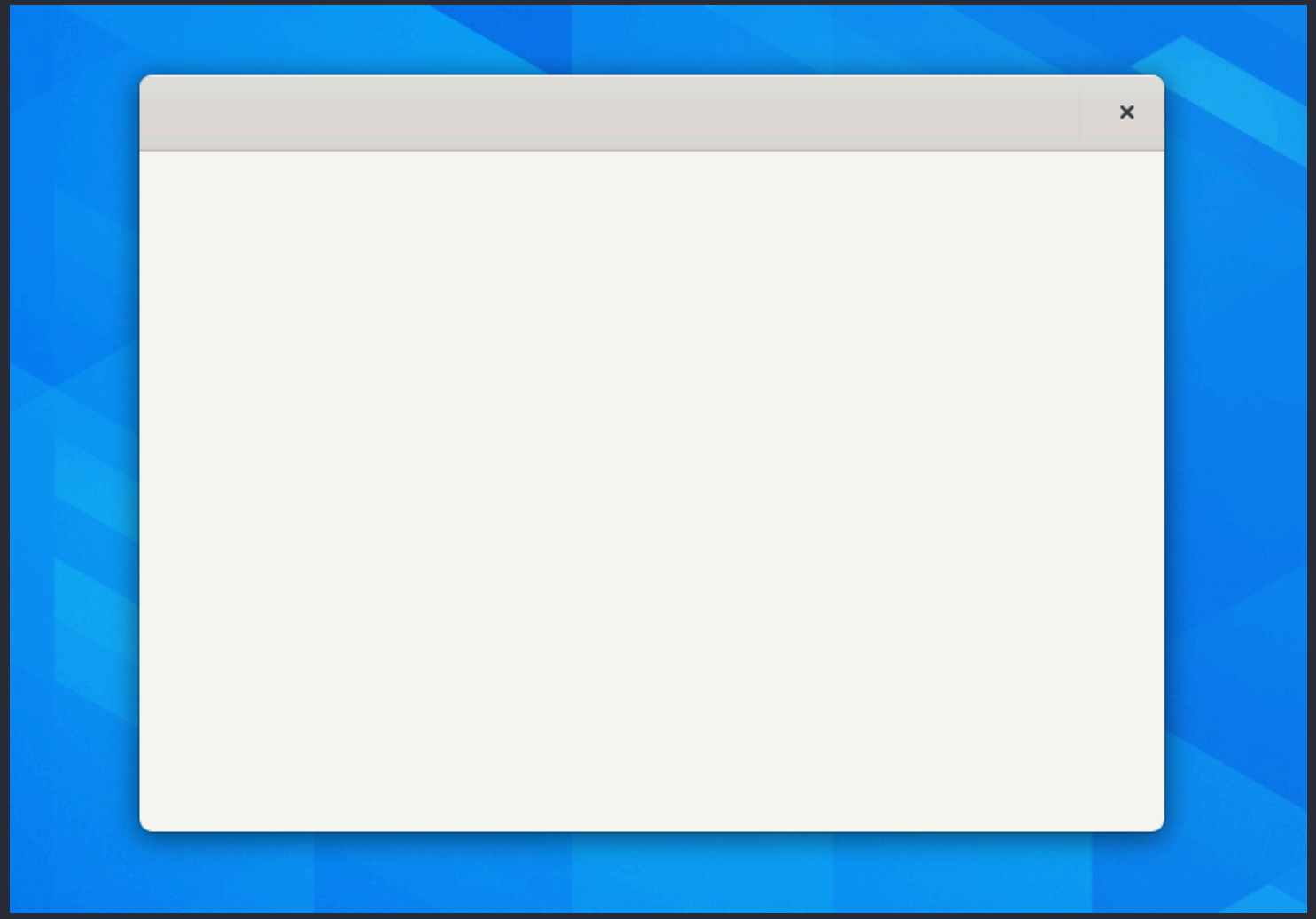
PV281: Programování v Rustu

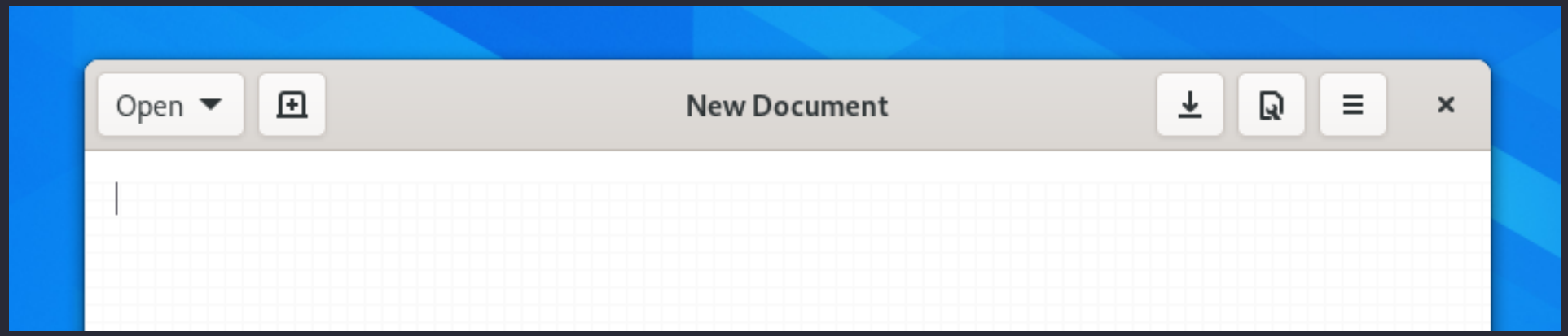
Obsah

Přístupy k vývoji desktopových aplikací

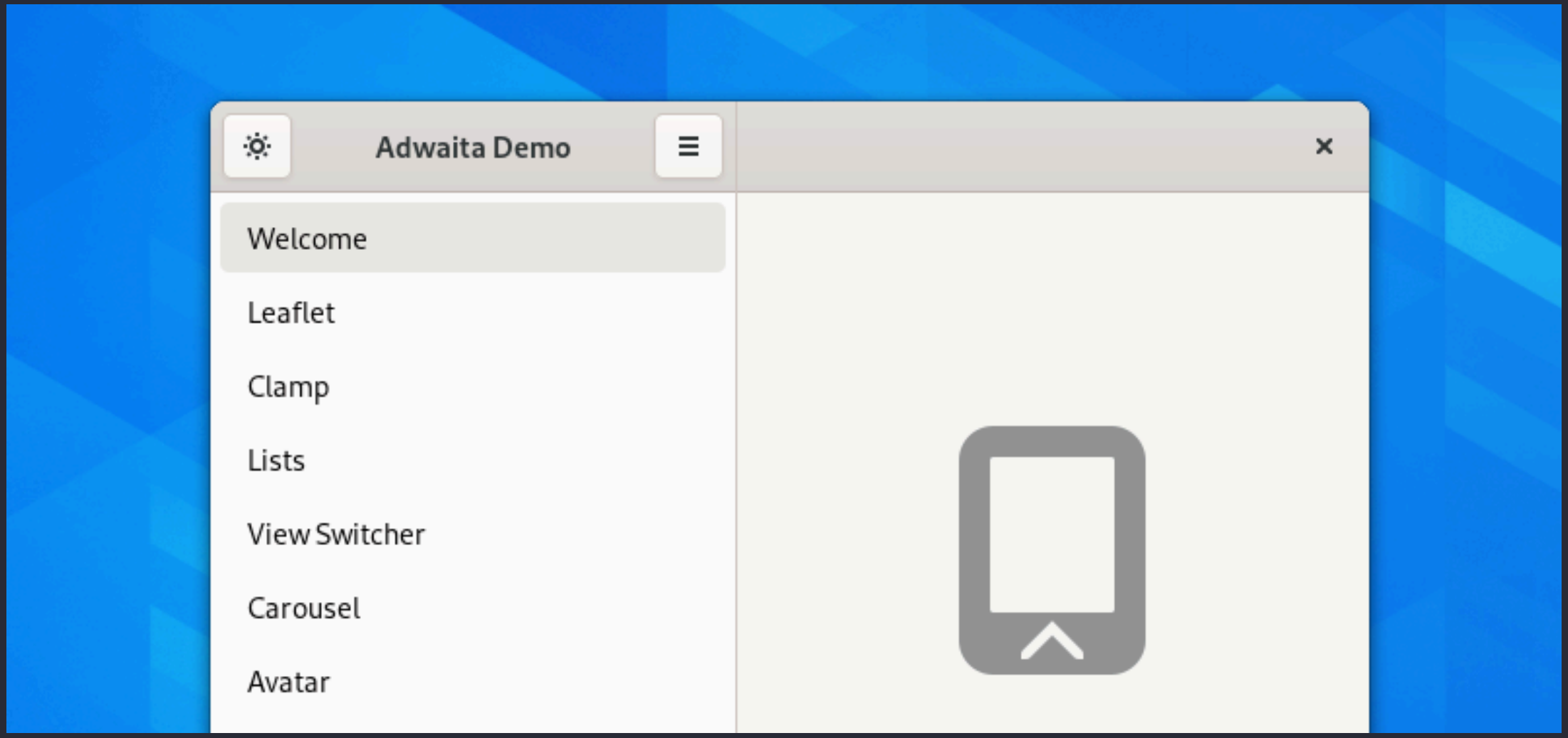
Koncept okna



