

# The Waku Network as Infrastructure for dApps

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## Agenda

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1. Problem statement
2. The Waku Protocol
3. The Waku Network
  - Routing
  - Rate limiting
  - Sharding
  - Peer discovery
  - Services
  - Sustainability
4. Questions

Problem Statement: A sends a message to BCD

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Alice Message



Server



Bob



Charlie



Dario

Problem Statement: A sends a message to BCD



Alice



Message Server



Bob

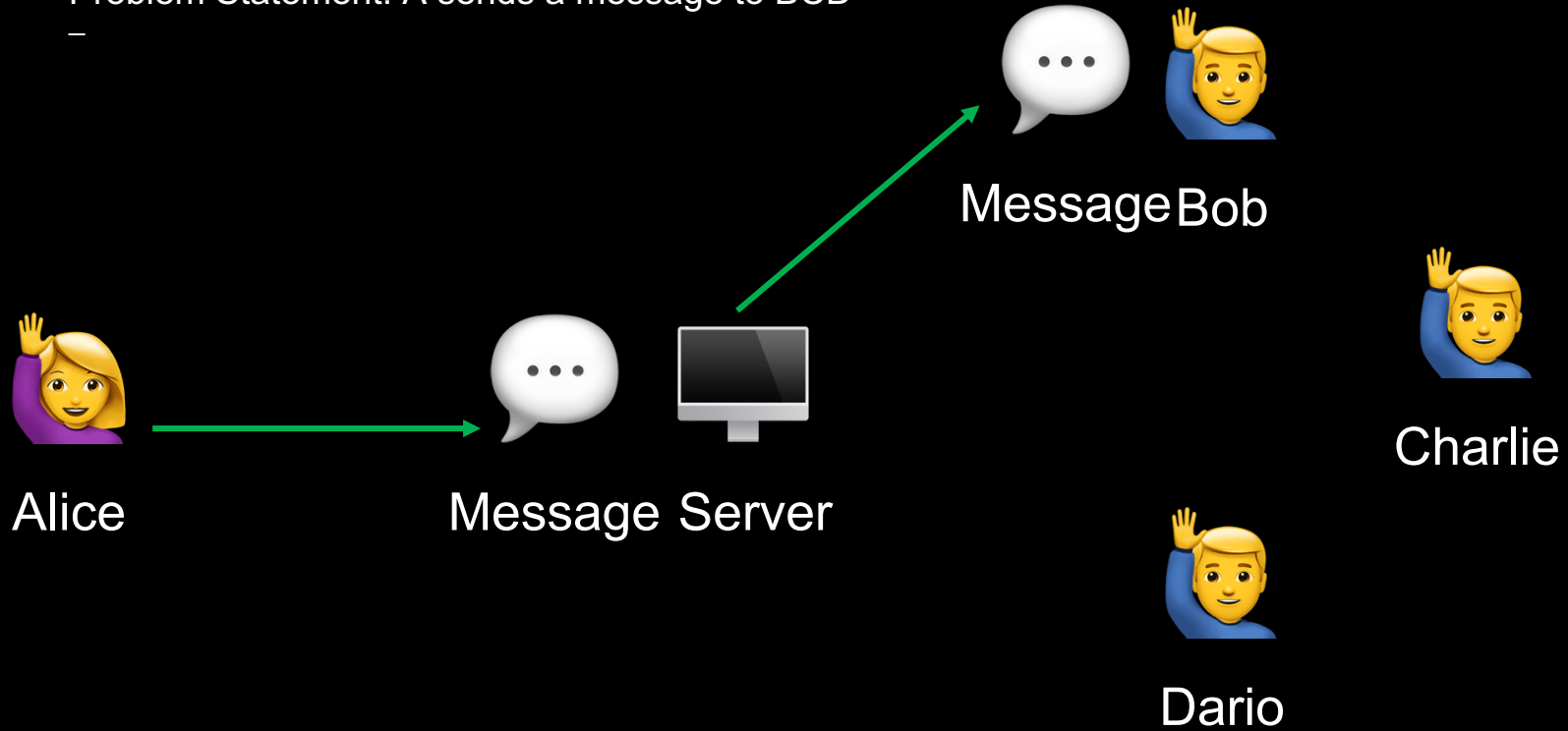


Charlie

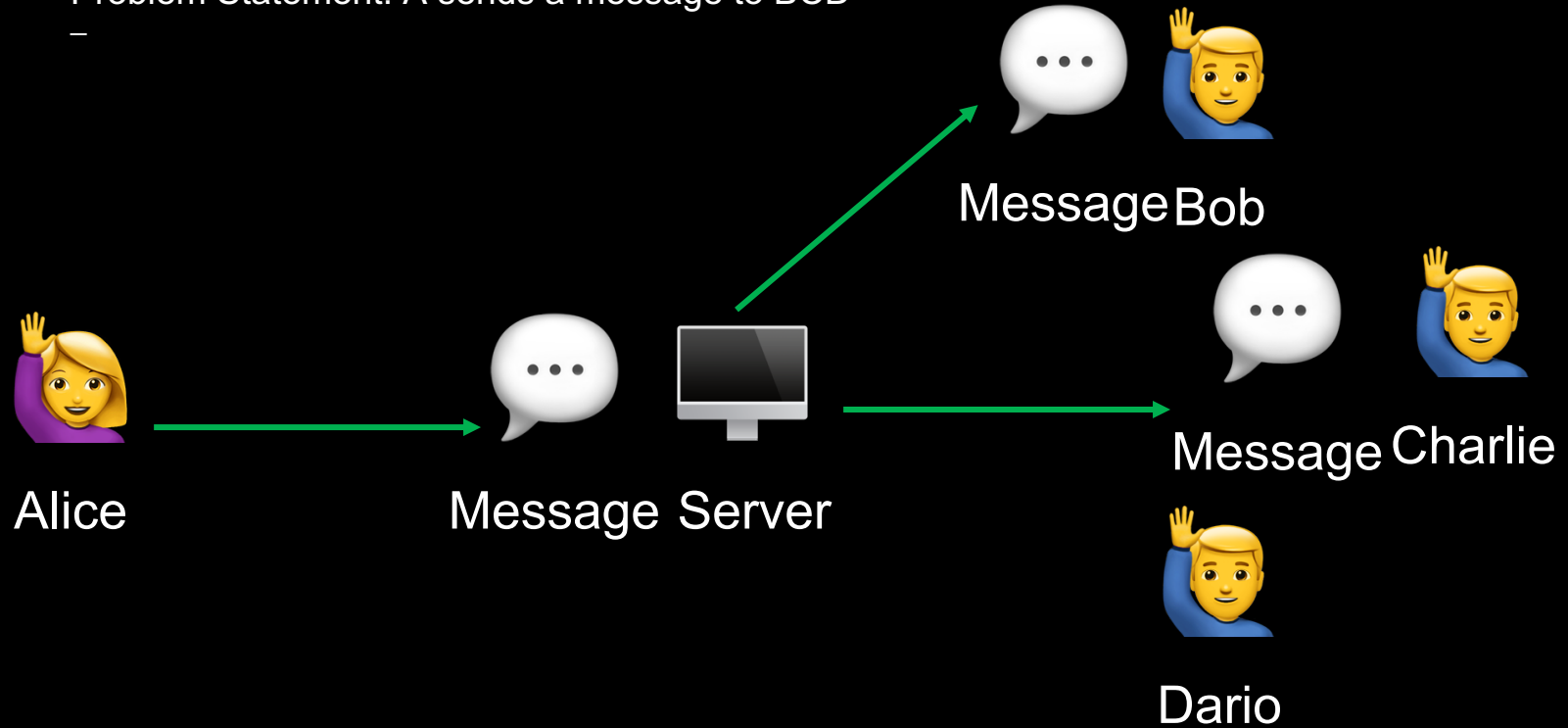


Dario

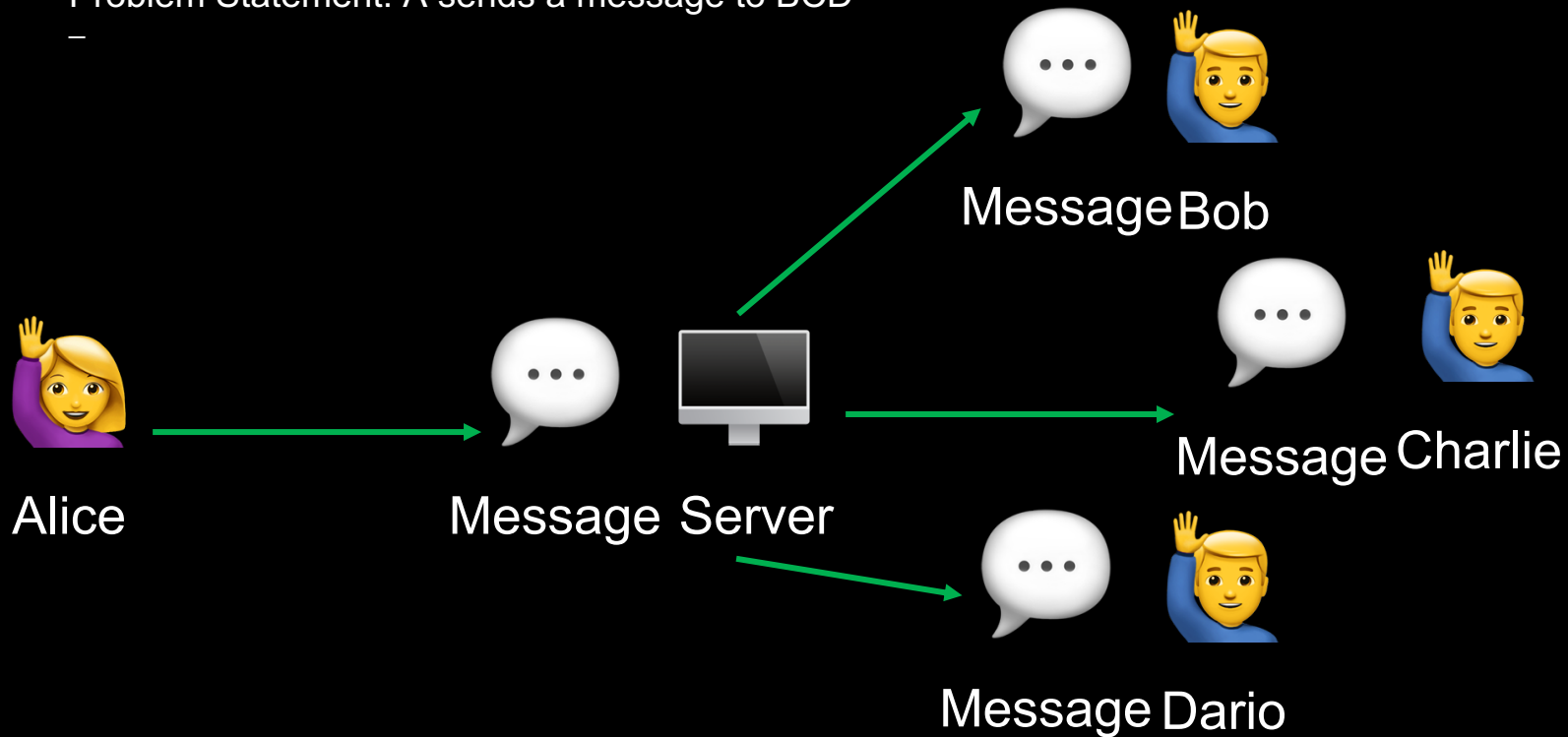
Problem Statement: A sends a message to BCD



