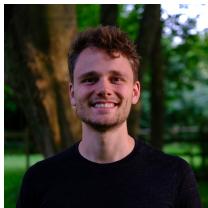


Peer-to-peer hole punching without centralized infrastructure

Max Inden (@mxinden)

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Max Inden



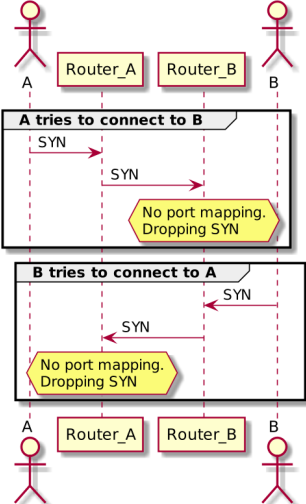
- ▶ Software Developer at Protocol Labs.
- ▶ Stewarding the libp2p project.
- ▶ Maintainer of the libp2p Rust implementation.
- ▶ Maintainer of Prometheus and Kubernetes in a past life.
- ▶ @mxinden on GitHub, Twitter, ...
- ▶ <https://max-inden.de>

Introduction to libp2p

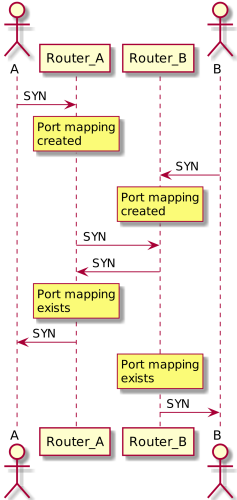


- ▶ A modular peer-to-peer networking stack
- ▶ Composable building blocks based on a shared core
- ▶ Specified and implemented in 7+ languages
- ▶ Runs on many runtimes: browser, mobile, embedded
- ▶ Powers the IPFS, Ethereum 2, Filecoin and Polkadot network
- ▶ ~ 100 000 libp2p based nodes online at any given time

The Problem with Firewalls and NATs



Hole Punching



Hole Punching

Goal: Full connectivity among all nodes of a libp2p network despite **NATs and Firewalls**.

Requirements

- ▶ No central infrastructure
- ▶ IPv4/v6
- ▶ QUIC / TCP (/ WebRTC)
- ▶ Integrate into libp2p stack

Project Flare

libp2p's way of decentralized hole punching

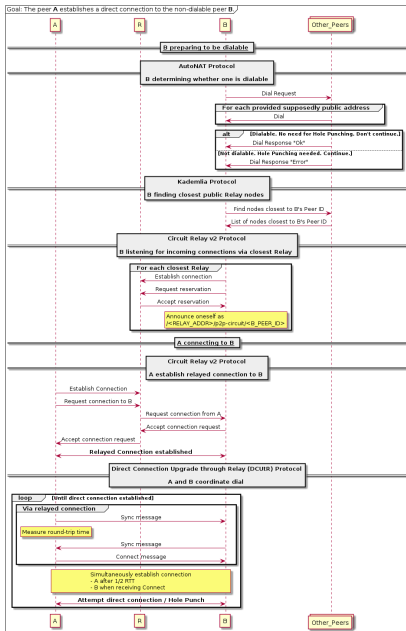
Phases

1. B: Preparing to be dialable.
 - 1.1 Determine whether one is dialable (AutoNAT).
 - 1.2 If not, find closest public Relay nodes (e.g. Kademlia).
 - 1.3 Listen for incoming connections via closest Relay (Circuit Relay v2).
2. A: Connecting to B.
 - 2.1 A: Establish relayed connection to B (Circuit Relay v2).
 - 2.2 A & B: Coordinate simultaneous dial (DCUtR).

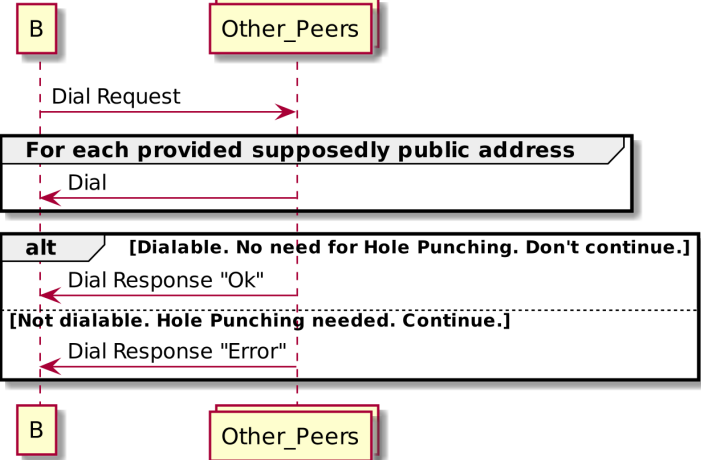
Project Flare / Status

- ▶ Works with TCP and UDP/QUIC (~90% success rate).
- ▶ Implemented in Go and Rust.
- ▶ Released in Go.
- ▶ Included in IPFS.
 - ▶ Public nodes run limited relay server.
 - ▶ Non-public nodes can punch holes (Not yet enabled by default).

