

PD-10.0 Tokens



ERC20



ERC721

PD-10.1 ERC20 Tokens

PD-10.1 ERC20 Token Functions



Information functions (optional)

- name()
- symbol()
- decimals() → usually 18
- totalSupply()

Token interactions

- balanceOf()
- Transfer()

Delegated token interactions

- transferFrom()
- Approve()
- allowance()

PD-10.1 ERC20 generator

ERC20 Token Generator | Create your Token for FREE

Easily deploy Smart Contract for a Standard, Capped, Mintable, Burnable ERC20 Token.

Token name *
Your token name
Choose a name for your token.

Token symbol *
Your token symbol
Choose a symbol for your token (usually 3-4 chars).

Token decimals *
Your token decimals
Insert the decimal precision of your token. If you don't know what to insert, use 18.

Token cap *
Your token cap
Insert the maximum number of tokens available.

Token initial balance *
Your token initial balance
Insert the initial number of tokens available. Will be put in your account.

Network *
Main Ethereum Network
Choose your Network.

Enable transfer
Enable transfer during deploy
Choose to enable transfer during deploy or enable manually later.

Create Token

<https://vittominacori.github.io/erc20-generator>

http://web3examples.com/ethereum/demo/Create_ERC20_via_web.html

PD-10.1 Demo in Play

<https://web3examples.com/ethereum/demo/Play ERC20.html>

PD-10.1 Web3ExamplesToken (Ropsten)

DEPLOY & RUN TRANSACTIONS

ENVIRONMENT
Injected Web3
Ropsten (3) network

ACCOUNT
0xe88...f0Bb2 (0.87662547552576t)

GAS LIMIT
3000000

VALUE
0 wei

CONTRACT
Token_erc20 - browser/Token_erc20.s

DEPLOY

NAME: Web3ExamplesToken
SYMBOL: W3ET
DECIMALS: 18

transact

Publish to IPFS

OR

At Address Load contract from Address

Transactions recorded 0

Deployed Contracts

Currently you have no contract instances to interact with.

```
1 // Adapted from https://github.com/OpenZeppelin/openzeppelin-contracts/tree/master/contracts/token/ERC20
2 // https://raw.githubusercontent.com/web3examples/ethereum/master/token_examples/VeryBasicToken.sol
3
4 pragma solidity ^0.6.12;
5
6 contract Token_erc20 {
7     string private _name;
8     string private _symbol;
9     uint8 private _decimals;
10    mapping (address => uint256) private _balances;
11    uint256 private _totalSupply;
12
13    event Transfer(address indexed from, address indexed to, uint256 value);
14
15    constructor (string memory name, string memory symbol, uint8 decimals) public {
16        _name = name;
17        _symbol = symbol;
18        _decimals = decimals;
19        _mint(msg.sender, 10000 * (10 ** uint256(_decimals)));
20    }
21    function name() public view returns (string memory) {
22        return _name;
23    }
24    function symbol() public view returns (string memory) {
25        return _symbol;
26    }
27    function decimals() public view returns (uint8) {
28        return _decimals;
29    }
30    function add(uint256 a, uint256 b) internal pure returns (uint256) {
31        uint256 c = a + b;
32        require(c >= a, "SafeMath: addition overflow");
33        return c;
34    }
35    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
36        require(b <= a, "SafeMath: subtraction overflow");
37        uint256 c = a - b;
38        return c;
39    }
40    function totalSupply() public view returns (uint256) {
41        return _totalSupply;
42    }
43    function balanceOf(address account) public view returns (uint256) {
44        return _balances[account];
45    }
46    function transfer(address recipient, uint256 amount) public returns (bool) {
47        _transfer(msg.sender, recipient, amount);
48        return true;
49    }
50    function _transfer(address sender, address recipient, uint256 amount) internal {
51        require(sender != address(0), "ERC20: transfer from the zero address");
52        require(recipient != address(0), "ERC20: transfer to the zero address");
53        _balances[sender] = sub(_balances[sender], amount);
54        _balances[recipient] = add(_balances[recipient], amount);
55        emit Transfer(sender, recipient, amount);
56    }
57    function _mint(address account, uint256 amount) internal {
58        require(account != address(0), "ERC20: mint to the zero address");
59        _totalSupply = add(_totalSupply, amount);
60        _balances[account] = add(_balances[account], amount);
61        emit Transfer(address(0), account, amount);
62    }
63 }
```

Parameters:
Web3ExamplesToken
W3ET
18

PD-10.1 Deployed Token



0x6e717970B902E29208d2b6fcFCa13594b3c37a89

PD-10.1 Token info

▼ TOKEN_ERC20 AT 0X6E7...37A89 (BLOCKCHAIN)

transfer address recipient, uint256 : ▼

balanceOf address account ▼

decimals
0: uint8: 18

name
0: string: Web3ExamplesToken

symbol
0: string: W3ET

totalSupply
0: uint256: 10000000000000000000
0

PD-10.1 BalanceOf & transfer

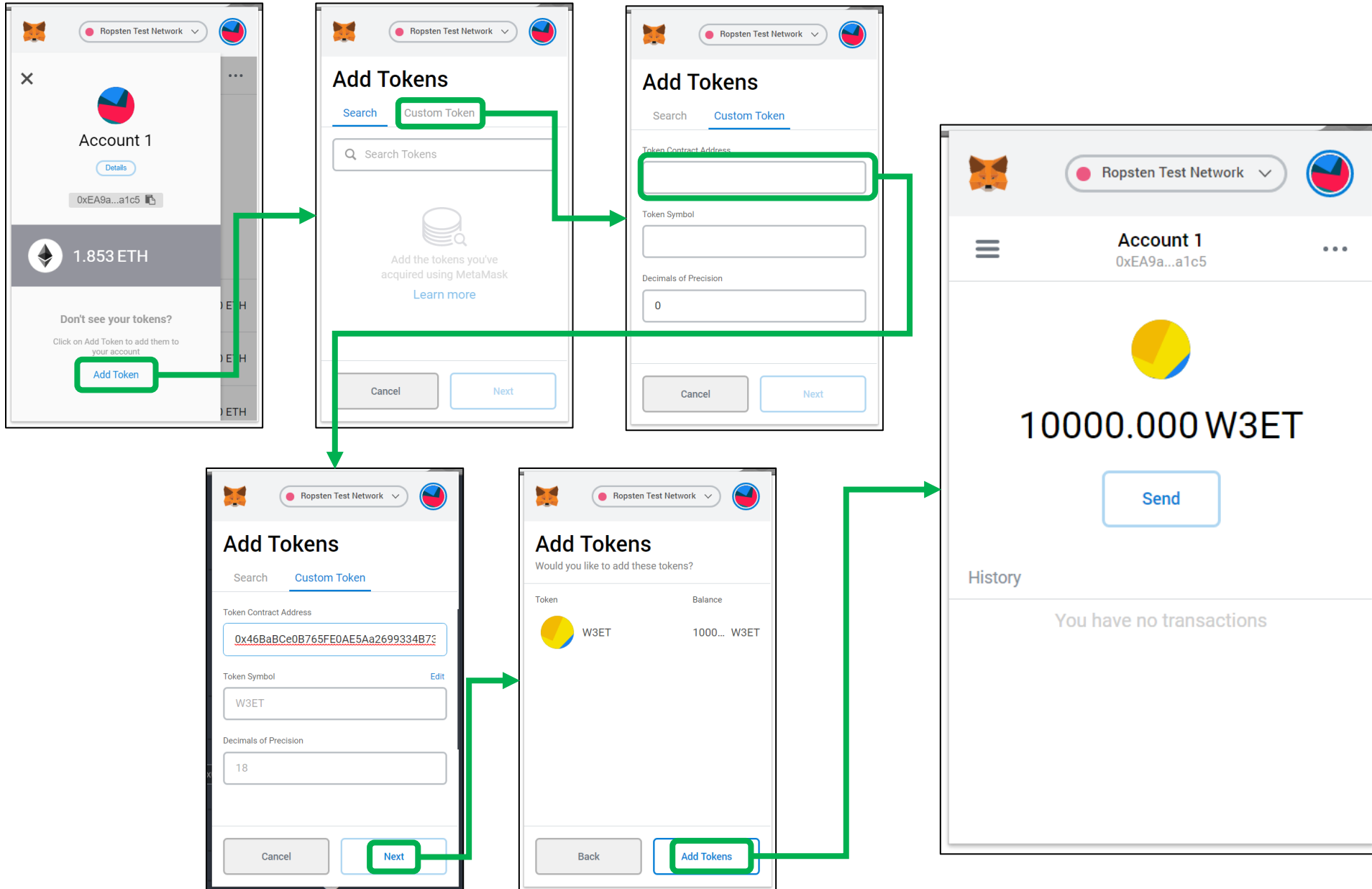
The screenshot displays three transaction forms on a dark-themed interface:

