

**21S1-CE4153-CZ4153**  
**BLOCKCHAIN TECHNOLOGY**

**Smart Contracts and Tokens**



# Anton Buenavista

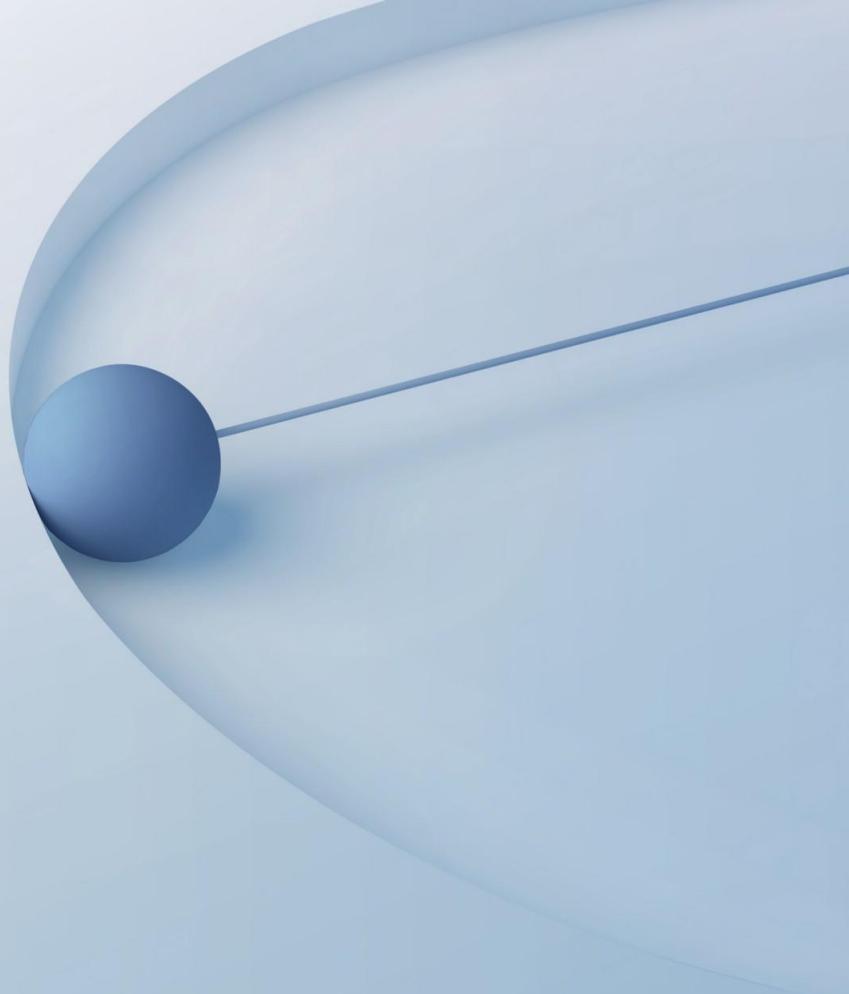
## Software Engineer



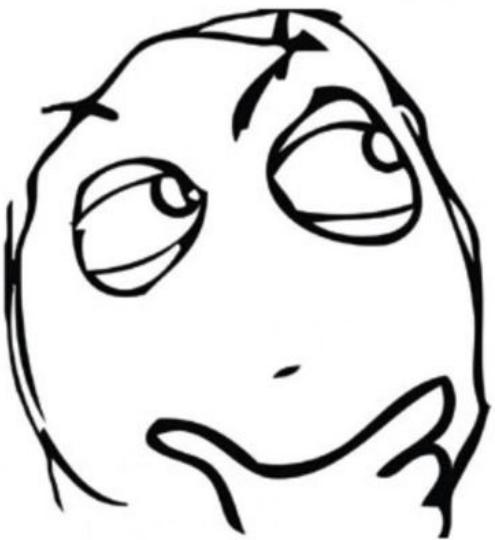
P E N D L E



# Smart Contracts

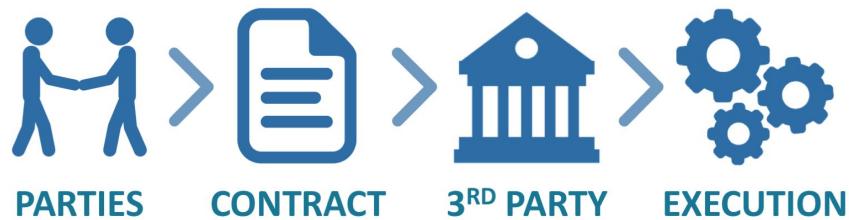


# Smart Contracts



Code is law

## TRADITIONAL CONTRACT



## SMART CONTRACT



# Smart Contracts



```
pragma solidity ^0.8.0;

interface IERC20 {
    function totalSupply() external view returns (uint256);

    function balanceOf(address account) external view returns (uint256);

    function transfer(address recipient, uint256 amount) external returns (bool);

    function allowance(address owner, address spender) external view returns (uint256);

    function approve(address spender, uint256 amount) external returns (bool);

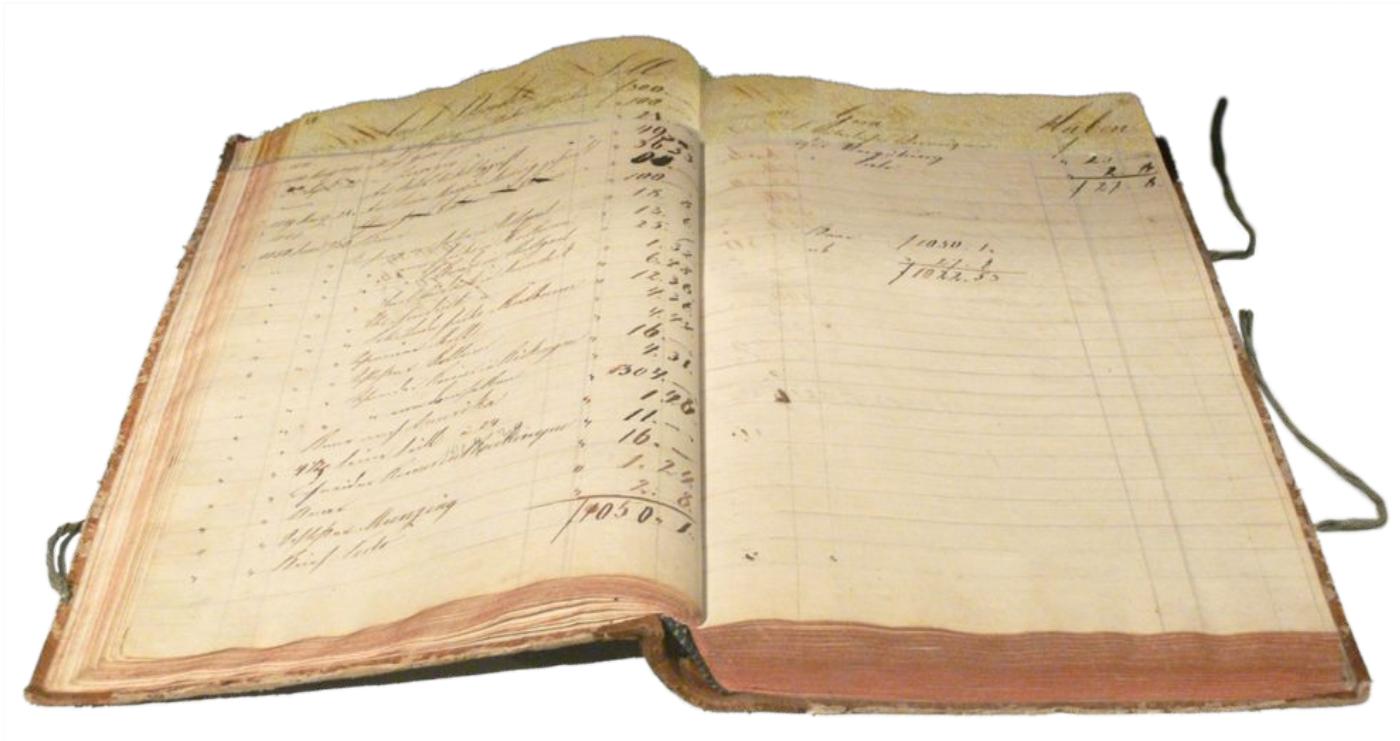
    function transferFrom(
        address sender,
        address recipient,
        uint256 amount
    ) external returns (bool);

    event Transfer(address indexed from, address indexed to, uint256 value);

    event Approval(address indexed owner, address indexed spender, uint256 value);
}
```



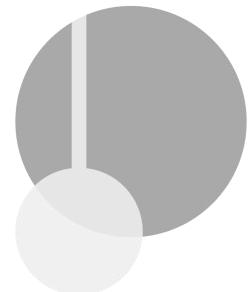
# Smart Contracts



# Smart Contracts

Date	Sender	Receiver	Amount
-----			
2021-01-01 06:00	(Deposit)	Anna	\$100
2021-01-01 06:01	(Deposit)	Bob	\$100
2021-01-01 06:08	(Deposit)	Charlie	\$100