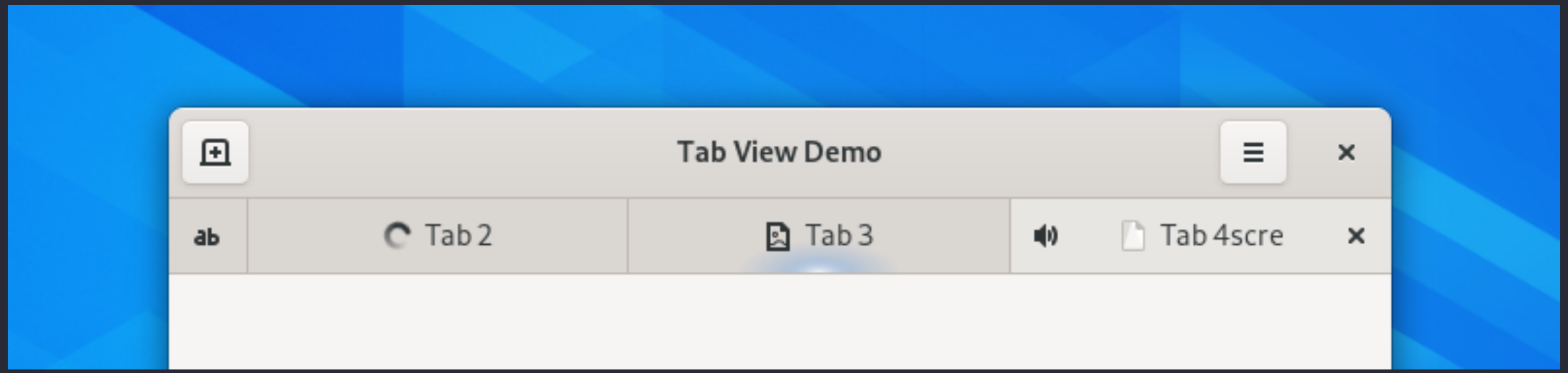
Header bar



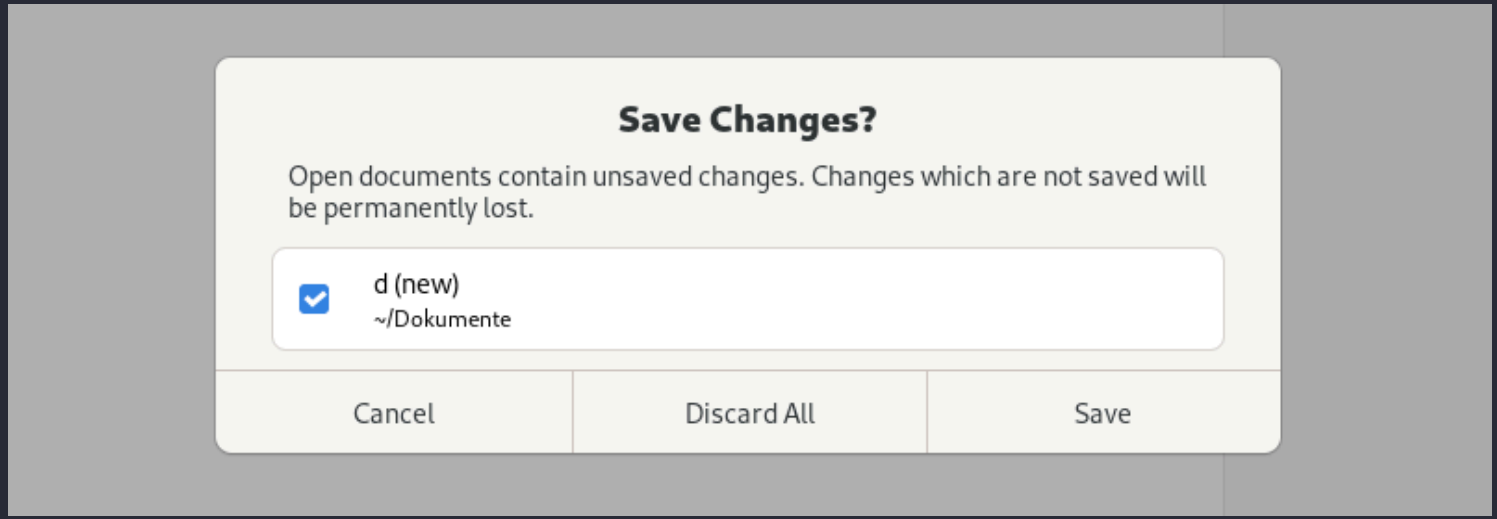
Sidebar


Adwaita Demo
Welcome
Leaflet
Clamp
Lists
View Switcher
Carousel
Avatar

Taby



Dialog


Save Changes?
Open documents contain unsaved changes. Changes which are not saved will be permanently lost.
d (new)
~/Dokumente
Cancel
Discard All
Save

GTK 4

GTK 4

GTK je multiplatformní knihovna pro tvorbu UI.

Je psaná v C, takže se vyžívá bindingů pro Rust.

