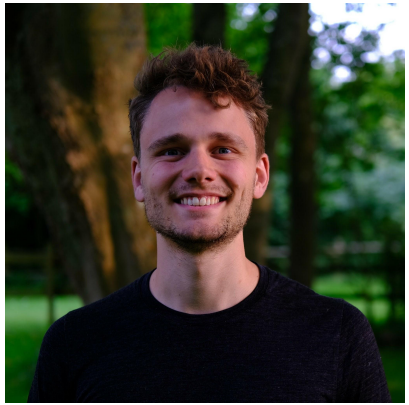
Peer-to-Peer Browser Connectivity

Leveraging WebRTC and the new WebTransport protocol to connect libp2p browser nodes.

@mxinden

About me

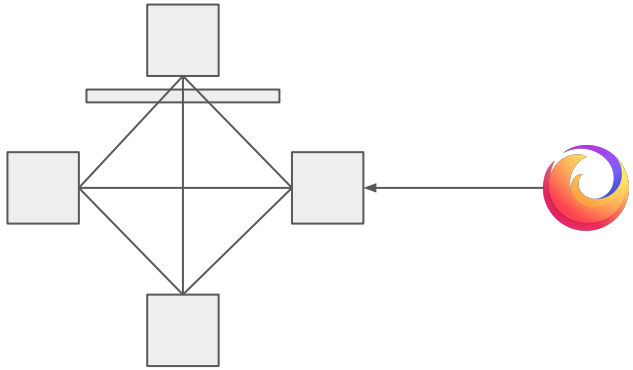
- **Max Inden**
- Software Developer at Protocol Labs, stewarding the libp2p project.
- Maintainer of the libp2p Rust implementation.
- **@mxinden** on the web
- https://max-inden.de

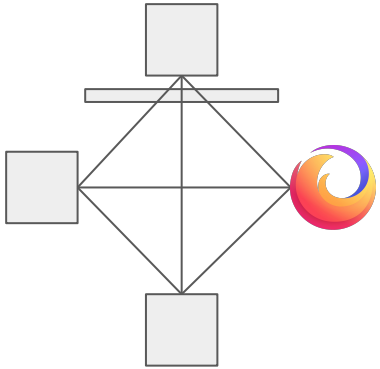


libp2p

- Peer-to-peer networking library
- One specification, many implementations (Go, JS, Rust, Nim, C++, Java, …)
- Low level features like encryption, authentication and hole punching
- High level features like DHT or Gossiping
- All you need to build peer-to-peer applications

Motivation: Peer-to-Peer Browser Connectivity





Connectivity Options / reachability

reachability		public	private	
public				
private				

Connectivity Options / platform

	platform	non-browser	non-browser	browser
	non-browser			
	non-browser			
	browser			

Connectivity Options

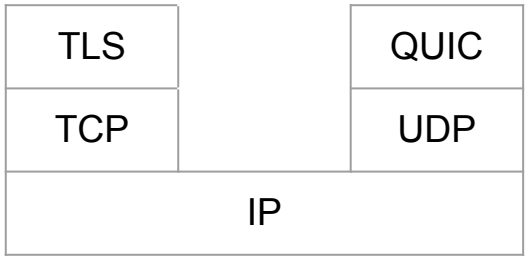
reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser			
private	non-browser			
	browser			

Connectivity Options

reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser			
private	non-browser			
	browser			

Public non-browser → public non-browser

- Easiest case
- Reachability
  - No firewall and/or NAT
- Platform
  - Direct access to TCP or UDP socket



Connectivity Options

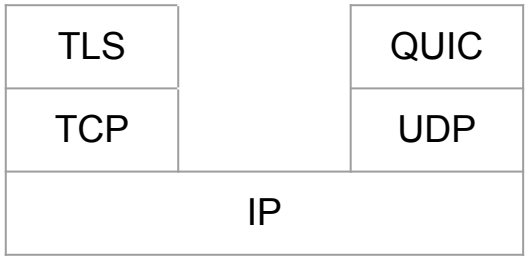
reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP		
private	non-browser			
	browser			