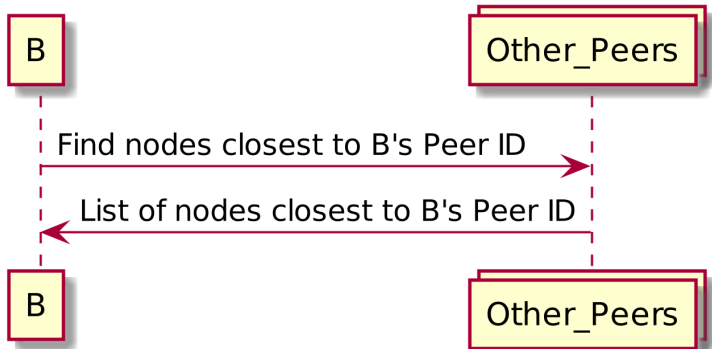
Overview



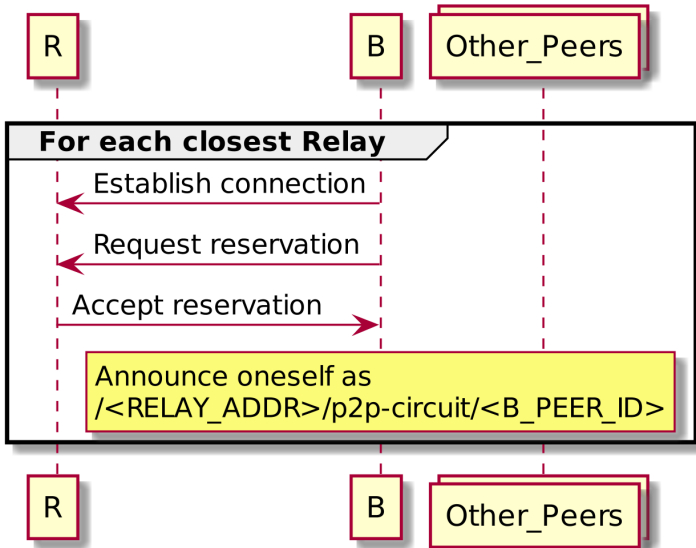
1.1 Determine whether one is dialable (AutoNAT)



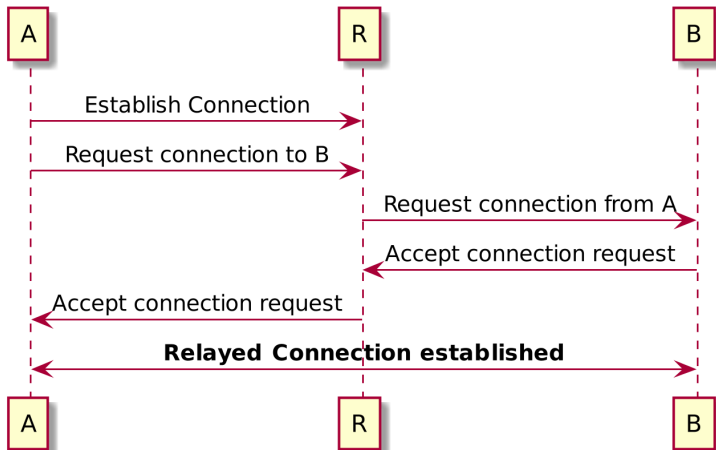
1.2 Find closest public Relay nodes (e.g. Kademlia)



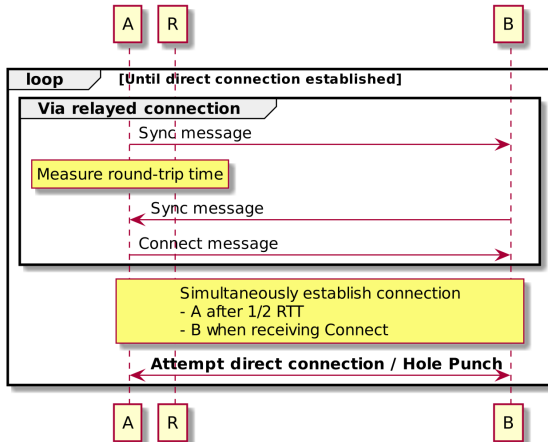
1.3 Listen for connections via Relay (Circuit Relay v2)



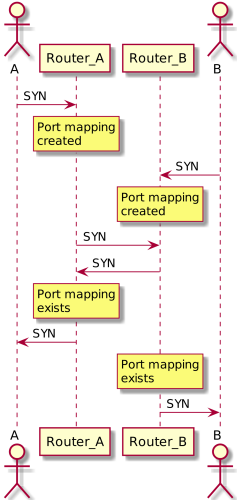
2.1 Establish relayed connection (Circuit Relay v2)



2.2. Coordinate simultaneous dial (DCUtR)



Hole Punching



Questions?

Next steps

- ▶ Documentation - docs.libp2p.io/
- ▶ Forum - discuss.libp2p.io/
- ▶ Specification & Roadmap - github.com/libp2p/specs/

Contact

- ▶ @mxinden on GitHub, Twitter, ...
- ▶ <https://max-inden.de>