Intro to Content Addressing & DHTs

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IPFS

libp2p

The Interplanetary File System (IPFS) is **a distributed file storage protocol that allows computers all over the globe to store and serve files as part of a giant peer-to-peer network**.

https://ipfs.tech/

Content Addressing vs Location Addressing

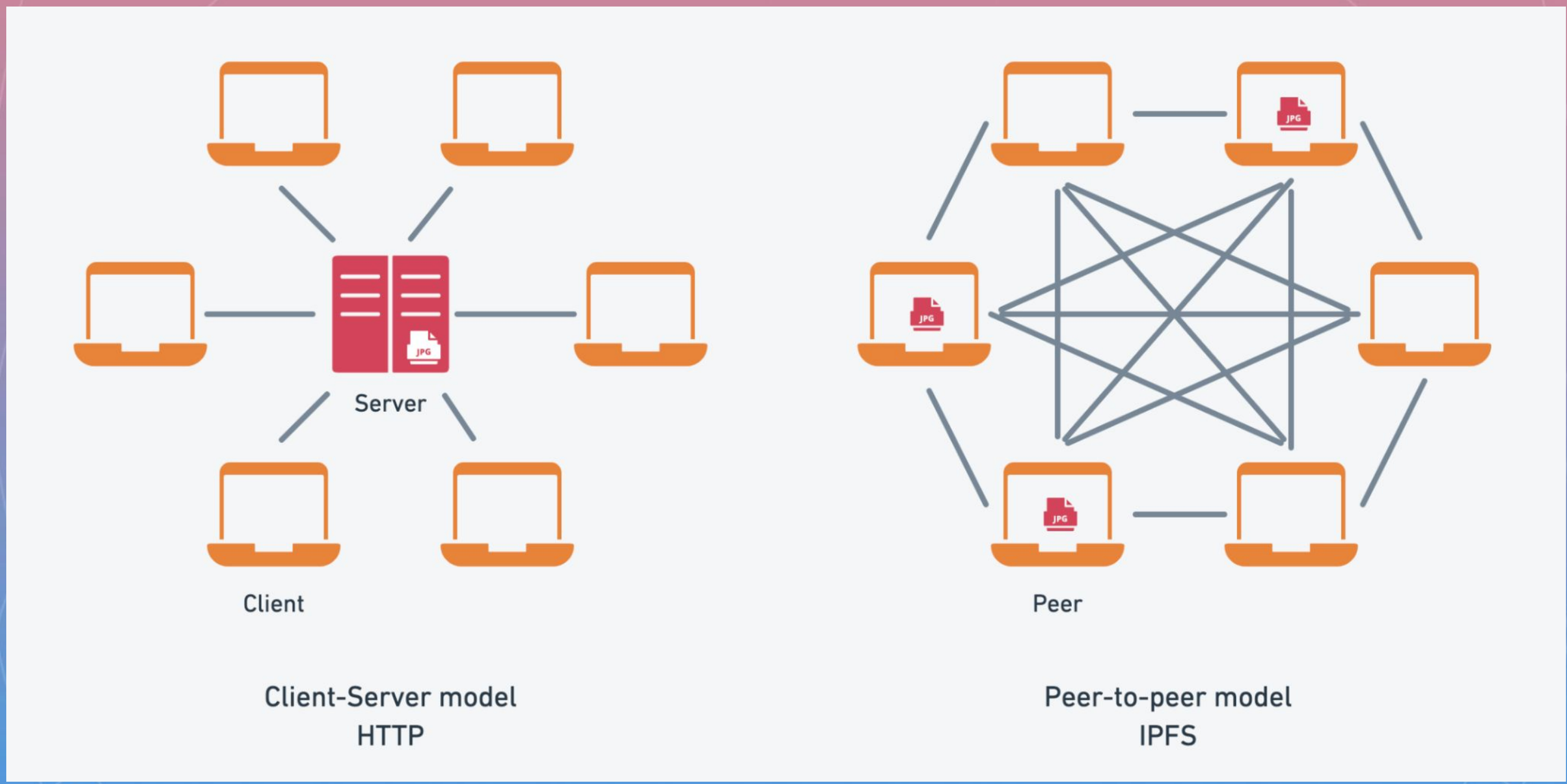


Image Credit: https://blog.ipfs.tech/2022-06-09-practical-explainer-ipfs-gateways-1/