Connectivity Options

reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP		
private	non-browser			
	browser			

Private non-browser → public non-browser

- Reachability:
  - No firewall and/or NAT **at receiver**
- Platform
  - Direct access to TCP or UDP socket



Connectivity Options

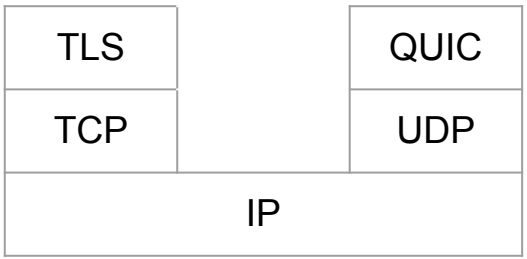
reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP		
private	non-browser	QUIC or TCP		
	browser			

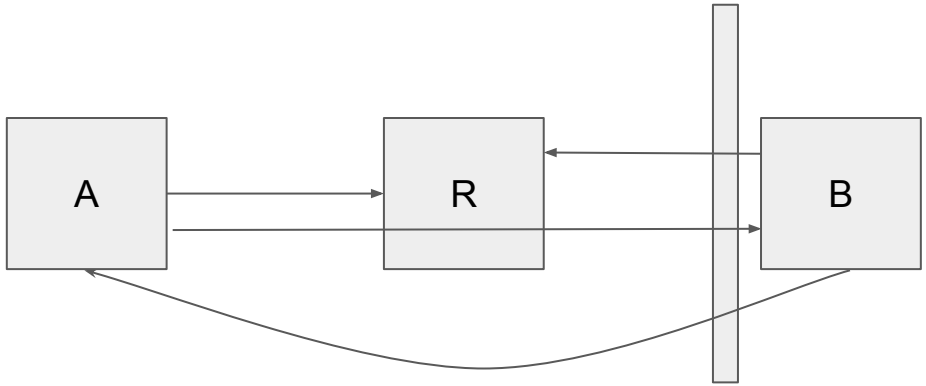
Connectivity Options

reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP		
private	non-browser	QUIC or TCP		
	browser			

Public non-browser → private non-browser

- Reachability
  - Connection reversal
- Platform
  - Direct access to TCP or UDP socket





Connectivity Options

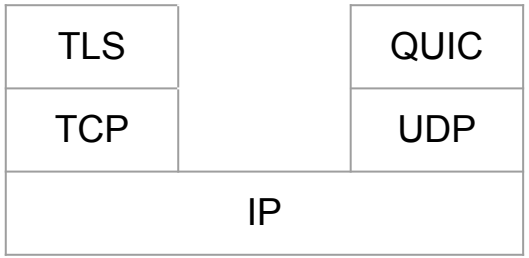
reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP	QUIC or TCP with connection reversal	
private	non-browser	QUIC or TCP		
	browser			

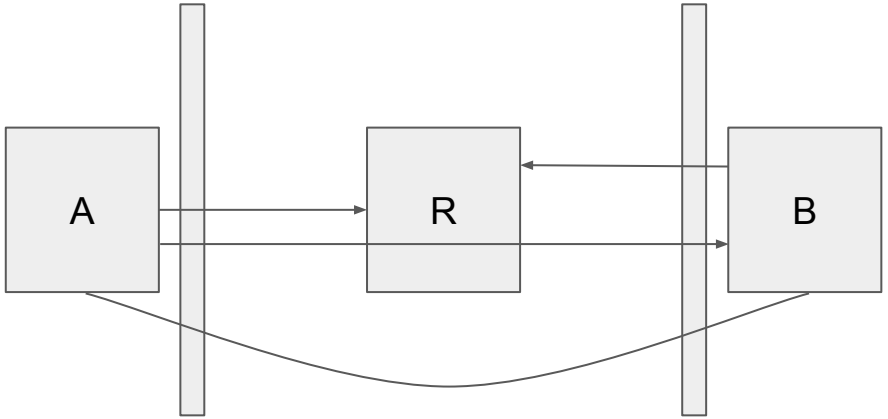
Connectivity Options

reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP	QUIC or TCP with connection reversal	
private	non-browser	QUIC or TCP		
	browser			