- transfer**:
 - recipient: "0x5C84209877934c61047100121C70a4CF68Ec270E"
 - amount: 123
 - Buttons: copy icon, **transact**
- balanceOf**:
 - account: "0xe88cAc4e10C4D316E0d52B82dd54f26ade3f0Bb2"
 - Buttons: copy icon, **call**
 - Output: 0: uint256: 10000000000000000000000000000000
- balanceOf**:
 - account: "0x5C84209877934c61047100121C70a4CF68Ec270E"
 - Buttons: copy icon, **call** (highlighted with a dashed border)
 - Output: 0: uint256: 123

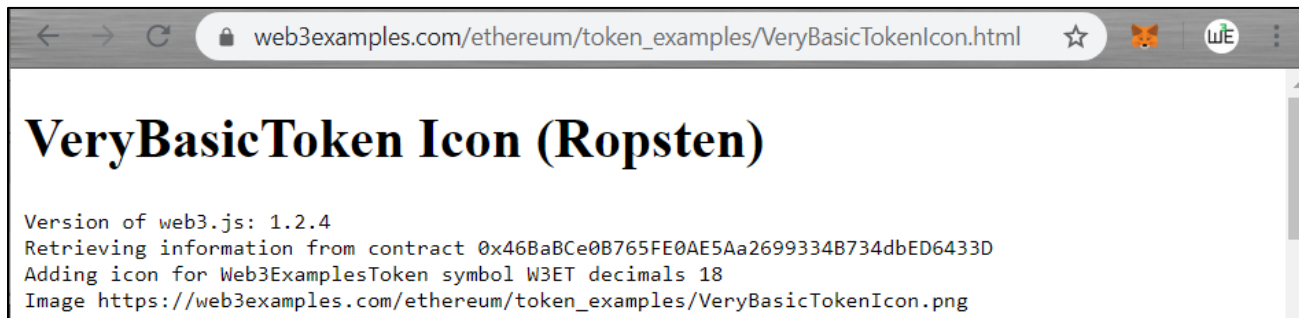
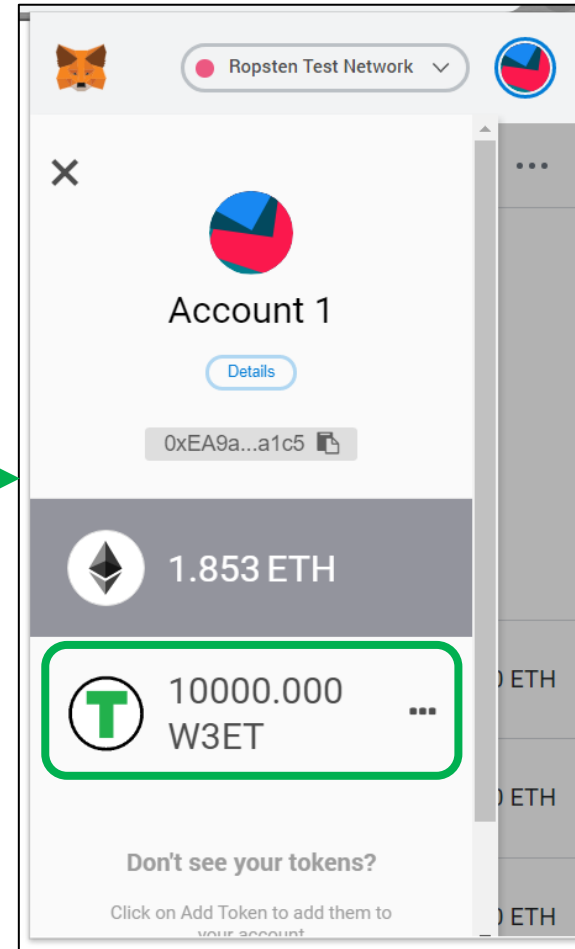
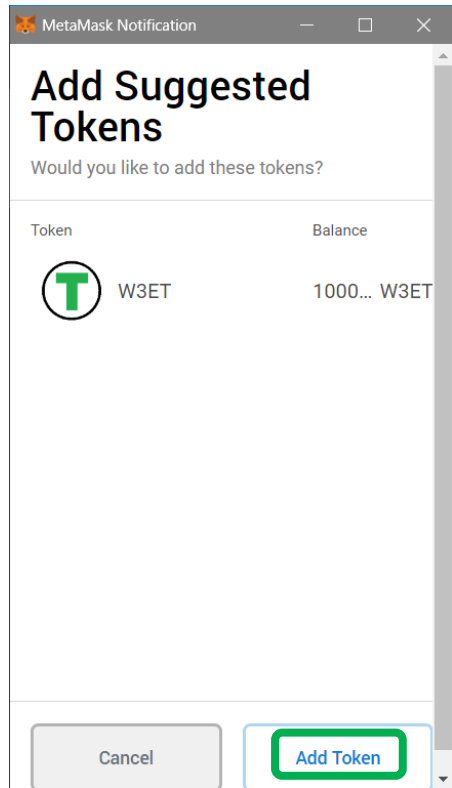
PD-10.1 VeryBasicToken.sol

```
function transfer(address recipient, uint256 amount) public returns (bool) {
    _transfer(msg.sender, recipient, amount);
    return true;
}
function _transfer(address sender, address recipient, uint256 amount) internal {
    require(sender != address(0), "ERC20: transfer from the zero address");
    require(recipient != address(0), "ERC20: transfer to the zero address");
    _balances[sender] = sub(_balances[sender], amount);
    _balances[recipient] = add(_balances[recipient], amount);
    emit Transfer(sender, recipient, amount);
}
```