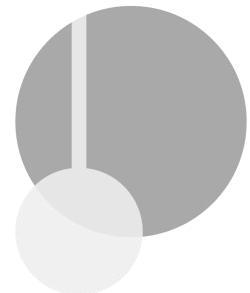
Date	Sender	Receiver	Amount	A	B	C
----- -----						
1	(Deposit)	Anna	\$100	\$100	\$0	\$0
2	(Deposit)	Bob	\$100	\$100	\$100	\$0
3	(Deposit)	Charlie	\$100	\$100	\$100	\$100
4	Bob	Charlie	\$20	\$100	\$80	\$120
5	Bob	Anna	\$30	\$130	\$50	\$120
6	Anna	Bob	\$130	\$0	\$180	\$120



# Smart Contracts

Txn Hash	Method ⓘ	Block	Age	From ↴	To ↴	Value	Txn Fee
0x68f6abc029a0f890b2d...	Tokenize Yield	13223182	2 hrs 20 mins ago	0xd5459ca680a84d557e...	IN Pendle: Router	0 Ether	0.011892805003 ⚡
0x6c20eeddba2415dd25...	Add Market Liqui...	13223070	2 hrs 45 mins ago	0x416cfb0a57c17de121...	IN Pendle: Router	0 Ether	0.039962876007 ⚡
0x11d04039a4a4a40338...	Swap Exact Out	13223035	2 hrs 54 mins ago	0x416cfb0a57c17de121...	IN Pendle: Router	0 Ether	0.010404357498 ⚡
0xae8c4c8badaae882cb...	Add Market Liqui...	13221915	7 hrs 8 mins ago	0xffd9b703d11040a5142...	IN Pendle: Router	0 Ether	0.0482472
0xc3a69e130545536668...	Swap Exact In	13221584	8 hrs 18 mins ago	0xa71b272556c04106fe...	IN Pendle: Router	0 Ether	0.012971927697 ⚡
0x4faf57f68d7f34421f44...	Add Market Liqui...	13220930	10 hrs 46 mins ago	⌚ paul2.eth	IN Pendle: Router	0 Ether	0.0331828939 ⚡
0xafdf94b3beda7cc9b0f...	Add Market Liqui...	13220830	11 hrs 6 mins ago	0xffd9b703d11040a5142...	IN Pendle: Router	0 Ether	0.05710369
0x6968ae4ef0848f1c93c...	Tokenize Yield	13220814	11 hrs 10 mins ago	⌚ paul2.eth	IN Pendle: Router	0 Ether	0.014006192917 ⚡
0x0572f8c7e3f3b65edfc...	Tokenize Yield	13220629	11 hrs 56 mins ago	0xffd9b703d11040a5142...	IN Pendle: Router	0 Ether	0.016633565
0x07190c79f9561851b2...	Add Market Liqui...	13220577	12 hrs 9 mins ago	0x9f1366863029b0ec05...	IN Pendle: Router	0 Ether	0.023581179599 ⚡
0x5ccccca8e089b672db...	Remove Market Li...	13220541	12 hrs 16 mins ago	0x9f1366863029b0ec05...	IN Pendle: Router	0 Ether	0.021135867511 ⚡
0x9dbc0eba8ddeae951d...	Add Market Liqui...	13219945	14 hrs 30 mins ago	0x280bf69d522bbcfb3ae...	IN Pendle: Router	0 Ether	0.022683517661 ⚡
0xb9932adafa463aef3c1...	Tokenize Yield	13219912	14 hrs 36 mins ago	0x280bf69d522bbcfb3ae...	IN Pendle: Router	0 Ether	0.008288153202 ⚡

# Smart Contracts as Trustware

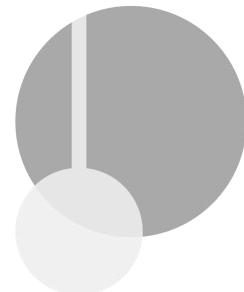


# Smart Contracts Analogy



```
function vend(money, snack selection)  
returns (snack dispensed)
```

- The only allowable state transition.
- Works in a fully deterministic way.



# Smart Contracts Analogy



```
pragma solidity 0.8.6;

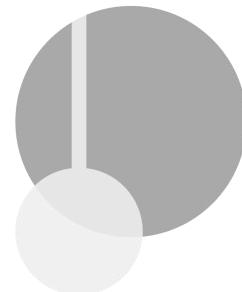
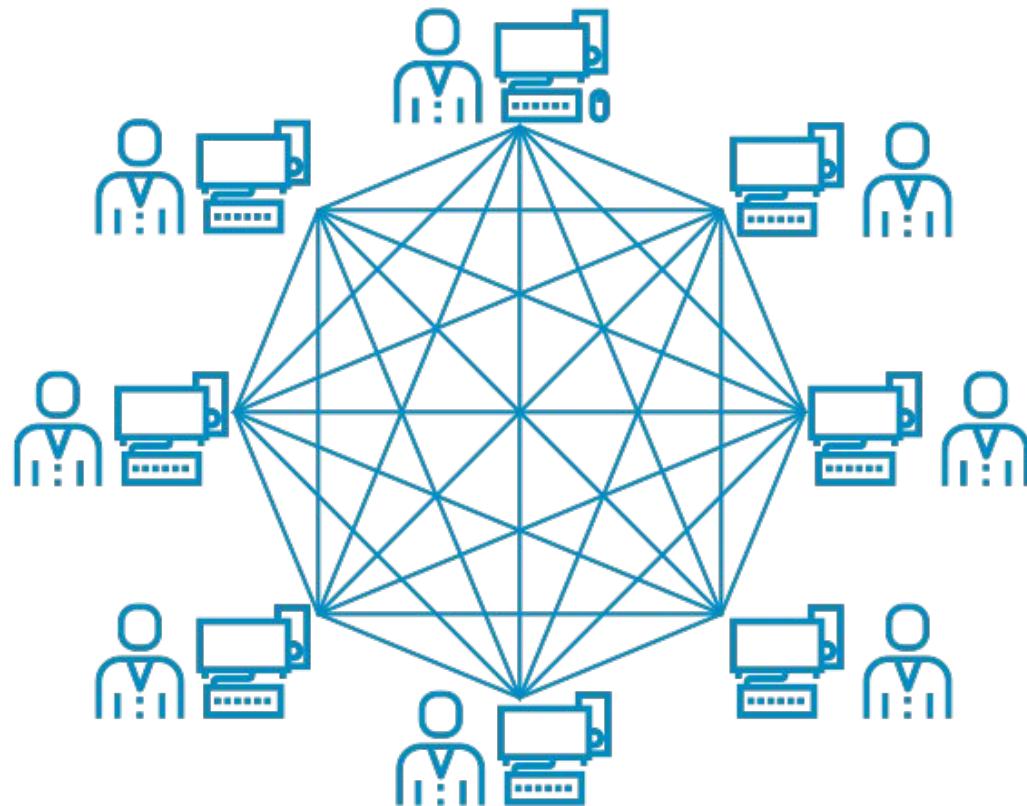
contract VendingMachine {
    // Declare state variables of the contract
    address public owner;
    mapping (address => uint) public cupcakeBalances;

    // When 'VendingMachine' contract is deployed:
    // 1. set the deploying address as the owner of the contract
    // 2. set the deployed smart contract's cupcake balance to 100
    constructor() public {
        owner = msg.sender;
        cupcakeBalances[address(this)] = 100;
    }

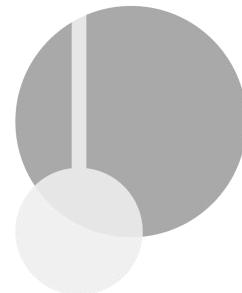
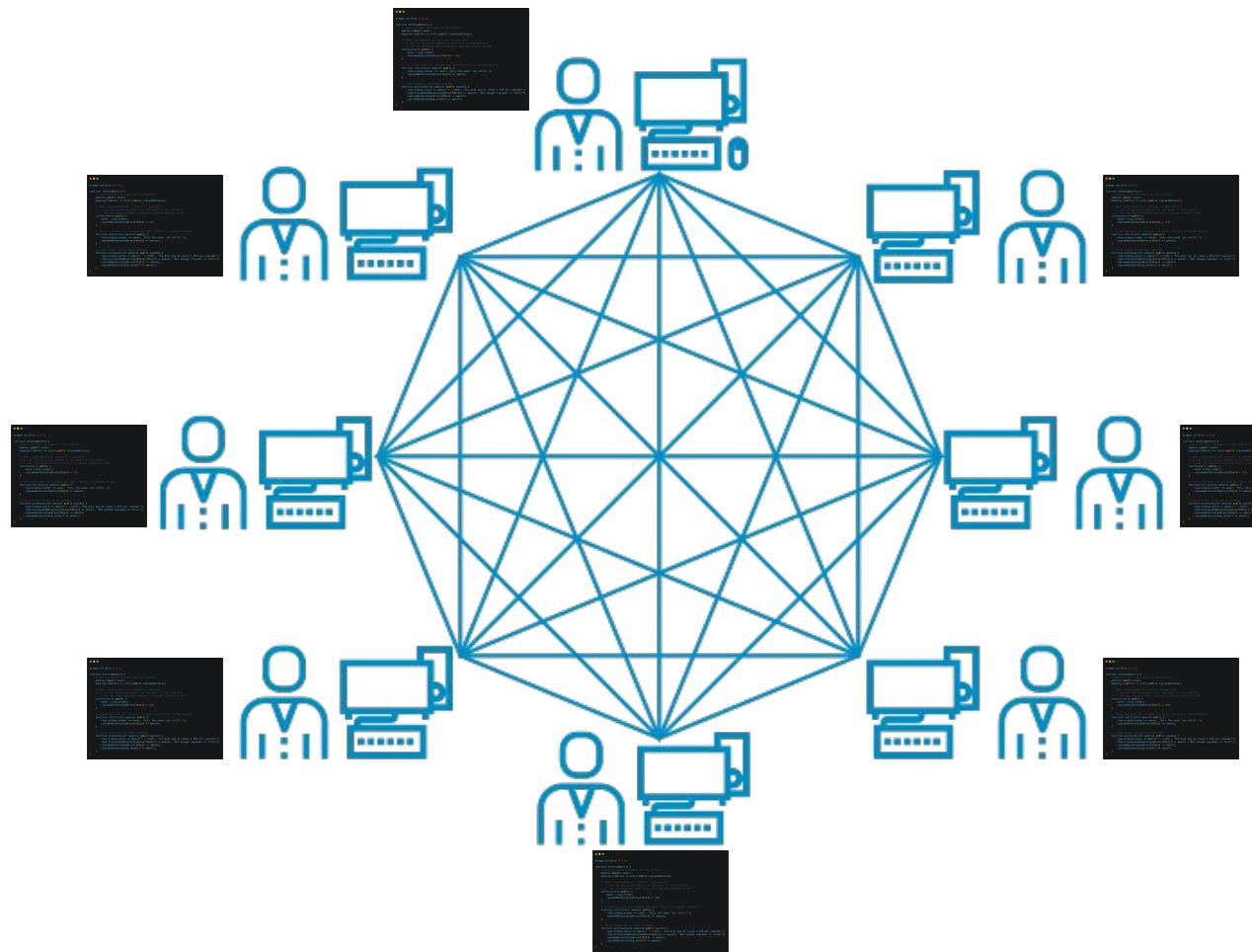
    // Allow the owner to increase the smart contract's cupcake balance
    function refill(uint amount) public {
        require(msg.sender == owner, "Only the owner can refill.");
        cupcakeBalances[address(this)] += amount;
    }

    // Allow anyone to purchase cupcakes
    function purchase(uint amount) public payable {
        require(msg.value >= amount * 1 ether, "You must pay at least 1 ETH per cupcake");
        require(cupcakeBalances[address(this)] >= amount, "Not enough cupcakes in stock");
        cupcakeBalances[address(this)] -= amount;
        cupcakeBalances[msg.sender] += amount;
    }
}
```

