Wayland Desktop Environments

Weston 10.0.5 on Buildroot 2021

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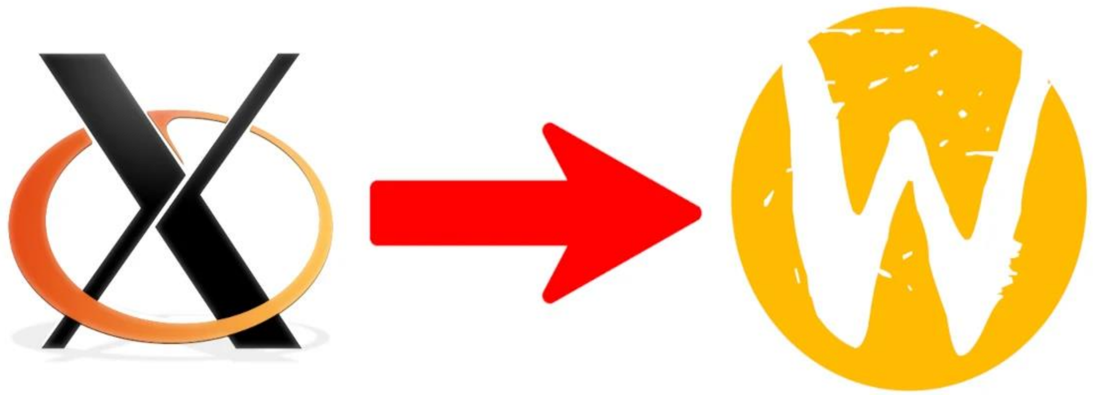
2024/12/05

Introduction to Wayland



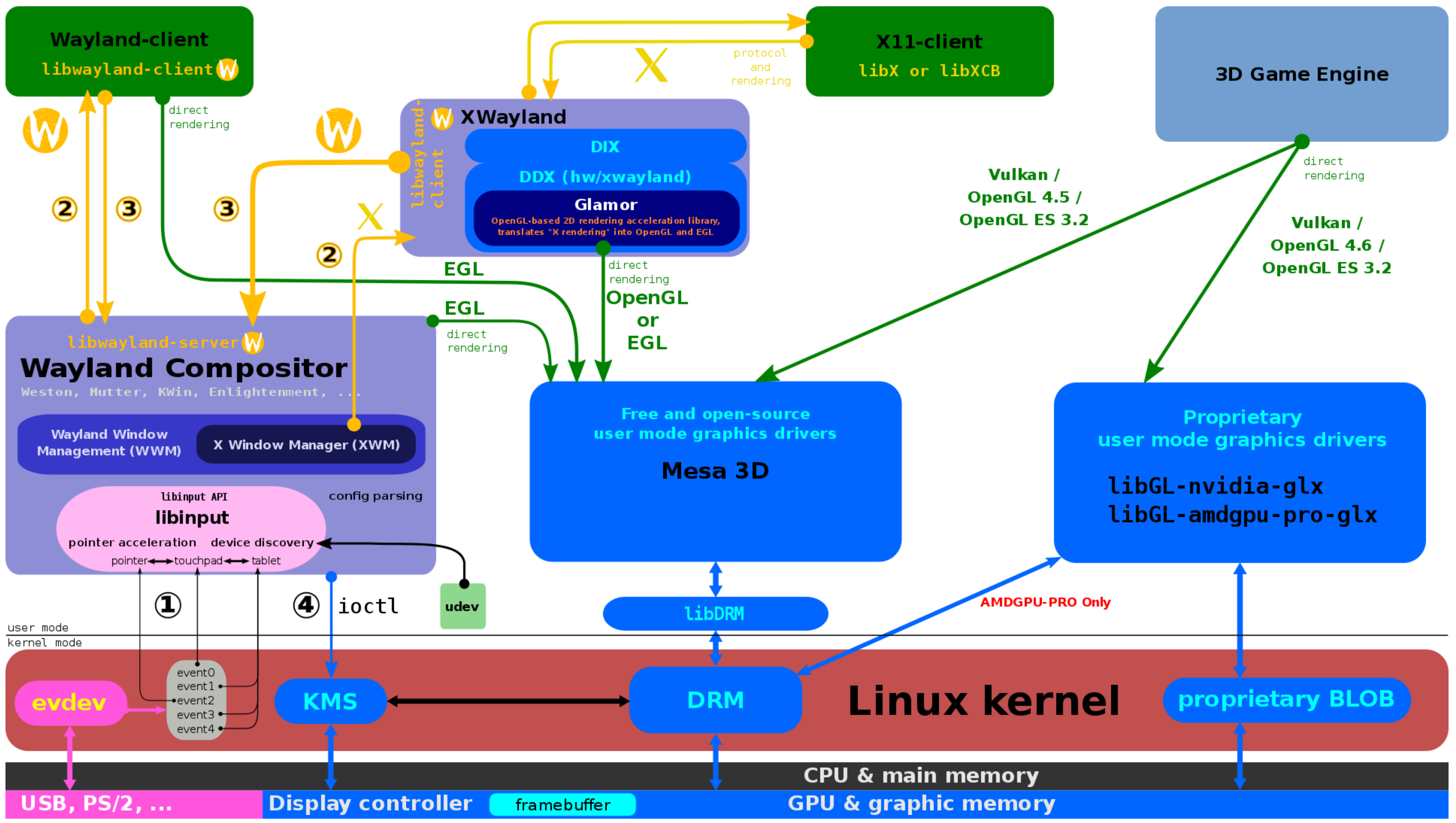
https://wayland.freedesktop.org

Wayland Protocol

- Wayland is a communication protocol that specifies the communication between a display server and its client, as well as a C library implementation of that protocol. A display server using the Wayland protocol is called a Wayland compositor, because it additionally performs the task of a compositing window manager.

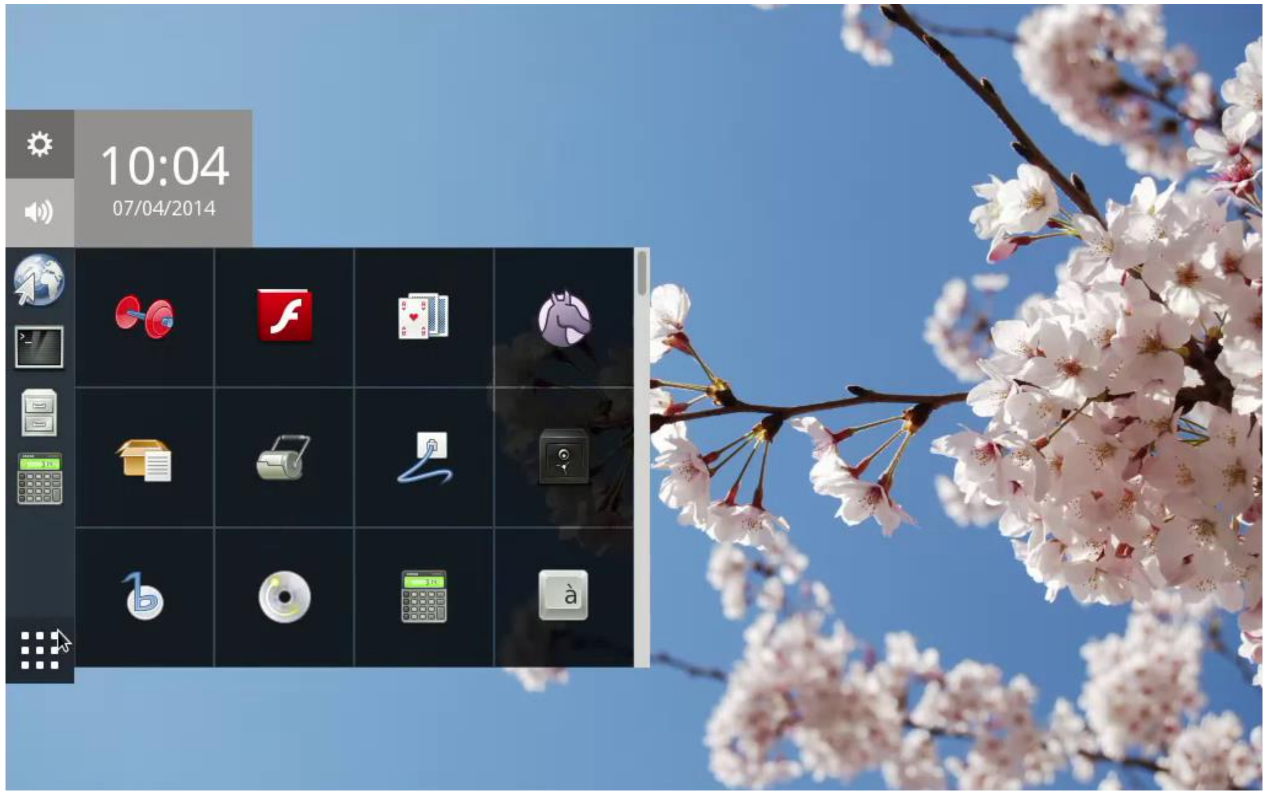
  Referral link: https://en.wikipedia.org/wiki/Wayland_(protocol)