PD-10.1 Add token in MetaMask



PD-10.1 Add Token Icon to MetaMask



<https://github.com/ethereum/EIPs/blob/master/EIPS/eip-747.md>

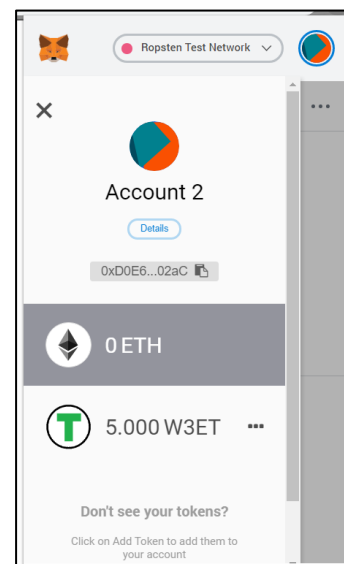
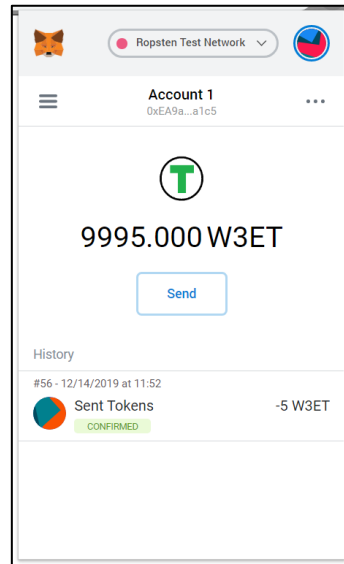
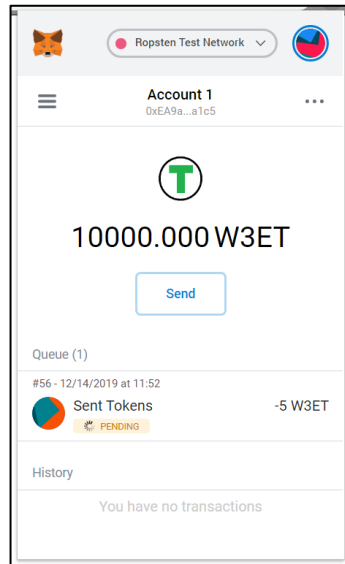
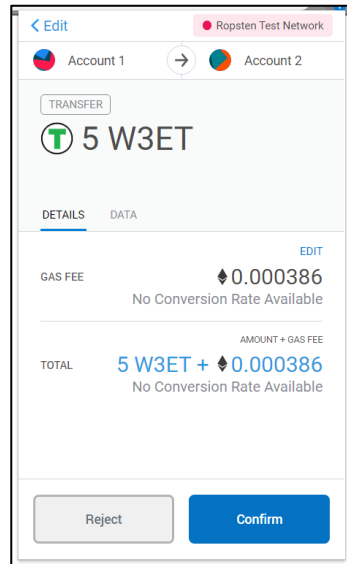
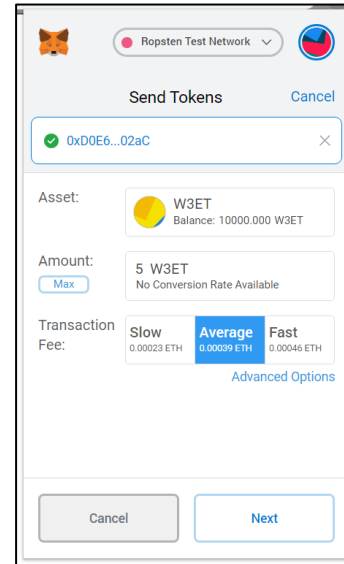
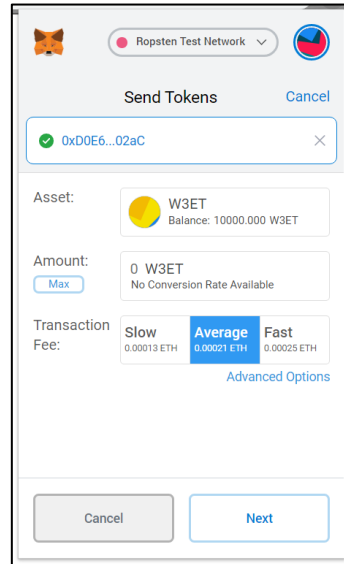
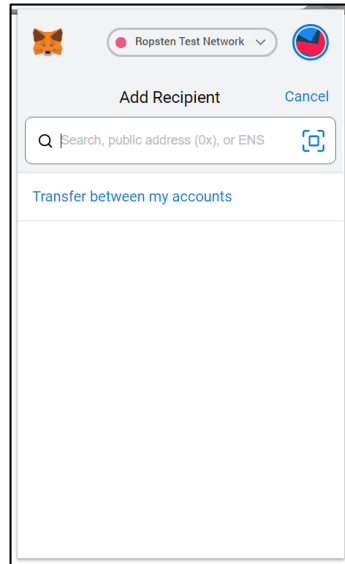
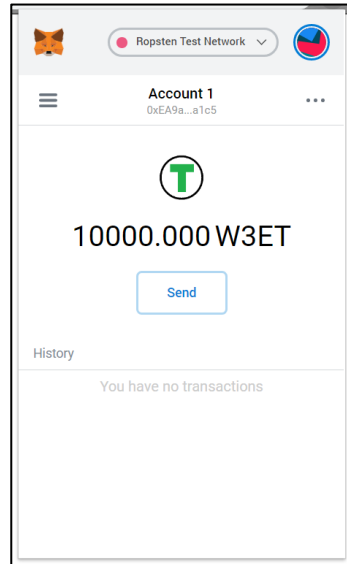
https://web3examples.com/ethereum/token_examples/VeryBasicTokenIcon.html

https://github.com/web3examples/ethereum/blob/master/token_examples/VeryBasicTokenIcon.html

PD-10.1 Source to add Token Icon to MetaMask

```
var VeryBasicTokenAddress="0x31a289430c79a38Ae290B9789DE4992710d796Ec";
var VeryBasicTokenContract=new web3.eth.Contract(VeryBasisTokenABI, VeryBasicTokenAddress);
log(`Retrieving information from contract ${VeryBasicTokenAddress}`);
const name      = await VeryBasicTokenContract.methods.name()
    .call({from: acts[0]}).catch(console.log);
const symbol    = await VeryBasicTokenContract.methods.symbol()
    .call({from: acts[0]}).catch(console.log);
const decimals  = await VeryBasicTokenContract.methods.decimals()
    .call({from: acts[0]}).catch(console.log);
const url = new URL("VeryBasicTokenIcon.png",window.location.href);
log(`Adding icon for ${name} symbol ${symbol} decimals ${decimals}`);
log(`Image ${url.href}`);
const params={type:'ERC20',"options": {
    "address": VeryBasicTokenAddress,
    "decimals": decimals,
    "symbol": symbol,
    "decimals": decimals,
    "image": url.href
}
}
window.web3.currentProvider.sendAsync({
    method: 'metamask_watchAsset',
    params: params,
    id: Math.round(Math.random() * 100000),
}, (err) => console.log(err) );
```

PD-10.1 Transfer tokens



PD-10.1 Etherscan - logs

Transaction Details

Overview **Logs (1)** State

Transaction Receipt Event Logs

0 **Address** `0x6e717970b902e29208d2b6fcfa13594b3c37a89` 🔍

Topics

- 0 `0xddf252ad1be2c89b69c2b068fc378daa952ba7f163c4a11628f55a4df523b3ef`
- 1 `→ 0x000000000000000000000000e88cac4e10c4d316e0d52b82dd54f26ade3f0bb2`
- 2 `→ 0x0000000000000000000000005c84209877934c61047100121c70a4cf68ec270e`

Data

Num → `10000000000000000000`

PD-10.1 After verification

Transactions Contract **Events**

Latest 4 Contract Events

Tip: Logs are used by developers/external UI providers for keeping track of contract actions and for auditing

Txn Hash	Method	Logs
0x842c80f45938167efe... # 9214275 4 mins ago	0xa9059cbb	<pre>> * Transfer (index_topic_1 address from, index_topic_2 address to, uint256 tokens) [topic0] 0xdddf252ad1be2c89b69c2b068fc378daa952ba7f163c4a11628f55a4df523b3ef [topic1] 0x000000000000000000000000e88cac4e10c4d316e0d52b82dd54f26ade3f0bb2 [topic2] 0x00000000000000000000000005c84209877934c61047100121c70a4cf68ec270e</pre> <div style="border: 2px solid green; padding: 5px; display: inline-block;">Num ▾ → 1000000000000000000000000000000000</div>

PD-10.1 Recognized as a token transaction

https://ropsten.etherscan.io/tokentxns

Etherscan

Ropsten Testnet Network




All Filters Search by Address / Txn Hash / Block / Token / Ens

Home Blockchain Tokens Misc Ropsten

Token Transfers ERC-20

A total of 30,729,916 txns found
(Showing the last 10,000 records only)

First < Page 1 of 200 > Last

Txn Hash	Age	From	To	Value	Token
 0x842c80f45938167efe...	29 secs ago	0xe88cac4e10c4d316e...	 0x5c84209877934c610...	100	 Web3Examples... (W3ET)

PD-10.1 Etherscan – token info

Transfers **Holders** Read Contract Write Contract



Token Holders Chart

(Last Updated 12/7/2020 12:33:58 PM)

A total of 2 token holders

First < Page 1 of 1 > Last

Rank	Address	Quantity	Percentage
1	0xe88cac4e10c4d316e0d52b82dd54f26ade3f0bb2	9,776.99999999999999877	97.7700%
2	0x5c84209877934c61047100121c70a4cf68ec270e	223.000000000000000123	2.2300%

