Foundation of P2P Networks

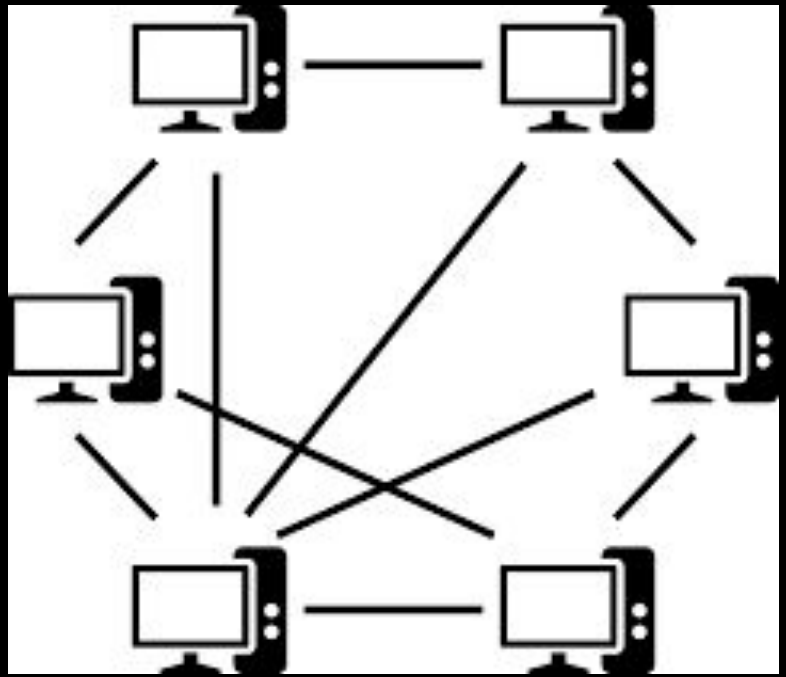
What are they and
how they work

What are decentralized p2p networks

- Each member of the network is equal to any other member

- Each member communicate to others directly

- Allows distributing processing power, storage between members



Key components of P2P networks

P2P protocols

Application level protocols in P2P networks. Comprises **transport**, **peer identity**, **addressing** and other components.

Peer discovery

Key challenge in P2P networking. Algorithms for identifying other peers in network.

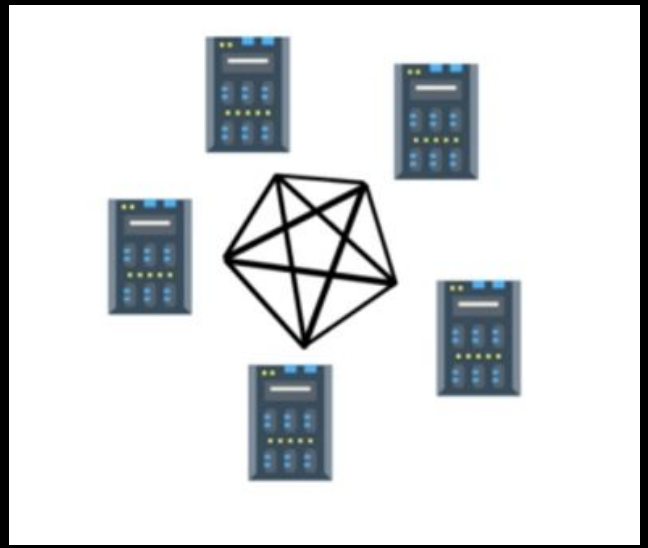
Transports

Transport level protocols for transferring data between peers.

NAT Traversal

Mechanisms for reaching peers that obstructed by firewall or private networks.

P2P protocols



https://learn.bybit.com/bybit-p2p-guide/peer-to-peer-blockchain-network/

Application layer protocol which defines base components in a P2P networks like peer identity, addressing, messaging, connection logic, etc...

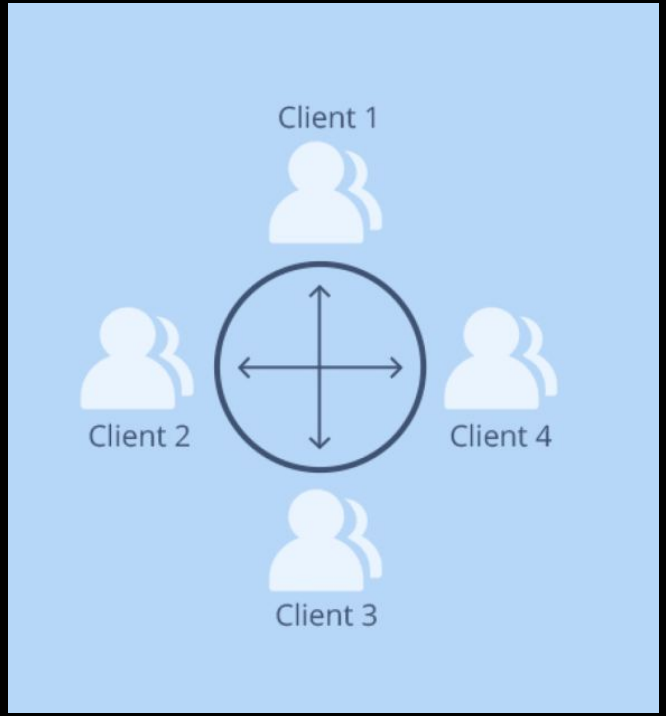
There is Libp2p ecosystem which provides great foundation for your own protocol.

Peer discovery

It is a mechanism for discovering and announcing other network participants to peers.

Implementation depends on the protocol, e.g., broadcasting a message in a network when new peer becomes a participant, bootstrap node which keeps a list of known network participants, etc...

