TAURI: CROSS-PLATFORM DESKTOP APPLICATIONS WITH RUST AND WEB TECHNOLOGIES

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TAURI IN A NUTSHELL

- A library for desktop (and recently mobile) application development
- Uses web technologies
  - But supports front end in Rust as well (Dioxus, Leptos, Yew)
  - Backend code is Rust, but third-party binaries can be embedded as sidecars
- Written in Rust
- Developers can write backend logic in Rust, but don’t have to

APPS SHOWCASE

I’m not affiliated with any of these. I just thought they serve as cool examples.

- pgMagic – a PostgreSQL client that supports naturual language
- RustDesk – open-source remote access and support software

TAURI VS ELECTRON (1)

- Rust based vs Node.js based
- A different philosophy of using the browser
  - Tauri uses the OS-provided WebView
  - Electron bundles Chromium
  - Impacts size

TAURI VS ELECTRON (2)

- Security
  - Electron apps **can** be very secure
  - But it's harder to misuse Tauri
    - IPC via message passing
    - Permissions mechanism
  - Caveat: Rust code is **not isolated**

CLI AND DEVELOPMENT SETUP

Two primary tools:

- Create-tauri-app – for scaffolding new Tauri projects
- Tauri CLI – for manual setup and other tasks (installed locally on projects, but can also be installed globally)

A Rust toolchain is necessary, as well as Node.js and your favorite build tool (if you use JS/TS for the frontend) or the .NET equivalent.

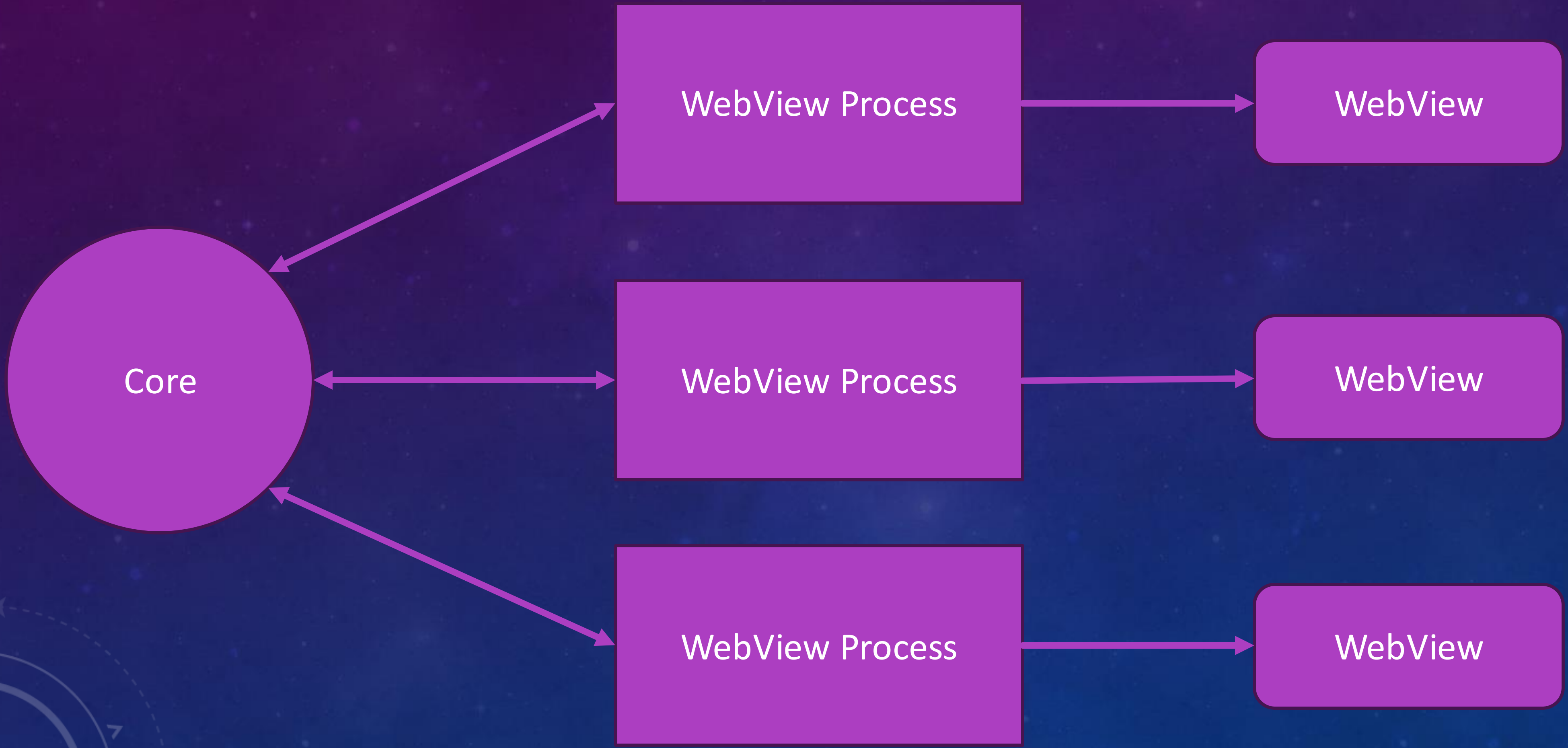
Regarding IDEs, the recommended setup is VS Code, Neovim or Jetbrains IDEs.

