

# **Design and Implementation of a Token-NFT-Liquidity Smart Contract Suite**

Roberto Di Rosa,Luca Sforza

Sapienza

3-12-2025

## 1. Introduction

---

—

We aim to present a suite of smart contracts designed to manage NFT auctions using a custom token called SapiCoin.

We used Solidity language for developing this suite of smart contracts.

A Token can be viewed as a class in other programming languages (e.g. Java), however to avoid binding a smart contract to a specific Token we used an abstraction standardized by the Ethereum Community.

In addition to token transfers and auctions, our system includes a liquidity pool implemented using Uniswap v3, which allows users to trade between Ether and SapiCoin.

# Blockchain Technology

## 2. Tokens

---

### 2. Tokens

---

## 2.1 ERC-20

ERC-20 is the standard that represents a token on EVM compatible blockchains.

There is no central authority responsible for issuing these standards; instead, communities such as **Ethereum Magicians** provide a space to discuss improvements to the Ethereum standard through EIPs (Ethereum Improvement Proposals).

### 2.1.1 Polymorphism

Achieving this requires polymorphism.

The Ethereum Virtual Machine does not provide instructions for handling abstract classes, but the VM itself is polymorphic.

## 2. Tokens

- 2. Tokens
  - 2.1 ERC-20

## 2.1 ERC-20

When a method of a smart contract is invoked through a transaction, the memory address of the method is accessed by computing the hash of the function signature. If the invoked method does not exist, a default fallback function is executed (which can be overridden).

```
contract SapiCoin is ERC20 {  
    /* Implementation */  
}
```

So Solidity exploit this behavior to defines interfaces. So ERC-20 can be viewed as an Interface.

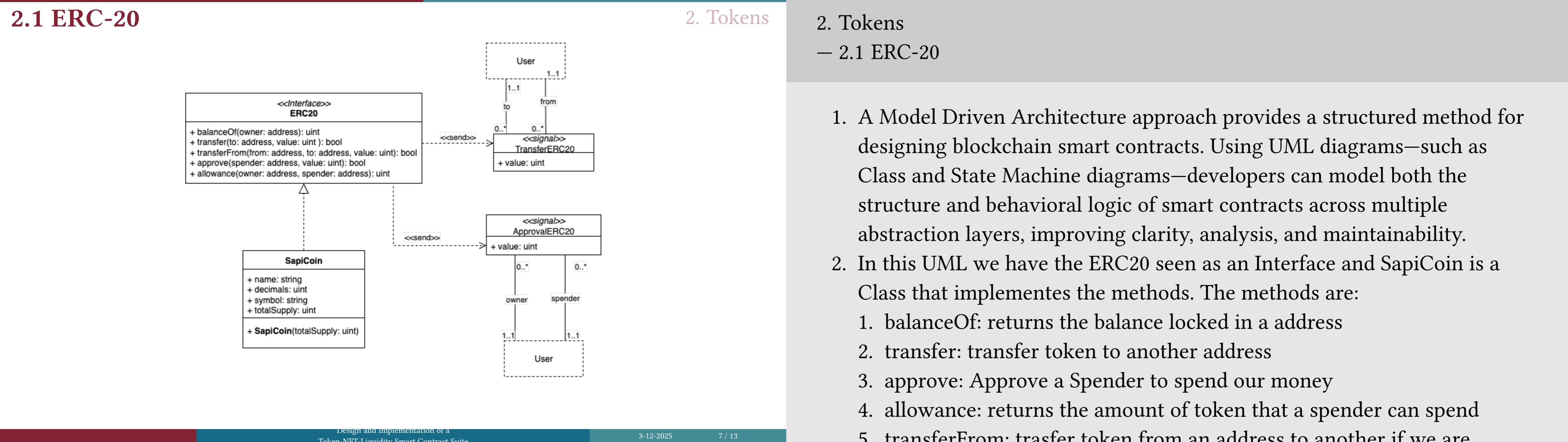
## 2. Tokens

- 2. Tokens
  - 2.1 ERC-20

# Design of the standard ERC-20

## 2. Tokens

- 2.1 ERC-20



## 2.2 Token ERC-721

2. Tokens

– 2.2 Token ERC-721

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do.

### 2.2.1 ERC-165

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliquam quaerat voluptatem. Ut enim  
aeque doleamus animo, cum corpore dolemus, fieri.

# 3. Auction

---

—

—

—

—

—

—

—

—

—

—

# 3. Auction

---

—

—

—

—

—

—

—

—

—

—

# 3. Auction

---

—

—

—

—

—

—

—

—

—

—

# 3. Auction

---

—

—

—

—

—

—

—

—

—

—

Another variant with primary color in  
background...

### 3. Auction

---

left

middle

right

### 3. Auction

---

### 3. Auction

---

top

bottom

Lorem ipsum dolor  
    sit amet,  
    consectetur  
    adipiscing elit.

orem ipsum dolor sit amet, consectetur  
adipiscing elit. sit amet, consectetur

orem ipsum dolor sit amet, consectetur  
adipiscing elit. sit amet, consectetur

orem ipsum dolor sit amet, consectetur  
adipiscing elit. sit amet, consectetur

## 3. Auction

---

color  
it.

color  
.  
it.

### 3. Auction

**–**  
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do.

### 3. Auction

–

## 4. Implementation details

---

—

### 4. Implementation details

---

**Lorem ipsum dolor sit amet,  
  consectetur adipiscing elit,  
  sed do.**

## 5. Liquidity Pool

---

—

### 5. Liquidity Pool

---

**Lorem ipsum dolor sit amet,  
  consectetur adipiscing elit,  
  sed do.**

## 6. Conclusions

---

—

### 6. Conclusions

**Lorem ipsum dolor sit amet,  
consectetur adipiscing elit,  
sed do.**