Wayland Architecture

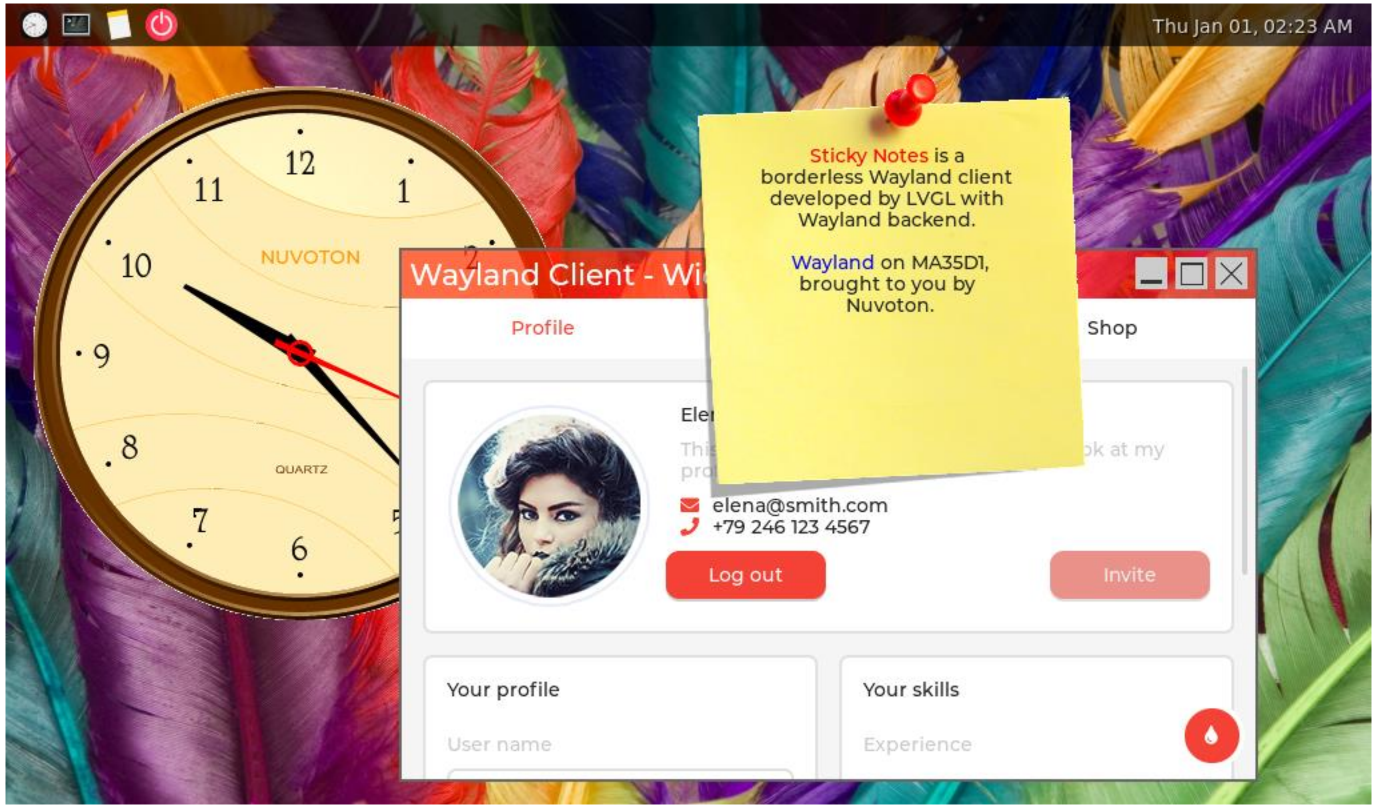


Weston Compositor

- Weston is the reference implementation of a Wayland compositor. When running on Linux, handling of the input hardware relies on evdev. Out of the box, Weston provides a very basic desktop, or a full-featured environment for non-desktop uses such as automotive, embedded, in-flight, industrial, kiosks, set-top boxes and TVs.



Customizing Weston



Sticky Notes is a borderless Wayland client developed by LVGL with Wayland backend.

Wayland on MA35D1, brought to you by Nuvoton.

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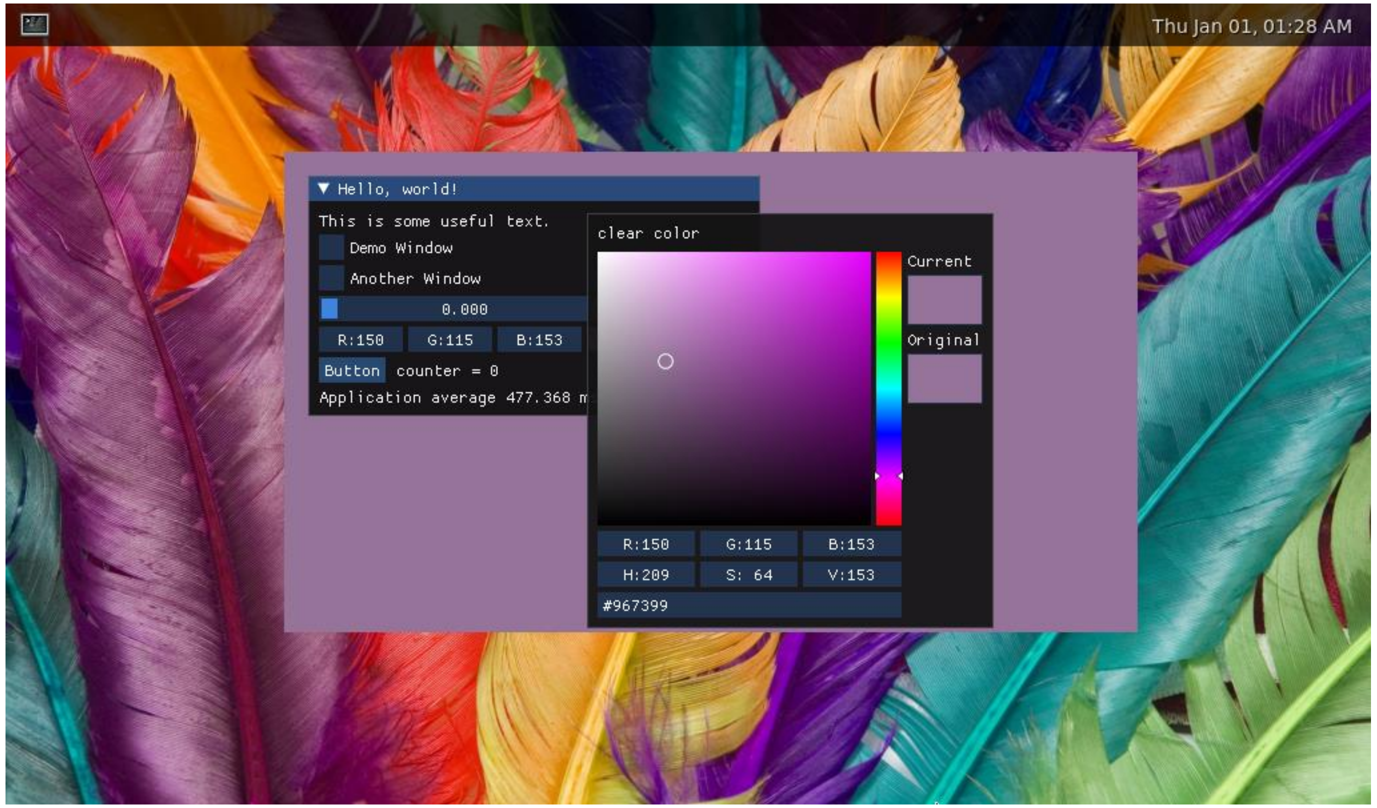
changing wallpaper, adding launch icons, setting idle lock time