See the documentation for more information.

PROJECT STRUCTURE

- Designed to be minimally invasive and allow existing frontend code to work with Tauri
- Rust code and Tauri configuration live in the src-tauri folder
- Create-tauri-app installs the tauri CLI into the project, but also allows separate frontend development

PROCESS MODEL



COMMANDS (FRONTEND -> RUST) (1)

- Every call is a command
- Permissions system (more on that shortly)
- Flexible payload (only needs to implement Serde::Deserialize)

COMMANDS (FRONTEND -> RUST) (2)

```rust
#[tauri::command]
fn login(user: String, password: String) -> Result<String, String> {
  if user == "tauri" && password == "tauri" {
    // resolve
    Ok("logged_in".to_string())
  } else {
    // reject
    Err("invalid credentials".to_string())
  }
}
```

EVENTS AND CHANNELS (1)

- For small events: Events
  - Also ideal for multi consumer and multi producer system
  - Unlike commands, no strong type support. Payloads are always JSON strings
  - No permissions/capabilities
- For low latency: Channels

EVENTS AND CHANNELS (2)

Global events

```
use tauri::{AppHandle, Emitter};

#[tauri::command]
fn download(app: AppHandle, url: String) {
  app.emit("download-started", &url).unwrap();
  for progress in [1, 15, 50, 80, 100] {
    app.emit("download-progress", progress).unwrap();
  }
  app.emit("download-finished", &url).unwrap();
}
```

EVENTS AND CHANNELS (3)

Webview events (specific to one view)

```rust
use tauri::{AppHandle, Emitter};

#[tauri::command]
fn login(app: AppHandle, user: String, password: String) {
  let authenticated = user == "tauri-apps" && password == "tauri";
  let result = if authenticated { "loggedIn" } else { "invalidCredentials" };
  app.emit_to("login", "login-result", result).unwrap();
}
```

EVENTS AND CHANNELS (4)

Listening to events on the frontend (global events)

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

type DownloadStarted = {
  url: string;
  downloadId: number;
  contentLength: number;
};

listen<DownloadStarted>('download-started', (event) => {
  console.log(
    `downloading ${event.payload.contentLength} bytes from ${event.payload.url}`
  );
});
```

EVENTS AND CHANNELS (5)

Listening to events on the frontend (webview-specific events)

```
import { getCurrentWebviewWindow } from '@tauri-apps/api/webviewWindow';

const appWebview = getCurrentWebviewWindow();
appWebview.listen<string>('logged-in', (event) => {
  localStorage.setItem('session-token', event.payload);
});
```

Unlisten

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

const unlisten = await listen('download-started', (event) => {});
unlisten();
```

EVENTS AND CHANNELS (6)