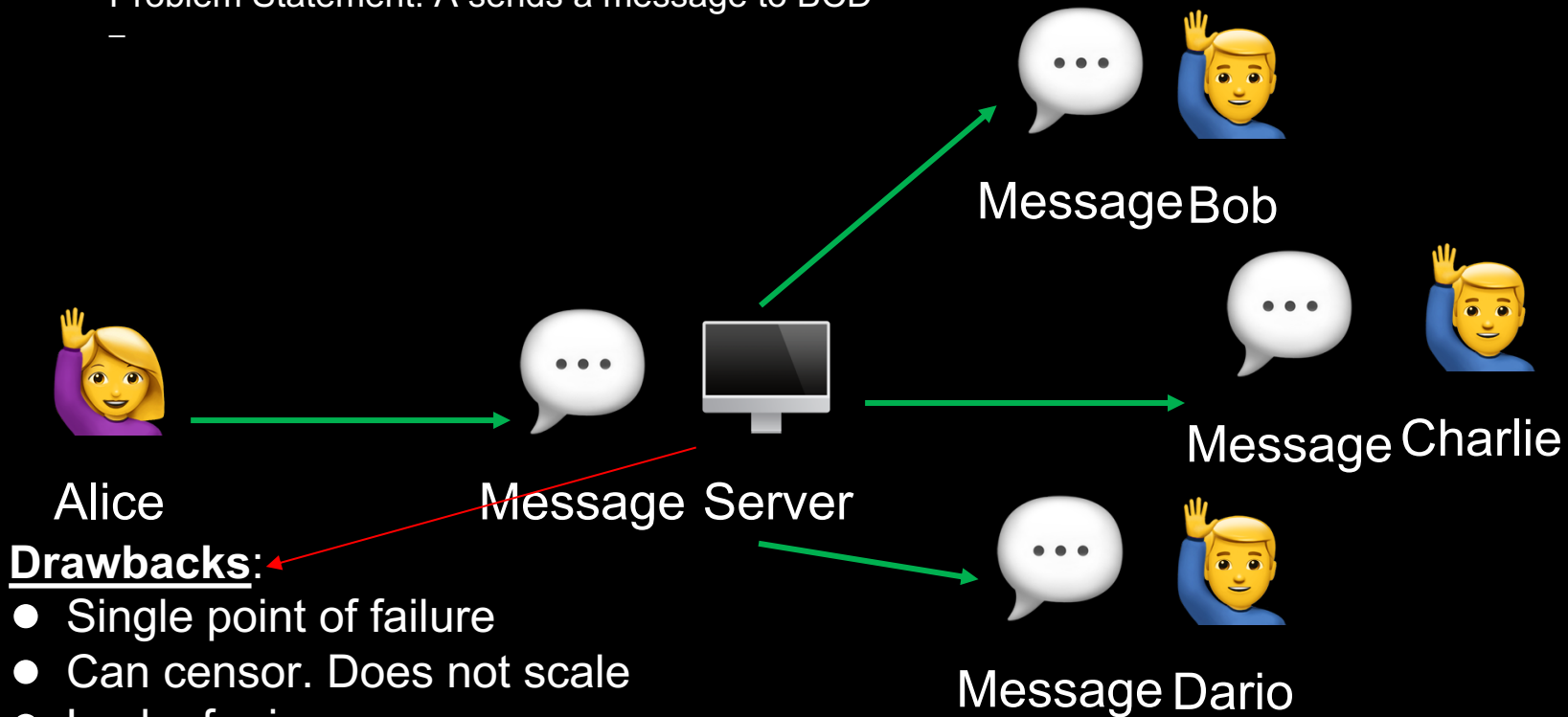
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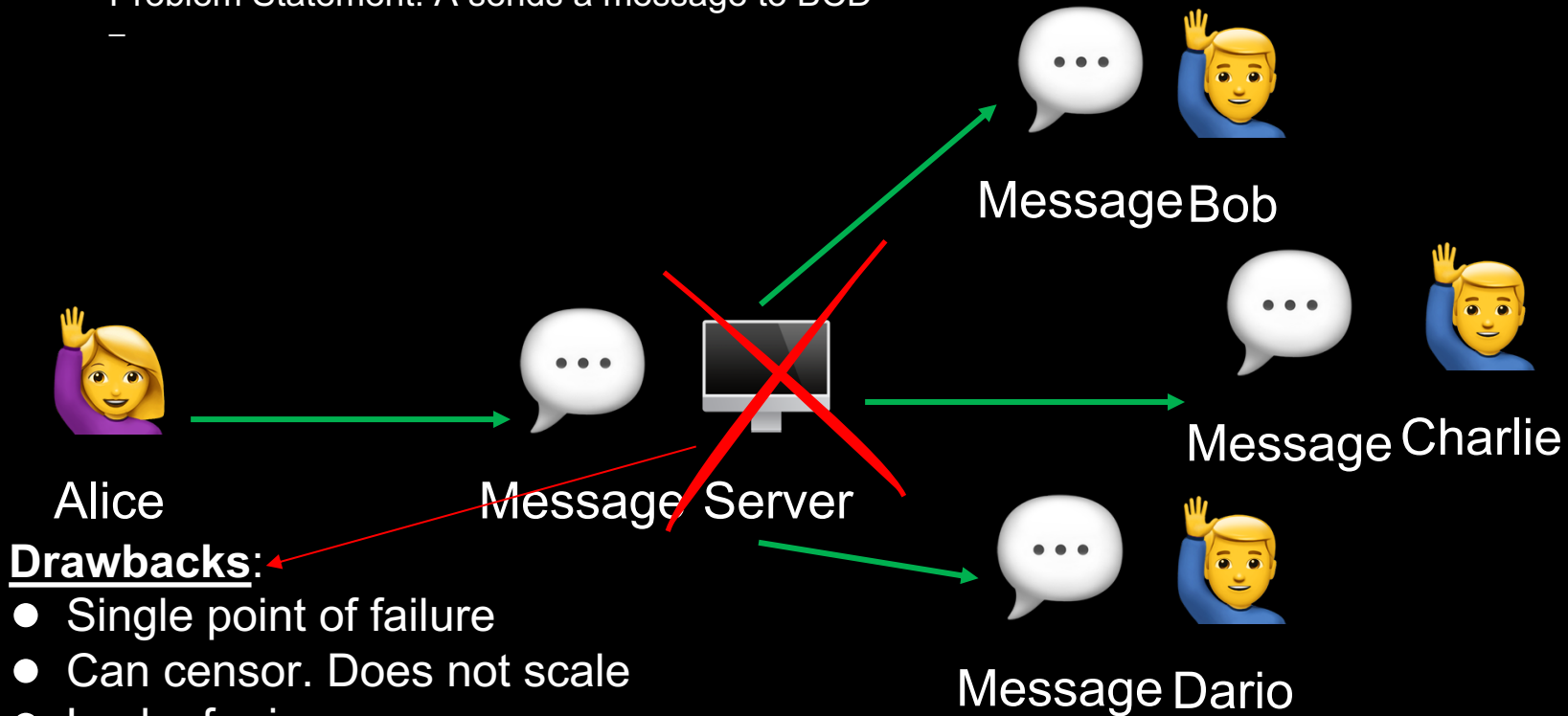


