Outline

libp2p & Rust

What is libp2p?

libp2p is a modular peer-to-peer networking stack, driven by well-designed specifications with several implementations (Go, JavaScript, Rust, C).

It powers projects like **IPFS**, **Polkadot**, **Filecoin**

Core Architecture

Transport Layer

- Modular transport protocols (TCP, UDP, WebSocket)
- Protocol negotiation & upgrade system
- Built-in multiplexing support

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Identity & Security

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Security Features

- TLS-like secure channels
- End-to-end encryption
- Perfect forward secrecy

Communication Protocols

GossipSub

- Efficient pub/sub messaging
- Message signing & validation
- Mesh network topology

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Request/Response

- Simple request-response patterns
- Protocol versioning
- Flow control

rust-libp2p Implementation

Core Components

```rust
use libp2p::{
    core::{Transport, Multiaddr},
    identity::Keypair,
    kad::Kademlia,
    gossipsub::GossipSub,
    mdns::Mdns,
    swarm::Swarm,
};
```

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Basic Node Setup

```
let local_key = identity::Keypair::generate_ed25519();
let local_peer_id = PeerId::from(local_key.public());

let transport = libp2p::development_transport(local_key)?;
```

rust-libp2p Implementation

```rust
let behavior = MyBehavior::new();

let mut swarm = Swarm::new(transport, behavior, local_peer_id);
```

P2P Chatting over LAN

Basic P2P Chat Application

- Node discovery via mDNS
- Message broadcasting with GossipSub
- Live coding demonstration