Location Addressing - Server Model

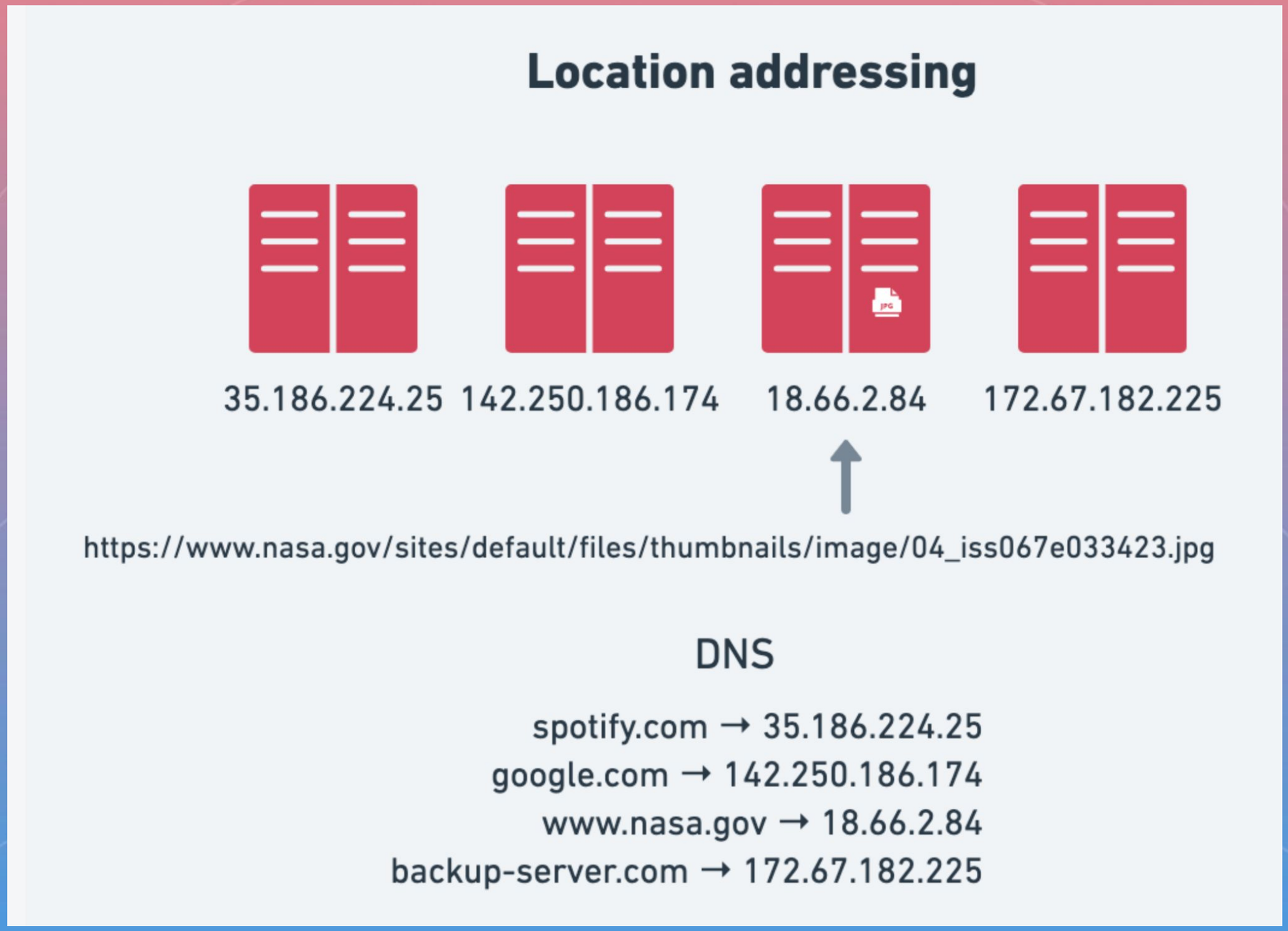
