Bringing peer-to-peer networks to ALL the peers

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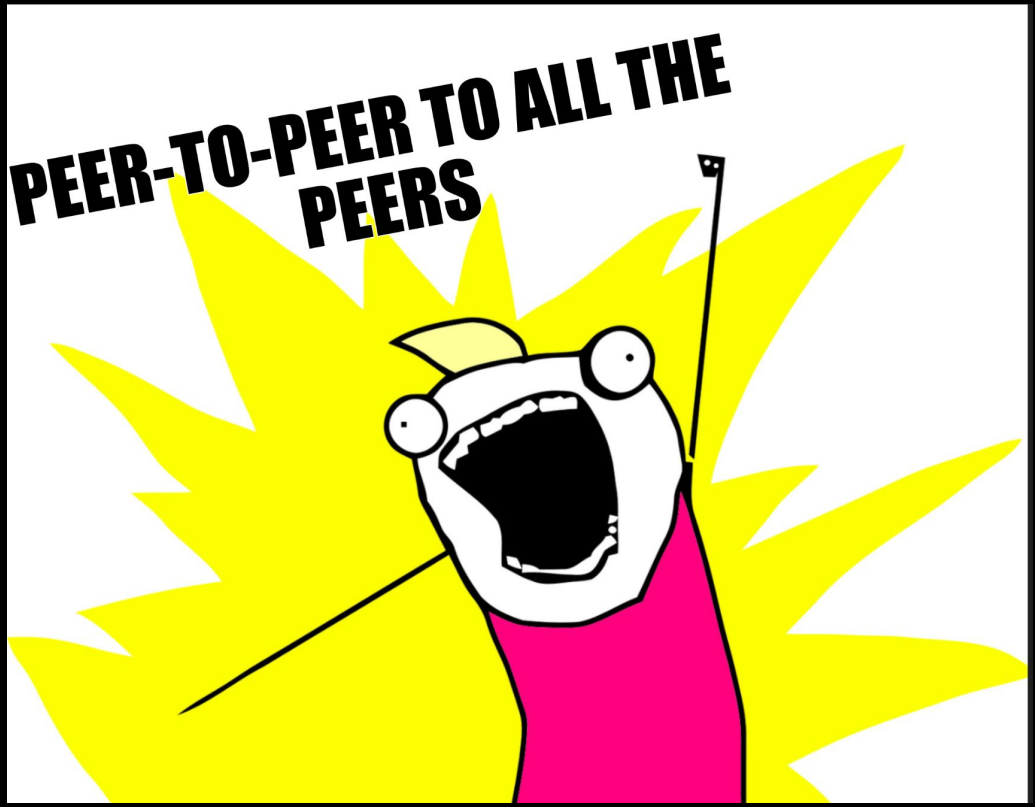

Context

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A peer-to-peer model for end user devices too:

- Desktop app
- Mobile app
- Web app

Libp2p gossipsub based networks

Status Quo

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- REST API and other Web gateways
- Anyone can run such API
  - If they have resources
- But, app developers or users select **one**

Problems (generalized)

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1. Trust data access and propagation
2. Privacy
3. Censorship

New Problems

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Gossipsub w/ unstable connections:

- Is my message sent?
  - No ACK
- Am I online?
  - TCP timeout (10-30s)
- What did I miss?
  - Messages missed when offline
- Can I trust this peer?
  - Randos
- Scaling: 1 user = 1 node
- High bandwidth usage on data plans

Solution

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libp2p-gossipsub + discv5 on desktop application