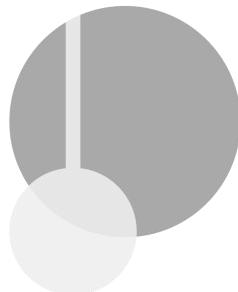
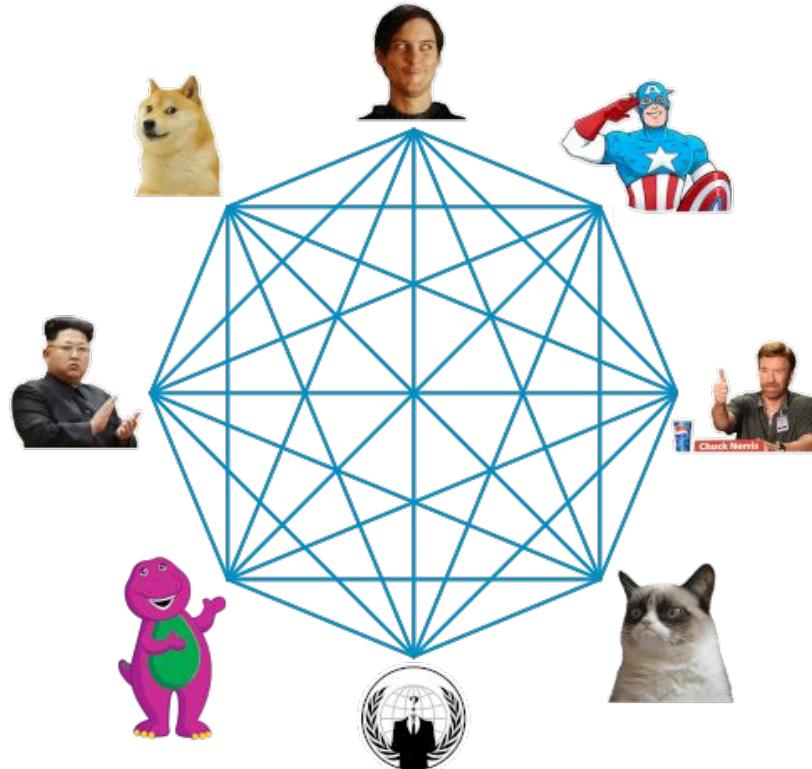
# Smart Contracts Execution



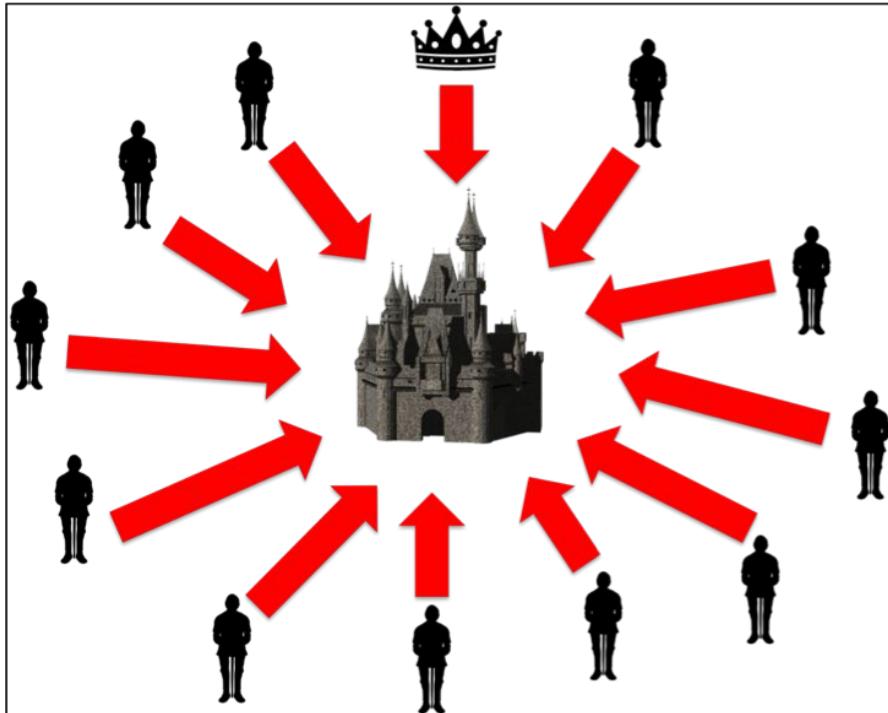
# Smart Contracts Execution



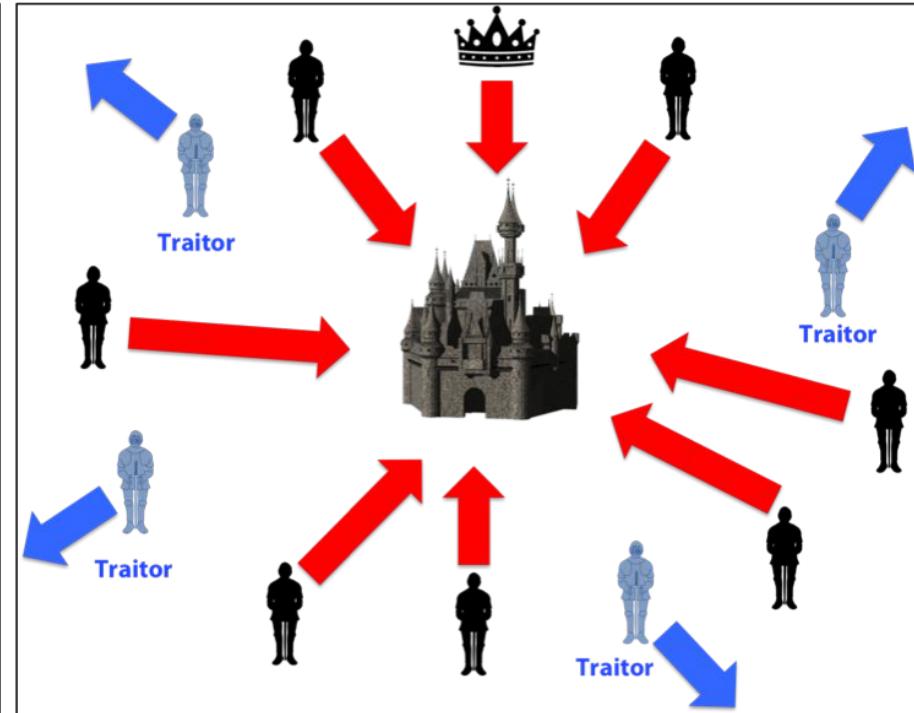
# Smart Contracts in an Adverse Environment