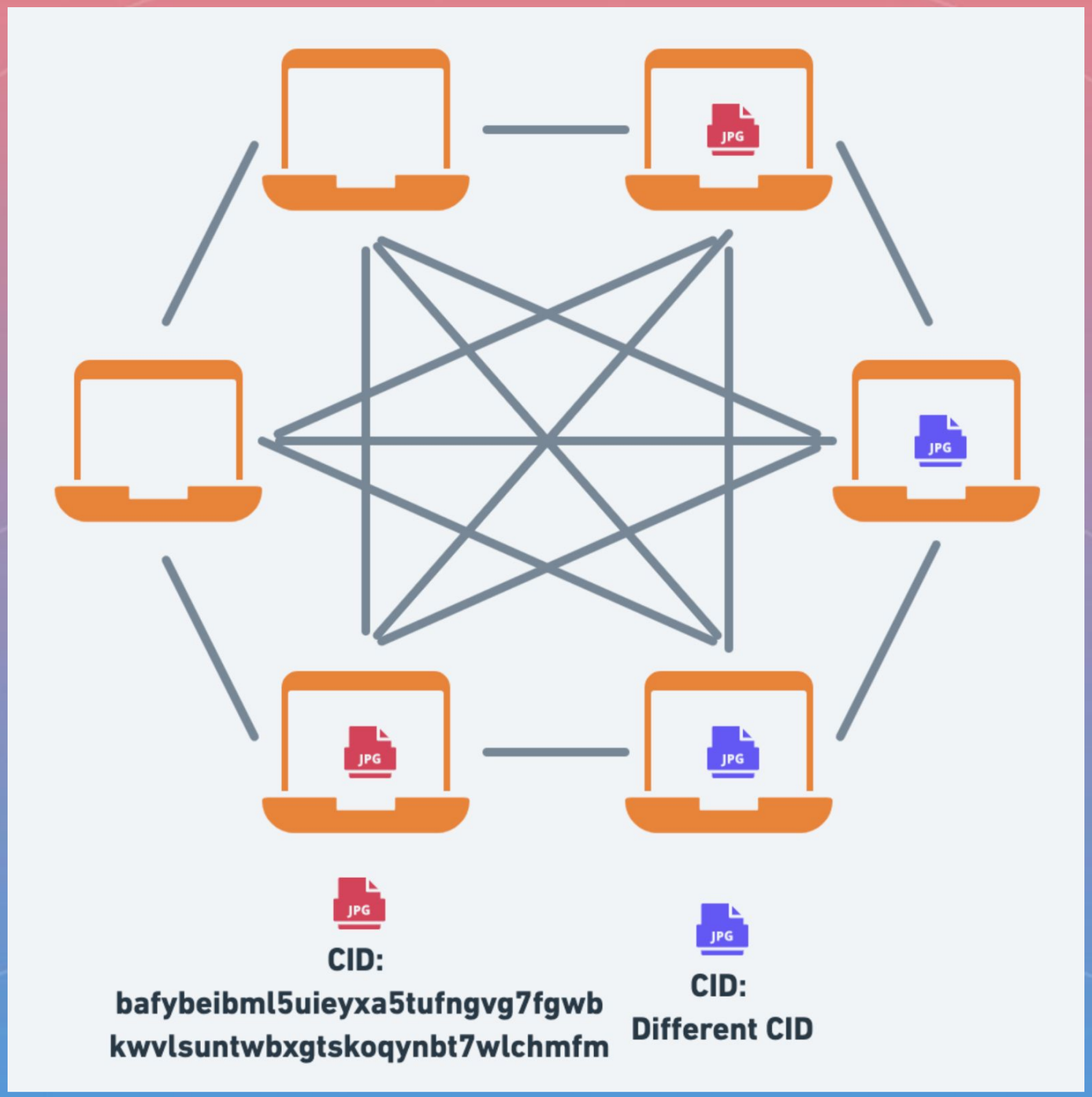