**Drawbacks:**

- Single point of failure
- Can censor. Does not scale
- Lack of privacy
- Can we get rid of it? YES



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**Drawbacks:**

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## The Waku Protocol

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- Open-source project:
  - [github.com/waku-org/nwaku](https://github.com/waku-org/nwaku)
- A suite of protocols, based on libp2p
- Provides privacy-preserving, scalable, spam-resistant, and censorship-resistant messaging services for decentralized applications

## The Waku Network

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- Public instance of The Waku Protocol
- Not linked to a single entity
- Rate-limited to ensure fair usage
- Live in a public testnet (EVM based)
- > 500 nodes
- Anyone can use it (users)
- Anyone can run a node (operator)
- Don't like it? Deploy your own

## The Waku Network

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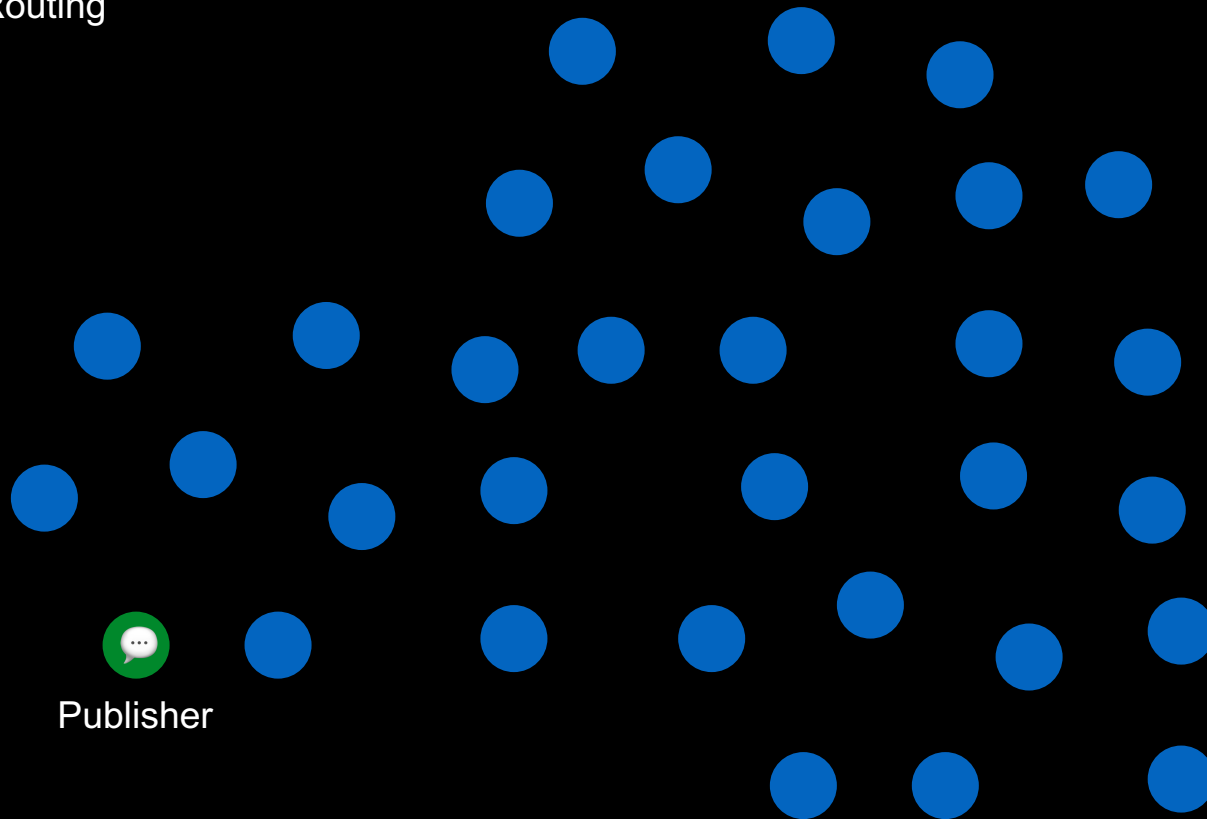
### Routing:

How are messages routed tx->rx?