Changing Wallpaper

- Prepare a wallpaper on target location
  /usr/share/weston/wall.jpg

- Edit */etc/xdg/weston/weston.ini*, under section ‘**shell**’, modify the entry ‘**background-image**’
  [shell]
  background-image=/usr/share/weston/wall.jpg



This is some useful text.
0.000
R:150 G:115 B:153
counter = 0
Application average 477.368 m
R:150 G:115 B:153
H:209 S: 64 V:153
#967399

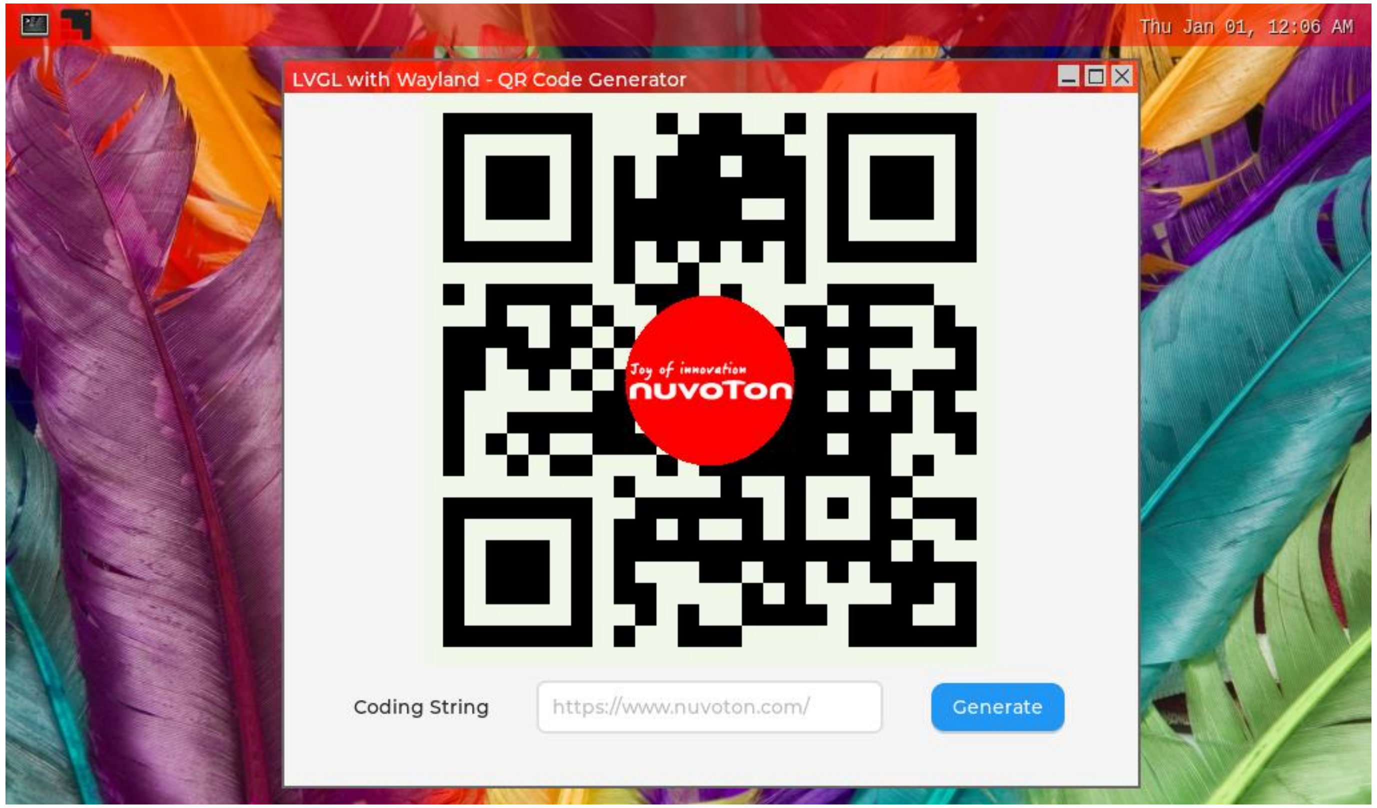
Modifying Task Panel Color

- Edit */etc/xdg/weston/weston.ini*, under section ‘**shell**’, modify the entry ‘**panel-color**’

```
[shell]
panel-color=0xffff0000
```

