



University  
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Center for  
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# Bitcoin, Blockchain and Cryptoassets

## Peer-to-Peer Networks

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Release Ver.: (Local Release)

Version Hash: (None)

Version Date: (None)

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# The Origin of Peer-to-Peer Networks

Peer-to-peer (p2p) networks were popularized by file sharing systems in the early 2000s.



Napster

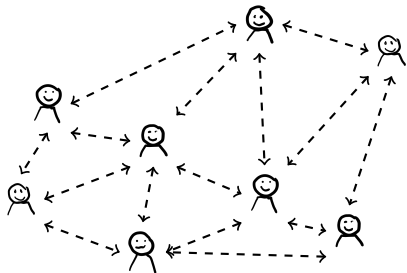


LimeWire

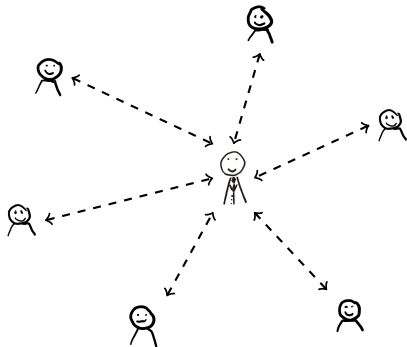
They allow network participants to directly interact with each other, without the need for servers or stable hosts.

# Peer-to-Peer vs. Centralized Networks

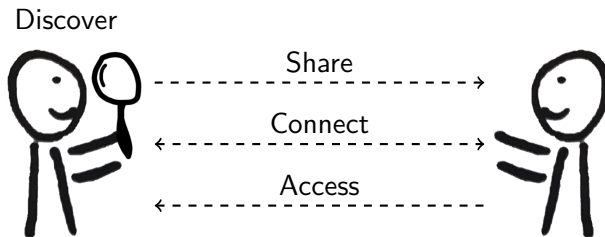
Peer-to-Peer



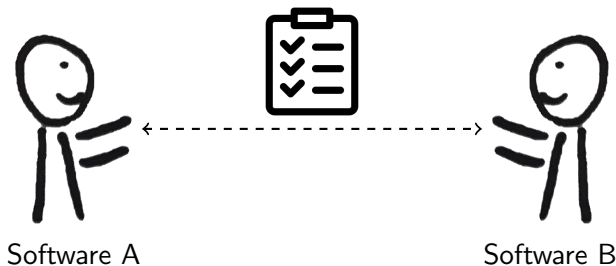
Centralized



# Node Software



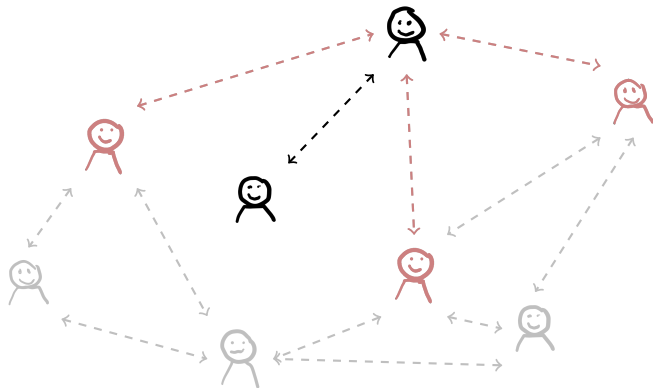
# Network Specification



Node communication is defined by the **protocol specifications**.

- Nodes can run different software implementations
- Allows specialization of nodes
- **Further decentralizes** the system

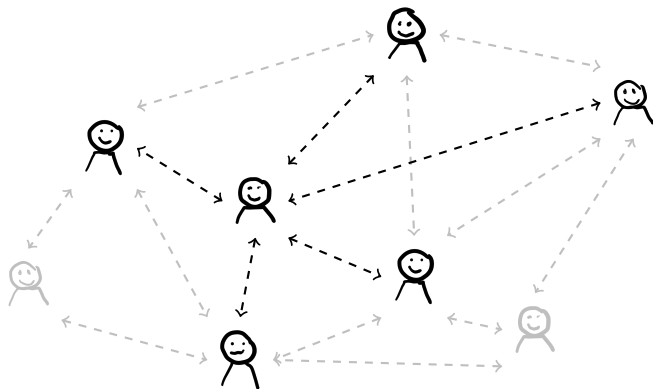
# Peer Discovery



Basic peer discovery:

1. Connect to a known peer
2. Ask this peer for a list of known nodes

# Peer Discovery



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1. Connect to a known peer
2. Ask this peer for a list of known nodes
3. Connect to a random subset of peers from this list
4. Repeat steps 2 and 3 until enough connections are established

# Advantages of P2P Networks

A peer-to-peer architecture offers key advantages:

- No central point of failure
  - No single node is critical for a functioning network
  - No bandwidth bottlenecks
- No central point of attack
  - No node has special privileges or powers
  - Very difficult to overload the network via DoS attacks
- No centralized infrastructure requirement
- Difficult to regulate or stop

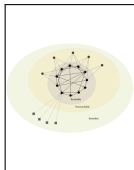


# Problems of P2P Networks

Trade-offs have to be made, especially regarding security:

- A node can share malicious or irrelevant resources
- Difficult to regulate illicit activity
- Limited by the nodes with the weakest hardware

# Recommended Literature



## **Cryptocurrency Networks: A New P2P Paradigm**

Delgado-Segura et al., 2018

↗ <https://doi.org/10.1155/2018/2159082>