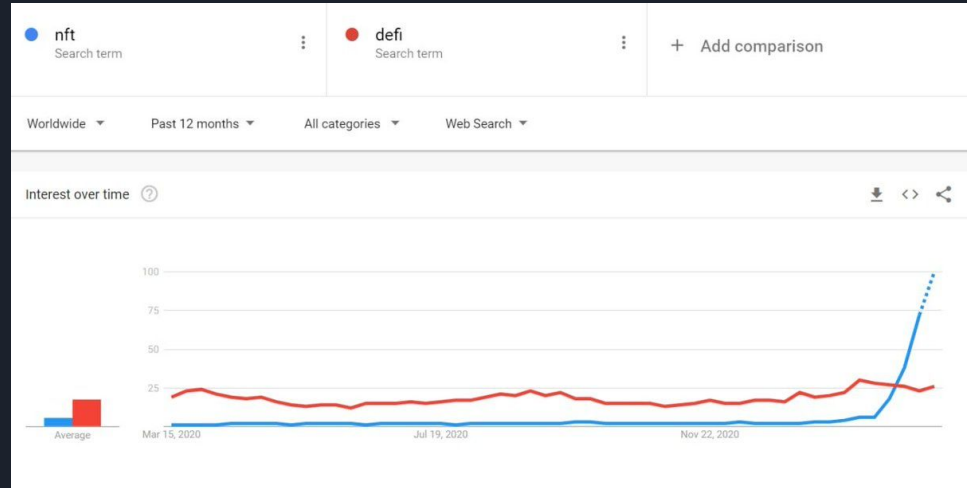# Ethereum: Non-Fungible Tokens (ERC-721)

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ICS6-52

Introduction

- NFT allows to exchange assets with unique values, which makes them Non-fungible
- Is widely developed in Ethereum, because it provides suitable smart contacts infrastructure for storing and exchange custom tokens

NFT vs DeFi capitalization during 2020

Smart contracts

- "Solidity" language
- open source
- executes and stores data "on chain"
- can transfer and store tokens and data
- everyone can publish his own smart contracts
- smart contract can represent a token - monetary unit of blockchain

```solidity
pragma solidity ^0.7.0;

contract HelloWorld {

    string public message;

    constructor(string memory initMessage) {
        message = initMessage;
    }

    function update(string memory newMessage)
public            {
    message = newMessage;
    }
}
```

simple smart-contract

ERC-20 & ERC-721 tokens

ERC-20

- base for DeFi (decentralised finances)
- fungible, not unique
- replaces money and bonds
- blockchain stores information about amount of tokens for each user

ERC-721

- base for NFT
- non-fungible, unique
- submits ownership for unique asset
- blockchain stores ownership relations between owners and each asset

ERC-20 & ERC-721 interfaces

IERC20

Interface of the ERC20 standard as defined in the EIP. Does not include the optional functions; to access them see `ERC20Detailed`.

FUNCTIONS

`totalSupply()`

`balanceOf(account)`

`transfer(recipient, amount)`

`allowance(owner, spender)`

`approve(spender, amount)`

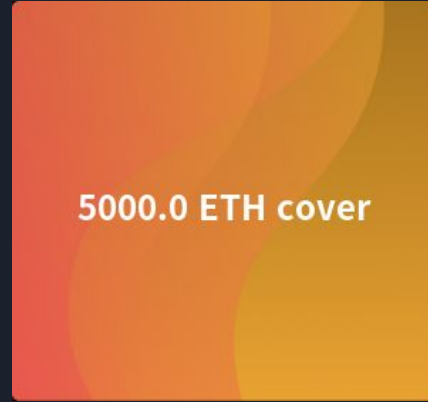`transferFrom(sender, recipient, amount)`

IERC721

Required interface of an ERC721 compliant contract.

FUNCTIONS

`balanceOf(owner)`

`ownerOf(tokenId)`

`safeTransferFrom(from, to, tokenId)`

`transferFrom(from, to, tokenId)`

`approve(to, tokenId)`

`getApproved(tokenId)`

`setApprovalForAll(operator, _approved)`

`isApprovedForAll(owner, operator)`

`safeTransferFrom(from, to, tokenId, data)`

ERC-721 applications

- in-game items
- digital art
- subscription to services

5000.0 ETH Cover - An analogue of bank insurance for cryptocurrency transfer to the list of smart contracts

Cost: 350 ETH (now - $1.3 M)

ERC-721 applications

**Pokras Lampas
(Arseniy Pyzhenkov)**

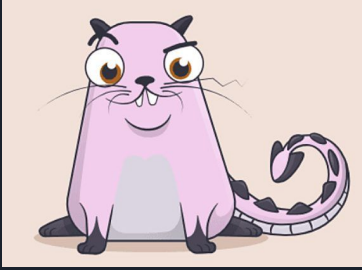10th point of the kalligrofuturism manifesto:

<<

Traditions dictate the rules for the formation of letters and their reading.
This formation has been destroyed.
These rules have been destroyed.
These restrictions have been destroyed.

>>

Cost: 80 BNB (then - RUB 2.3 M)

ERC-721 applications

CryptoKitties - collecting and trading NFT-based virtual kitties

Maximal cost: 600 ETH (then - $270 K)

CryptoPunks - collecting and trading NFT-based pixel avatars

Maximal cost: 4200 ETH (then - $7.58 M)

Thank you for your attention