- Add translucent color

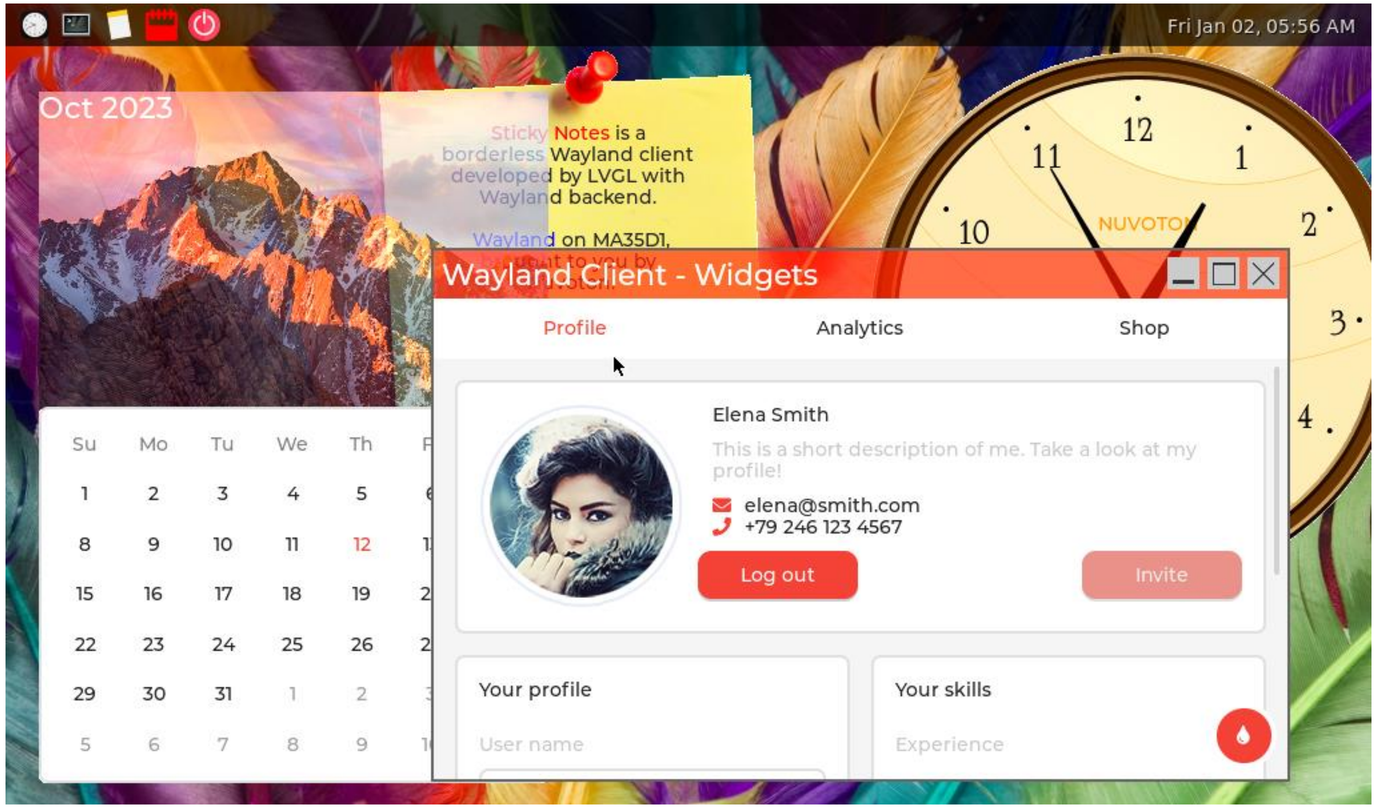
```
[shell]
panel-color=0x80ff0000
```



Adding Launch Icons in Task Panel

- Edit */etc/xdg/weston/weston.ini*, add section '**launcher**', append entries '**icon**' and '**path**' under the section '**launcher**'.

```
[launcher]
icon=/usr/share/weston/wayland24.png
path=/usr/bin/lvgl_fb
```



Sticky Notes is a borderless Wayland client developed by LVGL with Wayland backend.

Wayland on MA35D1,

Su	Mo	Tu	We	Th
1	2	3	4	5
8	9	10	11	12
15	16	17	18	19
22	23	24	25	26
29	30	31	1	2
5	6	7	8	9

Elena Smith

This is a short description of me. Take a look at my profile!

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Your profile

User name

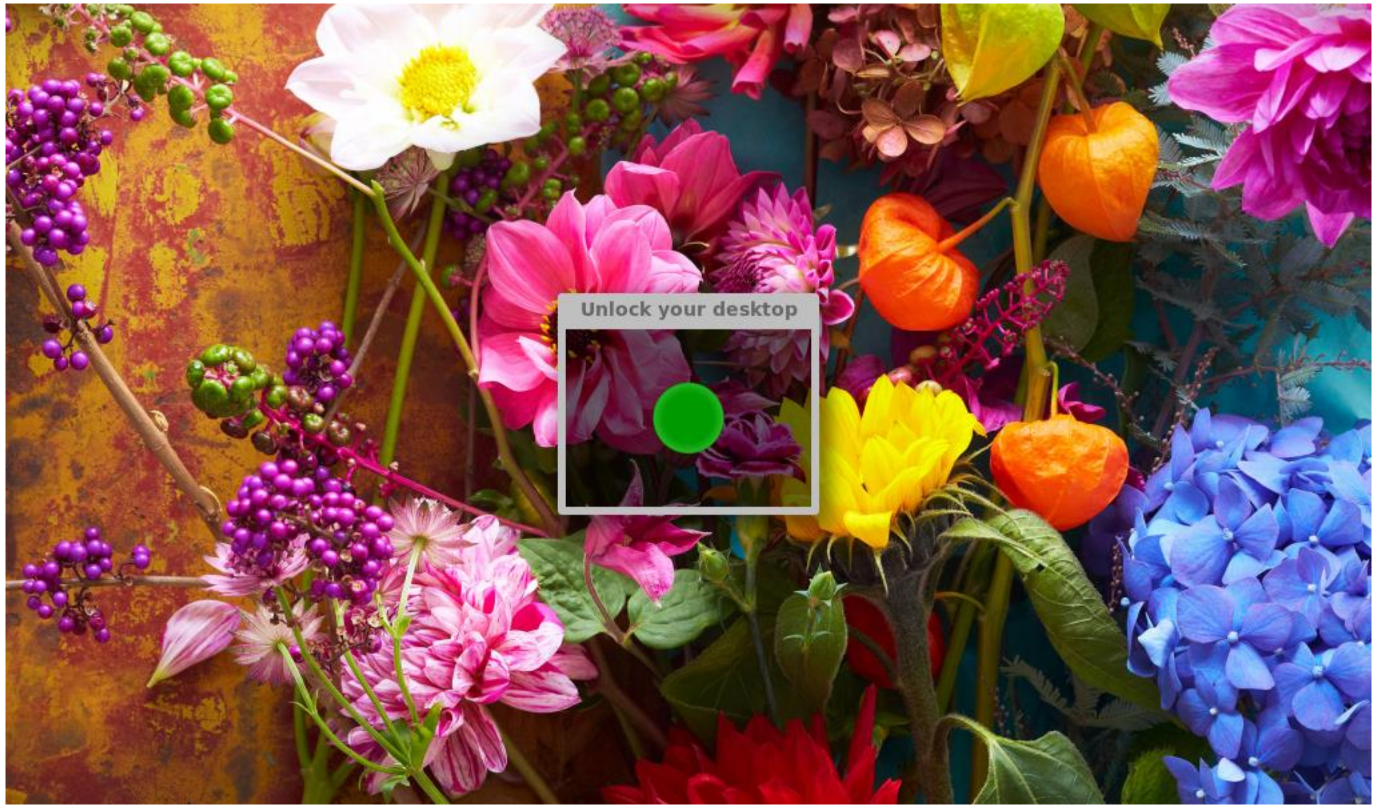
Your skills

Experience

Setting Idle Lock Time

- Edit */etc/xdg/weston/weston.ini*, under section ‘**core**’, modify the entry ‘**idle-time**’ (unit: seconds)

```
[core]
idle-time=3000
```