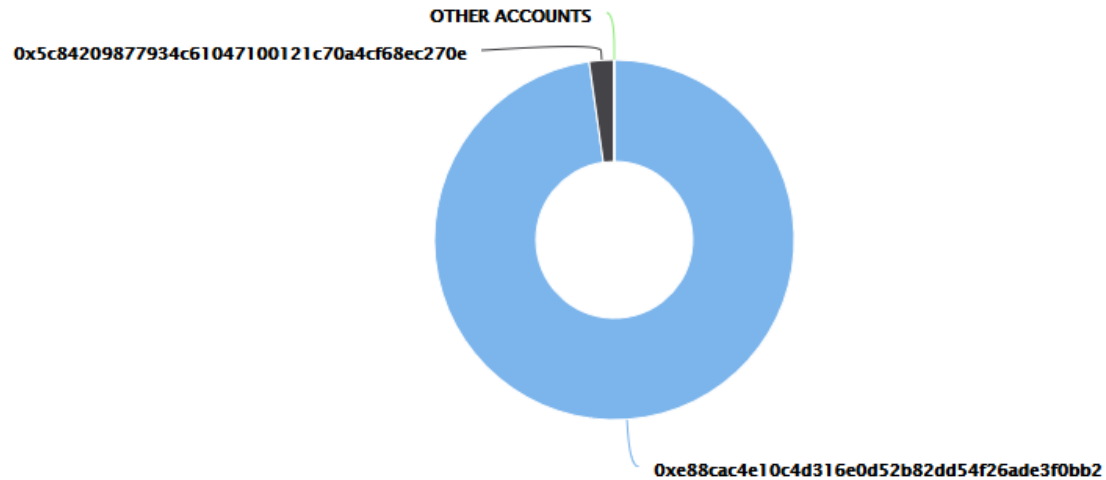
PD-10.1 Etherscan – token info

The top 100 holders collectively own 100.00% (10,000.00 Tokens) of Web3ExamplesToken

Token Total Supply: 10,000.00 Token | Total Token Holders: 2

Web3ExamplesToken Top 100 Token Holders

Source: Etherscan.io



(A total of 10,000.00 tokens held by the top 100 accounts from the total supply of 10,000.00 token)

Rank	Address	Quantity (Token)	Percentage
1	0xe88cac4e10c4d316e0d52b82dd54f26ade3f0bb2	9,776.999999999999999877	97.7700%
2	0x5c84209877934c61047100121c70a4cf68ec270e	223.000000000000000123	2.2300%

PD-10.1 Opnzeppelin contracts

```
>npm install @openzeppelin/contracts
```

```
+ @openzeppelin/contracts@2.4.0
```

```
added 1791 packages from 856 contributors, removed 2  
packages, updated 2 packages and audited 1036357 packages  
in 93.908s
```

PD-10.1 Truffle - OpenZeppelin - ERC20

```
Token_erc20.sol x
1  pragma solidity ^0.5.12;
2
3  import "@openzeppelin/contracts/token/ERC20/ERC20.sol";
4  import "@openzeppelin/contracts/token/ERC20/ERC20Detailed.sol";
5
6  contract Token_erc20 is ERC20, ERC20Detailed {
7
8      /**
9       * @dev Constructor that gives _msgSender() all of existing tokens.
10     */
11     constructor () public ERC20Detailed("Web3ExamplesTokenOpenZeppelin", "W3ETOZ", 18) {
12         _mint(msg.sender, 10000 * (10 ** uint256(decimals())));
13     }
14 }
```

```
2_token_erc20.js x
1  const Token_erc20 = artifacts.require("Token_erc20");
2
3  module.exports = function(deployer) {
4      deployer.deploy(Token_erc20);
5  };
```

https://github.com/web3examples/ethereum/blob/master/token_examples/ERC20TruffleOpenZeppelin/contracts/Token_erc20.sol

https://github.com/web3examples/ethereum/blob/master/token_examples/ERC20TruffleOpenZeppelin/migrations/2_token_erc20.js

PD-10.1 Included libraries

```
> tree /f
truffle-config.js
├── build
│   └── contracts
│       ├── Context.json
│       ├── ERC20.json
│       ├── ERC20Detailed.json
│       ├── IERC20.json
│       ├── Migrations.json
│       ├── SafeMath.json
│       └── Token_erc20.json
├── contracts
│   ├── Migrations.sol
│   └── Token_erc20.sol
├── migrations
│   ├── 1_initial_migration.js
│   └── 2_token_erc20.js
└── test
```

PD-10.1 SafeMath

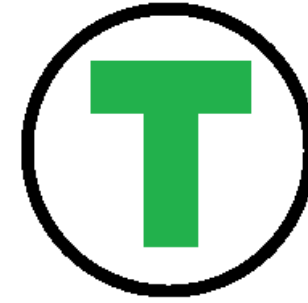
```
library SafeMath {
    /**
     * @dev Returns the addition of two unsigned integers, reverting on
     * overflow.
     *
     * Counterpart to Solidity's `+` operator.
     *
     * Requirements:
     * - Addition cannot overflow.
     */
    function add(uint256 a, uint256 b) internal pure returns (uint256) {
        uint256 c = a + b;
        require(c >= a, "SafeMath: addition overflow");

        return c;
    }
}
```

PD-10.2 ERC721 Tokens

Non fungible tokens

PD-10.2 ERC721 Token Functions



Information functions (optional)

- name()
- symbol()

Token interactions

- ownerOf()
- transferFrom()

Safe token interactions

- safeTransferFrom()

Delegated token interactions

- Approve()
- setApprovalForAll()
- getApproved()
- isApprovedForAll()

• Receive NFT's

- onERC721Received()

• Verification

- supportsInterface()

PD-10.2 ERC721 demo's

https://web3examples.com/ethereum/demo/Play_Deploy_contract_ERC721.html

https://web3examples.com/ethereum/demo/Play_See_ERC721_token_in_Metamask.html

https://web3examples.com/ethereum/demo/Play_Mint_one_ERC721_token.html

PD-10.2 VeryBasicNFT.sol

```
function settleTransfer(address _from, address _to, uint256 _tokenId) internal {
    removeToken(_from, _tokenId);
    addToken(_to, _tokenId);
    emit Transfer(_from, _to, _tokenId);
}
function addToken(address _to, uint256 _tokenId) internal {
    allTokens.push(_tokenId);
    allTokensIndex[_tokenId] = allTokens.length-1;
    ownerOfToken[_tokenId] = _to;
    ownedTokens[_to].push(_tokenId);
    ownedTokensIndex[_tokenId] = ownedTokens[_to].length-1;
}
function removeToken(address _from, uint256 _tokenId) internal {
    uint256 allIndex = allTokensIndex[_tokenId];
    uint256 allTokensLength = allTokens.length;
    allTokens[allIndex] = allTokens[allTokensLength - 1];
    allTokensIndex[allTokens[allTokensLength-1]] = allIndex;
    delete allTokens[allTokensLength-1];
    allTokens.length -= 1;
    uint256 ownerIndex = ownedTokensIndex[_tokenId];
    uint256 ownerLength = ownedTokens[_from].length;
    ownedTokens[_from][ownerIndex] = ownedTokens[_from][ownerLength-1];
    ownedTokensIndex[ownedTokens[_from][ownerLength-1]] = ownerIndex;
    delete ownedTokens[_from][ownerLength-1];
    ownedTokens[_from].length -= 1;
    delete ownerOfToken[_tokenId];
}
```

PD-10.2 createToken

```
uint256 public counter = 10;  
  
function createToken(address _minter) public {  
    require(msg.sender == admin);  
    addToken(_minter, counter);  
    emit Transfer(address(0), _minter, counter);  
    counter += 1; // every new token gets a new ID  
}
```

PD-10.2 Deploy via Play (On Rinkeby)

Publish **Connect**

_name ✓

_symbol ✓

Publish →

```
published
Sun Dec 15 2019 13:31:40 GMT+0100

contract address (rinkeby):
0x2e9cC4Cd27640e820f272F0272a09CAe78AA0FE2

published by
0xEA9a7c7cD8d4Dc3acc6f0AaEc1506C8D6041a1c5
```

Web3ExamplesNFTPlay
W3ENP

0x2e9cc4cd27640e820f272f0272a09cae78aa0fe2

<https://rinkeby.etherscan.io/tx/0xc0ba068a36b8311d9316f24aee0eda0375631e19e318fbf46310ad553fecda80>

PD-10.2 Check values

admin



```
"0xEA9a7c7cD8d4Dc3acc6f0AaEc1506C8D6041a1c5"
```

name



```
"Web3ExamplesNFTPlay"
```

symbol



```
"W3ENP"
```

PD-10.2 CreateToken

createToken

_minter

7c7cD8d4Dc3acc6f0AaEc1506C8D6041a1c5



totalSupply



"0"

"1"

counter



"11"