Image Credit: https://blog.ipfs.tech/2022-06-09-practical-explainer-ipfs-gateways-1/

Content Addressing



https://ipfs.io/ipfs/bafybeibml5uieyxa5tufngvg7fgwbkwvlsuntwbxgtskoqynbt7wlchmfm

DHT - Distributed Hash Tables

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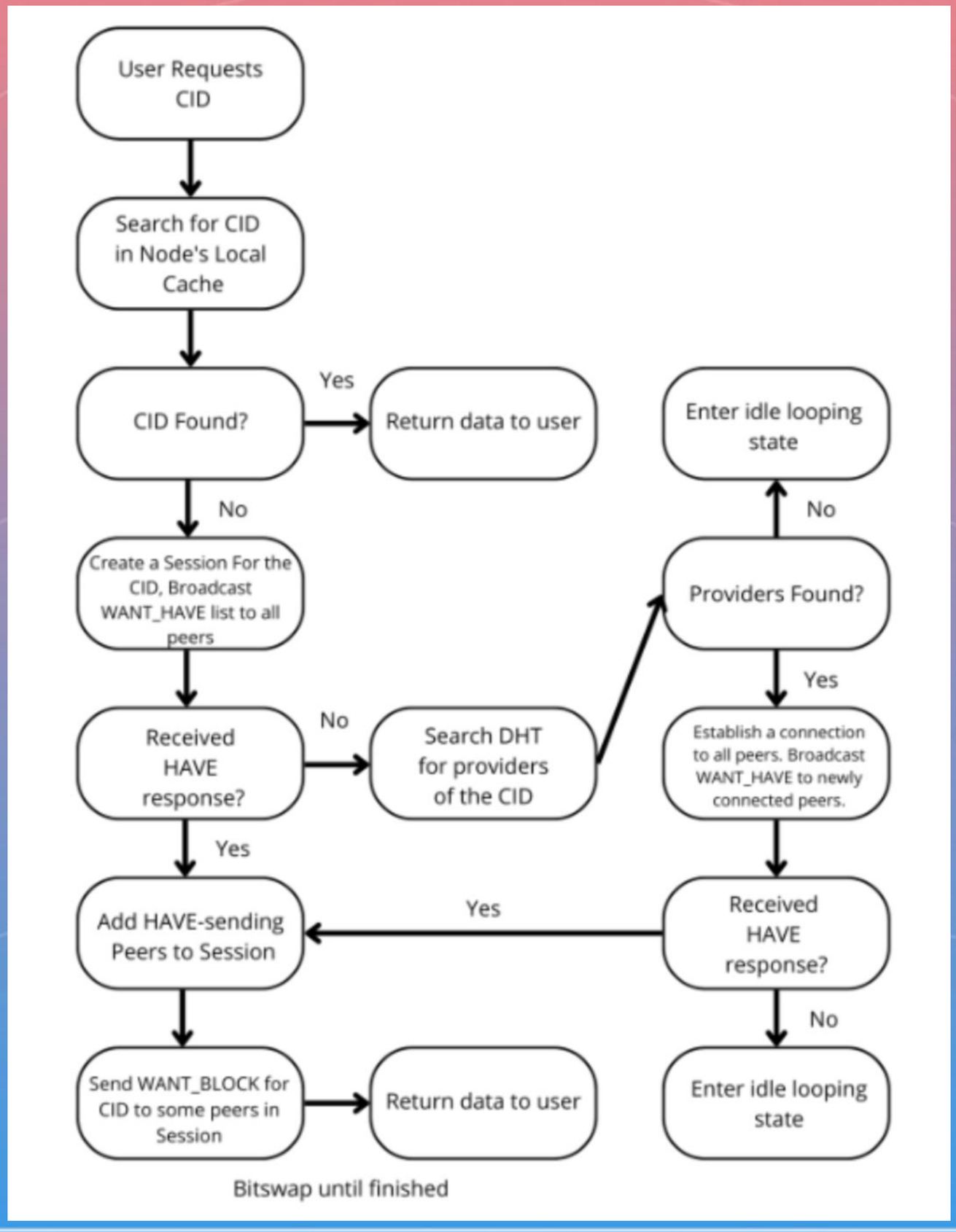
A Distributed Hash Table (DHT) is a method of mapping keys to their associated values. They are fundamentally databases of keys and value pairs that are split across all the peers on a distributed network.

In order to upload or retrieve data stored on IPFS, there must be a mapping of each node's PeerID and the content identifiers (CIDs) that the peer is storing. The DHT maintains this mapping of each CID with the PeerID of the nodes that are hosting that specific CID.