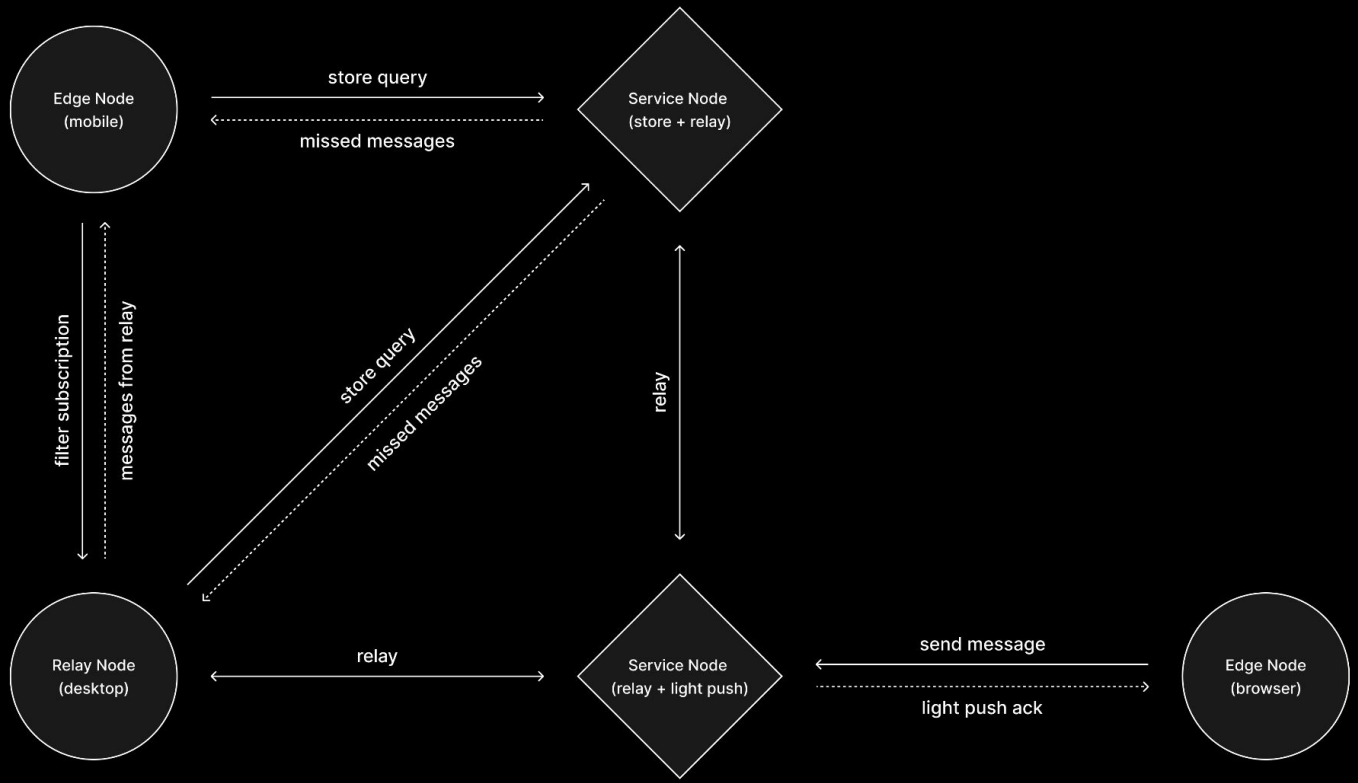
- Smart Contract + Zero-knowledge (RLN) based rate limiting to cap gossipsub bandwidth usage

Custom **libp2p request-response** protocols on all platforms (TCP/WS)

- Query for peers (discovery)
- Push messages to the gossipsub network
- Filter messages from the gossipsub network
- Retrieve historical messages

Sharding - separate gossipsub networks

Solution


Edge Node (mobile)
store query
missed messages
Service Node (store + relay)
filter subscription
messages from relay
store query
missed messages
relay
Relay Node (desktop)
relay
Service Node (relay + light push)
send message
light push ack
Edge Node (browser)

Solution

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Redundancy

- Push messages to several nodes
- Check message presence
- subscribe to several nodes, but less than gossipsub

End-to-end reliability protocols

- Acknowledgements from recipient (not scalable)
- Distributed log: Bloom filter + causal history (scalable)

Historical messages synchronisation via Ranged Based Set Reconciliation protocol 1 and 2

Result

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1. Trust data access and propagation
   - Redundancy
   - Message presence check
2. Privacy
   - Reduced view of third party
3. Censorship
   - Multiple access points

Hi!

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Franck - Waku - Decentralized messaging

https://fryorcraken.xyz/
https://github.com/waku-org/specs/