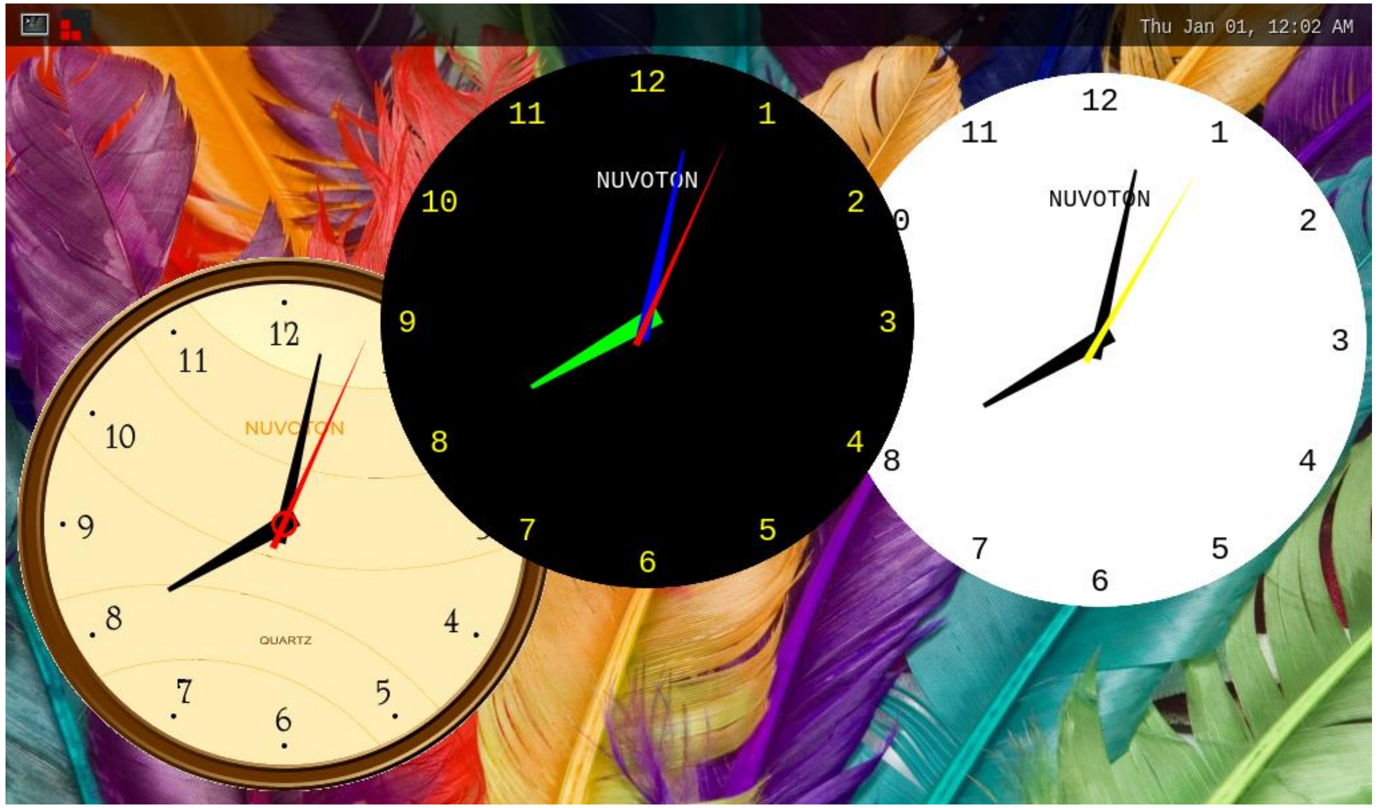


Toolkits with Wayland support

- Light and Versatile Graphics Library
  https://lvgl.io
- The Qt Group (Qt5)
  https://www.qt.io
- The GTK Project (GTK3)
  https://www.gtk.org
- The Simple DirectMedia Layer (SDL2)
  https://libsdl.org

Shaped Windows

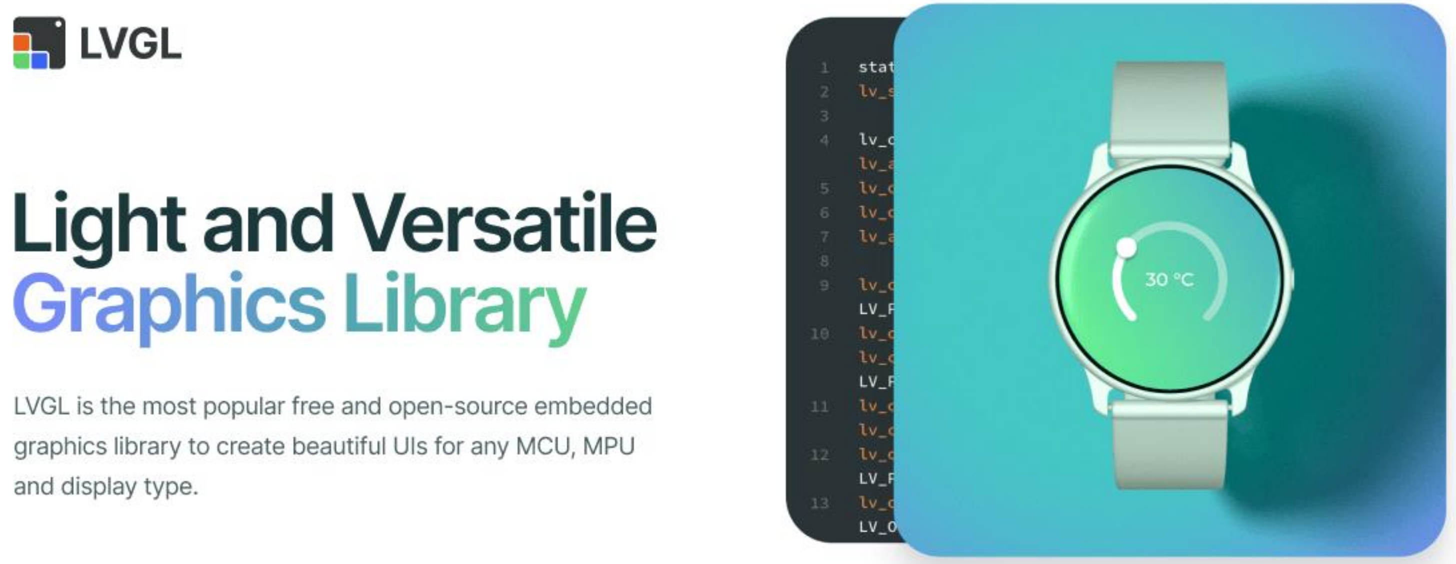
- Analog Clock implemented with various widget toolkits GTK3/Qt5/LVGL



Patching Buildroot 2021 (Weston 10.0.5)

- Get the 3 patch files: 0001-cmake-3.28.3.patch, 0002-Weston-10.0.5.patch, 0003-nvt-lvgl-wayland-8.3.0.patch from site https://githb.com/symfund/ma35d1-portal/tree/master/patches/buildroot-2021
- Put the 3 patch files into the root directory of Buildroot 2021 (https://github.com/OpenNuvoton/MA35D1_Buildroot.git)
- Apply the patch by executing the script on the command line
  ```
  $ for f in $(ls *.patch) ; do git am < $f && rm -rf $f ; done
  ```
- Configure buildroot to select the package Weston 10.05 and LVGL 8.3.0
  ```
  $ make menuconfig
  ```
  → Target packages → Graphic libraries and applications
  [*] weston

LVGL with Wayland


LVGL

Light and Versatile
Graphics Library

LVGL is the most popular free and open-source embedded graphics library to create beautiful UIs for any MCU, MPU and display type.

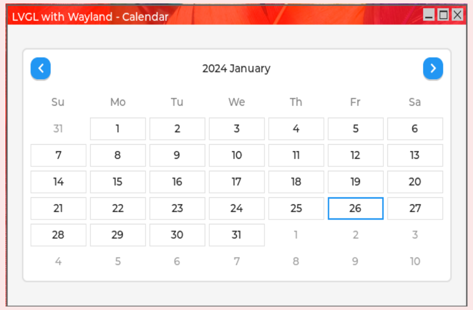
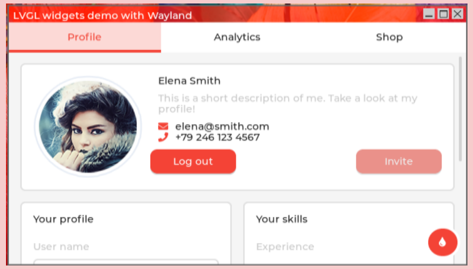
```
stat
lv_s

lv_c
lv_a
lv_c
lv_c
lv_a

lv_c
LV_F
lv_c
lv_c
LV_F
lv_c
lv_c
lv_c
LV_F
lv_c
LV_O
```

Configuring LVGL with Wayland in Buildroot

- Configure Buildroot 2021 to select LVGL 8.3.0 with Wayland

```
→System configuration →/dev management
  (X) Dynamic using devtmpfs + eudev
→Target packages →Graphics libraries and applications
  [*] mesa3d
  [*]   Gallium swrast driver
  [*]   OpenGL EGL
  [*]   OpenGL ES
  [*] weston
          default compositor (fbdev)
  [*] lvgl 8.3.0 with Wayland modified by Nuvoton
```