Závislosti

```
gtk = { version = "0.5.2", package = "gtk4" }

# Notice that we are renaming the package from `gtk4` to just `gtk`.
```

Kromě toho je potřeba nainstalovat knihovny pro vývoj dle dokumentace, např. pro UN*X:

Distribution	Binary package	Development package	Additional packages
Arch	`gtk4`	-	-
Debian/Ubuntu	`libgtk-4-1`	`libgtk-4-dev`	`gtk-4-examples`
Fedora	`gtk4`	`gtk4-devel`	-

Vytvoření aplikace

```rust
use gtk::prelude::*;
use gtk::Application;

fn main() {
    let app = Application::builder()          // Create a new application
        .application_id("org.gtk-rs.example")
        .build();

    app.run();                                // Run the application
}
```

Vytvoření okna

```rust
use gtk::{Application, ApplicationWindow, prelude::*};

fn main() {
    let app = Application::builder()          // Create a new application
        .application_id("org.gtk-rs.example")
        .build();

    app.connect_activate(build_ui);           // Connect to "activate" signal of `app`

    app.run();                                // Run the application
}

fn build_ui(app: &Application) {
    let window = ApplicationWindow::builder() // Create a window and set the title
        .application(app)
        .title("My GTK App")
        .build();

    window.present();                         // Present window to the user
}
```

Přidání tlačítka

```rust
fn build_ui(app: &Application) {
    let window = ApplicationWindow::builder() // Create a window and set the title
        .application(app)
        .title("My GTK App")
        .build();

    let button = Button::builder()            // Create a button with label and margins
        .label("Press me!")
        .margin_top(12)
        .margin_bottom(12)
        .margin_start(12)
        .margin_end(12)
        .build();

    button.connect_clicked(move |button| {    // Connect to "clicked" signal of `button`
        button.set_label("Hello World!");     // Set the label to "Hello World!" after the button has been clicked on
    });

    window.set_child(Some(&button));          // Add button

    window.present();                         // Present window to the user
}
```

Události (signály)

```
// ...

button.connect_local("clicked", false, move |args| { // Connect callback
    let button = args[0]                             // Get the button from the arguments
        .get::<Button>()
        .expect("Expected type `Button`");

    button.set_label("Hello World!");                // Set the label after the button has been clicked

    None
});

// ...
```

Zobrazení dialogu

```rust
use gtk::{glib::clone, prelude::*};
use std::rc::Rc;

fn main() {
    let application = gtk::Application::builder()
        .application_id("com.github.gtk-rs.examples.dialog")
        .build();

    application.connect_activate(build_ui);
    application.run();
}

fn build_ui(application: &gtk::Application) {
    // ...created button and window using builder patterns

    button.connect_clicked(clone!(@strong window =>
        move |_| {
            gtk::glib::MainContext::default()
                .spawn_local(my_dialog(Rc::clone(&window)));
        }
    ));
}
```

```rust
async fn my_dialog<W: IsA<gtk::Window>>(window: Rc<W>) {
    let question_dialog = gtk::MessageDialog::builder()
        .transient_for(&*window)
        .modal(true)
        .buttons(gtk::ButtonsType::OkCancel)
        .text("What is your answer?")
        .build();

    let answer = question_dialog.run_future().await;
    question_dialog.close();

    let info_dialog = gtk::MessageDialog::builder()
        .transient_for(&*window)
        .modal(true)
        .buttons(gtk::ButtonsType::Close)
        .text("You answered")
        .secondary_text(&format!("Your answer: {:?}", answer))
        .build();

    info_dialog.run_future().await;
    info_dialog.close();
}
```

Definice prvků přes XML

```
<?xml version="1.0" encoding="UTF-8"?>
<interface>
  <object class="GtkApplicationWindow" id="window">
    <property name="title">My GTK App</property>
    <child>
      <object class="GtkButton" id="button">
        <property name="label">Press me!</property>
        <property name="margin-top">12</property>
        <property name="margin-bottom">12</property>
        <property name="margin-start">12</property>
        <property name="margin-end">12</property>
      </object>
    </child>
  </object>
</interface>
```

Provázání XML definice a kódu

```rust
fn build_ui(app: &Application) {
    let builder = gtk::Builder::from_string(include_str!("window.ui")); // Init builder from file

    let window: ApplicationWindow = builder                             // Get object of id="window" from the builder
        .object("window")
        .expect("Could not get object `window` from builder.");

    let button: Button = builder                                        // Get object of id="button" from the builder
        .object("button")
        .expect("Could not get object `button` from builder.");

    window.set_application(Some(app));                                  // Set application

    button.connect_clicked(move |button| {                              // Connect to "clicked" signal
        button.set_label("Hello World!");                               // Set the label after the button has been clicked
    });

    window.set_child(Some(&button));                                    // Add button
    window.present();
}
```

