

 Build the Network – Peer-to-Peer Simulation

**Objective/Aim:**  
  
 To understand the concept of a peer-to-peer (P2P) network by simulating how blockchain nodes connect, share data, and achieve synchronization without a central server.

**Apparatus/Software Used:**

* Laptop
* Remix IDE
* MetaMask
* Pinata(IPFS)
* Vs code

**Theory/Concept:**

**Theory / Concept:**

* A peer-to-peer network is a distributed system where all nodes are equal participants (peers).
* Each peer stores a copy of the ledger and validates transactions independently.
* When one peer updates data (like a transaction), it broadcasts it to other peers.
* This decentralized communication forms the foundation of blockchain networks such as Bitcoin and Ethereum.

**Key Components:**

* Nodes: Participants that maintain blockchain data.
* Blocks: Data structures containing transactions.
* Broadcasting: Mechanism for sharing updates among nodes**.**



**Procedure:**

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Step 1: Set up multiple nodes in the simulation, each capable of sending and receiving messages autonomously

Step 2: Implement peer discovery protocols where nodes identify and connect to other nodes

Step 3: Simulate message broadcasting where a transaction or block is sent from one node and relayed to peers until all nodes receive it

Step 4: Introduce network latency, message loss, or node failures to observe network robustness

Step 5: Optionally, implement simple consensus or validation logic to mimic blockchain operations

Step 6: Monitor the network to verify successful data propagation and node synchronization

**Observation Table:**

**📊 Observation Table**



| **Step** | **Action** | **Peer A Status** | **Peer B Status** | **Peer C Status** | **Network State** |
| --- | --- | --- | --- | --- | --- |
| 1 | Initial state | ✅ Valid | ✅ Valid | ✅ Valid | All peers synchronized |
| 2 | Modify Block #2 in Peer A | ❌ Invalid | ✅ Valid | ✅ Valid | Peer A out of sync |
| 3 | Mine Block #2 in Peer A | ✅ Valid | ✅ Valid | ✅ Valid | Peer A valid but different data |
| 4 | Manually sync B & C with A | ✅ Valid | ✅ Valid | ✅ Valid | All peers synchronized again |