# Coordination - Byzantine Generals Problem



Coordinated Attack Leading to Victory

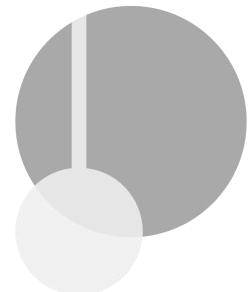


Uncoordinated Attack Leading to Defeat

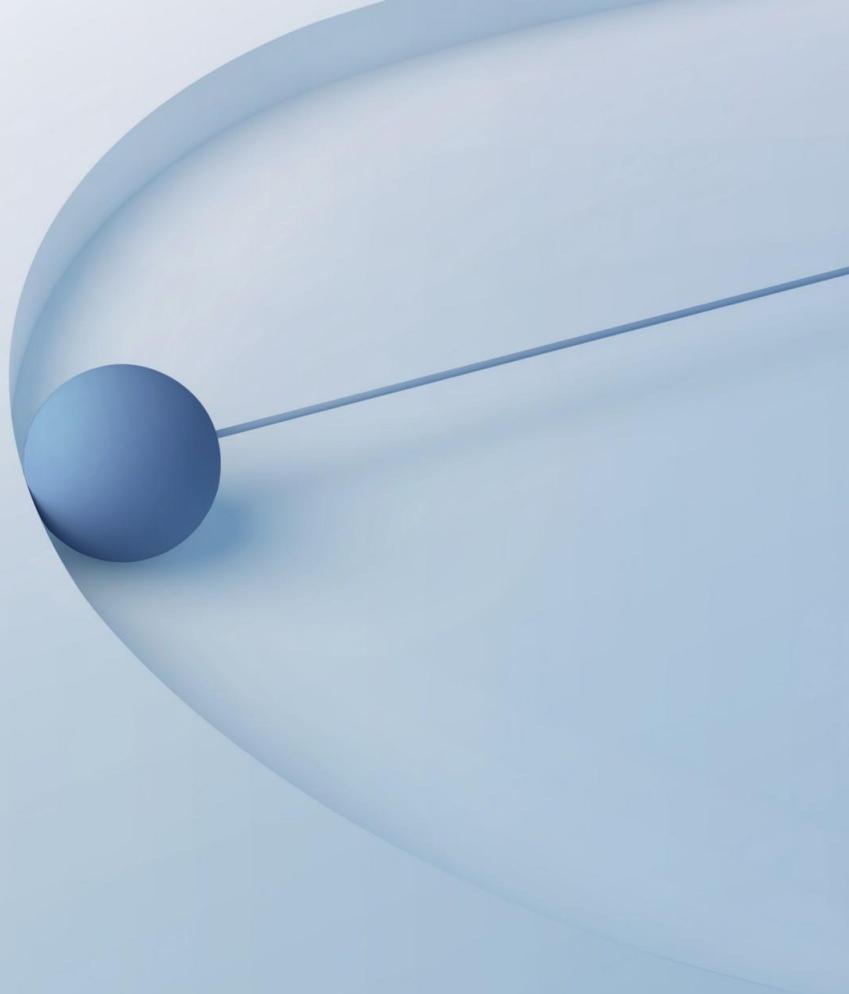
# Coordination - Byzantine Generals Problem



imgflip.com



# Tokens



# Tokens



Name		Price	24h %	7d %	Market Cap ⓘ	Volume(24h) ⓘ	Circulating Supply ⓘ	Last 7 Days
 Tether USDT	<a href="#">Buy</a>	\$1.00	+0.05%	-0.01%	\$68,318,522,276	\$78,467,843,607 78,401,793,730 USDT	68,261,015,534 USDT	
 USD Coin USDC		\$1.00	-0.03%	-0.05%	\$29,351,937,806	\$2,647,611,481 2,645,798,297 USDC	29,331,836,500 USDC	
 Uniswap UNI		\$25.04	+13.13%	+2.91%	\$15,316,855,524	\$453,892,185 18,125,150 UNI	611,643,724 UNI	
 Chainlink LINK		\$28.79	+8.55%	+0.36%	\$13,073,522,758	\$1,645,627,084 56,896,613 LINK	452,009,554 LINK	
 Binance USD BUSD		\$1.00	+0.05%	+0.03%	\$12,379,576,736	\$5,531,990,951 5,528,280,532 BUSD	12,371,273,502 BUSD	
 Wrapped Bitcoin WBTC		\$46,786.43	+5.52%	-0.20%	\$9,639,922,216	\$236,989,100 5,061 WBTC	205,871 WBTC	
 FTX Token FTT		\$68.12	+3.60%	-1.02%	\$8,232,787,064	\$905,888,362 13,299,829 FTT	120,869,925 FTT	
 Dai DAI		\$1.00	+0.09%	+0.05%	\$6,548,692,018	\$338,597,973 338,254,477 DAI	6,542,048,588 DAI	
 Aave AAVE		\$383.59	+22.79%	+12.41%	\$5,014,034,596	\$522,009,417 1,371,589 AAVE	13,174,466 AAVE	

- **Stablecoins**
  - DAI, TUSD, USDT, USDC, GUSD, sUSD, USDS...
- **Utility Tokens**
  - BAT, LINK, SNX, REP...
- **Governance Tokens**
  - PENDLE, AAVE, COMP, KNC...



Total market size  
**\$ 19,514,948,459.34**

AAVE V2  
market

AMM  
market

AAVE  
market  
POLYGON

USD

Native

Assets ▾	Market size ▾	Total borrowed ▾	Deposit APY ▾	Variable Borrow APY ▾	Stable Borrow APY ▾
 DAI	<b>2.09B</b>	<b>1.67B</b>	<b>2.90 %</b> 1.33 % APR	<b>3.99 %</b> 1.68 % APR	<b>12.00 %</b>
 Gemini Dollar (gUSD)	<b>26.73M</b>	<b>20.68M</b>	<b>2.69 %</b> 1.31 % APR	<b>3.87 %</b> 1.69 % APR	—
 USD Coin (usdc)	<b>5.71B</b>	<b>5.07B</b>	<b>3.20 %</b> 0.98 % APR	<b>3.94 %</b> 1.12 % APR	<b>10.97 %</b>
 USDT Coin (usdt)	<b>1.29B</b>	<b>1.11B</b>	<b>3.08 %</b> 1.77 % APR	<b>3.85 %</b> 2.07 % APR	<b>11.92 %</b>
 Ethereum (ETH)	<b>1.91M</b>	<b>83.25K</b>	<b>0.02 %</b> 0.37 % APR	<b>0.54 %</b> 0.45 % APR	<b>3.67 %</b>
 WBTC Coin (wbtc)	<b>37.75K</b>	<b>2.05K</b>	<b>0.03 %</b> 1.14 % APR	<b>0.67 %</b> 1.11 % APR	<b>3.84 %</b>
 Binance USD (busd)	<b>8.06M</b>	<b>6.78M</b>	<b>18.64 %</b>	<b>24.62 %</b>	—





# Aave

AAVE



Aave Price (AAVE)