Private non-browser → private non-browser

- Reachability
  - Hole punching
- Platform
  - Direct access to TCP or UDP socket





Connectivity Options

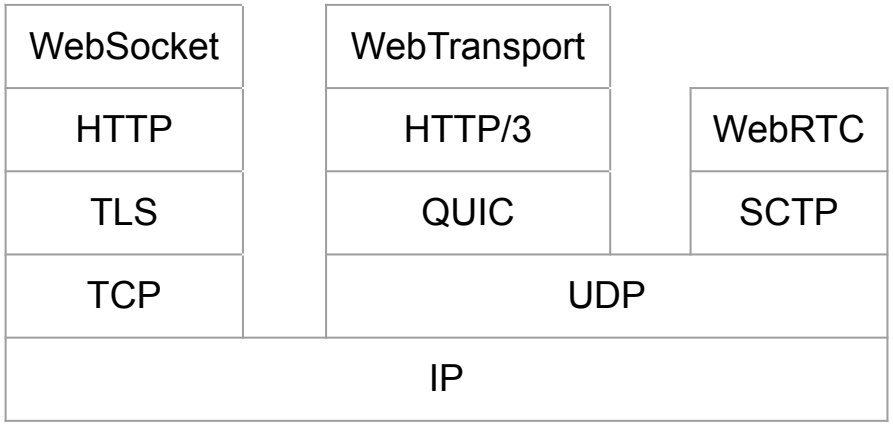
reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP	QUIC or TCP with connection reversal	
private	non-browser	QUIC or TCP	QUIC or TCP with hole punching	
	browser			

Connectivity Options

reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP	QUIC or TCP with connection reversal	
private	non-browser	QUIC or TCP	QUIC or TCP with hole punching	
	browser			

Private browser → public non-browser

- Reachability
  - No firewall and/or NAT **at receiver**
- Platform
  - No access to TCP or UDP socket
  - WebSocket
    - valid TLS certificate
  - WebTransport
    - allows certificate verification by certificate hash (e.g. self-signed certs)
  - WebRTC
    - allows certificate verification by certificate hash (e.g. self-signed certs)



Connectivity Options

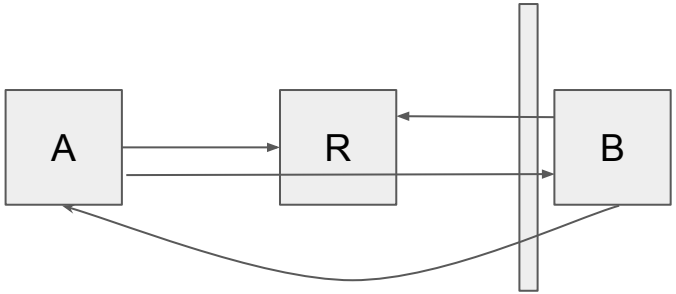
reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP	QUIC or TCP with connection reversal	
private	non-browser	QUIC or TCP	QUIC or TCP with hole punching	
	browser	WebTransport, WebSocket or WebRTC		