Credit: https://filebase.com/blog/ipfs-publishing-to-the-dht/

How DHT Works



Discovery Algorithms - Gossipsub

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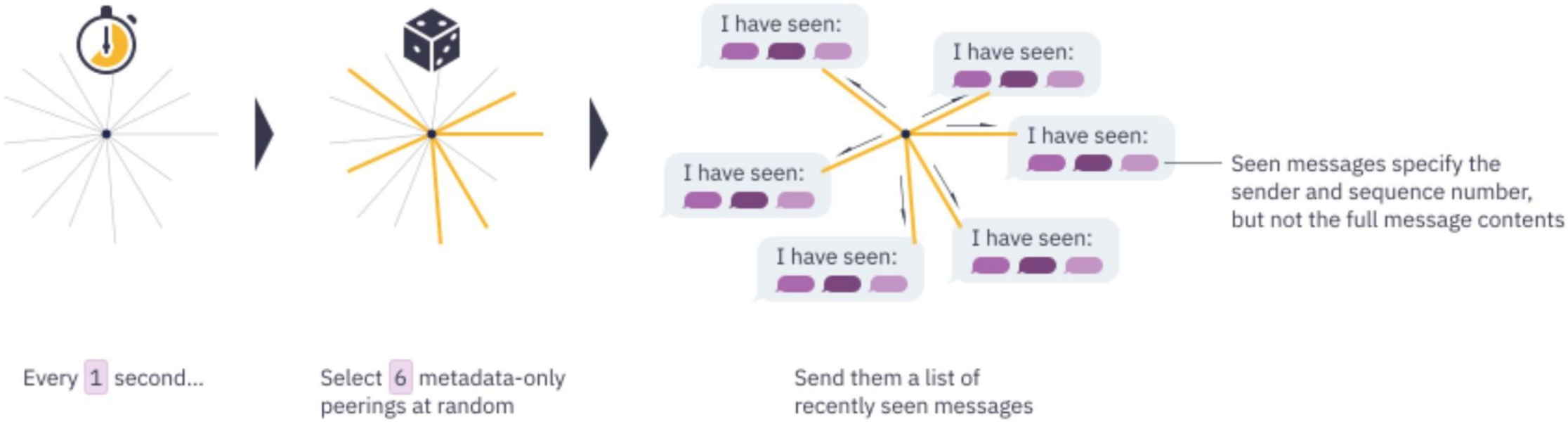
Gossip

Peers gossip about messages they have recently seen. Every 1 second each peer randomly selects 6 metadata-only peers and sends them a list of recently seen messages.



Gossiping gives peers a chance to notice in case they missed a message on the full-message network. If a peer notices it is repeatedly missing messages then it can set up new full-message peerings with peers that do have the messages.

Image Credit: https://research.protocol.ai/blog/2019/a-new-lab-for-resilient-networks-research/PL-TechRep- gossipsub-v0.1-Dec30.pdf

Discovery Algorithms - Gossipsub

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Types of peering

In gossipsub, peers connect to each other via either **full-message** peerings or **metadata-only** peerings. The overall network structure is made up of these two networks:

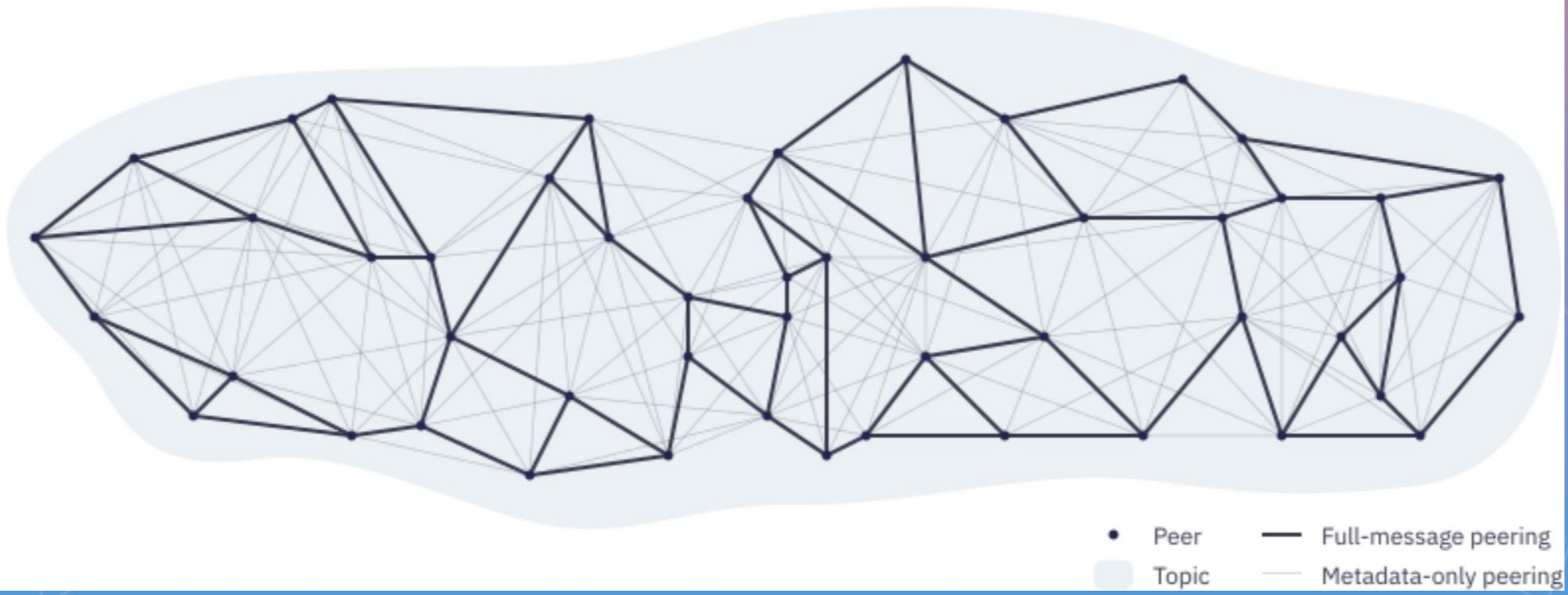
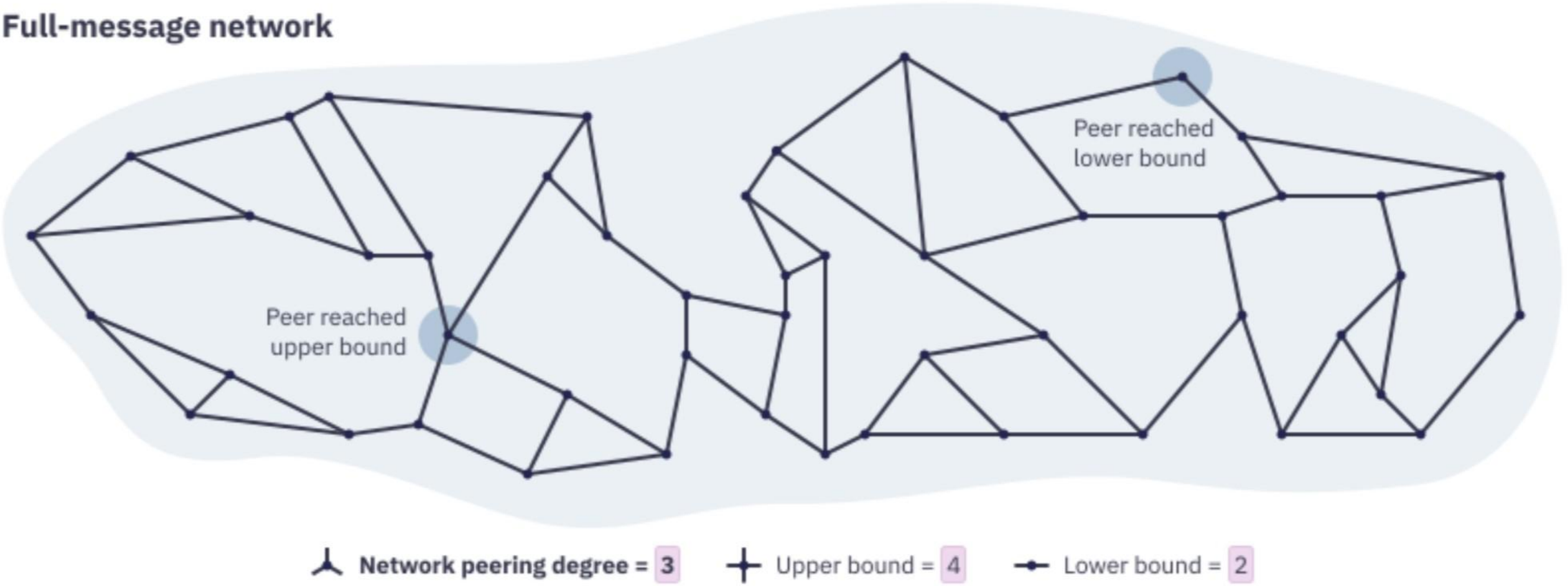