\$380.75

+21.29%

Rank #33

Token

On 225,026 watchlists

0.008147 BTC ▲15.11%

0.1127 ETH ▲14.88%

Low:\$313.45

High:\$384.96

24h

## Aave to USD Chart

Price Market Cap TradingView

1D 7D 1M 3M 1Y YTD ALL

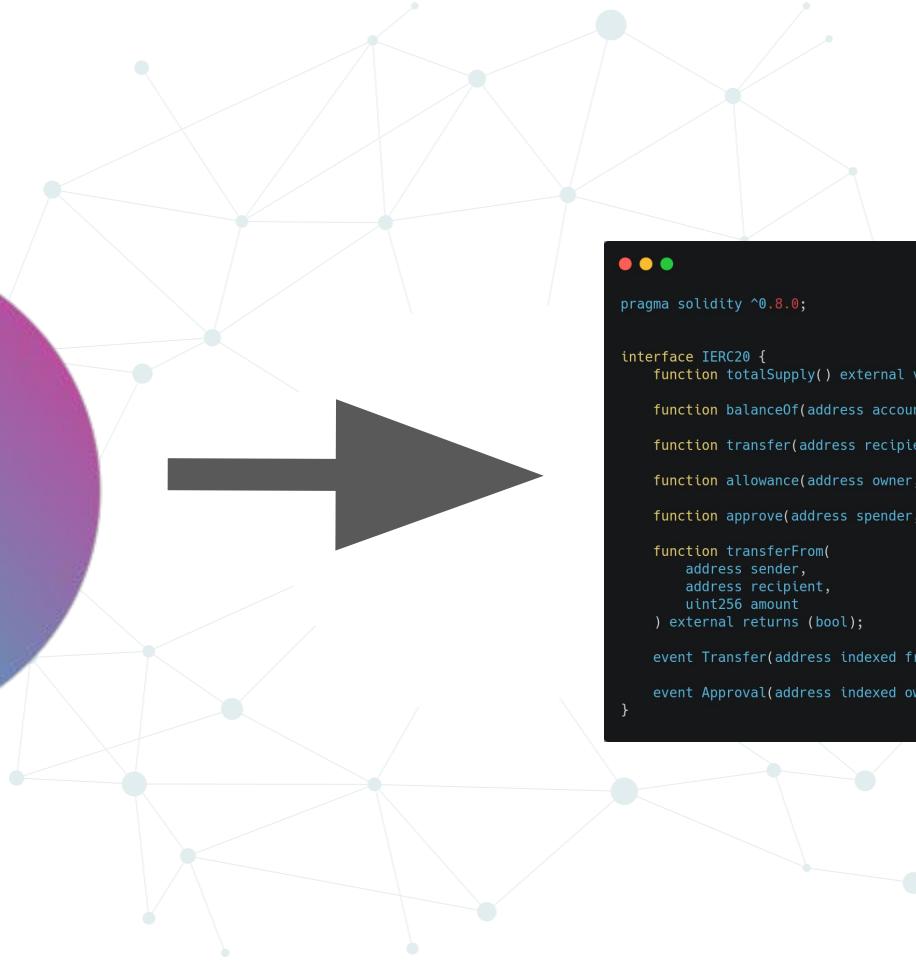
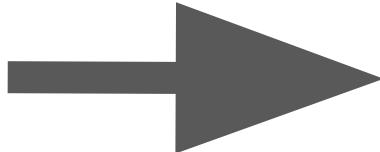


LOG

 USD

Want more data? Check out our API

# Tokens



```
pragma solidity ^0.8.0;

interface IERC20 {
    function totalSupply() external view returns (uint256);

    function balanceOf(address account) external view returns (uint256);

    function transfer(address recipient, uint256 amount) external returns (bool);

    function allowance(address owner, address spender) external view returns (uint256);

    function approve(address spender, uint256 amount) external returns (bool);

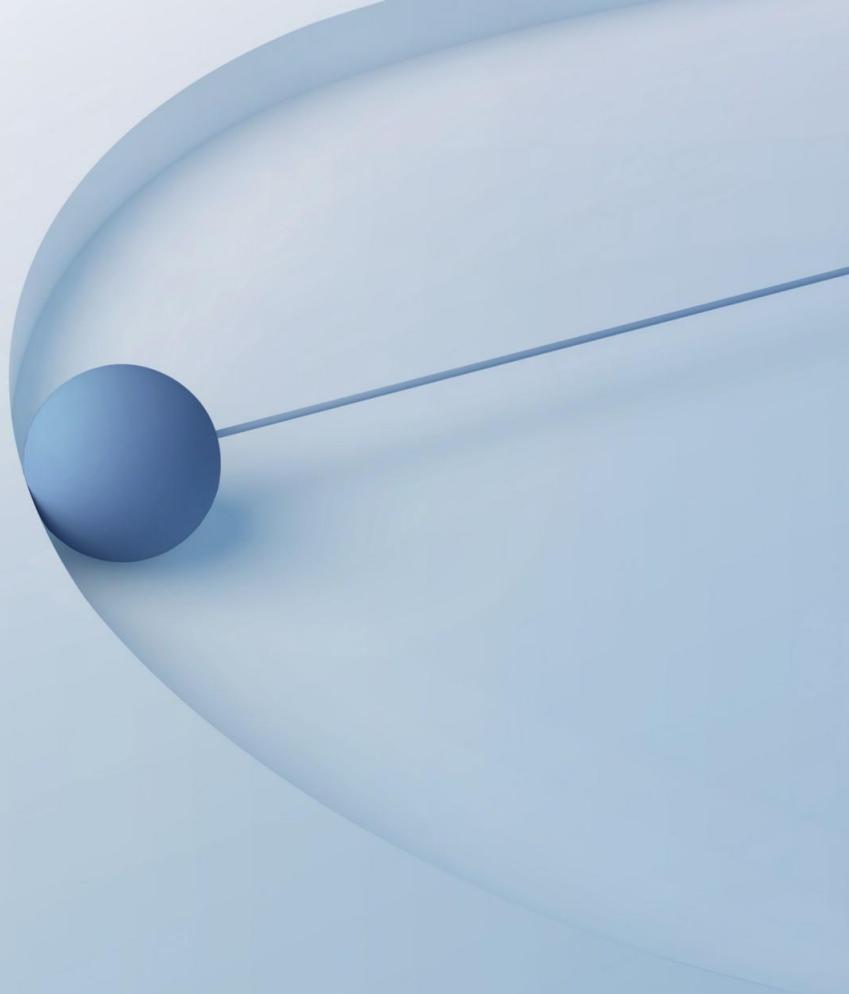
    function transferFrom(
        address sender,
        address recipient,
        uint256 amount
    ) external returns (bool);

    event Transfer(address indexed from, address indexed to, uint256 value);

    event Approval(address indexed owner, address indexed spender, uint256 value);
}
```

# **ERC20**

# **Token Standard**



# Tokens

```
● ● ●  
contract ERC20 {  
    mapping(address => uint256) private _balances;  
  
    uint256 private _totalSupply;  
    string private _name;  
    string private _symbol;  
  
    constructor(string memory name_, string memory symbol_) {  
        _name = name_;  
        _symbol = symbol_;  
    }  
  
    function name() public view virtual override returns (string memory) {  
        return _name;  
    }  
  
    function symbol() public view virtual override returns (string memory) {  
        return _symbol;  
    }  
  
    function totalSupply() public view virtual override returns (uint256) {  
        return _totalSupply;  
    }  
  
    function balanceOf(address account) public view virtual override returns (uint256) {  
        return _balances[account];  
    }  
}
```

# Tokens



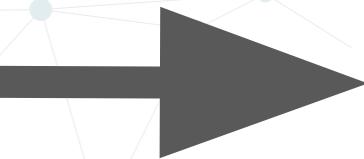
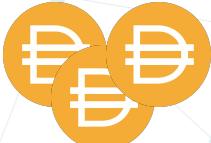
```
function transfer(address recipient, uint256 amount) public virtual override returns (bool) {
    require(sender != address(0), "ERC20: transfer from the zero address");
    require(recipient != address(0), "ERC20: transfer to the zero address");

    uint256 senderBalance = _balances[sender];
    require(senderBalance >= amount, "ERC20: transfer amount exceeds balance");
    _balances[sender] = senderBalance - amount;
    _balances[recipient] += amount;

    emit Transfer(sender, recipient, amount);

    return true;
}
```

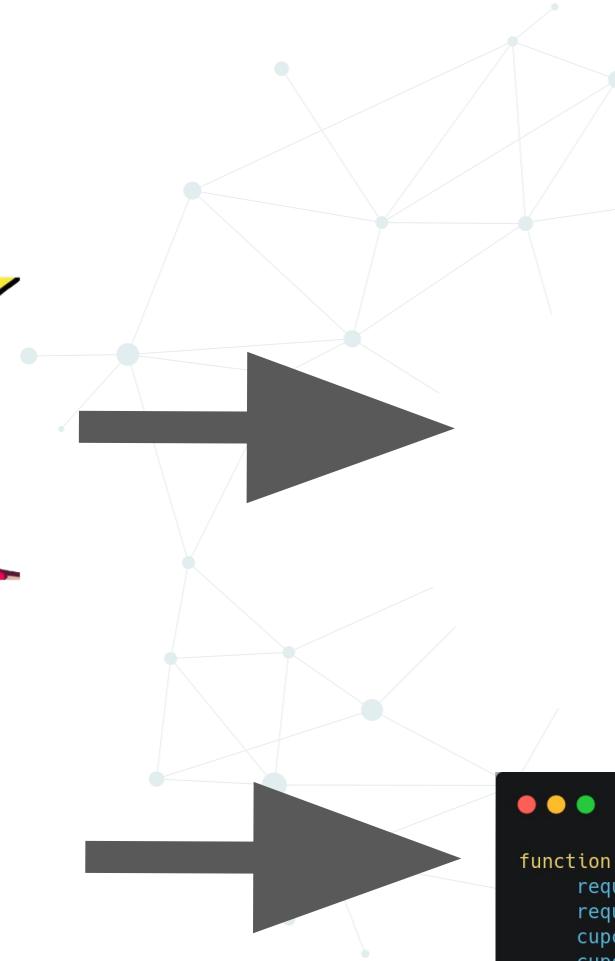
# Tokens



contract vendingMachine

```
function purchaseWithTokens(uint256 amount, ERC20 token) public {  
    // purchase a cupcake  
}
```