- Publisher-subscriber architecture. Uses gossipsub
- Nodes are organized around topics
- A message published to a topic reaches all nodes subscribed to it
- Origin of the message can't be tracked
- No PII (Personal Identifiable Information) is included
- D=6/12 and max message size 150KB

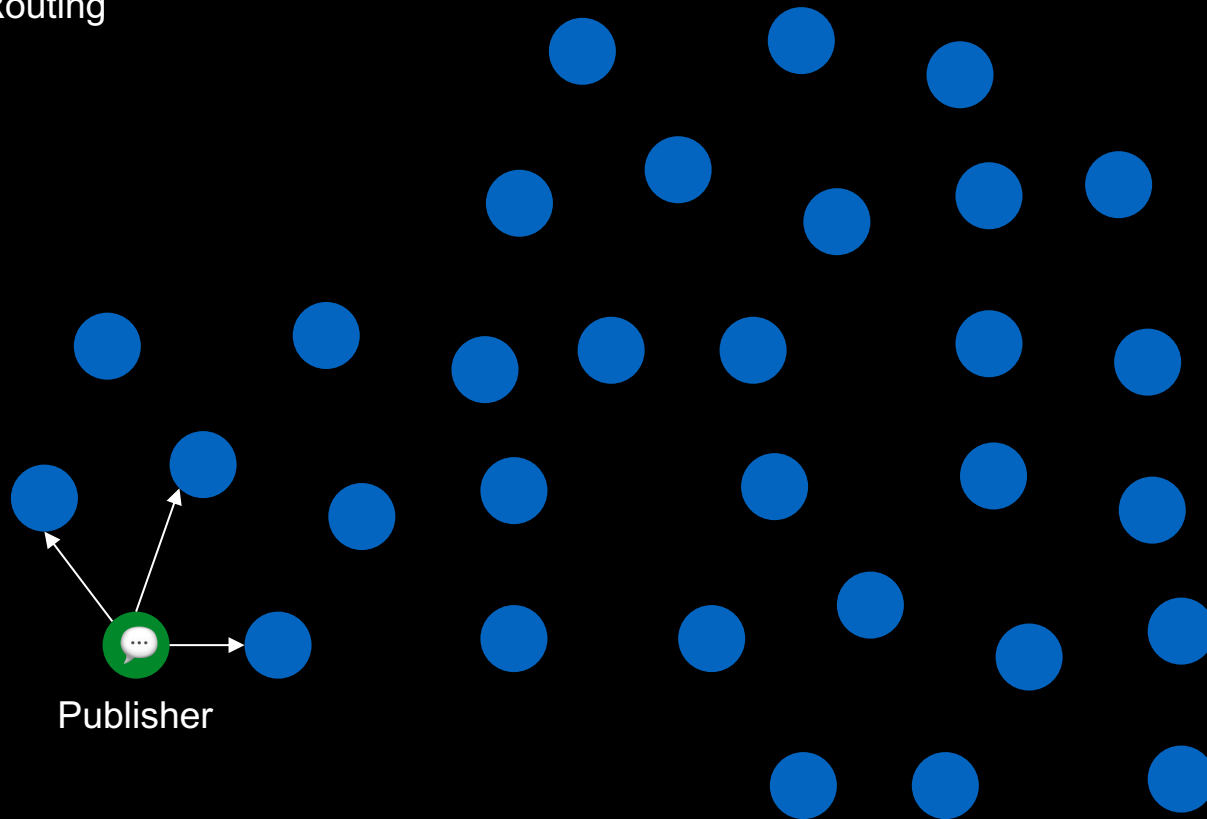
## Routing

Network  $D=3$   
Nodes=32



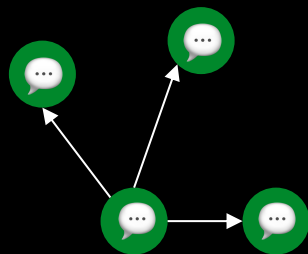
## Routing

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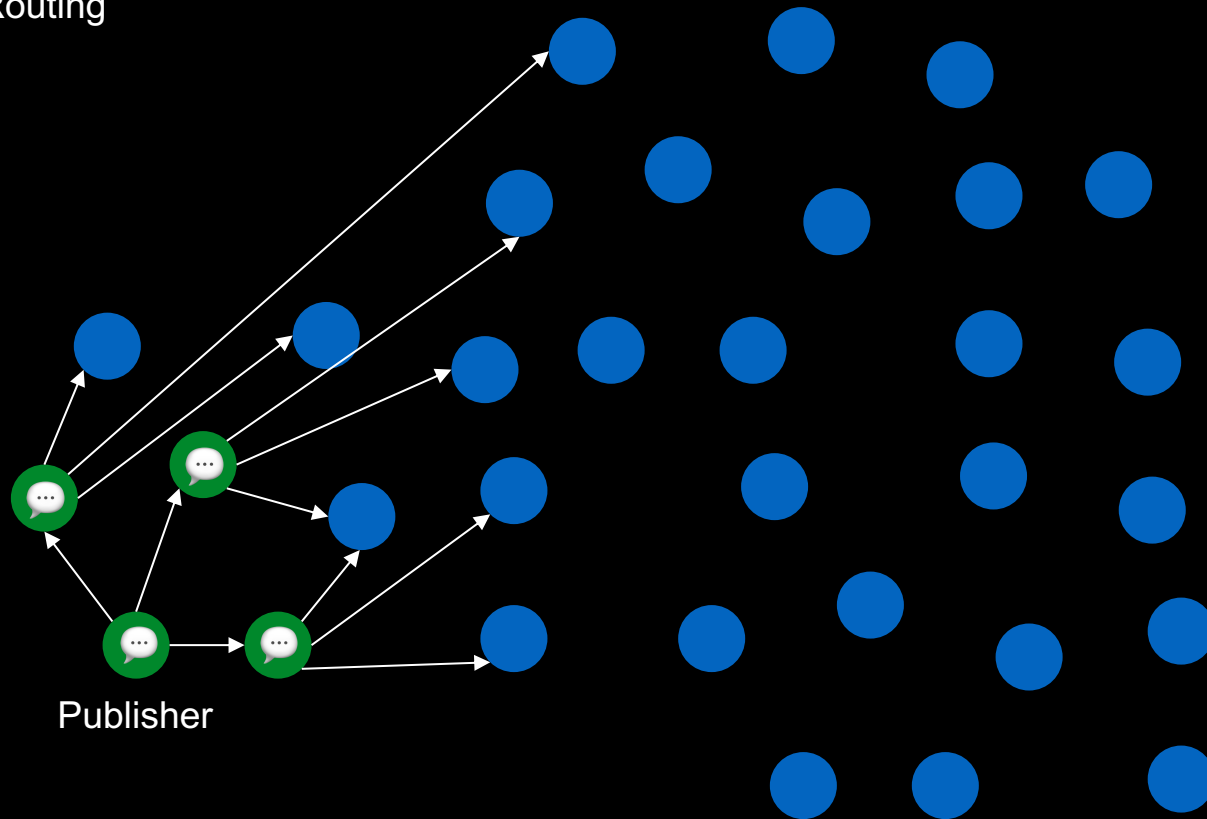
## Routing

