**Types of blockchain nodes**

**What is a Blockchain Node?**

* The precise definition of a blockchain node **varies by network**, **depending on its type and purpose**. In general, **a node is an electronic device that is connected to the blockchain network and has an IP address.**
* Users can interact with and within the network through nodes, **which serve as communication endpoints**. Not all electronic devices, are blockchain nodes.
* Contrary to popular belief, not all nodes perform the same function. **Some nodes, for example, are dedicated to storing transaction records, whereas others cannot store any records**.

**Types of Blockchain Nodes**

Blockchain nodes are **classified according to the functions they perform**.

#### ****1. Pruned Full Nodes****

* By pruning the older blocks, **pruned full nodes store data or blocks on the hard disc**. They have **allocated storage space**.
* Such nodes must **first download the entire blockchain to their hard drive** and then **delete older data block by block**, **beginning at the beginning**.
* They **continue to delete older blocks until the storage only contains the most recent transaction records**, up to the limit.

**Blockchain Pruning:**

* Pruning is a technique that allows nodes to **discard some of the historical transaction data** while still maintaining the integrity and security of the blockchain. This is especially **important for networks with large blockchains**, as storing the complete history on every node can become impractical in terms of storage capacity.

#### ****2. Full Node****

* When someone says “blockchain node,” they usually mean a full node. **Full nodes store the records of blockchain transactions**. As a result, **they are also referred to as blockchain servers.** **Many consensus models**, such as Proof of Work and Proof of Stake, **rely on full nodes to reach an agreemen**t.
* A full node stores the **entire transaction history of the blockchain from the genesis block to the most recent block**. It keeps a full copy of the blockchain, including all transactions and historical data.
* The network **makes sure that all full nodes are prepared for every upgrade or improvement before putting it into action. These nodes are a part of how a blockchain is governed.**
* For example, if a **pruned full node** only has 200 MB of storage space, it will keep the data from the most recent transactions up to that limit. It **will be synced with the network to continue adding newer records to its storage while deleting older ones.**
* However, full nodes **may employ pruning techniques to reduce storage requirements** by discarding older transaction data while maintaining the essential information.

#### ****3. Archival Full Node****

* Archival full nodes, as **opposed to pruned full nodes**, keep a complete and unpruned record of **the entire transaction history, including all historical data**.
* They are the most common type of blockchain node and **have no defined storage limit**.
* Archival nodes have **higher storage requirements compared to full nodes** because they retain all information from every block ever created.

**Difference between Full node and Archival node**

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| --- | --- | --- |
| **Aspect** | **Full Node** | **Archival Node** |
| **Storage Requirements** | Stores the entire blockchain, may use pruning techniques | Maintains an unpruned record of the complete blockchain history |
| **Use Cases** | Commonly used for transaction validation and security | Useful for applications requiring access to complete historical data (research, analysis) |
| **Bandwidth & Processing Power** | Requires significant resources for network participation | Demands considerable resources, especially due to larger data storage |
| **Network Support** | Backbone of the network, essential for decentralization | Provides a specialized service, not crucial for everyday network functioning |
| **Specifics** | May prune older transaction data to reduce storage | Keeps all transaction data, offering a comprehensive historical record |

#### ****4. Miner Nodes****

* Miner Nodes are **responsible for validating transactions and generating new** **blocks** on the Blockchain.
* For example, Miner nodes employ a **Proof of Work consensus model in Bitcoin**. To approve transactions on the blockchain, these **nodes must solve complex mathematical problems**. As an incentive, once a miner node has finished solving the problem and adding the block of transaction records to the blockchain, it is rewarded with some newly minted tokens.
* Miner Nodes **require specialized hardware and software to perform mining calculations**. They are often run by major mining pools or individuals with the financial ability to invest in the necessary equipment.

**5. Authority Nodes**

* As Blockchains become more active, their user count can rise. **To keep the Blockchain secure from cyber threats, some nodes need to limit access to the Blockchain**.
* Authority nodes **allow only authorized users to enter the network**.
* In a public Blockchain, a node that downloads and synchronizes Blockchain data with the network is called Authority Node.
* When it comes to private and some partially-centralized blockchains, however, this access is limited to a few authority nodes. These nodes can control and limit the access of the other nodes.

#### ****6. Staking Nodes****

#### A "staking node" refers to a node in a blockchain network that participates in the process of staking, typically associated with Proof of Stake (PoS) and related consensus mechanisms.

#### Staking involves locking up a certain amount of cryptocurrency as collateral to support the operations of the network.

#### In return for providing this collateral, stakers may receive rewards, such as additional cryptocurrency, transaction fees, or governance rights.

#### Here's how a staking node typically works:

#### Proof of Stake (PoS) Consensus:

#### Staking nodes are prevalent in blockchain networks that use PoS or similar consensus mechanisms. Unlike Proof of Work (PoW), where miners solve cryptographic puzzles to validate transactions and create new blocks, PoS relies on participants (validators or stakers) who are chosen to create blocks based on the amount of cryptocurrency they hold and are willing to "stake" as collateral.

#### Node Operation and Staking:

#### Staking nodes operate by running network nodes and staking a certain amount of the native cryptocurrency (e.g., Ether in Ethereum 2.0, ADA in Cardano) as collateral. This collateral is held in a "staking wallet" or a specialized contract.

#### Block Validation:

#### Staking nodes are selected to validate transactions and propose new blocks based on factors like the amount of cryptocurrency staked and other consensus rules. The more cryptocurrency staked, the higher the chance of being chosen to create a new block.

#### Rewards:

#### Stakers earn rewards for their participation in the consensus process. These rewards can come in the form of additional cryptocurrency, transaction fees, or other benefits. The idea is to incentivize participants to act honestly and in the best interest of the network.

#### Slashing:

#### Some PoS systems incorporate a mechanism called slashing, which penalizes stakers for malicious behavior. If a staker is found to be acting against the network's rules (double-signing blocks, for example), a portion of their staked cryptocurrency may be forfeited as a penalty.

#### Network Security:

#### Staking nodes contribute to the security of the network by staking their own assets as collateral. This economic security model is designed to align the interests of participants with the well-being and integrity of the blockchain.

#### ****7. Light Node****

* The light node is the **second most common type of blockchain node**. These nodes’ purpose is to **accommodate faster transactions and daily activities**.
* That is why they are **also referred to as Simplified Payment Verification (SPV) nodes**.They are designed to **store only the necessary information, i.e., block headers, rather than downloading and storing the entire blockchain.**
* As a result, they **save users a significant amount of time and storage space**.

#### ****8. Masternodes****

* Masternodes **are complete nodes that cannot add new blocks to the chain**.
* These nodes do nothing more than **validate and record transactions**. They can also **perform any additional functions or responsibilities** that are assigned to them.
* In 2014, Dash was the first blockchain to use master nodes in its network mechanism.

#### ****9. Lightning Nodes****

* When a blockchain network is overburdened, users may experience delayed transactions.
* Lightning nodes are used to **reduce transaction latency to a bare minimum**. These nodes **enable off-chain transactions by connecting the network** to users outside the blockchain. They **reduce network load, resulting in transactions that are instantaneous and cost very little.**

#### ****10. Super Nodes****

* Supernodes are a **less common type of blockchain node**. They are intended to **carry out specific tasks.**
* A blockchain, for example, **can use super nodes to maintain network regulations or to implement an upgrade.**