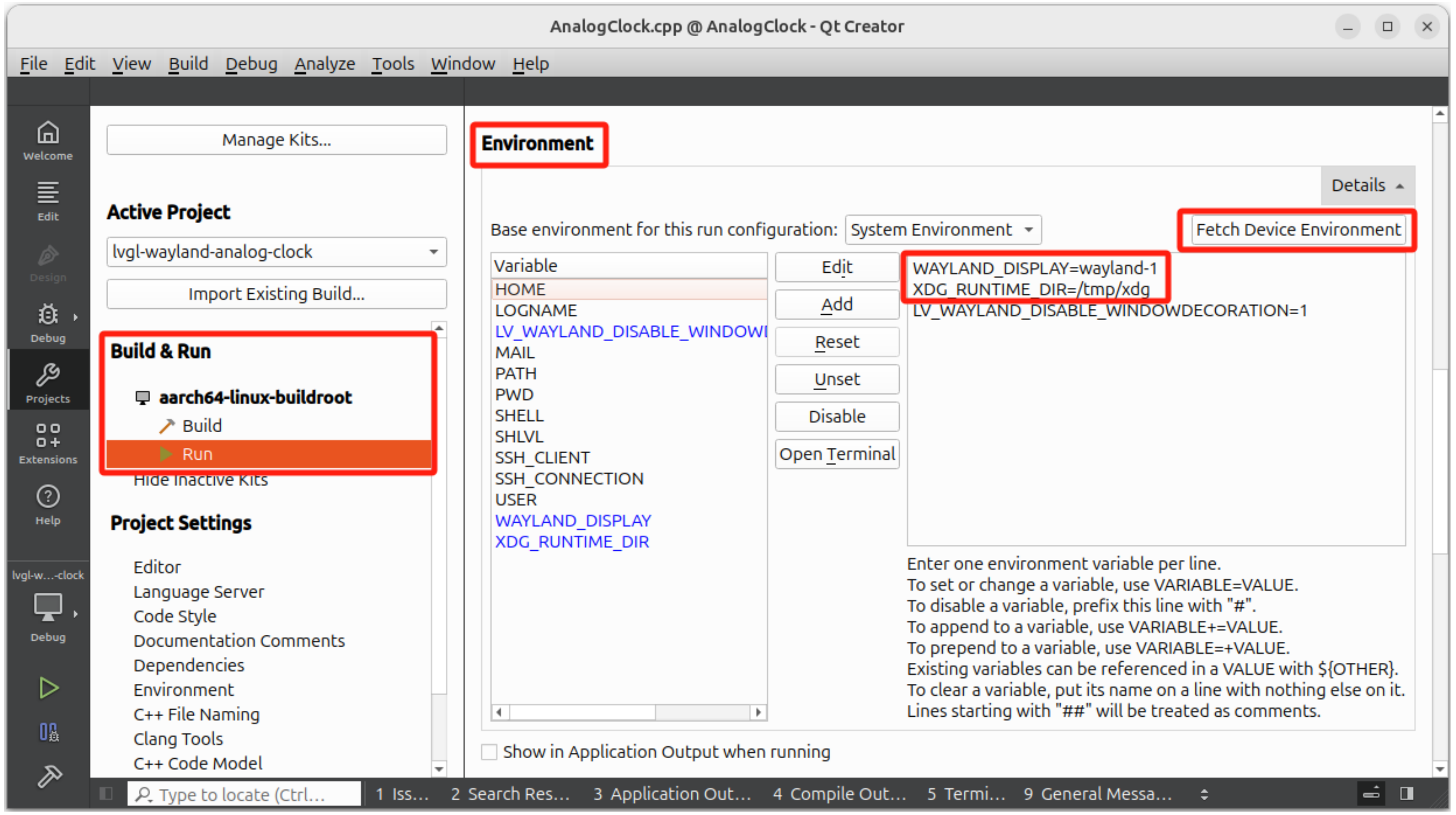
LVGL with Wayland examples

Apps	**Location (https://github.com/symfund/ma35d1-portal)** $ git clone -b weston-10.0.5 https://github.com/symfund/ma35d1-portal.git	Thumbnails
Minimal	examples/wayland/lvgl/lvgl-wayland-minimal	
Calendar	examples/wayland/lvgl/lvgl-wayland-calendar	 LVGL with Wayland - Calendar 2024 January Su Mo Tu We Th Fr Sa
Widgets	examples/wayland/lvgl/lvgl-wayland-widgets-demo	 LVGL widgets demo with Wayland Profile Analytics Shop Elena Smith This is a short description of me. Take a look at my profile! elena@smith.com +79 246 123 4567 Log out Invite Your profile User name Your skills Experience

Remote Debugging LVGL Apps with Qt Creator

- Modify *CMakeLists.txt*, change the environment variable ***BR2_DIR*** to point to the actual root path of ***Buildroot***.
- Launch ***Qt Creator*** to open project with *CMakeLists.txt*.
- Configure the settings of ***Build & Run***, fetch device environment, and add two variables:

  WAYLAND_DISPLAY=wayland-1
  XDG_RUNTIME_DIR=/tmp/xdg



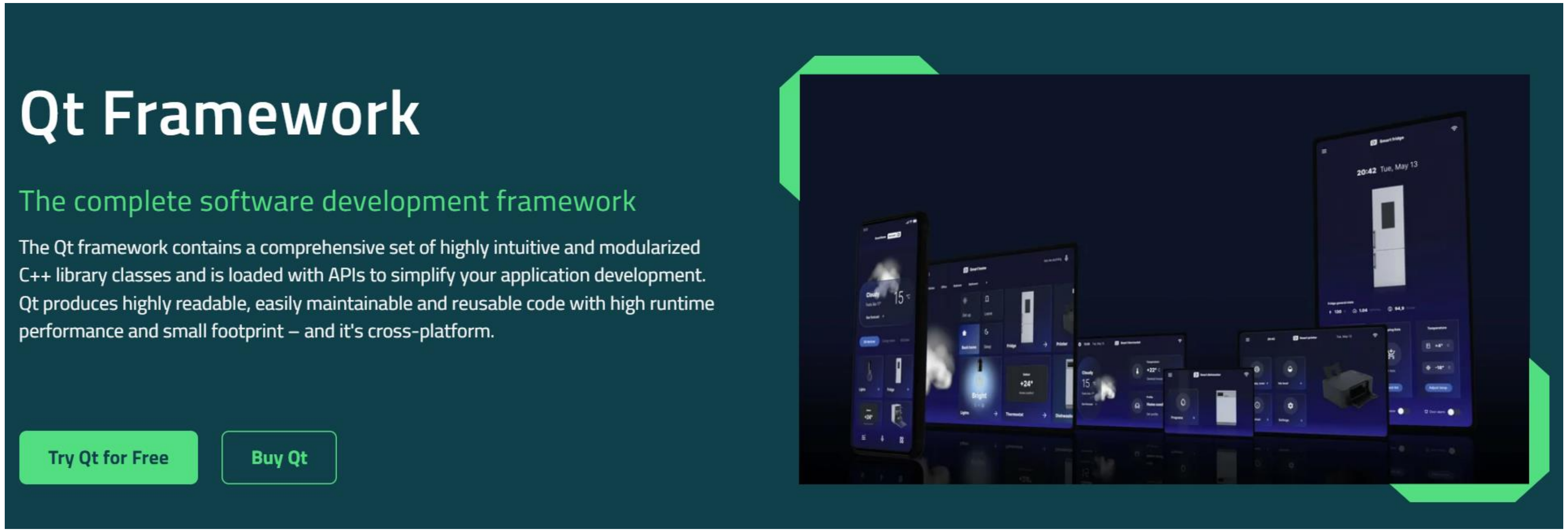
Base environment for this run configuration: System Environment

Variable
HOME
LOGNAME
LV_WAYLAND_DISABLE_WINDOWI
MAIL
PATH
PWD
SHELL
SHLVL
SSH_CLIENT
SSH_CONNECTION
USER
WAYLAND_DISPLAY
XDG_RUNTIME_DIR

```
WAYLAND_DISPLAY=wayland-1
XDG_RUNTIME_DIR=/tmp/xdg
LV_WAYLAND_DISABLE_WINDOWDECORATION=1
```

Enter one environment variable per line.
To set or change a variable, use VARIABLE=VALUE.
To disable a variable, prefix this line with "#".
To append to a variable, use VARIABLE+=VALUE.
To prepend to a variable, use VARIABLE=+VALUE.
Existing variables can be referenced in a VALUE with ${OTHER}.
To clear a variable, put its name on a line with nothing else on it.
Lines starting with "##" will be treated as comments.