Vytvoření menu

```
<?xml version="1.0" encoding="UTF-8"?>
<interface>
  <menu id="menu">
    <section>
      <item>
        <attribute name="label" translatable="yes">Incendio</attribute>
        <attribute name="action">app.incendio</attribute>
      </item>
    </section>
    <section>
      <attribute name="label" translatable="yes">Defensive Charms</attribute>
      <item>
        <attribute name="label" translatable="yes">Expelliarmus</attribute>
        <attribute name="action">app.expelliarmus</attribute>
        <attribute name="icon">/usr/share/my-app/poof!.png</attribute>
      </item>
    </section>
  </menu>
</interface>
```

Akce

```rust
impl Window {
    pub fn new(app: &Application) -> Self {
        // Create new window
        Object::new(&[("application", app)]).expect("Failed to create Window")
    }

    fn add_actions(&self) {
        let imp = imp::Window::from_instance(self);
        let label = imp.label.get();

        // Add stateful action "count" to `window` taking an integer as parameter
        let original_state = 0;
        let action_count = SimpleAction::new_stateful(
            "count",
            Some(&i32::static_variant_type()),
            &original_state.to_variant(),
        );

        action_count.connect_activate(clone!(@weak label => move |action, parameter| {
            // Get state
            let mut state = action
                .state()
                .expect("Could not get state.")
                .get::<i32>()
                .expect("The value needs to be of type `i32`.");

            // Get parameter
            let parameter = parameter
                .expect("Could not get parameter.")
                .get::<i32>()
                .expect("The value needs to be of type `i32`.");

            // Increase state by parameter and save state
            state += parameter;
            action.set_state(&state.to_variant());

            // Update label with new state
            label.set_label(&format!("Counter: {}", state));
        }));
        self.add_action(&action_count);
    }
}
```

Stylování přes CSS

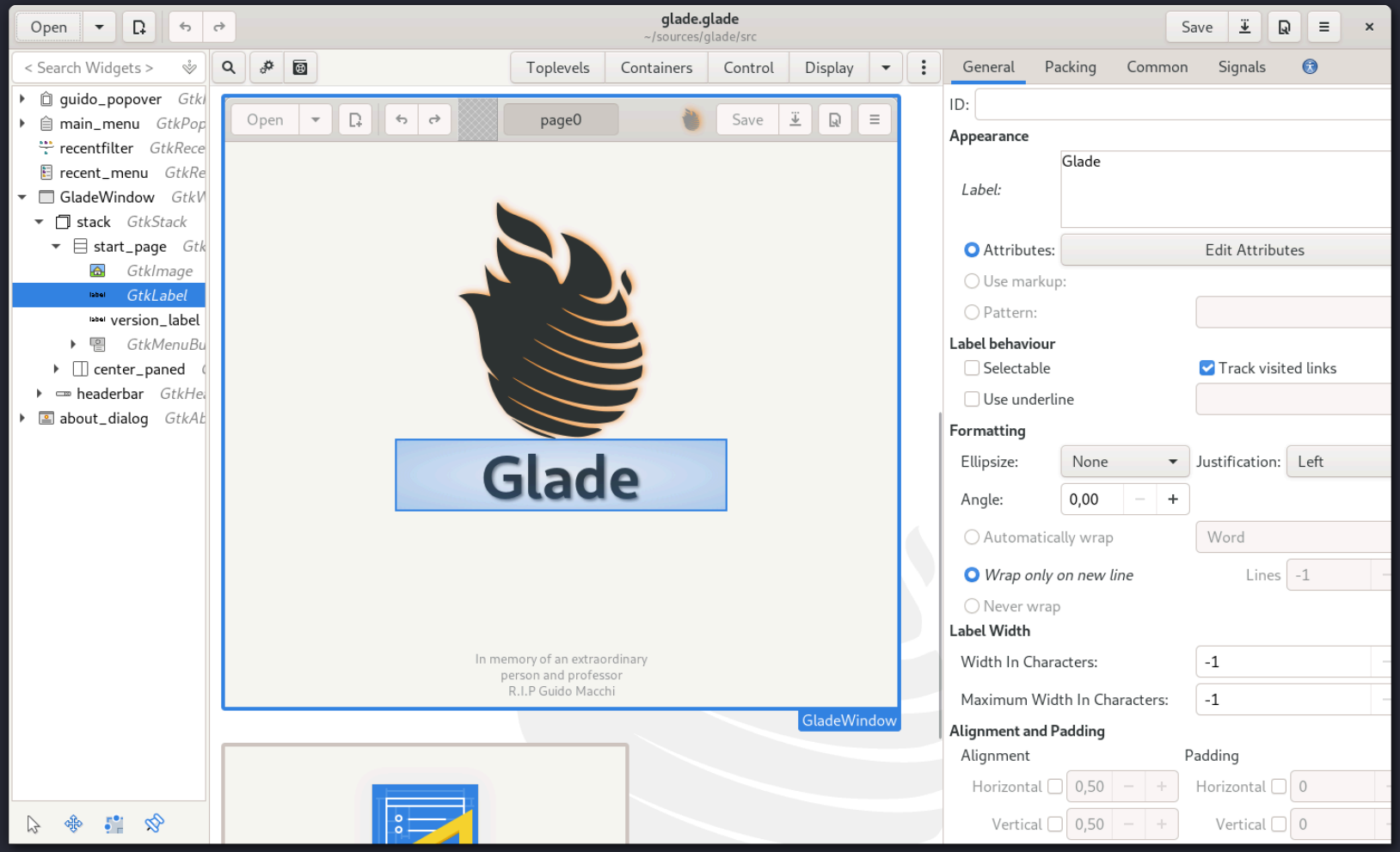
```rust
use gtk::{
    Application, ApplicationWindow, Box as Box_, Button, ComboBoxText,
    CssProvider,Entry, gdk::Display,  prelude::*, Orientation,
    StyleContext, STYLE_PROVIDER_PRIORITY_APPLICATION
};

fn main() {
    let application = Application::new(
        Some("com.github.css"), Default::default()
    );

    // The CSS "magic" happens here.
    application.connect_startup(|app| {
        let provider = CssProvider::new();
        provider.load_from_data(include_bytes!("style.css"));

        // Give the provider to the screen so the CSS rules are applied.
        StyleContext::add_provider_for_display(
            &Display::default().expect("Error initializing gtk css provider."),
            &provider,
            STYLE_PROVIDER_PRIORITY_APPLICATION,
        );

        // We build the application UI.
        build_ui(app);
    });

    application.run();
}
```

```rust
fn build_ui(application: &Application) {
    let window = ApplicationWindow::new(application);
    window.set_title(Some("CSS"));

    let button = Button::with_label("hover me!");
    button.add_css_class("button1");

    let entry = Entry::new();
    entry.add_css_class("entry1");
    entry.set_text("Some text");

    let combo = ComboBoxText::new();
    combo.append_text("option 1");
    combo.append_text("option 2");
    combo.append_text("option 3");
    combo.set_active(Some(0));

    let vbox = Box_::new(Orientation::Vertical, 0);
    vbox.append(&button);
    vbox.append(&entry);
    vbox.append(&combo);

    window.set_child(Some(&vbox));
    application.connect_activate(move |_| {
        window.show();
    });
}
```