Network  $D=3$   
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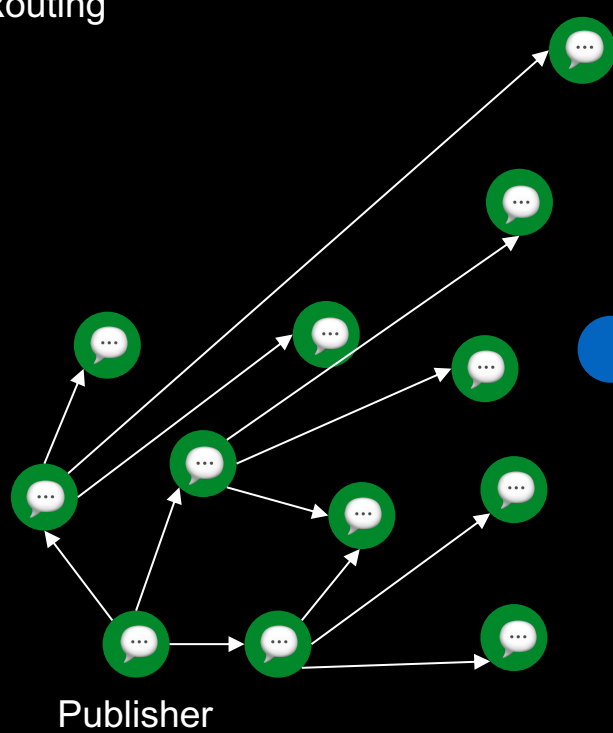
Publisher

