is done within the **gtk_cpu_paint()** function.

```
 cairo_t *cr;



 cr = gdk_cairo_create(widget->window);



 cairo_translate(cr, 0, 7);



 cairo_set_source_rgb(cr, 0, 0, 0);

 cairo_paint(cr);
```

As usual, we create a cairo context. We shift the origin 7 unit down. Next we paint the background of the widget to black color.

```
gint pos = GTK_CPU(widget)->sel;

gint rect = pos / 5;
```

Here we retrieve the sel number. It is the number that we got from the scale widget. The slider has 100 numbers. The rect parameter makes a convertion from slider values into rectangles, that will be drawn in bright green color.

```
gint i;

for ( i = 1; i <= 20; i++) {

    if (i > 20 - rect) {
        cairo_set_source_rgb(cr, 0.6, 1.0, 0);

    } else {

        cairo_set_source_rgb(cr, 0.2, 0.4, 0);

    }

    cairo_rectangle(cr, 8, i*4, 30, 3);

    cairo_rectangle(cr, 42, i*4, 30, 3);

    cairo_fill(cr);

}
```

Depending on the rect number, we draw 40 rectangles in two dark green color or in bright green color. Remember, that we are drawing these rectangles from top to bottom.

```
GtkRange *range = (GtkRange *) widget;

GtkWidget *cpu = (GtkWidget *) data;

GTK_CPU(cpu)->sel = gtk_range_get_value(range);
```

In the **set_value()** call, we get the reference to the CPU widget and set the sel value to current value, selected on the scale widget.

```
GdkRegion *region;
...
region = gdk_drawable_get_clip_region(cpu->window);
gdk_window_invalidate_region(cpu->window, region, TRUE);
gdk_window_process_updates(cpu->window, TRUE);
```

This code invalides the complete window of the CPU widget and thus makes it redraw itself.

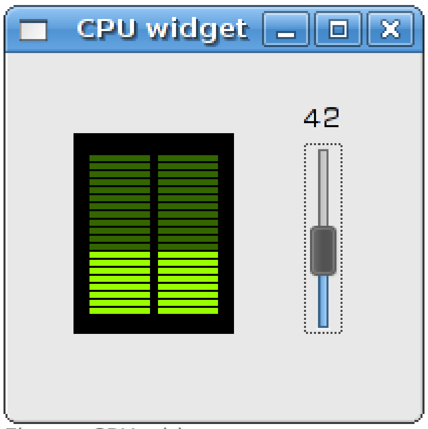


Figure: CPU widget