PD-10.2 setToken URI

setTokenURI

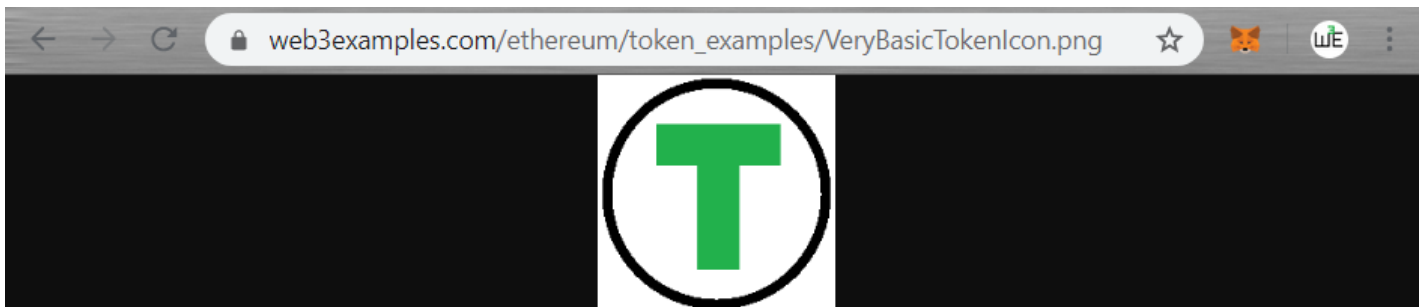
_tokenId ✓

URI ✓

➔

```
Not secure | web3examples.com/ethereum/token_examples/10.json
```

```
{
  "description": "web3examples demo",
  "external_url": "https://web3examples.com",
  "image": "https://web3examples.com/ethereum/token_examples/VeryBasicTokenIcon.png",
  "name": "web3examples"
}
```



https://web3examples.com/ethereum/token_examples/10.json

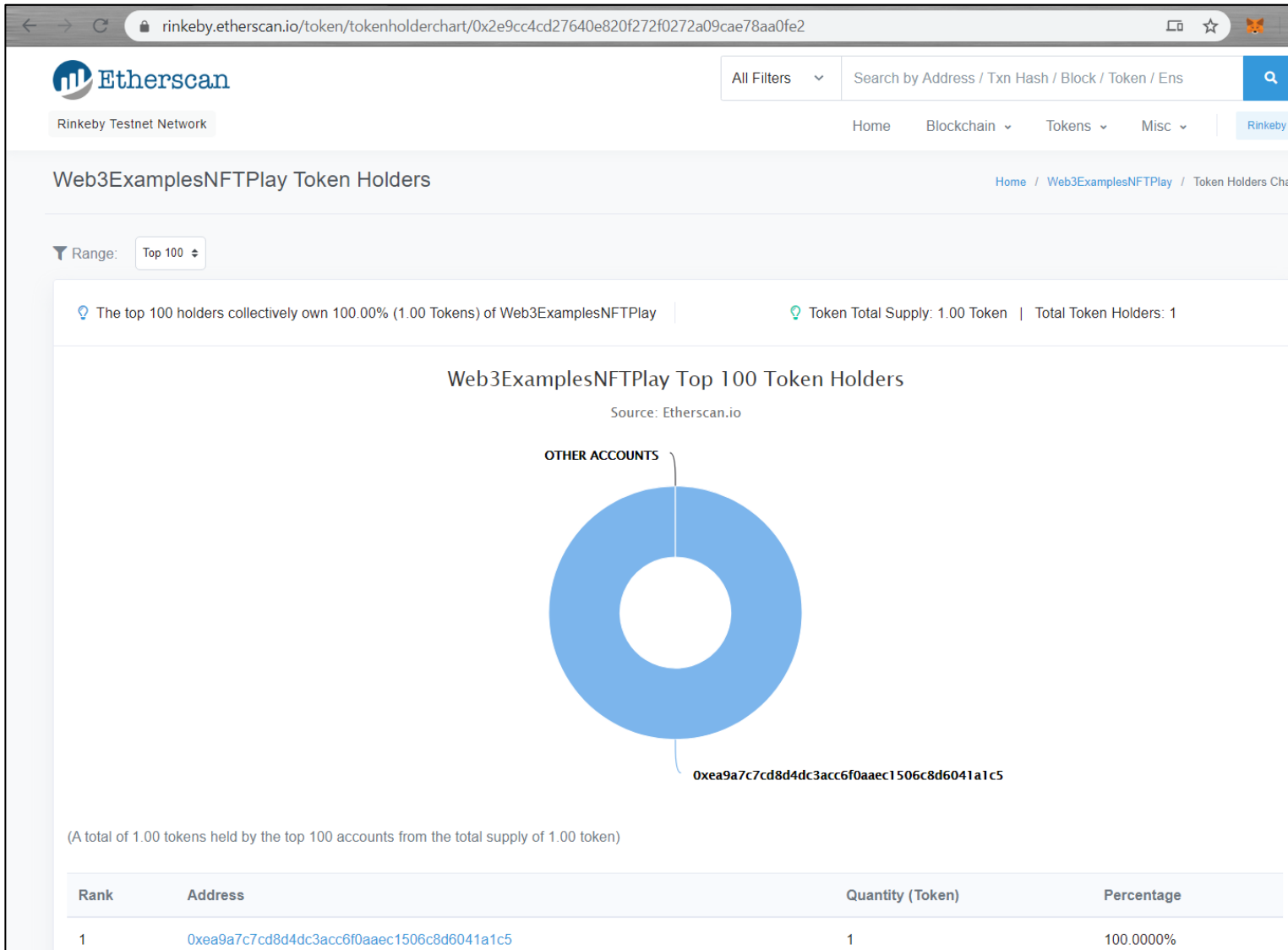
https://web3examples.com/ethereum/token_examples/VeryBasicTokenIcon.png

PD-10.2 Etherscan (after verification of source)

The screenshot shows the Etherscan interface for the Rinkeby Testnet Network. The main heading is "Non Fungible Tokens Transfers" with a filter for "ERC-721". Below the heading, there is a sponsored message for "Hashing Systems Hackathon bounty". The page indicates that a total of 1,905,844 transactions were found, and the current view shows the last 10,000 records. A table of transactions is displayed with the following columns: Txn Hash, Age, From, To, TokenID, and Token. The first transaction in the table has a TokenID of "10", which is highlighted with a green box. The token name is "Web3Examples... (W3ENP)".