Peer routing - algorithm to find specific peer through other peers. Usually implemented by maintaining routing table.



https://listing.help/what-is-peer-to-peer-p2p-in-blockchain/

Transports

https://blog.libp2p.io/2022-12-19-libp2p-webtransport/

Most popular examples of P2P protocols are TCP and UDP.

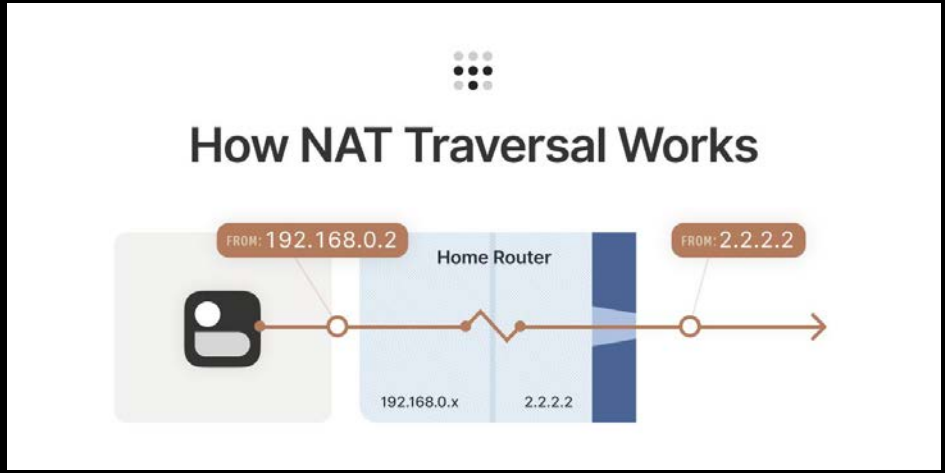
There are alternatives at lower levels (e.g. sending raw ethernet packets or bluetooth frames), and higher levels (e.g. QUIC, which is layered over UDP).

There are WebTransport and WebRTC protocols which are efficient ways of communication in browser environment.

NAT Traversal

NAT is the mechanism that allows communication between public peer and peer in private network like laptop connected to home wifi router.

One of the popular way to communicate through NAT is to setup a relay peer which acts as a proxy between 2 peers.



https://tailscale.com/blog/how-nat-traversal-works

Examples of P2P networks:

IPFS

Protocol for file storage and sharing

BitTorrent

Protocol for file sharing

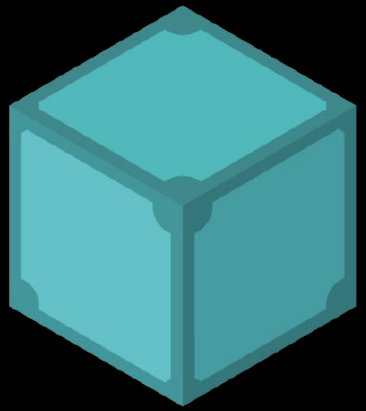
Fluence Network

Protocol for distributed computation

Etherium

Decentralized blockchain protocol

IPFS

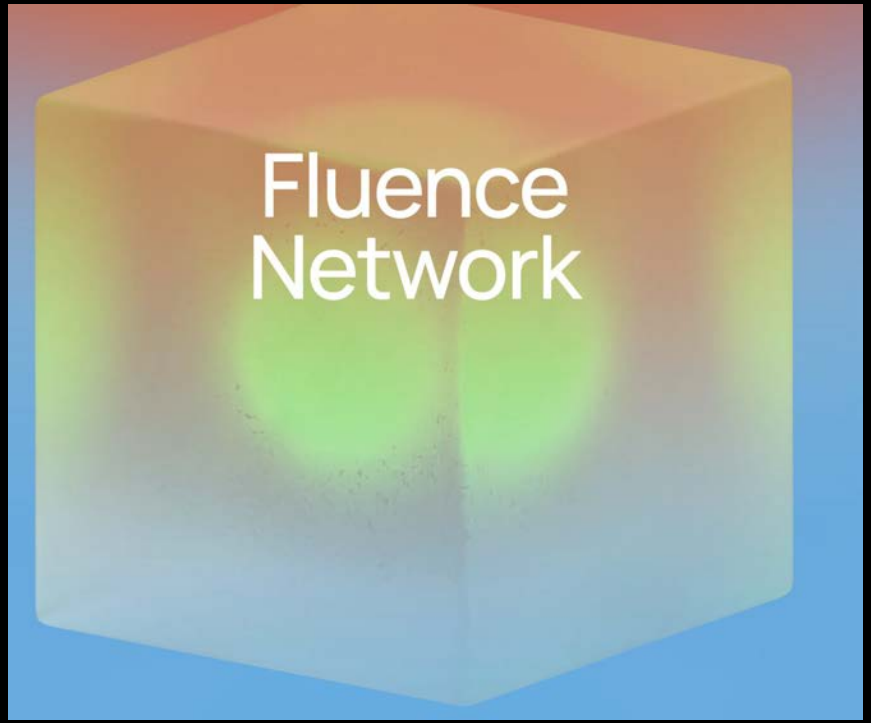


IPFS

IPFS is a distributed system for storing and accessing files, websites, applications, and data.

IPFS stands for InterPlanetary File System.

Fluence Network



Fluence protocol manages distributed computation

The protocol uses network of providers of computing power to produce some calculations and return the result to host machine

Additional information

Check these links to get a deeper understanding of P2P building components:

- https://docs.libp2p.io/concepts/fundamentals/
- https://pl-launchpad.io/curriculum/libp2p/objectives/

Thanks for listening!