Qt5 with Wayland



Qt Framework

The complete software development framework

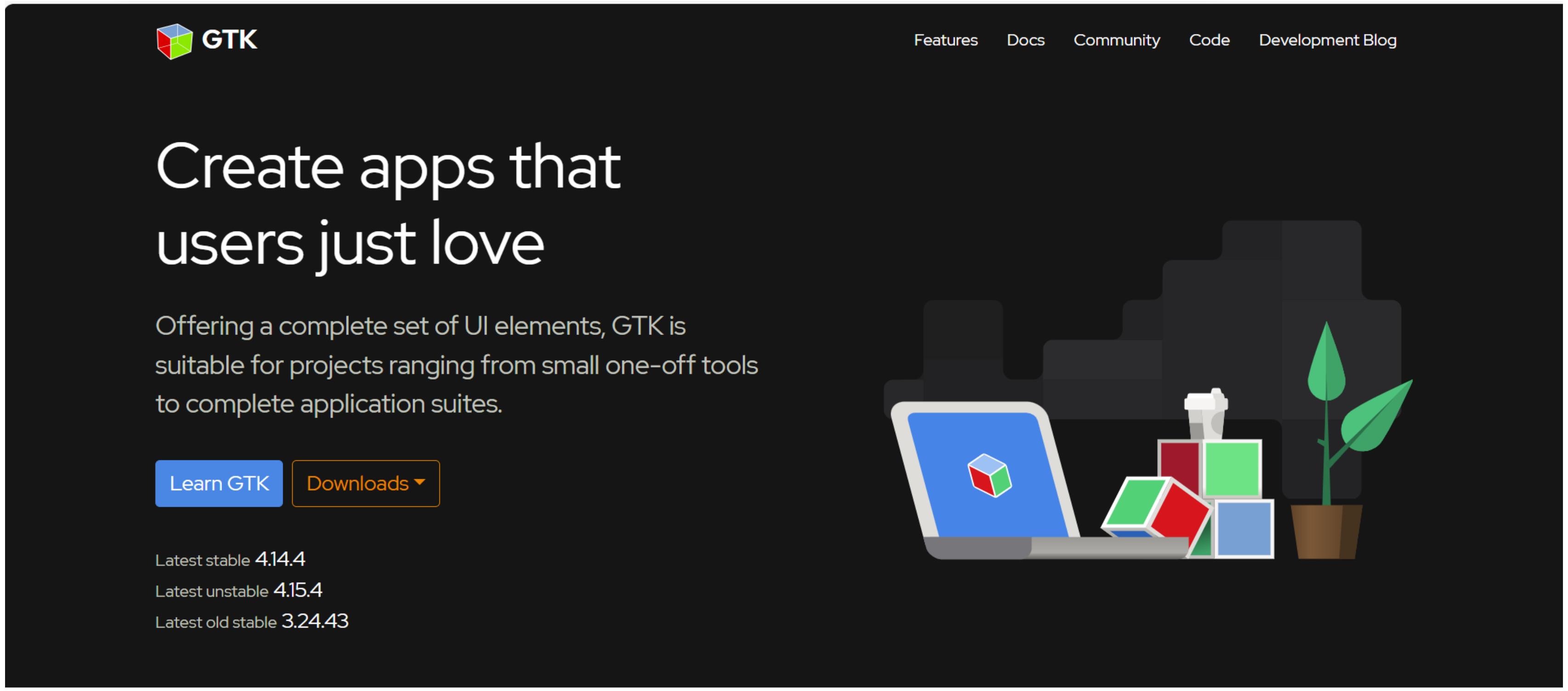
The Qt framework contains a comprehensive set of highly intuitive and modularized C++ library classes and is loaded with APIs to simplify your application development. Qt produces highly readable, easily maintainable and reusable code with high runtime performance and small footprint – and it's cross-platform.

Configuring Qt5 with Wayland in Buildroot

- Configure Buildroot to select Qt5 with Wayland

```
→System configuration →/dev management
   (X) Dynamic using devtmpfs + eudev

→Target packages →Fonts, cursors, icons, sounds and themes
   [*] Liberation (Free fonts)
   [*]    mono fonts
   [*]    sans fonts
   [*]    serif fonts

→Target packages →Graphics libraries and applications
   [*] weston
          default compositor (fbdev)
   [*] Qt5
          -*- qt5base
          [*]    gui module
          [*]       widgets module
                       Default graphical platform (wayland)
          [*]    fontconfig support
          [*]    harfbuzz support
          [*]    JPEG support
          [*]    PNG support
          [*]    qt5wayland
```

GTK3 with Wayland



GTK

Features Docs Community Code Development Blog

Create apps that users just love

Offering a complete set of UI elements, GTK is suitable for projects ranging from small one-off tools to complete application suites.

Learn GTK Downloads

Latest stable 4.14.4
Latest unstable 4.15.4
Latest old stable 3.24.43

Configuring GTK3 with Wayland in Buildroot

- Configure Buildroot to select the libgtk3 and Wayland backend

```
→System configuration →/dev management
   (X) Dynamic using devtmpfs + eudev

→Target packages →Graphics libraries and applications
   [*] weston
           default compositor (fbdev)

→Target packages →Libraries →Graphics
   [*] libgtk3
          [*] Wayland GDK backend
          [*] Install libgtk3 demo program
          [*] Install libgtk3 tests
```

GTK3 with Wayland example (minimal app)

- The project structure of GTK 3 with Wayland example (minimal app)

```
---gtk3app
      |__ CMakeLists.txt
      |__ main.c
```

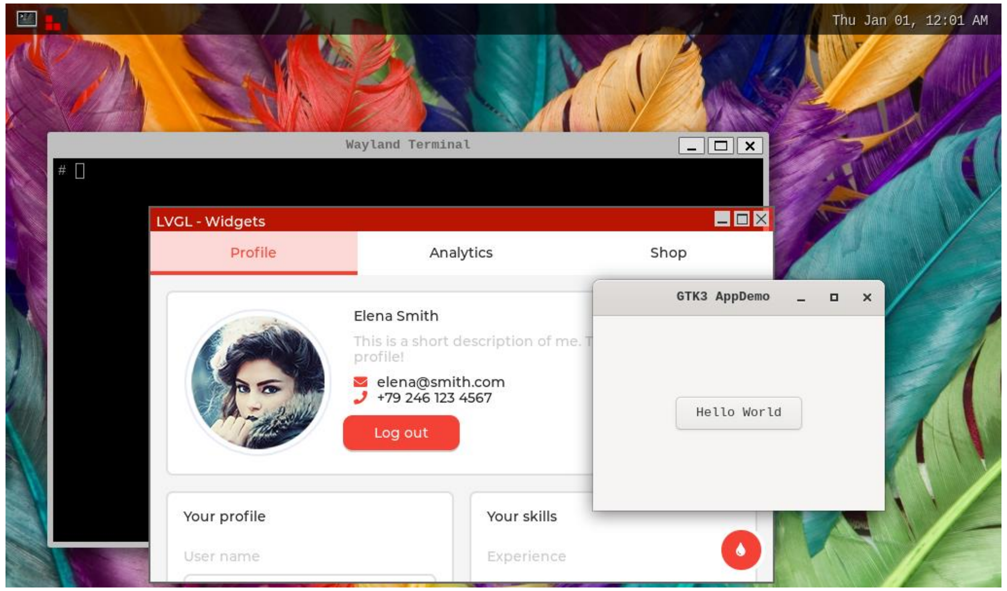
- Change the environment variable ***BR2_DIR*** to point to the actual root path of ***Buildroot***, then launch Qt Creator to open project with ***CMakeLists.txt***.