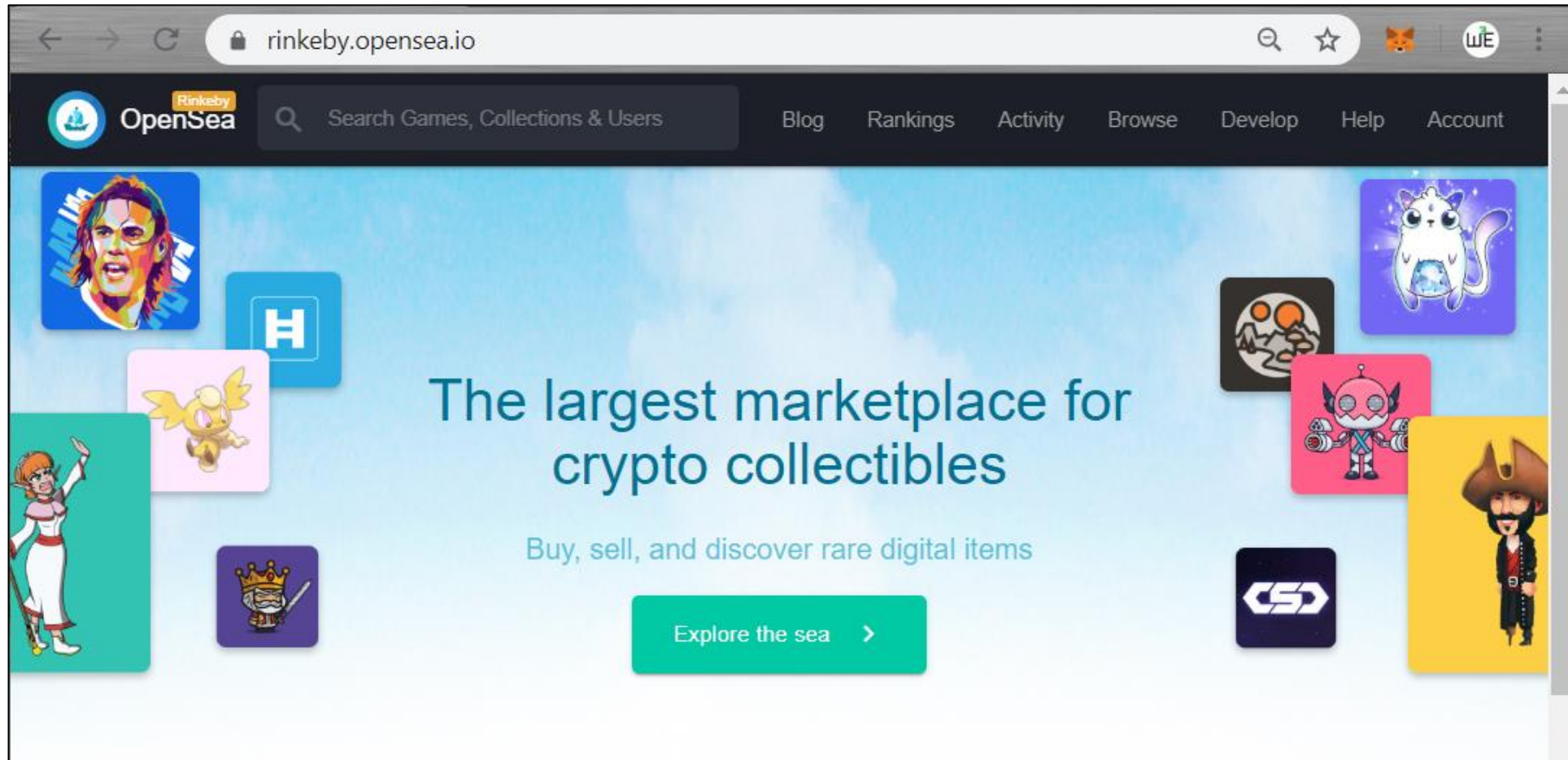
Txn Hash	Age	From	To	TokenID	Token
0x4cc9cd4bb0bcfce...	7 mins ago	0x0000000000000000...	→ 0xea9a7c7cd8d4dc...	10	Web3Examples... (W3ENP)

PD-10.2 Etherscan Token Holders



<https://rinkeby.etherscan.io/token/tokenholderchart/0x2e9cc4cd27640e820f272f0272a09cae78aa0fe2>

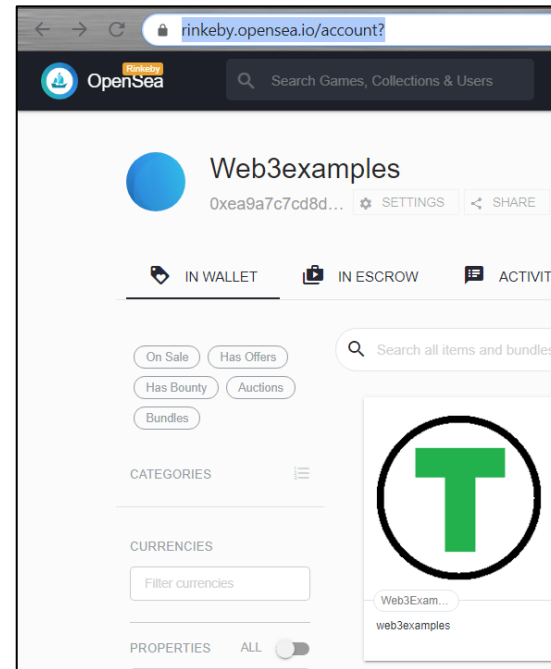
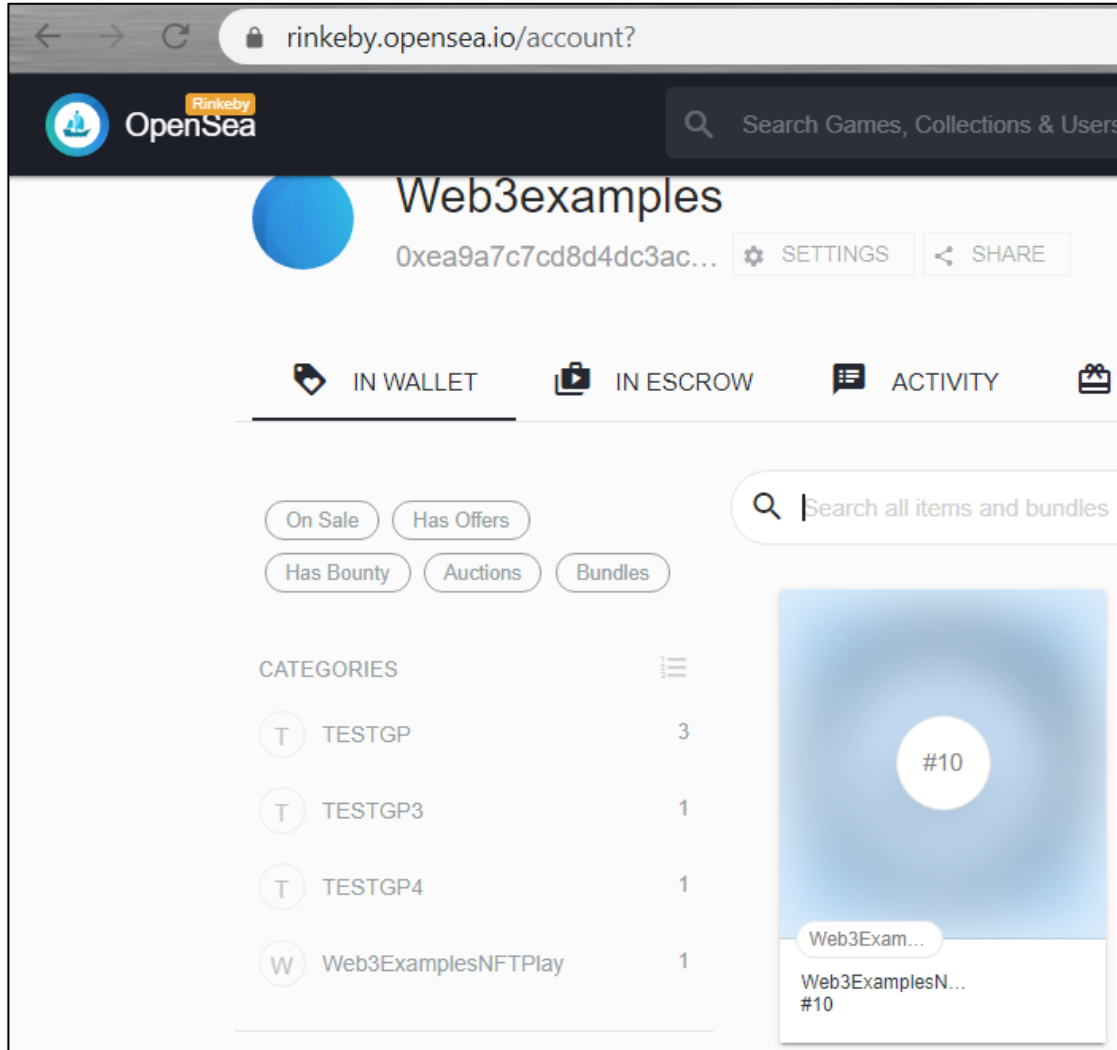
PD-10.2 OpenSea