# Tokens



## contract daiToken

```
function transfer(address recipient, uint256 amount) public virtual override returns (bool) {
    require(sender != address(0), "ERC20: transfer from the zero address");
    require(recipient != address(0), "ERC20: transfer to the zero address");

    uint256 senderBalance = _balances[sender];
    require(senderBalance >= amount, "ERC20: transfer amount exceeds balance");
    _balances[sender] = senderBalance - amount;
    _balances[recipient] += amount;

    emit Transfer(sender, recipient, amount);
    return true;
}
```

## contract vendingMachine

```
function purchaseWithTokens(uint256 amount, ERC20 dai) public {
    require(dai.transferFrom(msg.sender, address(this), amount*1e18), "Not enough DAI");
    require(cupcakeBalances[address(this)] >= amount, "Not enough cupcakes in stock");
    cupcakeBalances[address(this)] -= amount;
    cupcakeBalances[msg.sender] += amount;
}
```

# Token Allowance Workflow



```
contract ERC20 {
    mapping(address => mapping(address => uint256)) private _allowances;
    mapping(address => uint256) private _balances;

    uint256 private _totalSupply;
    string private _name;
    string private _symbol;

    function allowance(address owner, address spender) public view virtual override returns (uint256) {
        return _allowances[owner][spender];
    }

    function approve(address spender, uint256 amount) public virtual override returns (bool) {
        require(owner != address(0), "ERC20: approve from the zero address");
        require(spender != address(0), "ERC20: approve to the zero address");

        _allowances[owner][spender] = amount;
        emit Approval(owner, spender, amount);

        return true;
    }

    function transferFrom(
        address sender,
        address recipient,
        uint256 amount
    ) public virtual override returns (bool) {
        require(sender != address(0), "ERC20: transfer from the zero address");
        require(recipient != address(0), "ERC20: transfer to the zero address");

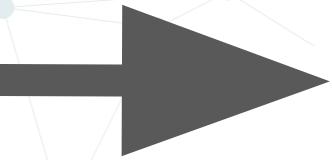
        uint256 senderBalance = _balances[sender];
        require(senderBalance >= amount, "ERC20: transfer amount exceeds balance");
        _balances[sender] = senderBalance - amount;
        _balances[recipient] += amount;

        emit Transfer(sender, recipient, amount);

        uint256 currentAllowance = _allowances[sender][msg.sender];
        require(currentAllowance >= amount, "ERC20: transfer amount exceeds allowance");
        _approve(sender, msg.sender, currentAllowance - amount);

        return true;
    }
}
```

# Token Allowance Workflow



contract vendingMachine

```
function purchaseWithTokens(uint256 amount, ERC20 dai) public {
    require(dai.transferFrom(msg.sender, address(this), amount*1e18), "Not enough DAI");
    require(cupcakeBalances[address(this)] >= amount, "Not enough cupcakes in stock");
    cupcakeBalances[address(this)] -= amount;
    cupcakeBalances[msg.sender] += amount;
}
```

contract daiToken

```
function transferFrom(
    address sender,
    address recipient,
    uint256 amount
) public virtual override returns (bool) {
    // transfer from msg.sender to contract
}
```

# ERC20

```
interface IERC20 {
    function name() external view returns (string memory);

    function symbol() external view returns (string memory);

    function totalSupply() external view returns (uint256);

    function allowance(address owner, address spender) external view returns (uint256);

    function approve(address spender, uint256 amount) external returns (bool);

    function balanceOf(address account) external view returns (uint256);

    function transfer(address recipient, uint256 amount) external returns (bool);

    function transferFrom(
        address sender,
        address recipient,
        uint256 amount
    ) external returns (bool);

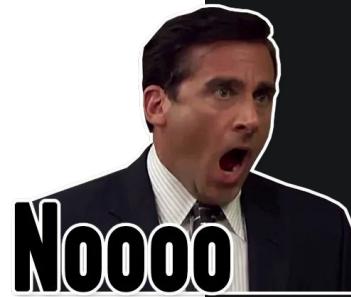
    event Transfer(address indexed from, address indexed to, uint256 value);

    event Approval(address indexed owner, address indexed spender, uint256 value);
}
```

# ERC20



```
function userBalance(ERC20 token) public returns (uint256) {  
    if (token == DAI) {  
        return token.balanceOf(msg.sender);  
    } else if (token == AAVE) {  
        return token.myBalance(msg.sender);  
    } else if (token == COMPOUND) {  
        return token.balances(msg.sender);  
    } else if (token == PENDLE) {  
        return token.leBalanceMonCheri(msg.sender);  
    } else if (token == KNC) {  
        return token.nanananaBaaalaaaannnccee(msg.sender);  
    }  
}
```





Last edit: [@ensaryusuf ↗](#), April 12, 2021

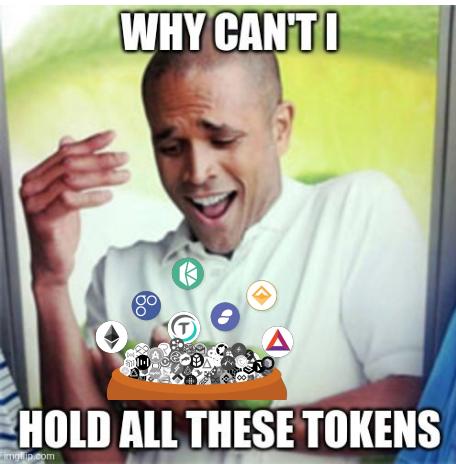
[See contributors](#)

## INTRODUCTION

### What is a Token?

Tokens can represent virtually anything in Ethereum:

- reputation points in an online platform
- skills of a character in a game
- lottery tickets
- financial assets like a share in a company
- a fiat currency like USD
- an ounce of gold
- and more...



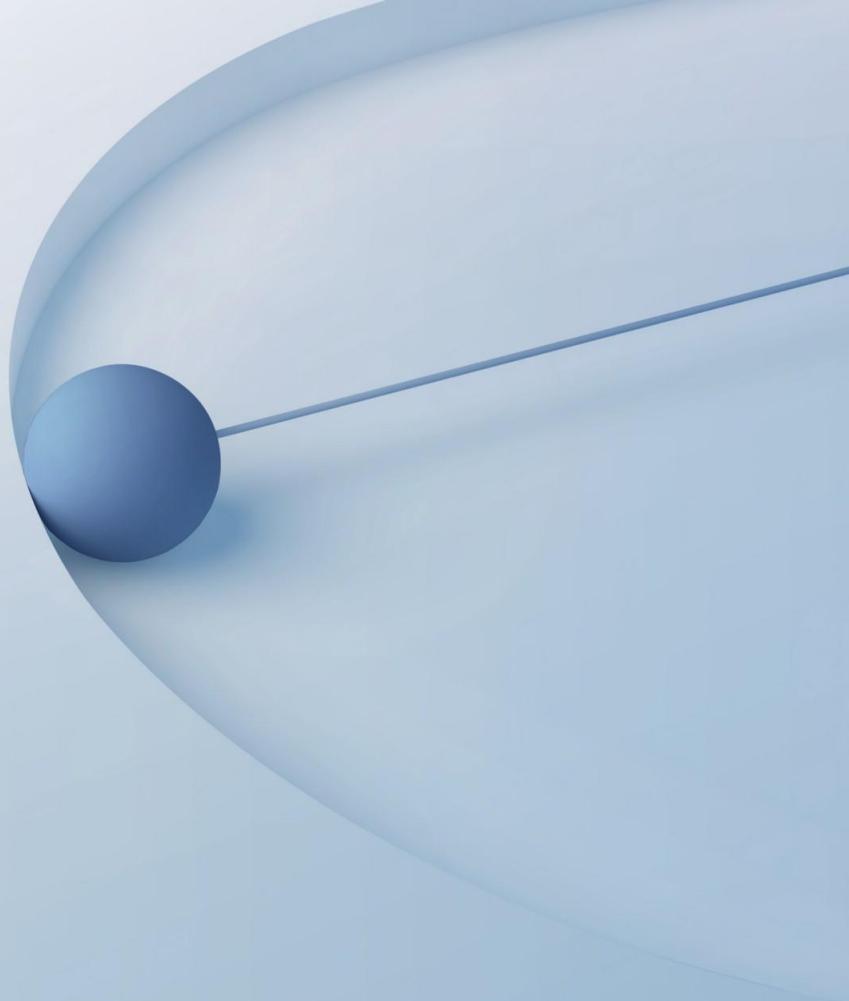
# Malicious ERC20



```
function transfer(address recipient, uint256 amount) public virtual override returns (bool) {  
    require(recipient != address(0), "ERC20: transfer to the zero address");  
  
    _proxy.transfer(recipient, amount);  
  
    emit Transfer(sender, recipient, amount);  
  
    return true;  
}
```