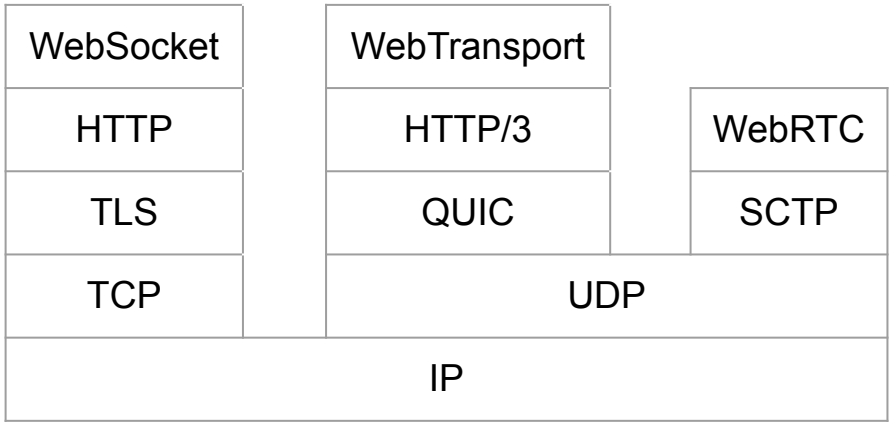
Connectivity Options

reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP	QUIC or TCP with connection reversal	
private	non-browser	QUIC or TCP	QUIC or TCP with hole punching	
	browser	WebTransport, WebSocket or WebRTC		

Public non-browser → private browser

- Reachability
  - Connection reversal
- Platform
  - No access to TCP or UDP socket
  - WebSocket
    - valid TLS certificate
  - WebTransport
  - WebRTC





Connectivity Options

reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP	QUIC or TCP with connection reversal	WebTransport, WebSocket, WebRTC with connection reversal
private	non-browser	QUIC or TCP	QUIC or TCP with hole punching	
	browser	WebTransport, WebSocket or WebRTC		

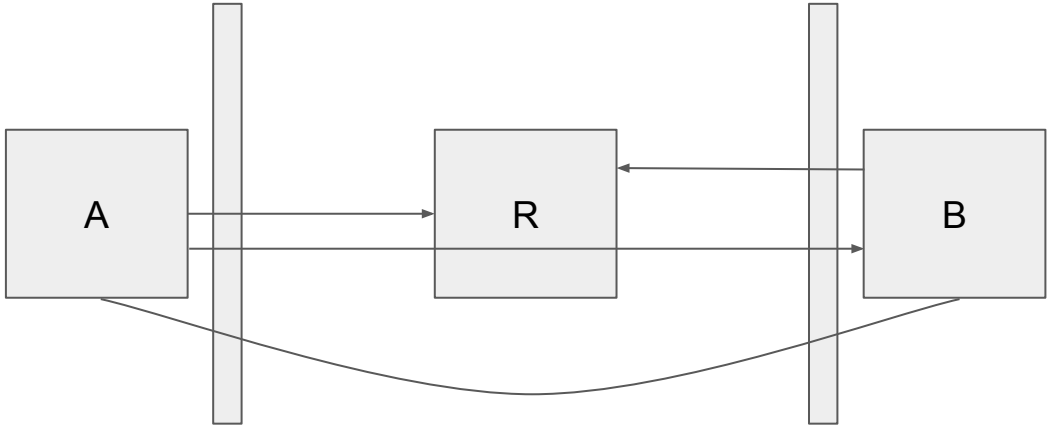
Connectivity Options

reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP	QUIC or TCP with connection reversal	WebTransport, WebSocket, WebRTC with connection reversal
private	non-browser	QUIC or TCP	QUIC or TCP with hole punching	
	browser	WebTransport, WebSocket or WebRTC		

Private (non-)browser → private (non-)browser

- Reachability
  - Hole punching
- Platform
  - No access to TCP or UDP socket
  - WebRTC

WebRTC
SCTP
UDP
IP



Connectivity Options

reachability		public	private	
	platform	non-browser	non-browser	browser
public	non-browser	QUIC or TCP	QUIC or TCP with connection reversal	WebTransport, WebSocket, WebRTC with connection reversal
private	non-browser	QUIC or TCP	QUIC or TCP with hole punching	WebRTC with hole punching
	browser	WebTransport, WebSocket or WebRTC	WebRTC with hole punching	WebRTC with hole punching

Thank you!

- Talk to us here at the venue
- Documentation - docs.libp2p.io/
- https://connectivity.libp2p.io
- Forum - discuss.libp2p.io/
- Specification & Roadmap - github.com/libp2p/specs/
- Implementations - github.com/libp2p/<LANGUAGE>-libp2p
- Join the community call