Image Credit:

https://research.protocol.ai/blog/2019/a-new-lab-for-resilient-networks-research/PL-TechRep- gossipsub-v0.1-Dec30.pdf



The peering degree (also called the *network degree* or *D*) controls the trade-off between speed, reliability, resilience and efficiency of the network. A higher peering degree helps messages get delivered faster, with a better chance of reaching all subscribers and with less chance of any peer disrupting the network by leaving. However, a high peering degree also causes additional redundant copies of each message to be sent throughout the network, increasing the bandwidth required to participate in the network.

In libp2p's default implementation the ideal network peering degree is 6 with anywhere from 4–12 being acceptable.

Discovery Algorithms - Pub/Sub

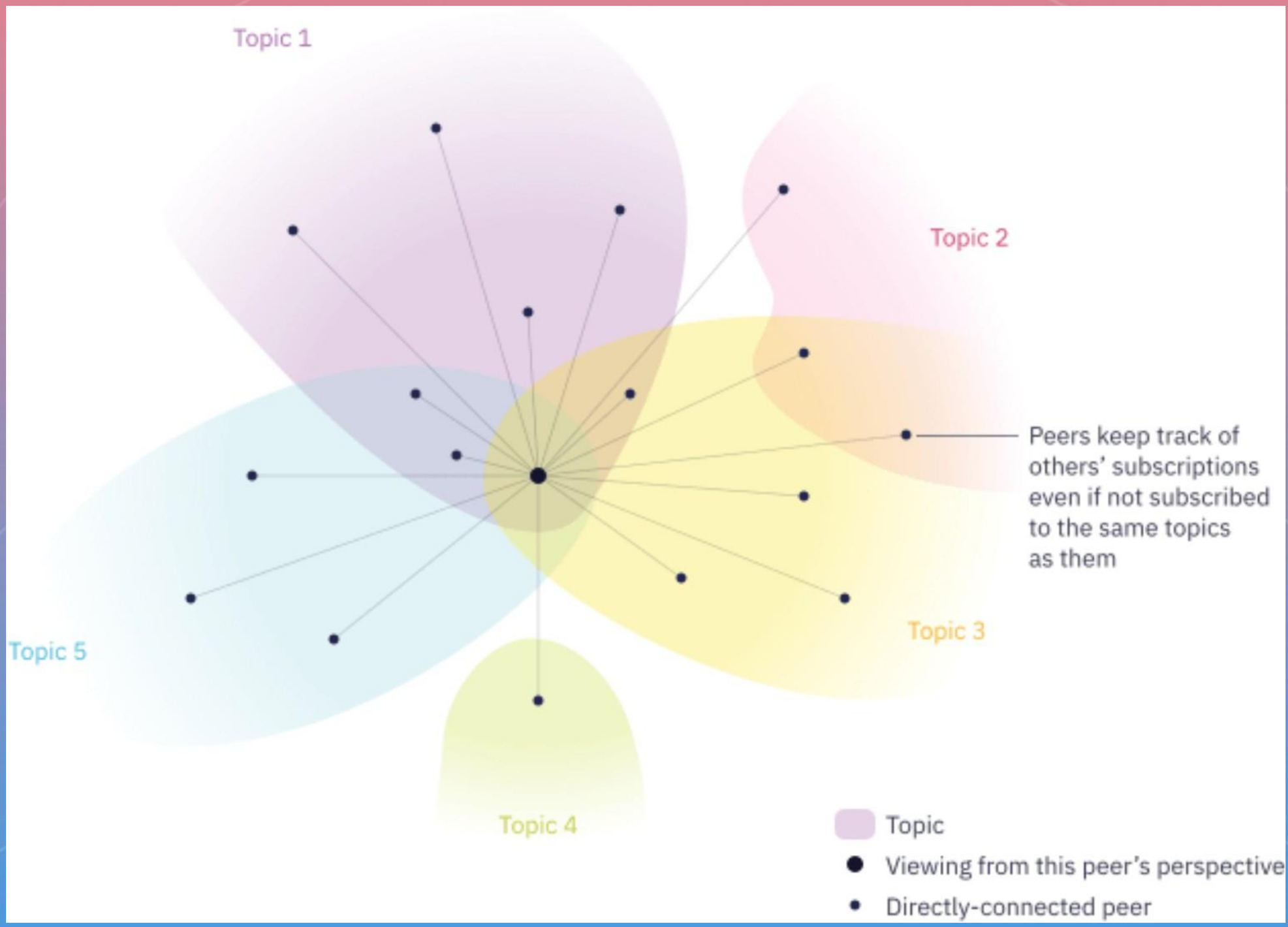


Image Credit: https://docs.libp2p.io/concepts/publish-subscribe/

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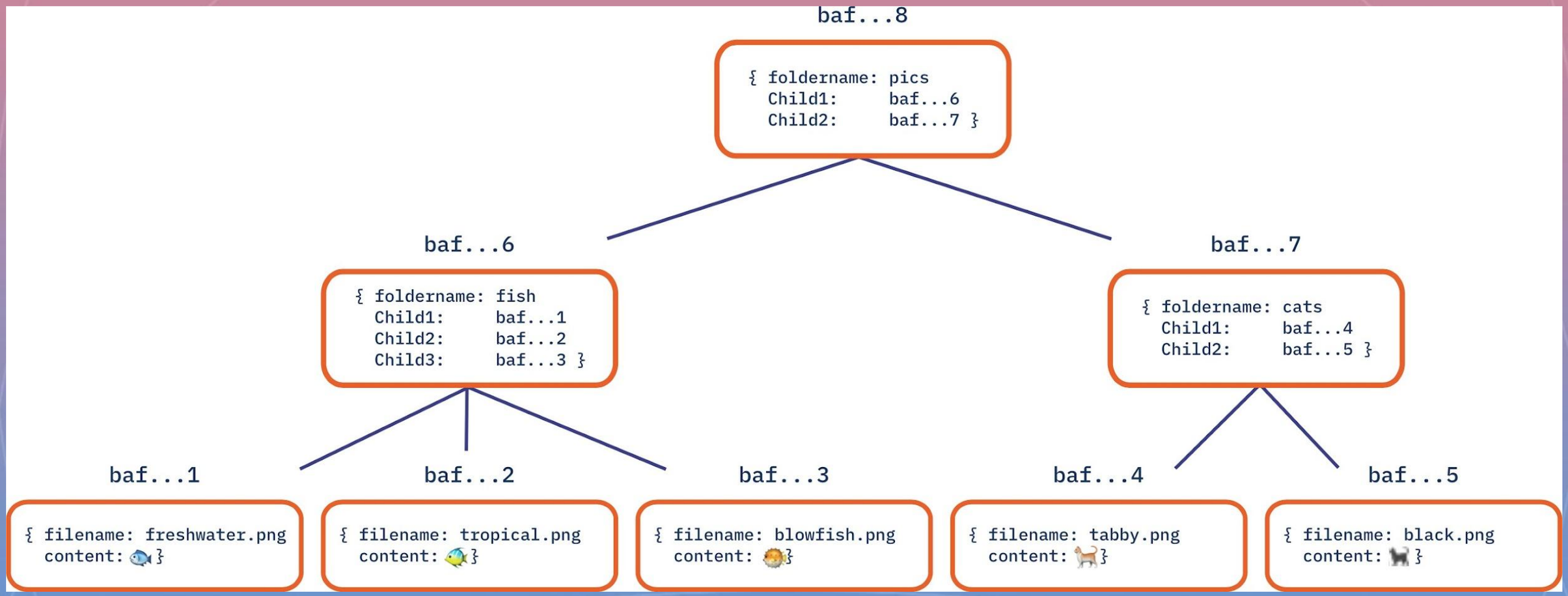
Discovery Algorithms - Graph-Sync



Installing IPFS Node - Kubo

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https://docs.ipfs.tech/install/command-line/#system-requirements

Installing IPFS Desktop - Host a Single Page Application

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https://docs.ipfs.tech/how-to/websites-on-ipfs/single-page-website/#install-ipfs-desktop

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Thank You

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