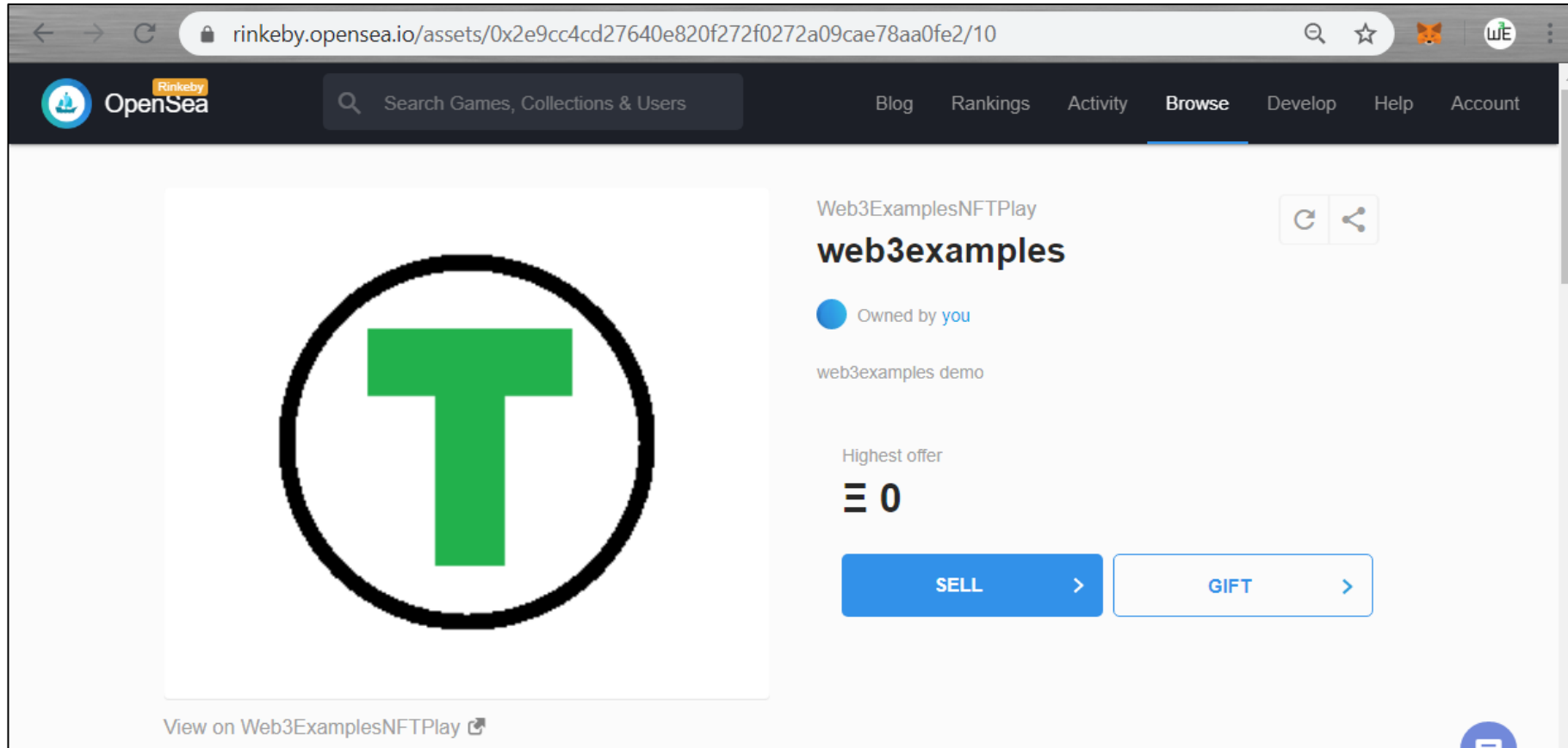
<https://opensea.io>

<https://rinkeby.opensea.io/>

PD-10.2 OpenSea



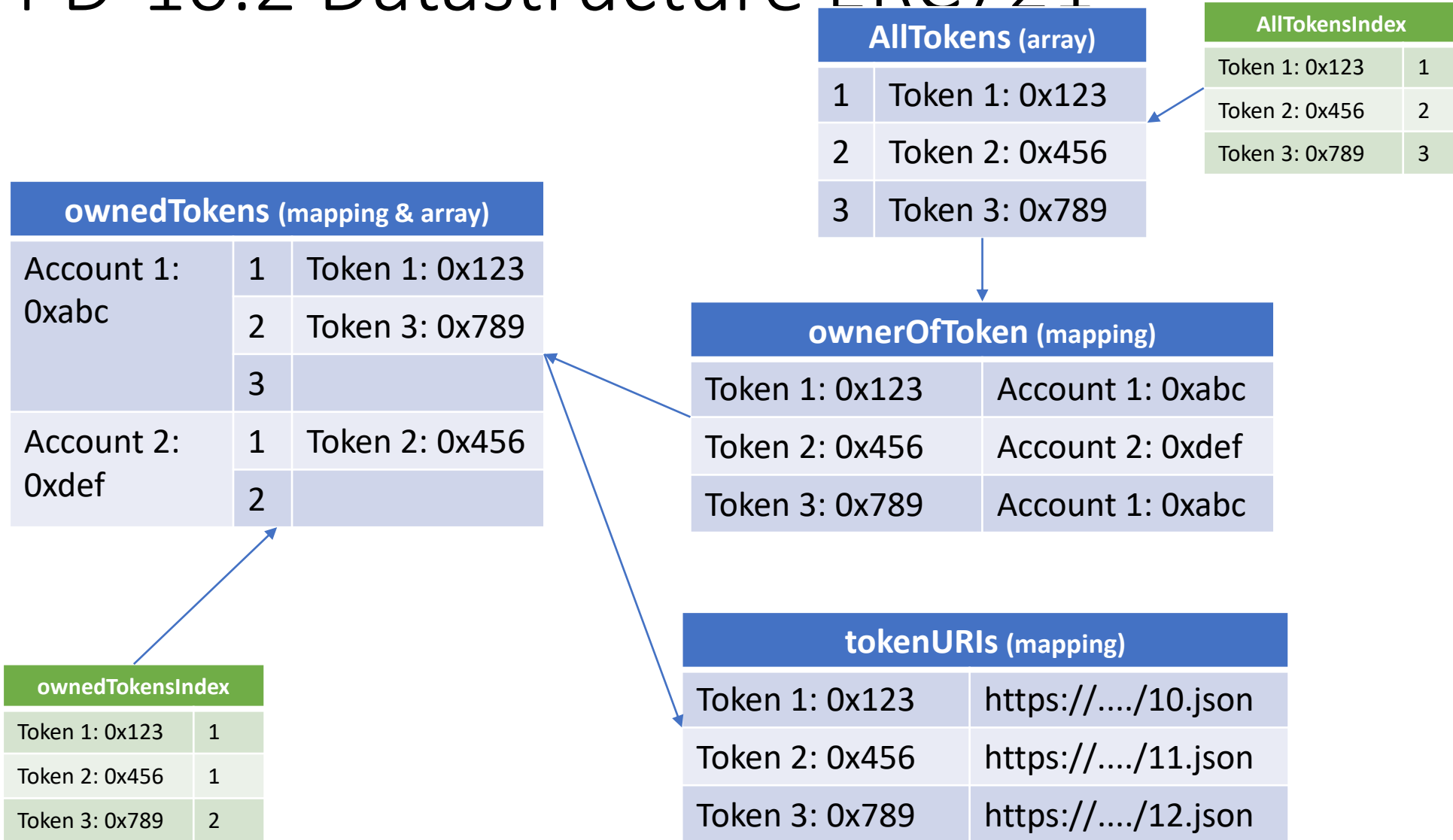
PD-10.2 OpenSea asset



<https://rinkeby.opensea.io/assets/0x2e9cc4cd27640e820f272f0272a09cae78aa0fe2/10>

https://web3examples.com/ethereum/demo/Find_ERC721_token_in_Opensea.html

PD-10.2 Datastructure ERC721



PD-10.2 JSON Structure

<https://.../10.json>

```
{  
  "description": "web3examples demo",  
  "external_url": "https://web3examples.com",  
  "image": "https://web3examples.com/logo.png",  
  "name": "web3examples"  
}
```



PD-10.2 ERC721 Metadata JSON Schema

```
{
  "title": "Asset Metadata",
  "type": "object",
  "properties": {
    "name": {
      "type": "string",
      "description": "Identifies the asset to which this NFT represents"
    },
    "description": {
      "type": "string",
      "description": "Describes the asset to which this NFT represents"
    },
    "image": {
      "type": "string",
      "description": "A URI pointing to a resource with mime type image"
    }
  }
}
```


PD-10.2 OpenSea MetaData

image	This is the URL to the image of the item. Can be just about any type of image (including SVGs, which will be cached into PNGs by OpenSea), and can be IPFS URLs or paths.
image_data	Raw SVG image data, if you want to generate images on the fly (not recommended). Only use this if you're not including the <code>image</code> parameter.
external_url	This is the URL that will appear below the asset's image on OpenSea and will allow users to leave OpenSea and view the item on your site.
description	A human readable description of the item. Markdown is supported.
name	Name of the item.
attributes	These are the attributes for the item, which will show up on the OpenSea page for the item. (see below)
background_color	Background color of the item on OpenSea. Must be a six-character hexadecimal <i>without</i> a pre-pended #.
animation_url	A URL to an animated image of the item. GLTF, GLB, and WEBM are supported.
youtube_url	A URL to a YouTube video.

