L08: NFTs & Token Standards

BSc Blockchain Course

Digital Finance

2026

Learning Objectives

By the end of this lesson, you will be able to:

1. Understand ERC-20, ERC-721, and ERC-1155 standards
2. Explain NFT metadata structure and storage options
3. Describe the NFT marketplace ecosystem
4. Analyze tokenomics and distribution models
5. Evaluate NFT use cases beyond digital art

Token standards enable interoperability across the ecosystem.

ERC-20: The Fungible Token Standard

ERC-20: Fungible Token Standard

Required Functions

```
totalSupply()
balanceOf(account)
transfer(to, amount)
allowance(owner, spender)
approve(spender, amount)
transferFrom(from, to, amount)
```

Required Events

```
Transfer(from, to, value)
Approval(owner, spender, value)
```

Optional (Metadata)

```
name()
symbol()
decimals()
```

Key: All tokens are identical and interchangeable (fungible)

Fungible tokens: all units identical and interchangeable.

ERC-721: The NFT Standard

ERC-721: Non-Fungible Token Standard

Core Functions

```
balanceOf(owner)
ownerOf(tokenId)
safeTransferFrom(...)
transferFrom(...)
approve(to, tokenId)
setApprovalForAll(...)
```

Metadata Extension

```
name()
symbol()
tokenURI(tokenId)
```

Each token is unique:

Key: Each token has unique tokenId - not interchangeable

Non-fungible: each token is unique with its own tokenId.

ERC-1155: Best of Both Worlds

ERC-1155: Multi-Token Standard

Single Contract, Multiple Types:

Fungible:

Non-Fungible:

Key Features:

* Batch transfers
* Mixed fungible/NFT
* Gas efficient
* Single contract

Ideal for: Gaming items (swords x100, unique legendaries)

Multi-token: both fungible and non-fungible in one contract.

Token Metadata

NFT Metadata Structure

NFT Metadata JSON

```
{
  "name": "CryptoPunk #1234",
  "description": "A unique punk",
  "image": "ipfs://Qm...",
  "external_url": "https://...",
  "attributes": [
    {"trait_type": "Background",
     "value": "Blue"},
    {"trait_type": "Rarity",
     "value": "Legendary"}
  ]
}
```

Storage Options

IPFS Decentralized, content-addressed

Arweave Permanent, pay once

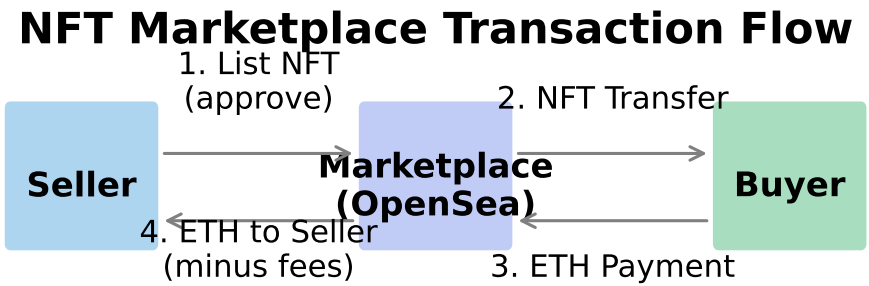
On-chain Most secure, expensive

Centralized Risky, avoid

tokenURI(id) -> returns metadata URL -> JSON -> image URL

Metadata stored off-chain; IPFS preferred for decentralization.

Marketplace Flow



Fee Structure (typical):

Marketplace: 2.5%

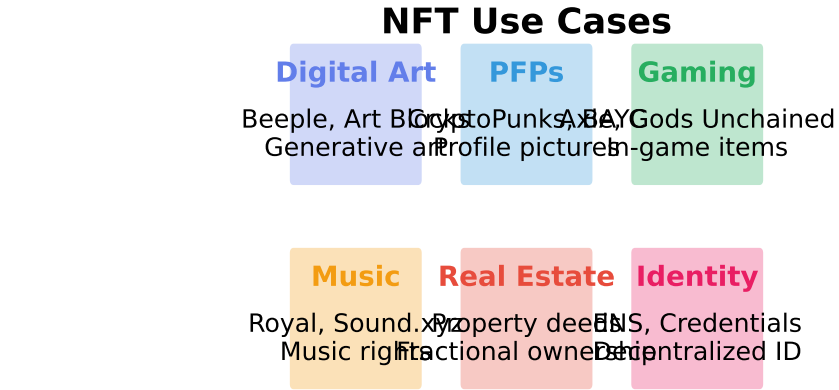
Creator Royalty: 2.5-10%

Gas: variable

Royalties: Creator earns on every resale

OpenSea, Blur dominate Ethereum NFT trading.

NFT Use Cases

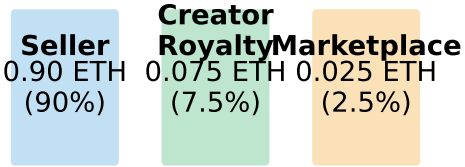


NFTs enable provable ownership and scarcity for any digital asset

NFTs enable digital ownership beyond just art.

Royalties Mechanism

NFT Royalties: Creator Earnings on Resales
Secondary Sale: 1 ETH



EIP-2981: Royalty Standard

`royaltyInfo(tokenId, salePrice) returns (receiver, amount)`

Note: On-chain royalties are optional - marketplaces choose to honor them

EIP-2981 standardizes royalties; enforcement is optional.

Key Takeaways

Remember These Points

1. ERC-20: fungible tokens (all identical)
2. ERC-721: NFTs (each unique)
3. ERC-1155: multi-token (both types)
4. Metadata: usually stored on IPFS
5. Royalties: EIP-2981 standard, not enforced

Next Lesson: Layer 2 and Scaling Solutions.