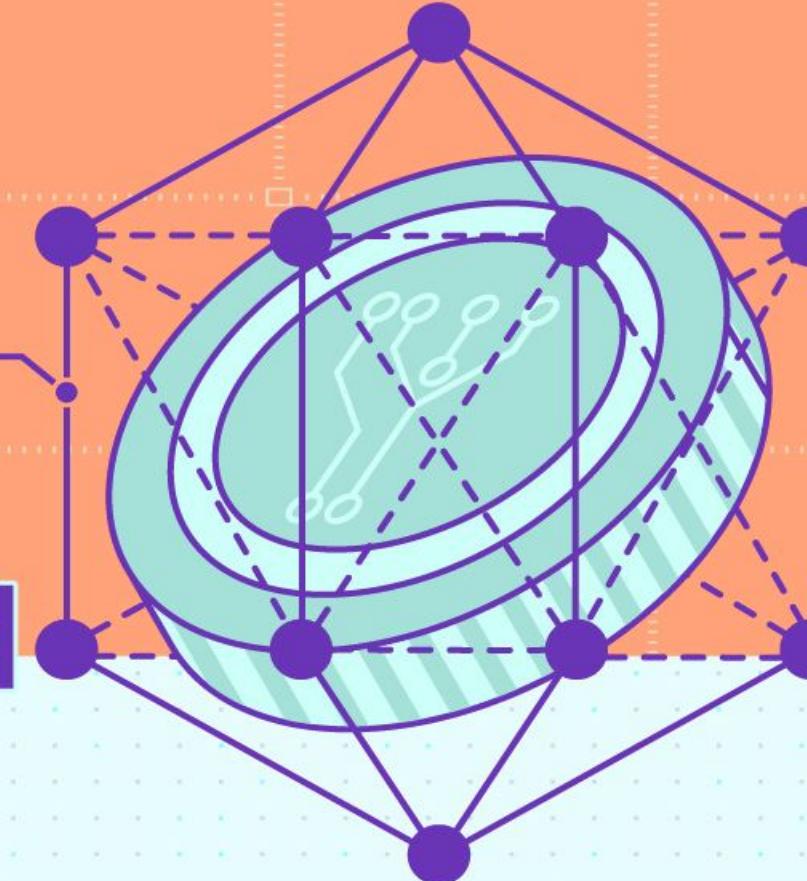


# Decentralized Finance



# Decentralized Finance

An Emerging Alternative  
to the Global Financial System

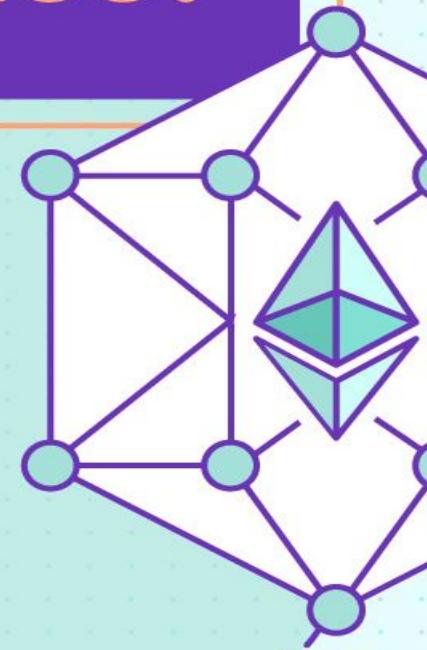
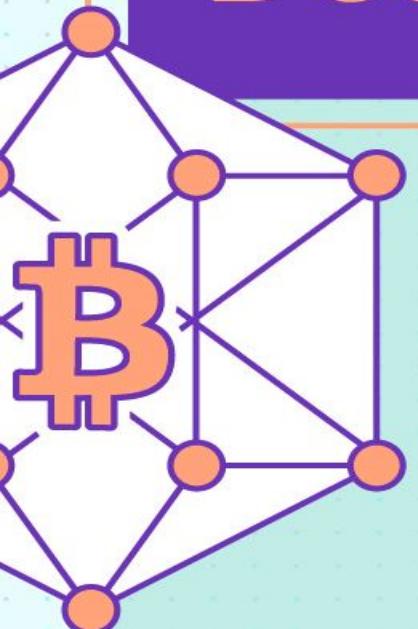




# WHAT IS Decentralized Finance?

A NEW DECENTRALIZED FINANCIAL SYSTEM IS BEING BUILT ON PUBLIC BLOCKCHAINS LIKE BITCOIN AND ETHEREUM.

Bitcoin and Ethereum aren't just digital currencies — they're the **foundational open source networks** needed to decentralize economic activity.



# Decentralized Finance

## Aave

The Aave dashboard displays the total market size of \$19,506,657,697.27. It shows the following asset statistics:

Asset	Total size	Total borrowed	Deposit APY	Borrow APY
DAI	2.09B	1.67B	2.00% 0.131% APR	3.99% 0.166% APR
Gemini Dollar (usdt)	26.73M	20.68M	2.69% 0.131% APR	3.87% 0.169% APR
USD Coin (usdc)	5.71B	5.07B	2.20% 0.041% APR	3.94% 0.112% APR
USDT Coin (usen)	1.29B	1.12B	3.09% 0.177% APR	3.85% 0.207% APR
Ethereum (eth)	1.91M	83.25K	0.02% 0.037% APR	0.54% 0.645% APR
WBTC Coin (werc)	37.76K	2.05K	0.03% 0.114% APR	0.67% 0.111% APR
Binance USD (usdo)	8.1M	6.78M	16.77%	22.28%

## Compound Finance

The Compound Finance dashboard shows the following market statistics:

Supply Markets	Borrow Markets		
Asset	APY	Asset	APY
Aave Token	0.07%	0 AAVE	0.00%
Basic Attention ...	0.82%	0 BAT	0.00%
Compound Gov...	0.88%	0 COMP	0.00%
Dai	2.61%	0.0001 DAI	0.00%
Ether	0.13%	0.2009 ETH	0.00%
ChainLink Token	0.51%	0 LINK	0.00%

# Decentralized Finance

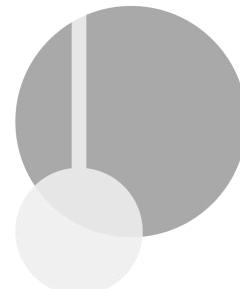
## Kyber

The Kyber Yield dashboard displays the Rainmaker Liquidity Mining Program. It shows a total of \$1.81 available for staking. The main section highlights the Rainmaker Liquidity Mining Program, which allows users to stake their DMM Liquidity Provider tokens to earn token rewards. The program has a total reward of 0 KNC and \$0 available. The end date is 100855 blocks (~16d 13hr 1m). Below this, there is a table of liquidity pools:

POOLS (AMP)	STAKED TVL	APR	MY REWARDS	MY DEPOSIT
USDC - USDT (AMP = 200)	\$110,396,302	16.63%	0 KNC	\$0
ETH - USDT (AMP = 1.5)	\$65,705,582	34.03%	0 KNC	\$0
WSTC - USDT (AMP = 1.5)	\$50,791,095	37.20%	0 KNC	\$0
WSTC - ETH (AMP = 2)	\$78,397,558	25.22%	0 KNC	\$0
ETH - KNC (AMP = 1.5)	\$29,490,397	64.43%	0 KNC	\$0

## Uniswap

The Uniswap Swap interface shows a transaction attempt to swap ETH for DAI. The user has 0.2 ETH in their account. They are attempting to swap 1 ETH for 3375.9 DAI. The transaction fails with the message "Insufficient ETH balance".



# Decentralized Finance



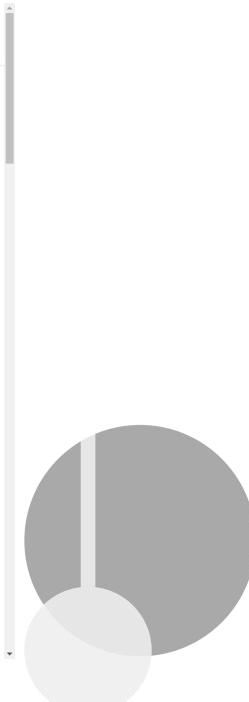
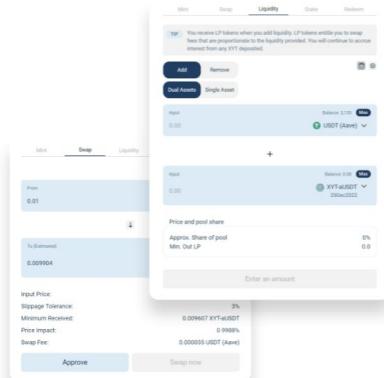
# P E N D L E

Docs M 📺 Twitter GitHub App

## Liberating Future Yield.

Trade and hedge future income.  
Do more with your yield today.