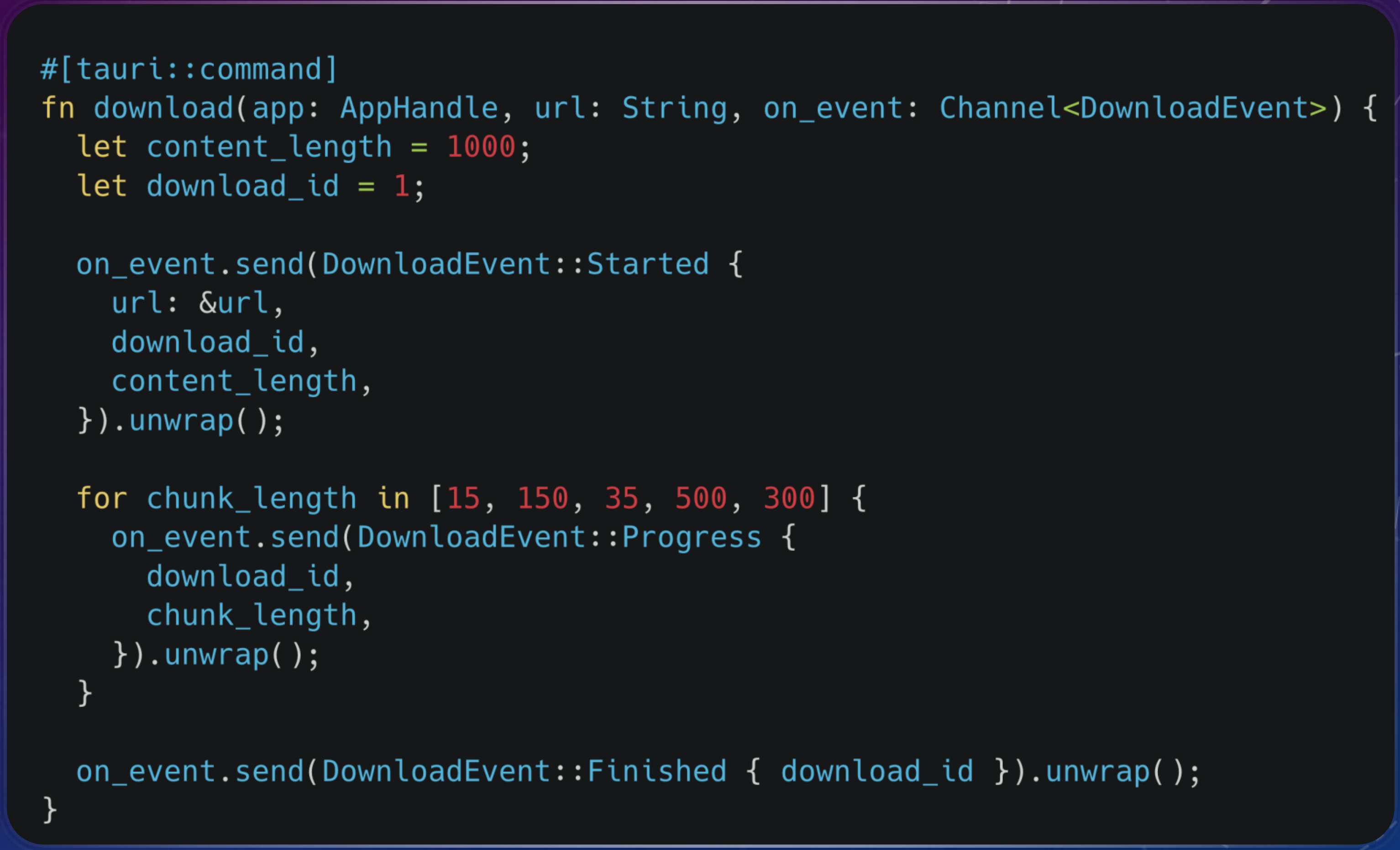
Channels (fast, ordered)

```rust
use tauri::{AppHandle, ipc::Channel};
use serde::Serialize;

#[derive(Clone, Serialize)]
#[serde(rename_all = "camelCase", tag = "event", content = "data")]
enum DownloadEvent<'a> {
  #[serde(rename_all = "camelCase")]
  Started {
    url: &'a str,
    download_id: usize,
    content_length: usize,
  },
  #[serde(rename_all = "camelCase")]
  Progress {
    download_id: usize,
    chunk_length: usize,
  },
  #[serde(rename_all = "camelCase")]
  Finished {
    download_id: usize,
  },
}
```

