Information Technologies for Industrial Engineers

เทคโนโลยีสารสนเทศสำหรับวิศวกรอุตสาหการ

Smart contract applications

Decentralized lottery

Decentralized lottery

- Code
- Unit converter

ERC Token

What is a token?

- Something of value
  - Currency
  - Voting right
  - Stock
- Token standard
  - EIP (*Ethereum Improvement Proposal*)
    - Guideline
  - ERC (*Ethereum Request for Comments*)
    - Implementation

Popular token standards

- **ERC-20**
  - Fungible tokens
  - Most used for representing currency
- **ERC-721**
  - Non-fungible tokens (NFTs)
  - Most used for representing digital artwork and collectibles
- **ERC-1155**
  - Multi-token standard
  - Combining the abilities of ERC-20 and ERC-720

Timeline

Source

Token list

- https://etherscan.io/tokens

Let's make your own ERC-20 token.

- Contract generator
- Source code

IPFS

Interplanetary File System

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.

Pinata

- IPFS pinning service.
- https://www.pinata.cloud/

Gateway

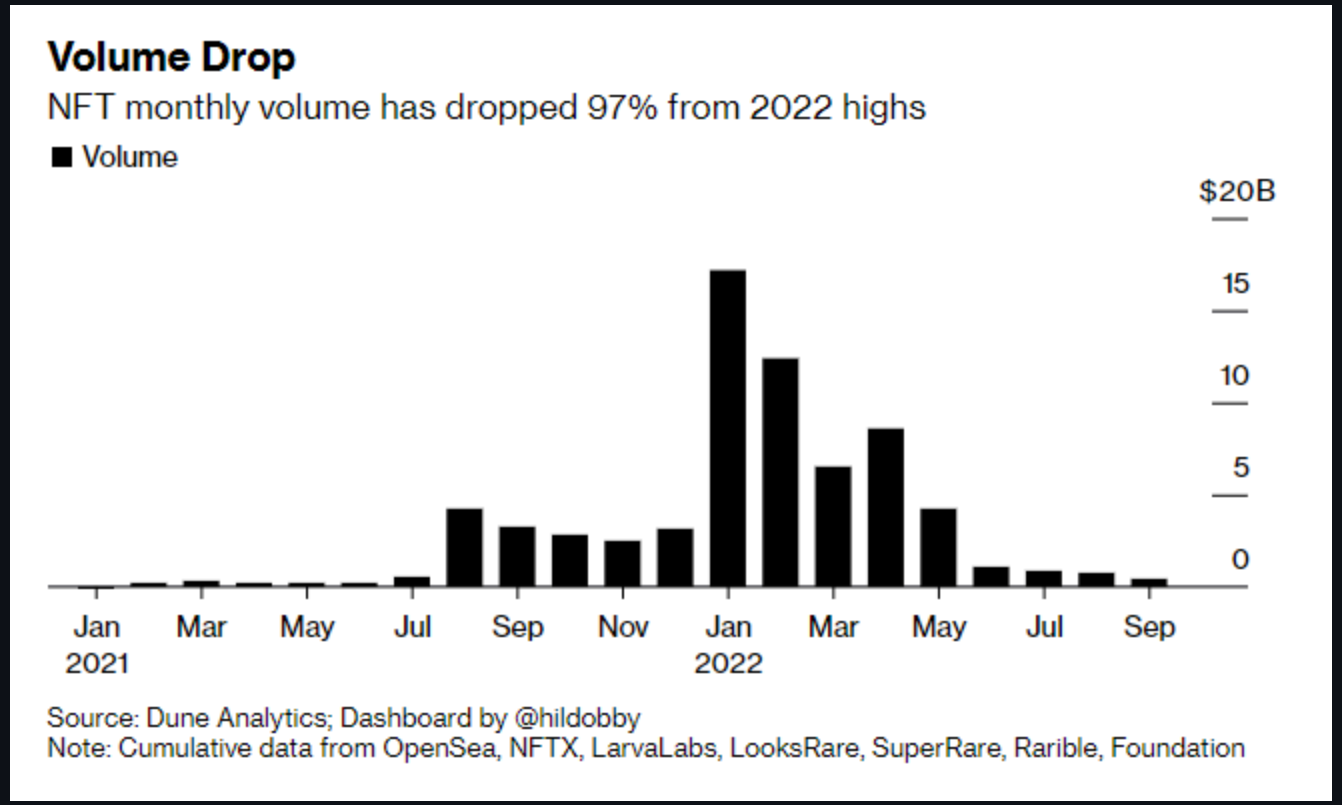
- Allows browsers to access IPFS.
- **Local gateway** (need to run IPFS client)
  - `http://localhost:8080/ipfs/[CID]` (ex)
- **Private gateway**
- **Public gateway**
  - `https://ipfs.io/ipfs/[CID]` (ex)
  - `https://gateway.pinata.cloud/ipfs/[CID]` (ex)

Non-Fungible Token (NFT)

Non-Fungible Token (NFT)?

- Cryptographic assets on a blockchain with unique identification codes and metadata that distinguish them from each other.
- Cannot be traded or exchanged at equivalency.
- NFTs can represent real-world items like artwork and real estate.

Hype?