Stylování přes CSS

```css
/* style.css */

entry.entry1 {
    background: linear-gradient(to right, #f00, #0f0);
    color: blue;
    font-weight: bold;
}

button {
    /* If we don't put it, the yellow background won't be visible */
    background-image: none;
}

button.button1:hover {
    transition: 500ms;
    color: red;
    background-color: yellow;
}

combobox button.combo box {
    padding: 5px;
}
combobox box arrow {
    -gtk-icon-source: -gtk-icontheme('pan-down-symbolic');
    border-left: 5px solid transparent;
    border-right: 5px solid transparent;
    border-top: 5px solid black;
}
```

Glade


Open
glade.glade
~/sources/glade/src
Save
< Search Widgets >
Toplevels
Containers
Control
Display
General
Packing
Common
Signals
guido_popover
main_menu
recentfilter
recent_menu
GladeWindow
stack
start_page
GtkImage
GtkLabel
version_label
center_paned
headerbar
about_dialog
page0
Glade
In memory of an extraordinary
person and professor
R.I.P Guido Macchi
GladeWindow
ID:
Appearance
Label:
Glade
Attributes:
Edit Attributes
Use markup:
Pattern:
Label behaviour
Selectable
Track visited links
Use underline
Formatting
Ellipsize:
None
Justification:
Left
Angle:
0,00
Automatically wrap
Word
Wrap only on new line
Lines
-1
Never wrap
Label Width
Width In Characters:
-1
Maximum Width In Characters:
-1
Alignment and Padding
Alignment
Padding
Horizontal
0,50
Vertical
0,50
Horizontal
0
Vertical
0

Tauri

Tauri

- postavené na podobných principech jako Electron
- využívá webview pro renderování HTML
- pro tvorbu view využíváme HTML a související technologie
- logiku a další důležité součásti vytváříme přes Rust

Instalace

Je nutné mít nainstalovaný Node.
Doporučujeme instalovat přes NVM.

Kromě Node musíte nainstalovat webview2.

Pro vývoj na UN*Xu jsou také potřeba další knihovny.

