Blockchain for Industrial Engineers: Decentralized Application Development

บล็อกเชนสำหรับวิศวกรอุตสาหการ: การพัฒนาแอปพลิเคชันแบบกระจายศูนย์

ERC Token

Remaining implementation

- `transfer()` function does not work when tokens are being used to in more complex activities.
  - Trading
- ERC20 standard defines
  - `allowed` (mapping data structure)
  - `approve()` function
  - `transferFrom()` function
- These permit owner to give another address to transfer up to a number of tokens
  - `allowance`

```solidity
function allowance(address _owner, address _spender) external view returns (uint256 remaining);

function approve(address _spender, uint256 _value) external returns (bool success);

function transferFrom(address _from, address _to, uint256 _value) external returns (bool success);

event Approval(address indexed _owner, address indexed _spender, uint256 _value);
```

Case study

- A has 100 tokens.
- A approves B to spend 50 tokens.
- B can now transfer up to 50 tokens to C .

Decentralized data storage

- DApps need to store/retrieve data in a decentralized manner.

- Saving data in the blockchain is very expensive.

- We need to save data **off-chain**.

IPFS

- *Interplanetary File System*
  - Decentralized off-chain solution for data storage.
- When we put data on IPFS, we obtain **content identifier (CID)** that uniquely indentifies the data.
  - For example, `QmTHUf5DiynRc5WRJBMcZYtigmWqkdtJVxuQVKoAjMPnoB`
  - We store CID on the ethereum block chain.
- Note: `Swarm` is an alternative to IPFS.

IPFS

- Aims to replace HTTP.

- Peer-to-peer (based on bit-torrent)
  - Network consists of multiple *nodes*.

- Data is permanent and cannot be deleted or modified
  - Data are already distributed to other nodes.

Content/Location addressing

- **Location addressing**

    - `https://cmu.ac.th/file.pdf`

    - Who ever controls that location control the content.

- **Content addressing**

    - Files are based on **where they are**, but on **what they are**.

    - There is no location of the files.

    - No one controls the files.

Pinning

- Mechanism that allows IPFS to always keep a given content and never remove it.

Gateway

- Allows browsers to access IPFS.
- **Local gateway** (need to run IPFS client)
  - `http://localhost:8080/ipfs/[CID]` (ex)
- **Private gateway**
- **Public gateway**
  - `https://ipfs.io/ipfs/[CID]` (ex)
  - `https://gateway.pinata.cloud/ipfs/[CID]` (ex)

Pinata

- IPFS pinning service.

- https://www.pinata.cloud/