Volume Drop
NFT monthly volume has dropped 97% from 2022 highs
Volume
$20B
15
10
5
0
Jan 2021
Mar
May
Jul
Sep
Nov
Jan 2022
Mar
May
Jul
Sep
Source: Dune Analytics; Dashboard by @hildobby
Note: Cumulative data from OpenSea, NFTX, LarvaLabs, LooksRare, SuperRare, Rarible, Foundation

Standard

- ERC-721 standard
  - Most common
- The ERC-1155 standard takes the concept further.
  - Reducing the transaction and storage costs required for NFTs.
  - Natching multiple types of non-fungible tokens into a single contract.

NFTs in action

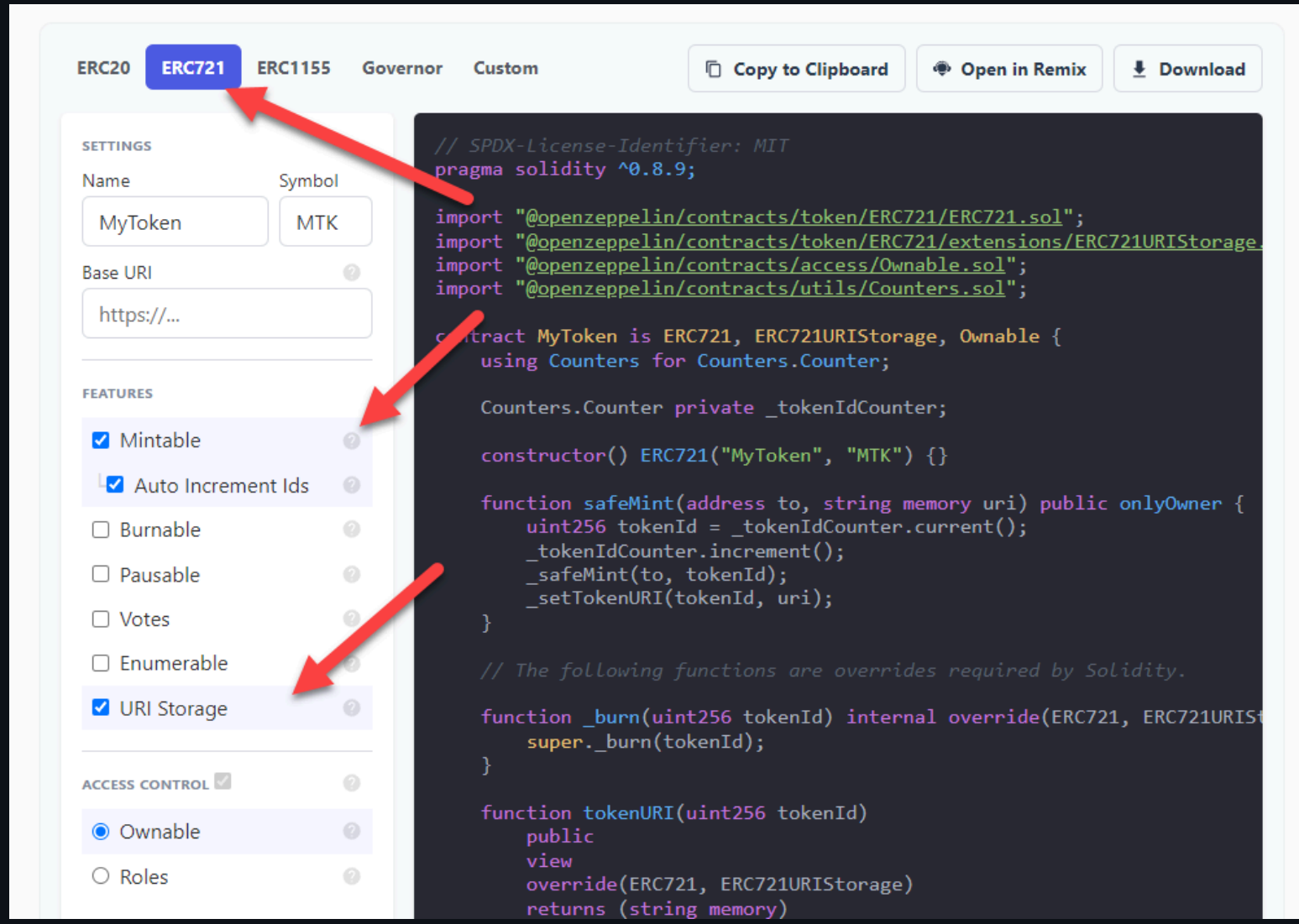
- CLOAKS #19345
  - Contract
  - Token URI
  - Image

Create your own NFTs (simple)

OpenSea Testnet

Implementing ERC721

- OpenZeppelin



Create your own NFTs (real)

1. **Create image**
2. **Upload to IPFS**
   2.1 Get `image_url`
3. **Create metadata**
   3.1 Save as `JSON` file
4. **Upload metadata file to IPFS**
   4.1 Get `token_uri`
5. **Deploy contract**
6. **Mint token**

Metadata

```
{
  "name": "<<name>>",
  "description": "<<description>>",
  "external_url": "<<external_link>>",
  "image": "<<image_url>>",
  "attributes": [
    {
      "trait_type": "Personality",
      "value": "Sad"
    },
    {
      "trait_type": "Level",
      "value": 5
    },
    {
      "display_type": "boost_number",
      "trait_type": "Power",
      "value": 40
    }
  ]
}
```