Vytvoření projektu

```
corepack enable

pnpm create tauri-app
```

```
# cargo install tauri-cli
cargo tauri init # alternativne `pnpm tauri init`

cargo tauri dev
```

Výchozí struktura projektu

```
src-tauri
├── Cargo.toml
├── tauri.conf.json
└── src
    └── main.rs
```

Spuštění aplikace

```
pnpm tauri dev
```

```
cargo tauri dev
```

Rust Commands

```rust
#[tauri::command]
fn my_custom_command() {
  println!("I was invoked from JS!");
}

fn main() {
  tauri::Builder::default()
    .invoke_handler(tauri::generate_handler![my_custom_command]) // <- This is new.
    .run(tauri::generate_context!())
    .expect("failed to run app");
}
```

Zavolání z JS aplikace

`tauri.conf.json`

```
{
  "build": {
    "beforeBuildCommand": "",
    "beforeDevCommand": "",
    "devPath": "../ui",
    "distDir": "../ui",
    "withGlobalTauri": true
  },
```

Zavolání z JS aplikace

```
import { invoke } from '@tauri-apps/api/tauri'
// With the Tauri global script, enabled when `tauri.conf.json > build > withGlobalTauri` is set to true:
const invoke = window.__TAURI__.invoke

// Invoke the command
invoke('my_custom_command').then((response) => console.log(response))
```

Předávání argumentů

Parametrem může být cokoliv umožňující deserializaci přes Serde.

Command

```
#[tauri::command]
fn my_custom_command(invoke_message: String) {
  println!("I was invoked from JS, with this message: {}", invoke_message);
}
```

A jeho následné provolání

```
invoke('my_custom_command', { invokeMessage: 'Hello!' })
```

Návratová hodnota

Návratovou hodnotou může být cokoliv implementující Serde::Serialize

```
#[tauri::command]
fn my_custom_command() -> String {
  "Hello from Rust!".into()
}
```

a získání přes Promise

```
invoke('my_custom_command').then((message) => console.log(message))
```

Error Handeling

```rust
#[tauri::command]
fn my_custom_command() -> Result<String, String> {
  // If something fails
  Err("This failed!".into())
  // If it worked
  Ok("This worked!".into())
}
```

lze transparentně zpracovat jako kteroukoliv JS exception.

```javascript
invoke('my_custom_command')
  .then((message) => console.log(message))
  .catch((error) => console.error(error))
```

Události

```
import { emit, listen } from '@tauri-apps/api/event'

// listen to the `click` event and get a function to remove the event listener
// there's also a `once` function that subscribes to an event and automatically unsubscribes the listener on the first event
const unlisten = await listen('click', event => {
  // event.event is the event name (useful if you want to use a single callback fn for multiple event types)
  // event.payload is the payload object
})

// emits the `click` event with the object payload
emit('click', {
  theMessage: 'Tauri is awesome!'
})
```

Události

V rustu jsou události dostupné přes objekt Window.

```rust
use tauri::Manager;

// the payload type must implement `Serialize`.
// for global events, it also must implement `Clone`.
#[derive(Clone, serde::Serialize)]
struct Payload {
  message: String,
}

fn main() {
  tauri::Builder::default()
    .setup(|app| {
      // listen to the `event-name` (emitted on any window)
      let id = app.listen_global("event-name", |event| {
        println!("got event-name with payload {:?}", event.payload());
      });
      // unlisten to the event using the `id` returned on the `listen_global` function
      // an `once_global` API is also exposed on the `App` struct
      app.unlisten(id);

      // emit the `event-name` event to all webview windows on the frontend
      app.emit_all("event-name", Payload { message: "Tauri is awesome!".into() }).unwrap();
      Ok(())
    })
    .run(tauri::generate_context!())
    .expect("failed to run app");
}
```

Události specifické pro okno

```
import { getCurrent, WebviewWindow } from '@tauri-apps/api/window'

// emit an event that are only visible to the current window
const current = getCurrent()
current.emit('event', { message: 'Tauri is awesome!' })

// create a new webview window and emit an event only to that window
const webview = new WebviewWindow('window')
webview.emit('event')
```

Události specifické pro okno

```rust
use tauri::{Manager, Window};

// the payload type must implement `Serialize`.
#[derive(serde::Serialize)]
struct Payload {
  message: String,
}

// init a background process on the command, and emit periodic events only to the window that used the command
#[tauri::command]
fn init_process(window: Window) {
  std::thread::spawn(move || {
    loop {
      window.emit("event-name", Payload { message: "Tauri is awesome!".into() }).unwrap();
    }
  });
}

fn main() {
  tauri::Builder::default()
    .setup(|app| {
      // `main` here is the window label; it is defined on the window creation or under `tauri.conf.json`
      // the default value is `main`. note that it must be unique
      let main_window = app.get_window("main").unwrap();

      // listen to the `event-name` (emitted on the `main` window)
      let id = main_window.listen("event-name", |event| {
        println!("got window event-name with payload {:?}", event.payload());
      });
      // unlisten to the event using the `id` returned on the `listen` function
      // an `once` API is also exposed on the `Window` struct
      main_window.unlisten(id);

      // emit the `event-name` event to the `main` window
      main_window.emit("event-name", Payload { message: "Tauri is awesome!".into() }).unwrap();
      Ok(())
    })
    .invoke_handler(tauri::generate_handler![init_process])
    .run(tauri::generate_context!())
    .expect("failed to run app");
}
```