## Routing



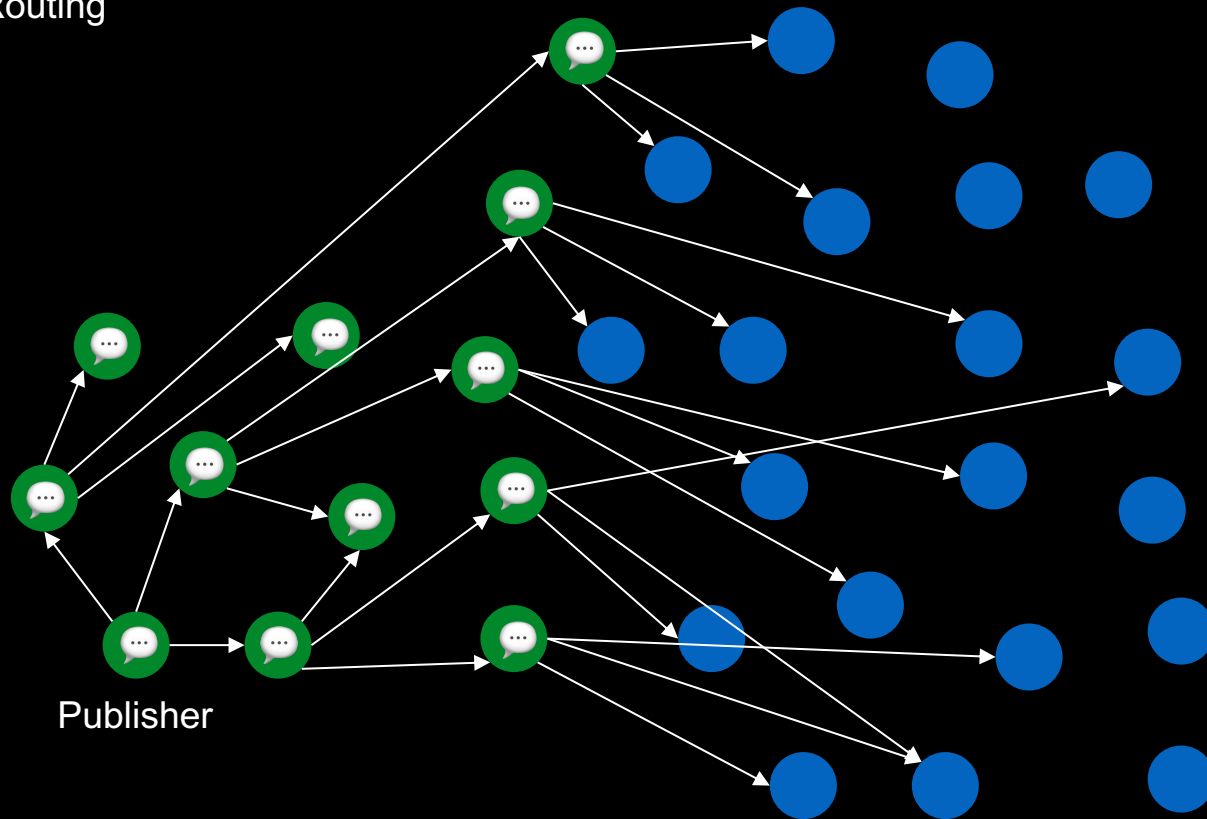


## Routing



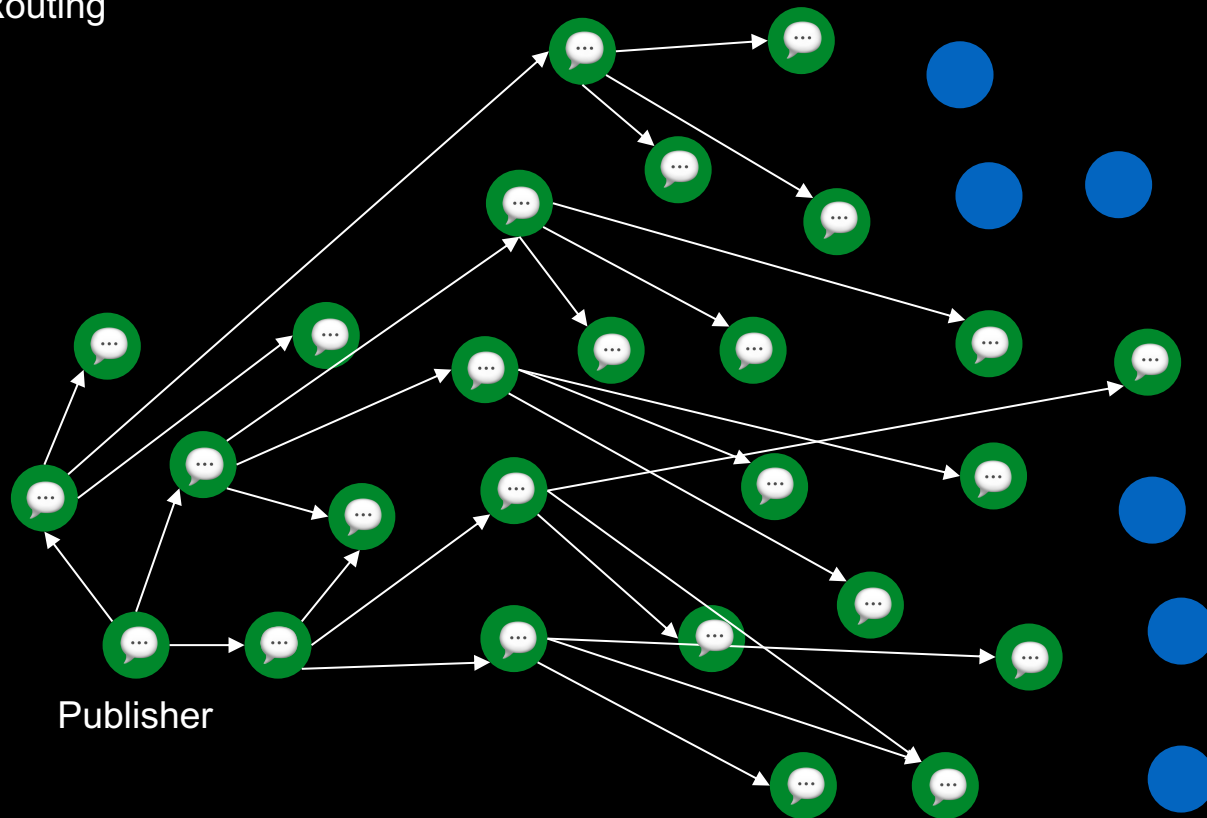
Network D=3  
Nodes=32

## Routing

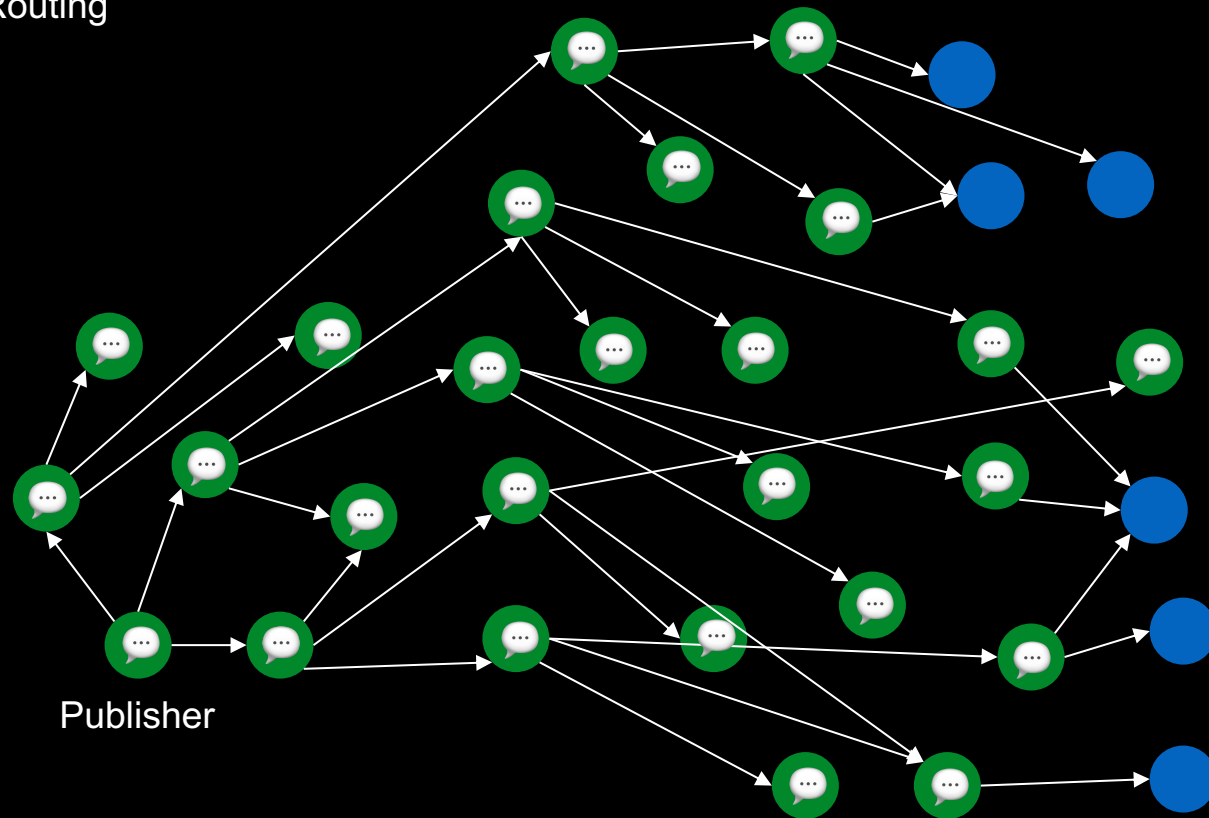


Network D=3  
Nodes=32

## Routing

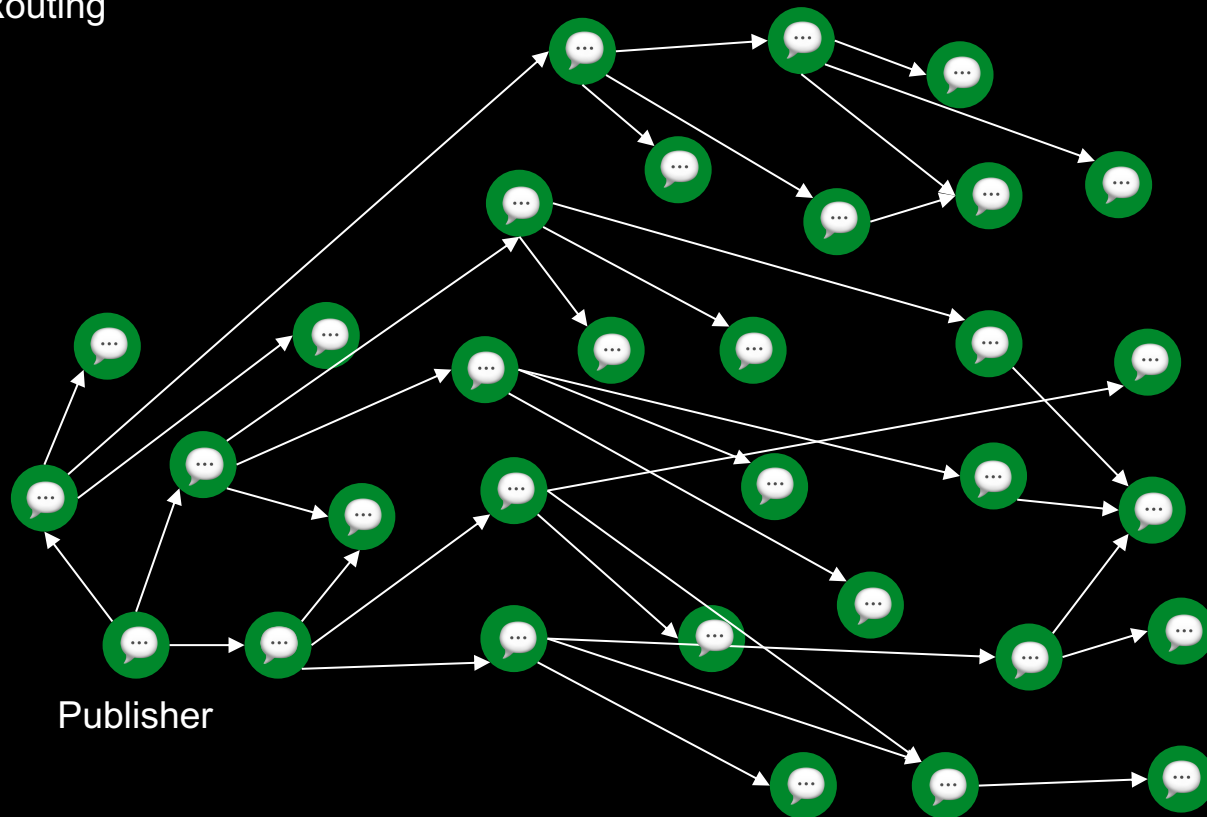


## Routing



Network D=3  
Nodes=32

## Routing



Network  $D=3$   
Nodes=32

## The Waku Network

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### Rate limiting:

How do we prevent Denial of Service?

- The protocol is permissionless, we need to rate limit to ensure fair usage.
- But preserving privacy.
- Uses RLN (Rate Limiting Nullifiers), based on zero-knowledge cryptography.
- Anyone can register a membership in the contract.
- Currently set to 100 messages every 10 minutes per membership.

## The Waku Network

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### Sharding:

How does the network scale?

- Since it is publisher/subscribed-based, all nodes get all the traffic
- This does not scale
- Fixed with sharding
- The network is split on shards (subnetworks)
- Nodes opt to which shards they participate in
- Currently, 8 shards.

## The Waku Network

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### Peer discovery:

How do peer find each other?

- Peers discover each other using DISCV5
- A DHT (Distributed Hash Table) is used to find other peers in a decentralized way
- Nodes uses ENR (Ethereum Name Record) to advertise themselves



## The Waku Network

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### Services:

Which services are offered?

- Store: To retrieve historical messages
- Lightpush/filter: For light clients running in resource-restricted devices.

## The Waku Network

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### Sustainability:

How is it sustainable?

- Use of incentives to ensure sustainability:
  - Reputation-based: Already in place
  - Economic-based: Under research

# Questions

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