gtk3app/CMakeLists.txt

```
cmake_minimum_required(VERSION 3.16)
project(gtk3app LANGUAGES C)
set(BR2_DIR "/home/arthur/Projects/buildroot_2024")
set(CMAKE_SYSROOT "${BR2_DIR}/output/host/aarch64-nuvoton-linux-gnu/sysroot")

include_directories(
   ${CMAKE_SYSROOT}/usr/include/gtk-3.0
   ${CMAKE_SYSROOT}/usr/include/glib-2.0
   ${CMAKE_SYSROOT}/usr/lib/glib-2.0/include
   ${CMAKE_SYSROOT}/usr/include/pango-1.0
   ${CMAKE_SYSROOT}/usr/include/harfbuzz
   ${CMAKE_SYSROOT}/usr/include/cairo
   ${CMAKE_SYSROOT}/usr/include/gdk-pixbuf-2.0
   ${CMAKE_SYSROOT}/usr/include/atk-1.0)

add_executable(gtk3app
   main.c
)

target_link_libraries(
   gtk3app
   glib-2.0
   gtk-3
   gdk_pixbuf-2.0
   gobject-2.0   gio-2.0
   pango-1.0
)

include(GNUInstallDirs)
install(TARGETS gtk3app
   LIBRARY DESTINATION ${CMAKE_INSTALL_LIBDIR}
   RUNTIME DESTINATION ${CMAKE_INSTALL_BINDIR}
)
```

GTK3 with Wayland example (minimal app)

- The GTK 3 minimal app running in Wayland desktop environment



gtk3app/main.c

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

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

static void activate(GtkApplication *app, gpointer user) {
   GtkWidget *widget, *button, *button_box;

   widget = gtk_application_window_new(app);
   gtk_window_set_title(GTK_WINDOW(widget), "GTK3 AppDemo");
   gtk_window_set_default_size(GTK_WINDOW(widget), 300, 200);
   button_box = gtk_button_box_new(GTK_ORIENTATION_HORIZONTAL);
   gtk_container_add(GTK_CONTAINER(widget), button_box);
   button = gtk_button_new_with_label("Hello World");
   g_signal_connect(button, "clicked", G_CALLBACK(button_clicked), NULL);
   g_signal_connect_swapped(button, "clicked", G_CALLBACK(gtk_widget_destroy), widget);
   gtk_container_add(GTK_CONTAINER(button_box), button);
   gtk_widget_show_all(widget);
}

int main(int argc, char *argv[]) {
   GtkApplication *app;
   int status;

   app = gtk_application_new("com.nuvoton.gtk3app", G_APPLICATION_FLAGS_NONE);
   g_signal_connect(app, "activate", G_CALLBACK(activate), NULL);
   status = g_application_run(G_APPLICATION (app), argc, argv);
   g_object_unref(app);

   return status;
}
```

SDL2 with Wayland

Simple DirectMedia Layer is a cross-platform development library designed to provide low level access to audio, keyboard, mouse, joystick, and graphics hardware via OpenGL and Direct3D. It is used by video playback software, emulators, and popular games including Valve's award winning catalog and many Humble Bundle games.

Official site: https://libsdl.org

Configuring SDL2 with Wayland in Buildroot

- Configure Buildroot to select the package sdl2

```
→System configuration →/dev management
   (X) Dynamic using devtmpfs + eudev

→Target packages →Graphics libraries and applications
   [*] mesa3d
   [*]     Gallium swrast driver
   [*]     OpenGL EGL
   [*]     OpenGL ES
   [*] weston
              default compositor (fbdev)
   [*] sdl2
   [*]     OpenGL ES
   [*] sdl2_gfx
   [*] sdl2_image
   [*] sdl2_ttf
```

SDL2 with Wayland example

- The project structure of SDL2 with Wayland example

```
---SDL2
        |__ CMakeLists.txt
        |__ main.c
```

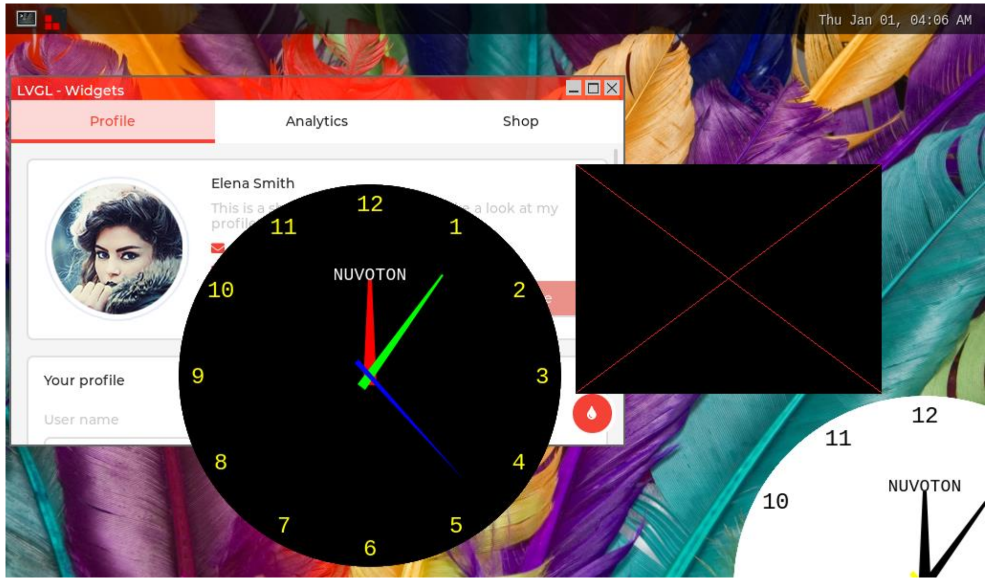
- Change the environment variable ***BR2_DIR*** to point to the actual root path of ***Buildroot***, then launch Qt Creator to open project with ***CMakeLists.txt***.

SDL2/CMakeLists.txt

```
cmake_minimum_required(VERSION 3.16)

project(sdl2-wayland LANGUAGES C)

set(BR2_DIR "/home/arthur/Projects/buildroot_2024")
set(CMAKE_SYSROOT "${BR2_DIR}/output/host/aarch64-nuvoton-linux-gnu/sysroot")

add_executable(sdl2-wayland
    main.c
)

target_link_libraries(sdl2-wayland
    SDL2
    wayland-client
)

include(GNUInstallDirs)
install(TARGETS sdl2-wayland
    LIBRARY DESTINATION ${CMAKE_INSTALL_LIBDIR}
    RUNTIME DESTINATION ${CMAKE_INSTALL_BINDIR}
)
```

SDL2 with Wayland example

- The SDL2 with Wayland demo running in Wayland desktop environment



SDL2/main.c

```
#include <stdbool.h>
#include <SDL2/SDL.h>

int main(int argc, char* argv[]) {
   SDL_Window* window = NULL;
   SDL_Renderer *renderer = NULL;
   bool quit = true;

   if (SDL_Init(SDL_INIT_VIDEO) < 0)  return 1;

   window = SDL_CreateWindow(“SDL Tutorial”, SDL_WINDOWPOS_UNDEFINED, SDL_WINDOWPOS_UNDEFINED,
                  640, 480, SDL_WINDOW_SHOWN);
   if (window == NULL) {
      SDL_Quit();
      return 1;
   }

   renderer = SDL_CreateRenderer(window, -1, SDL_RENDERER_SOFTWARE);
   if (renderer == NULL) {
      SDL_DestroyWindow(window);
      SDL_Quit();
      return 1;
   }

   SDL_SetRenderDrawColor(renderer, 0, 0, 0, 255);
   SDL_RenderClear(renderer);

   while (quit) {
      SDL_SetRenderDrawBlendMode(renderer, SDL_BLENDMODE_ADD);
      SDL_SetRenderDrawColor(renderer, 255, 0, 0, 255);
      SDL_RenderDrawLine(renderer, 0, 0, 639, 479);
      SDL_RenderDrawLine(renderer, 639, 0, 0, 479);
      SDL_RenderPresent(renderer);
      SDL_Delay(16);
   }

   SDL_DestroyRenderer(renderer);
   SDL_DestroyWindow(window);
   SDL_Quit();

   return 0;
}
```

Joy of innovation

nuvoTon

谢谢
謝謝
Děkuji
Bedankt
Thank you
Kiitos
Merci
Danke
Grazie
ありがとう
감사합니다
Dziękujemy
Obrigado
Спасибо
Gracias
Teşekkür ederim
Cảm ơn