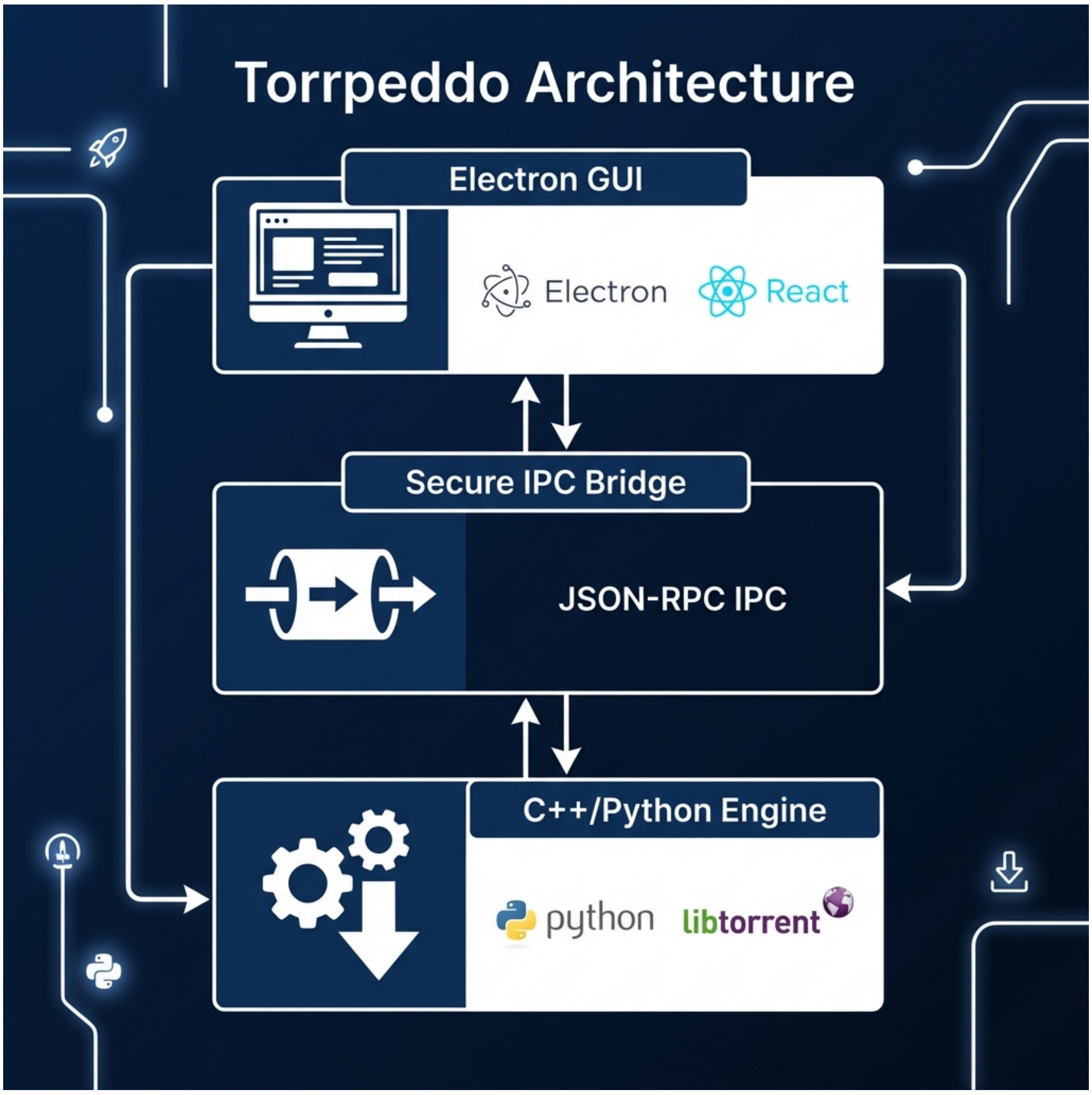
TORRPEDDO PROJECT BOOK



Executive Summary

Torrpeddo is an industrial-grade, premium torrent client designed for the modern desktop. Built primarily with Python and the Electron framework, Torrpeddo leverages the powerful `libtorrent` suite to offer a seamless, high-performance experience that bridges the gap between complex network protocols and professional user interfaces.

Architectural Deep Dive

Torrpeddo follows a decoupled architectural pattern, separating the presentation layer from the core logic and network engine. This is achieved through three primary layers:

1. Frontend: Electron Framework

What is Electron?
Electron is an open-source framework developed by GitHub that allows developers to build cross-platform desktop applications using web technologies: HTML, CSS, and JavaScript. It combines the Chromium rendering engine (for the UI) and the Node.js runtime (for system-level access).

Benefits for Torrpeddo:
- Visual Excellence: Leveraging the full power of modern CSS and web components to create a "WOW" factor UI that feels premium.
- Cross-Platform Compatibility: A single codebase provides a consistent experience across Linux, Windows, and macOS.
- Native Experience: Provides access to native OS features like file dialogs, tray notifications, and filesystem integration.

2. The Bridge: IPC (Inter-Process Communication)

What is IPC?
IPC, or Inter-Process Communication, is a mechanism that allows different processes to share data and coordinate actions. In Torrpeddo, we use a custom IPC bridge to connect the Electron frontend with the Python backend.

Implementation: Secure JSON-RPC
Communication is handled via a JSON-RPC protocol over stdin/stdout channels.
- The Electron process spawns a dedicated Python child process.
- Commands (e.g., `add_magnet`, `get_status`) are serialized into JSON strings and sent to the Python process.
- The Python process executes the logic and returns a structured JSON response.

Why this approach?
- Decoupling: The engine can be updated, debugged, or even replaced without touching

the UI.

- Security: The backend runs as a separate process, providing a layer of isolation.
- Performance: High-speed communication with minimal overhead compared to HTTP-based local servers.

3. Backend Engine: Python & libtorrent

The Core: libtorrent with Python Bindings
At the heart of Torrpeddo is `libtorrent`, a feature-complete BitTorrent implementation. While the underlying engine is implemented in high-performance C++, Torrpeddo utilizes the official Python bindings for rapid development and seamless integration with the bridge logic.

Multi-threaded Performance:

- Engine Level: The `libtorrent` 2.0+ engine utilizes an internal thread pool for disk I/O, network polling, and piece validation. This allows for parallel processing of multiple torrent fragments simultaneously.
- Manager Level: The Python `TorrentManager` utilizes daemon threads to handle non-blocking torrent additions, ensuring that the IPC bridge never stalls while metadata is being fetched from the DHT or trackers.

Development Process & Methodology

The Torrpeddo project followed a "Platform-First" methodology:

1. Language Choice: Python was selected for its extensive library support and ease of integration with libtorrent and IPC protocols.
2. Engine Validation: Rigorous testing of `libtorrent` benchmarks to ensure maximum throughput on varied hardware.
3. Bridge Optimization: Implementation of non-blocking I/O in the IPC bridge to prevent UI "micro-stutters".
4. Packaging: Integration of `electron-builder` and `PyInstaller` to create unified, single-binary distributors for end-users.
