Crosschain 2022
Crosschain asset transfer for Non-Fungible Tokens
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About NFT

non-fungible tokens (NFT) are distinguishable assets that can be used to represent ownership.

- Physical assets such as houses, cars, or artwork
- Virtual collectables such as digital art, or collectable cards,
- Certificates such as Birth certificates, diplomas
NFT token and applications

- The NFT is a kind of token that has a unique identification and cannot be replaced or swapped with another.
- The specification of the NFT is in ERC721 and in a later version of ERC1440.
- One key feature of ERC721 is a field called id that contains a unique value for each token.
- ERC721 are most frequently used to represent creative artwork.
- Projects in NFT include 0xCert, Cryptokitty, OpenSea, DecentraLand, Cryptopunk, etc.
pragma solidity ^0.7.0;

contract TTCDiploma is ERC721 {
    uint private _tokenId;
    address admin;

    constructor() ERC721("TexasTechnologyCollegeDiploma", "TTC") public {
        admin = msg.sender;
    }

    function issueDiploma(address student, string memory tokenURI) public returns (uint256) {
        require(msg.sender == admin); // only admin can issue diploma.
        _tokenId++;

        uint256 newDiplomaId = _tokenId;
        _mint(student, newDiplomaId);
        _setTokenURI(newDiplomaId, tokenURI);
        return newDiplomaId;
    }
}
NFT Characteristics

- Each NFT token has an index that is unique
- Each NFT token has an owner
- Since NFTs can point to a physical or virtual asset outside the blockchain, there is an interface ERC721Metadata that defines a function called tokenURL.
  ```solidity
  function tokenURI(uint256 _tokenId) external view returns (string);
  ```
- This tokenURL function takes an input of _tokenId and returns a Universal Resource Identifier (URI) that points to a NFT item defined in a conventional digital system.
- Each NFT token can be transferred from one owner to another with the following function:
  ```solidity
  function transferFrom(address _from, address _to, uint256 _tokenId) external payable;
  ```
- There are also other functions or interfaces that help NFT tokens to be assigned, transferred or identified.
What is crosschain

- What is crosschain: transfer of assets and data
  - Lock-and-Mint
  - Lock with source chain
  - Transfer with crosschain bridge nodes
  - Mint on the target chain

- Burn and Unlock (Redeem)
  - Unburn the asset on the target chain
  - Transfer unlock transaction to the target chain
  - Unlock the asset on the source chain
NFT crosschain characteristics

Uniqueness: When a NFT is minted on another blockchain, the NFT on the source chain should be locked.

Multiple crosschain: A NFT can be cross-transfer from source chain A, to the first target chain B, and then to the second target chain C, and so forth.

Usability: The third party application should render the URI of the NFT on the target chain

Market place on both chains: a NFT can be traded on the marketplace on both chains.

Crosschain staking and slashing for NFT: The value of NFT are subjective and make staking for NFT not accurate
Why NFT crosschain

- NFT asset can be crosschain transfer to other blockchains for trading
- Save transaction gas fee and improve scalability
- NFT specific applications
- Mint-once, Use anywhere
NFT crosschain use case
NFT crosschain use case
## NFT crosschain use case

<table>
<thead>
<tr>
<th>Asset</th>
<th>BFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chain Pair</td>
<td>Moonbase Alpha  Ethereum</td>
</tr>
<tr>
<td>From</td>
<td>0xE1584AF421F95E3...c7985Af7C783327</td>
</tr>
<tr>
<td>Recipient</td>
<td>0xE1584AF421F95E3...c7985Af7C783327</td>
</tr>
<tr>
<td>Card ID</td>
<td>15</td>
</tr>
<tr>
<td>Fee</td>
<td>2e-18 DEV</td>
</tr>
<tr>
<td>Received</td>
<td>15</td>
</tr>
<tr>
<td>Status</td>
<td>Success</td>
</tr>
<tr>
<td>TxHash</td>
<td>0x9bfdd7b24012aee2...10ce26ecc144ebc6</td>
</tr>
</tbody>
</table>
# NFT crosschain use case

![Wanchain Crosschain Transaction Dashboard](image.png)

<table>
<thead>
<tr>
<th>No</th>
<th>LockHash</th>
<th>HTLC/Time</th>
<th>From</th>
<th>To</th>
<th>Status</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0x8d4d7d240132e...</td>
<td>5 mins 15 secs ago</td>
<td>(Moonbase Alpha) 0xa158fa42195e3...</td>
<td>(Ethereum) 0xa158fa42195e3...</td>
<td>Processing</td>
<td>15 BFT.m</td>
</tr>
<tr>
<td>2</td>
<td>0xe390641af7056e...</td>
<td>70 days 23 hrs ago</td>
<td>(Ethereum) 0xa158fa42195e3...</td>
<td>(Moonbase Alpha) ...</td>
<td>Success</td>
<td>15 BFT</td>
</tr>
<tr>
<td>3</td>
<td>0x2f627a1957069...</td>
<td>81 days 2 hrs ago</td>
<td>(Moonbase Alpha) 0x8a157b38ead48c...</td>
<td>(Moonbase Alpha) 0x8a157b38ead48c...</td>
<td>Success</td>
<td>5 BFT.m</td>
</tr>
<tr>
<td>4</td>
<td>0xb24330e3095d291e...</td>
<td>81 days 3 hrs ago</td>
<td>(Ethereum) 0x8a157b38ead48c...</td>
<td>(Moonbase Alpha) ...</td>
<td>Success</td>
<td>10 BFT</td>
</tr>
<tr>
<td>5</td>
<td>0x25001cb7b9d19...</td>
<td>81 days 3 hrs ago</td>
<td>(Ethereum) 0x8a157b38ead48c...</td>
<td>(Moonbase Alpha) ...</td>
<td>Success</td>
<td>5 BFT</td>
</tr>
<tr>
<td>6</td>
<td>0x7fe839f565e1b...</td>
<td>81 days 6 hrs ago</td>
<td>(Moonbase Alpha) 0x8a157b38ead48c...</td>
<td>(Ethereum) 0x8a157b38ead48c...</td>
<td>Success</td>
<td>5 BFT.m</td>
</tr>
<tr>
<td>7</td>
<td>0x5fcb1b3751c69...</td>
<td>81 days 6 hrs ago</td>
<td>(Ethereum) 0x8a157b38ead48c...</td>
<td>(Moonbase Alpha) ...</td>
<td>Success</td>
<td>5 BFT</td>
</tr>
<tr>
<td>8</td>
<td>0xb7282d03730e67...</td>
<td>81 days 7 hrs ago</td>
<td>(Moonbase Alpha) 0xd53824f86309...</td>
<td>(Ethereum) 0x8a157b38ead48c...</td>
<td>Success</td>
<td>5 BFT.m</td>
</tr>
</tbody>
</table>

**Crosschain 2022**
NFT crosschain mechanism

Initiate transfer

- Locking NFT asset
- Messaging NFT asset crosschain event
- Minting NFT asset
NFT crosschain mechanism

Redeem

- Burning NFT asset
- Messaging NFT asset crosschain event
- Unlocking NFT asset
NFT crosschain challenges

- Staking for NFT bridges
- tokenURI transfer
- Third party dapps for crosschain NFT
- Updating of NFT smart contract on the source chain
- Security considerations (MPC etc)