Vytvoření menu

```rust
use tauri::{CustomMenuItem, Menu, MenuItem, Submenu};

let quit = CustomMenuItem::new("quit".to_string(), "Quit");
let close = CustomMenuItem::new("close".to_string(), "Close");
let submenu = Submenu::new("File", Menu::new().add_item(quit).add_item(close));
let menu = Menu::new()
  .add_native_item(MenuItem::Copy)
  .add_item(CustomMenuItem::new("hide", "Hide"))
  .add_submenu(submenu);

fn main() {
  let menu = Menu::new(); // configure the menu
  tauri::Builder::default()
    .menu(menu)
    .run(tauri::generate_context!())
    .expect("error while running tauri application");
}
```

Události z menu

```rust
use tauri::{CustomMenuItem, Menu, MenuItem};

fn main() {
  let menu = Menu::new(); // configure the menu
  tauri::Builder::default()
    .menu(menu)
    .on_menu_event(|event| {
      match event.menu_item_id() {
        "quit" => {
          std::process::exit(0);
        }
        "close" => {
          event.window().close().unwrap();
        }
        _ => {}
      }
    })
    .run(tauri::generate_context!())
    .expect("error while running tauri application");
}
```

System tray

úprava v configu

```
{
  "tauri": {
    "systemTray": {
      "iconPath": "icons/icon.png",
      "iconAsTemplate": true // template image pro macOs
    }
  }
}
```

Vytvoření system tray

```rust
use tauri::{CustomMenuItem, SystemTray, SystemTrayMenu};

fn main() {
  let quit = CustomMenuItem::new("quit".to_string(), "Quit");
  let hide = CustomMenuItem::new("hide".to_string(), "Hide");

  let tray_menu = SystemTrayMenu::new()
    .add_item(quit)
    .add_native_item(SystemTrayMenuItem::Separator)
    .add_item(hide);

  let system_tray = SystemTray::new()
    .with_menu(tray_menu);

  tauri::Builder::default()
    .system_tray(system_tray)
    .run(tauri::generate_context!())
    .expect("error while running tauri application");
}
```

Události ze system tray

```rust
use tauri::{CustomMenuItem, SystemTray, SystemTrayMenu, SystemTrayEvent};
use tauri::Manager;

fn main() {
  let tray_menu = SystemTrayMenu::new(); // insert the menu items here
  tauri::Builder::default()
    .system_tray(SystemTray::new().with_menu(tray_menu))
    .on_system_tray_event(|app, event| match event {
      SystemTrayEvent::MenuItemClick { id, .. } => {
        match id.as_str() {
          "quit" => {
            std::process::exit(0);
          }
          "hide" => {
            let window = app.get_window("main").unwrap();
            window.hide().unwrap();
          }
          _ => {}
        }
      }
      _ => {}
    })
    .run(tauri::generate_context!())
    .expect("error while running tauri application");
}
```

Splashscreen

vytovříme `splashscreen.html` v `distDir` a přidáme záznam do configu.

```
"windows": [
  {
    "title": "Tauri App",
    "width": 800,
    "height": 600,
    "resizable": true,
    "fullscreen": false,
    "visible": false // Hide the main window by default
  },
  // Splashscreen
  {
    "width": 400,
    "height": 200,
    "decorations": false,
    "url": "splashscreen.html",
    "label": "splashscreen"
  }
]
```

Splashscreen při čekání na Rust

```rust
use tauri::Manager;
fn main() {
  tauri::Builder::default()
    .setup(|app| {
      let splashscreen_window = app.get_window("splashscreen").unwrap();
      let main_window = app.get_window("main").unwrap();
      // we perform the initialization code on a new task so the app doesn't freeze
      tauri::async_runtime::spawn(async move {
        // initialize your app here instead of sleeping :)
        println!("Initializing...");
        std::thread::sleep(std::time::Duration::from_secs(2));
        println!("Done initializing.");

        // After it's done, close the splashscreen and display the main window
        splashscreen_window.close().unwrap();
        main_window.show().unwrap();
      });
      Ok(())
    })
    .run(tauri::generate_context!())
    .expect("failed to run app");
}
```

Debugging přes devtools

```rust
use tauri::Manager;
tauri::Builder::default()
  .setup(|app| {
    #[cfg(debug_assertions)] // only include this code on debug builds
    {
      let window = app.get_window("main").unwrap();
      window.open_devtools();
      window.close_devtools();
    }
    Ok(())
  });
```

spuštění přes `pnpm tauri build --debug`

Dotazy?

Děkuji za pozornost