PD-10.2 ERC-165

Creates a standard method to publish and detect what interfaces a smart contract implements.

```
function supportsInterface(bytes4  
interfaceID) constant returns (bool) {  
    If (interfaceID == i0) return false;  
    If (interfaceID == i1) return true;  
    If (interfaceID == i2) return true;  
    If (interfaceID == i3) return true;  
    return false;  
}
```

i0=0xffffffff

i1=this.supportsInterface.selector
(0x01ffc9a7)

i2=this.f1.selector ^
this.f2.selector;
0x21212121

i3=this.f3.selector ^
this.f4.selector ^
this.f5.selector;
0x00030405

function supportsInterface(..) ..

function f1(..) ...
0x20202020

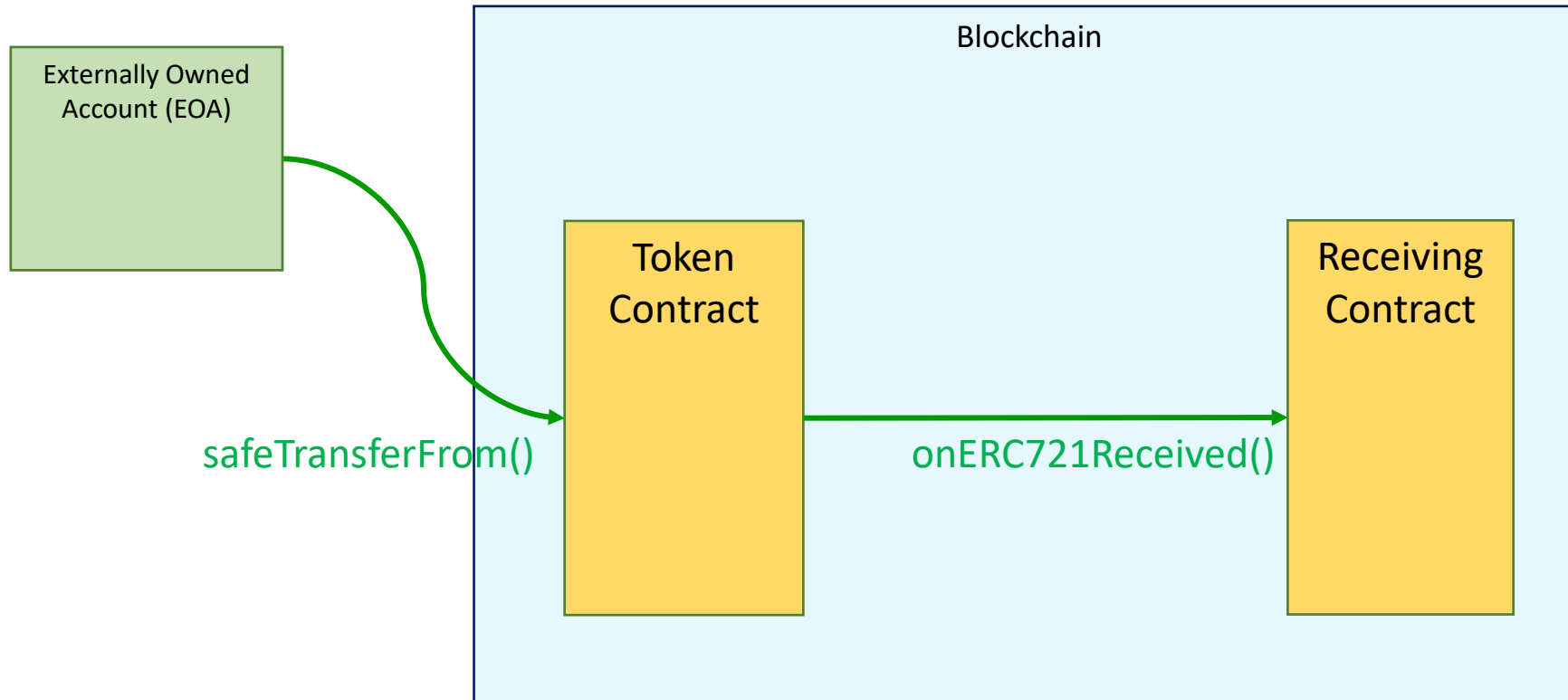
function f2(..) ...
0x01010101

function f3(..) ...
0x00030000

function f4(..) ...
0x00000400

function f5(..) ...
0x00000005

PD-10.2 onERC721Received



PD-10.2 onERC721Received signature

```
bytes4 (keccak256 ("onERC721Received(address,address,uint256,bytes)"));  
bytes4 internal constant ONERC721RECEIVED_FUNCTION_SIGNATURE = 0x150b7a02;
```

Keccak-256

Keccak-256 online hash function

```
onERC721Received(address,address,uint256,bytes)
```

Hash Auto Update

```
150b7a023d4804d13e8c85fb27262cb750cf6ba9f9dd3bb30d90f482ceeb4b1f
```

<https://www.4byte.directory/>

https://emn178.github.io/online-tools/keccak_256.html

PD-10.2 ERC721TokenReceiver

```
bytes4 internal constant ONERC721RECEIVED_FUNCTION_SIGNATURE = 0x150b7a02;

function onERC721Received(address _operator, address _from, uint256
_tokenId, bytes memory _data) public returns(bytes4) {
    receivedOperator = _operator;
    receivedFrom     = _from;
    receivedTokenId  = _tokenId;
    receivedData     = _data;
    return ONERC721RECEIVED_FUNCTION_SIGNATURE;
}
```

PD-10.2 safeTransferFrom

```
bytes4 internal constant ONERC721RECEIVED_FUNCTION_SIGNATURE = 0x150b7a02;

function safeTransferFrom(address _from, address _to, uint256 _tokenId,
bytes memory data) public payable
    tokenExists(_tokenId)
    allowedToTransfer(_from, _to, _tokenId) {
        settleTransfer(_from, _to, _tokenId);
        uint256 size;
        assembly { size := extcodesize(_to)
        if (size > 0) {
            require(EIP721(_to).onERC721Received(
                msg.sender, _from, _tokenId, data)
                == ONERC721RECEIVED_FUNCTION_SIGNATURE);
        }
    }
}
```

PD-10.2 ERC721 via Truffle

```
Token_erc721.sol x
1  pragma solidity ^0.5.12;
2
3  import "@openzeppelin/contracts/token/ERC721/ERC721Full.sol";
4  import "@openzeppelin/contracts/token/ERC721/ERC721Mintable.sol";
5
6  contract Token_erc721 is ERC721Full, ERC721Mintable {
7      constructor() ERC721Full("Web3ExamplesNFTOpenZeppelin", "W3ENFT") public {
8      }
9  }
```

```
2_token_erc721.js x
1  const Token_erc721 = artifacts.require("Token_erc721");
2
3  module.exports = function(deployer) {
4      deployer.deploy(Token_erc721);
5  };
```

https://github.com/web3examples/ethereum/blob/master/token_examples/ERC721TruffleOpenZeppelin/contracts/Token_erc721.sol

https://github.com/web3examples/ethereum/blob/master/token_examples/ERC721TruffleOpenZeppelin/migrations/2_token_erc721.js

PD-10.2 Included libraries

```
> tree /f
truffle-config.js
├── build
│   └── contracts
│       ├── Address.json
│       ├── Context.json
│       ├── Counters.json
│       ├── ERC165.json
│       ├── ERC721.json
│       ├── ERC721Enumerable.json
│       ├── ERC721Full.json
│       ├── ERC721Metadata.json
│       ├── ERC721Mintable.json
│       ├── IERC165.json
│       ├── IERC721.json
│       ├── IERC721Enumerable.json
│       ├── IERC721Metadata.json
│       ├── IERC721Receiver.json
│       ├── Migrations.json
│       ├── MinterRole.json
│       ├── Roles.json
│       ├── SafeMath.json
│       └── Token_erc721.json
│
│   ├── contracts
│   │   ├── Migrations.sol
│   │   └── Token_erc721.sol
│
│   └── migrations
│       ├── 1_initial_migration.js
│       └── 2_token_erc721.js
│
└── test
```