EVENTS AND CHANNELS (7)

Channels (fast, ordered)



```rust
#[tauri::command]
fn download(app: AppHandle, url: String, on_event: Channel<DownloadEvent>) {
  let content_length = 1000;
  let download_id = 1;

  on_event.send(DownloadEvent::Started {
    url: &url,
    download_id,
    content_length,
  }).unwrap();

  for chunk_length in [15, 150, 35, 500, 300] {
    on_event.send(DownloadEvent::Progress {
      download_id,
      chunk_length,
    }).unwrap();
  }

  on_event.send(DownloadEvent::Finished { download_id }).unwrap();
}
```

EVENTS AND CHANNELS (9)

Channels (fast, ordered) – Frontend Side

```
import { invoke, Channel } from '@tauri-apps/api/core';

type DownloadEvent =
// redacted for simplicity
    };

const onEvent = new Channel<DownloadEvent>();
onEvent.onmessage = (message) => {
  console.log(`got download event ${message.event}`);
};

await invoke('download', {
  url: 'https://raw.githubusercontent.com/tauri-apps/tauri/dev/crates/tauri-schema-generator/schemas/
config.schema.json',
  onEvent,
});
```

LISTENING TO EVENTS IN RUST

```rust
use tauri::Listener;

#[cfg_attr(mobile, tauri::mobile_entry_point)]
pub fn run() {
  tauri::Builder::default()
    .setup(|app| {
      app.listen("download-started", |event| {
        if let Ok(payload) = serde_json::from_str::<DownloadStarted>(&event.payload()) {
          println!("downloading {}", payload.url);
        }
      });
      Ok(())
    })
    .run(tauri::generate_context!())
    .expect("error while running tauri application");
}
```

DEMO TIME: BASICS

PERMISSIONS (1)

- IPC is the only way of the UI to communicate with the application core
  - Done via message passing, and each message is also known as a command
  - Permissions give **explicit privileges** to commands
  - Can be scoped. For example, filesystem permissions can be restricted to the home folder
  - Example in the next slide

PERMISSIONS (2)

```
[[permission]]
identifier = "my-identifier"
description = "This describes the impact and more."
commands.allow = [
    "read_file"
]

[[scope.allow]]
my-scope = "$HOME/*"

[[scope.deny]]
my-scope = "$HOME/secret"
```

Allowed variables

CAPABILITIES

- Build upon the permissions system
- A set of permissions mapped to application windows by their label
  - Label ≠ title
  - Still need to carefully manage window creation permissions
- Can also be platform-specific
- Can be defined in JSON or in TOML

```json
{
  "$schema": "../gen/schemas/desktop-schema.json",
  "identifier": "desktop-capability",
  "windows": ["main"],
  "platforms": ["linux", "macOS", "windows"],
  "permissions": ["global-shortcut:allow-register"]
}
```

IPC: BROWNFIELD

- Default pattern
- No sanitization layer, but still limited ways of misuse

IPC: ISOLATION

- Protects against development threats
- Not enabled by default
- Introduces some overhead
- Isolation application runs separately

PLUGINS

- Provide out-of-the-box functionality
- Can be used directly in JS/TS, no need to write custom Rust code
  - but some can be also used directly from Rust
- Examples:
  - Log – configurable logging
  - Deep-link – allows to set the app as the default handler for a URL
  - Dialog – native system dialogs along with message dialogs
- List of all official plugins
- Awesome-Tauri

WRAPPING EXISTING PROJECTS IN TAURI

Relatively straightforward: using the tauri CLI, init a project and use `..` as the location of web assets

DISTRIBUTION AND PACKAGING

- Tauri supports packaging out of the box
    - Caveat: Apart from specific (experimental) use cases, you'll need to run the build command on each target platform
    - Run the bundle command in the Tauri CLI
- See the documentation for more info and caveats

DEMO: MORE ADVANCED SETUP

ADDITIONAL LINKS

- Official documentation
- Awesome Tauri
- GitHub
- Discord

THANK YOU

Personal contact info:

- GitHub
- Email: lielft <at> gmail
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