Ethereum

Blockchain technology gained public notice with the advent of bitcoin in 2009. Bitcoin is a cryptocurrency that runs on blockchain technology and is by far, the most popular and most ranked cryptocurrency. Ethereum was initially released in 2015. Within two years of its release, it was ranked the second best blockchain network, Bitcoin is the first. The Ethereum network acquired more global interest when china stated that it is the best blockchain network ever created.

What is Ethereum?

Ethereum is a Blockchain network that introduced a built-in Turing-complete programming language that can be used for creating various decentralized applications(also called Dapps). The Ethereum network is fueled by its own cryptocurrency called 'ether'.

- The Ethereum network is currently famous for allowing the implementation of smart contracts. Smart contracts can be thought of as 'cryptographic bank lockers' which contain certain values.
- These cryptographic lockers can only be unlocked when certain conditions are met.
- Unlike bitcoin, Ethereum is a network that can be applied to various other sectors.
- Ethereum is often called Blockchain 2.0 since it proved the potential of blockchain technology beyond the financial sector.
- The consensus mechanism used in Ethereum is Proof of Stakes(PoS), which is more energy efficient when compared to that used in the Bitcoin network, that is, Proof of Work(PoW). PoS depends on the amount of stake a node holds.

History of Ethereum

- **2013:** Ethereum was first described in Vitalik Buterin's white paper in 2013 with the goal of developing decentralized applications.

- **2014:** In 2014, EVM was specified in a paper by Gavin Wood, and the formal development of the software also began.

- **2015:** In 2015, Ethereum created its genesis block marking the official launch of the platform.

- **2018:** In 2018, Ethereum took second place in Bitcoin in terms of market capitalization.

- **2021:** In 2021, a major network upgrade named London included Ethereum improvement proposal 1559 and introduced a mechanism for reducing transaction fee volatility.

- **2022:** In 2022, Ethereum has shifted from PoW(Proof-of-Work) to PoS(Proof-of-State) consensus mechanism, which is also known as Ethereum Merge. It has reduced Ethereum's energy consumption by ~ 99.95%.

Features of Ethereum

1. [Smart contracts](): Ethereum allows the creation and deployment of smart contracts. Smart contracts are created mainly using a programming language called solidity. Solidity is an Object Oriented Programming language that is comparatively easy to learn.

2. [Ethereum Virtual Machine (EVM)](): It is designed to operate as a runtime environment for compiling and deploying Ethereum-based smart contracts.

3. [Ether](): Ether is the cryptocurrency of the Ethereum network. It is the only acceptable form of payment for transaction fees on the Ethereum network.

4. [Decentralized applications (Daaps)](): Dapp has its backend code running on a decentralized peer-to-peer network. It can have a frontend and user interface written in any language to make calls and query data from its backend. They operate on Ethereum and perform the same function irrespective of the environment in which they get executed.

5. [Decentralized autonomous organizations (DAOs)](): It is a decentralized organization that works in a democratic and decentralized fashion. DAO relies on smart contracts for decision-making or decentralized voting systems within the organization.

Type of Ethereum Accounts

Ethereum has two types of accounts: An externally owned account (EOA), and a Contract account. These are explained as following below:

Externally owned account (EOA): Externally owned accounts are controlled by private keys. Each EOA has a public-private key pair. The users can send messages by creating and signing transactions.

Contract Account: Contract accounts are controlled by contract codes. These codes are stored with the account. Each contract account has an ether balance associated with it. The contract code of these accounts gets activated every time a transaction from an EOA or a message from another contract is received by it. When the contract code activates, it allows to read/write the message to the local storage, send messages and create contracts.

How Does Ethereum Work?

Ethereum implements an execution environment called Ethereum Virtual Machine (EVM).

- When a transaction triggers a smart contract all the nodes of the network will execute every instruction.
- All the nodes will run The EVM as part of the block verification, where the nodes will go through the transactions listed in the block and runs the code as triggered by the transaction in the EVM.
- All the nodes on the network must perform the same calculations for keeping their ledgers in sync.
- Every transaction must include:
- Gas limit.
- Transaction Fee that the sender is willing to pay for the transaction.
- If the total amount of gas needed to process the transaction is less than or equal to the gas limit then the transaction will be processed and if the total amount of the gas needed is more than the gas limit then the transaction will not be processed the fees are still lost.
- Thus it is safe to send transactions with the gas limit above the estimate to increase the chances of getting it processed.

Real-World Applications of Ethereum

- **Voting:** Voting systems are adopting Ethereum. The results of polls are available publicly, ensuring a transparent fair system thus eliminating voting malpractices.
- **Agreements:** With Ethereum smart contracts, agreements and contracts can be maintained and executed without any alteration. Ethereum can be used for creating smart contracts and for digitally recording transactions based on them.

- **Banking systems:** Due to the decentralized nature of the Ethereum blockchain it becomes challenging for hackers to gain unauthorized access to the network. It also makes payments on the Ethereum network secure, so banks are using Ethereum as a channel for making payments.

- **Shipping:** Ethereum provides a tracking framework that helps with the tracking of cargo and prevents goods from being misplaced.

- **Crowdfunding:** Applying Ethereum smart contracts to blockchain-based crowdfunding platforms helps to increase trust and information symmetry. It creates many possibilities for startups by raising funds to create their own digital cryptocurrency.

- **Domain names:** Ethereum name service allows crypto users to buy and manage their own domain names on Ethereum, thus simplifying decentralized transactions without putting users to remember long, machine-readable addresses.

Benefits of Ethereum

- **Availability:** As the Ethereum network is decentralized so there is no downtime. Even if one node goes down other computing nodes are available.

- **Privacy:** Users don't need to enter their personal credentials while using the network for exchanges, thus allowing them to remain anonymous.

- **Security:** Ethereum is designed to be unhackable, as the hackers have to get control of the majority of the network nodes to exploit the network.

- **Less ambiguity:** The smart contracts that are used as a basis for trade and agreement on Ethereum ensure stronger contracts that differ

from the normal traditional contracts which require follow-through and interpretation.

- **Rapid deployment:** On Ethereum decentralized networks, enterprises can easily deploy and manage private blockchain networks instead of coding blockchain implementation from scratch.
- **Network size:** Ethereum network can work with hundreds of nodes and millions of users.
- **Data coordination:** Ethereum decentralized architecture better allocates information so that the network participants don't have to rely on a central entity to manage the system and mediate transactions.

Drawbacks of Ethereum

- **Complicated programming language:** Learning solidity from programming smart contracts on Ethereum can be challenging and one of the main concerns is the scarcity of beginner-friendly classes.
- **Volatile cryptocurrency:** Ethereum investing can be risky as the price of Ether is very volatile, resulting in significant gains as well as a significant loss.
- **Low transaction rate:** Bitcoin has an average transaction rate of 7TPS and Ethereum has an average speed of 15 TPS which is almost double that of bitcoin but it is still not enough.