[App](#) [Learn More](#)





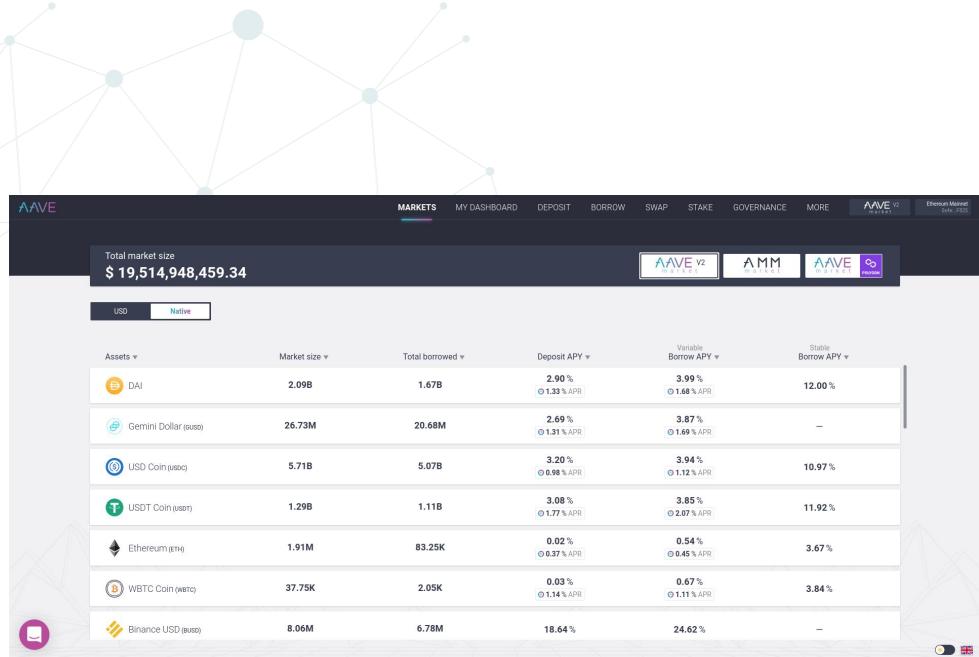
P E N D L E

*...shameless plug to make my  
benevolent overlords happy*

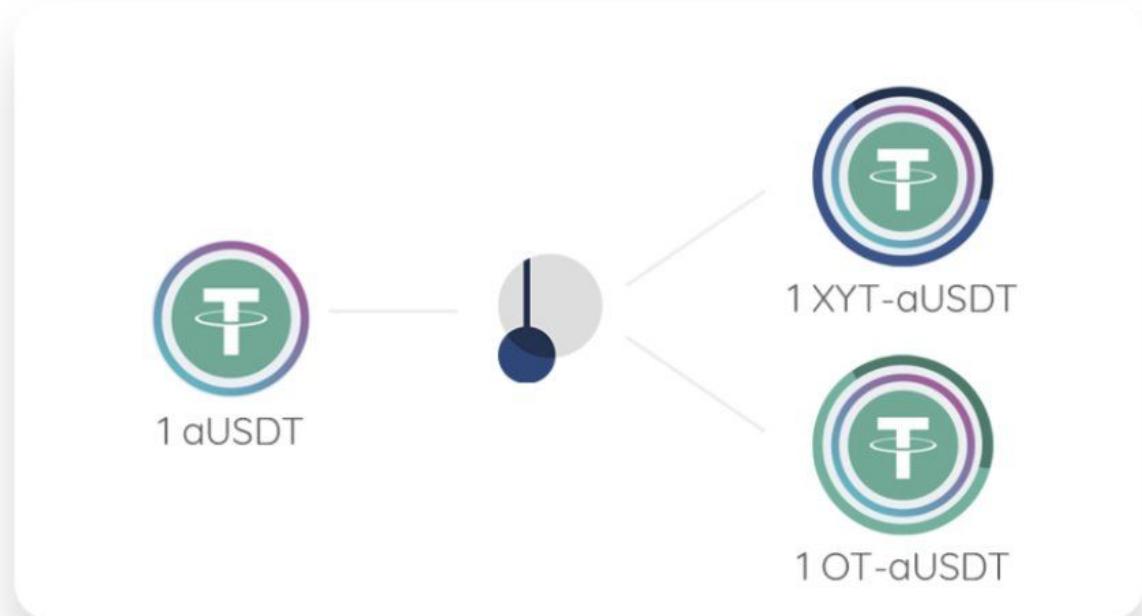
# How Pendle works

AAVE		MARKETS	MY DASHBOARD	DEPOSIT	BORROW	SWAP	STAKE	GOVERNANCE	MORE	AAVE V2 market	Ethereum Mainnet 0x4e...F825
Total market size						AAVE V2 market			AMM market		AAVE market 
USD	Native										
Assets ▾	Market size ▾	Total borrowed ▾	Deposit APY ▾	Variable Borrow APY ▾	Stable Borrow APY ▾						
 DAI	<b>2.09B</b>	<b>1.67B</b>	<b>2.90 %</b> 1.33 % APR	<b>3.99 %</b> 1.68 % APR	<b>12.00 %</b>						
 Gemini Dollar (GUSD)	<b>26.73M</b>	<b>20.68M</b>	<b>2.69 %</b> 1.31 % APR	<b>3.87 %</b> 1.69 % APR	<b>—</b>						
 USD Coin (usdc)	<b>5.71B</b>	<b>5.07B</b>	<b>3.20 %</b> 0.98 % APR	<b>3.94 %</b> 1.12 % APR	<b>10.97 %</b>						
 USDT Coin (usdt)	<b>1.29B</b>	<b>1.11B</b>	<b>3.08 %</b> 1.77 % APR	<b>3.85 %</b> 2.07 % APR	<b>11.92 %</b>						
 Ethereum (ETH)	<b>1.91M</b>	<b>83.25K</b>	<b>0.02 %</b> 0.37 % APR	<b>0.54 %</b> 0.45 % APR	<b>3.67 %</b>						
 WBTC Coin (wbtc)	<b>37.75K</b>	<b>2.05K</b>	<b>0.03 %</b> 1.14 % APR	<b>0.67 %</b> 1.11 % APR	<b>3.84 %</b>						
 Binance USD (busd)	<b>8.06M</b>	<b>6.78M</b>	<b>18.64 %</b>	<b>24.62 %</b>	<b>—</b>						

# How Pendle works



# How Pendle works



# How Pendle works

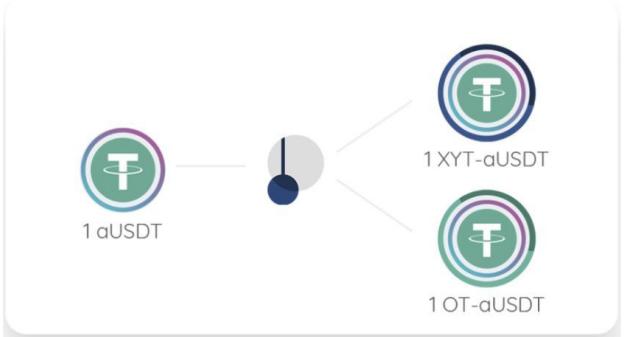
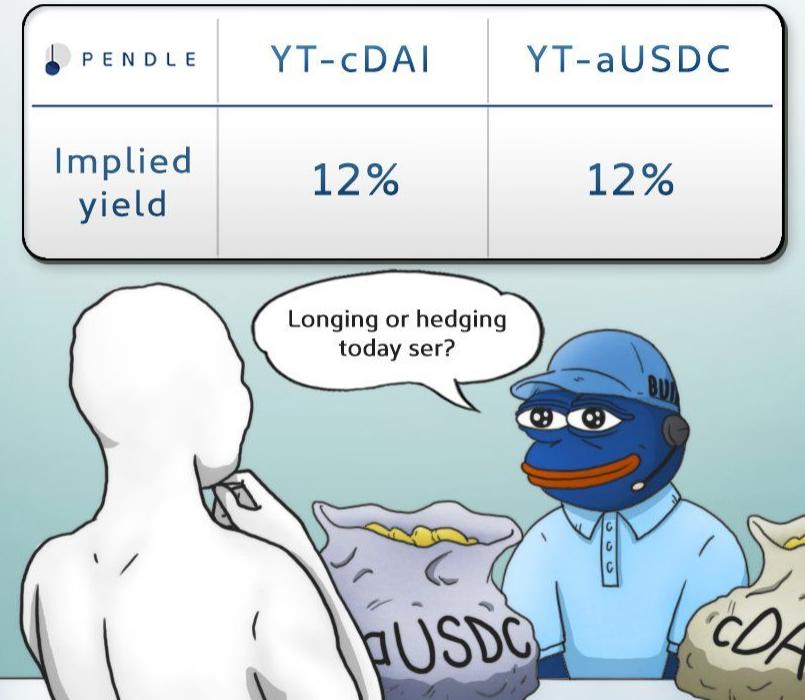
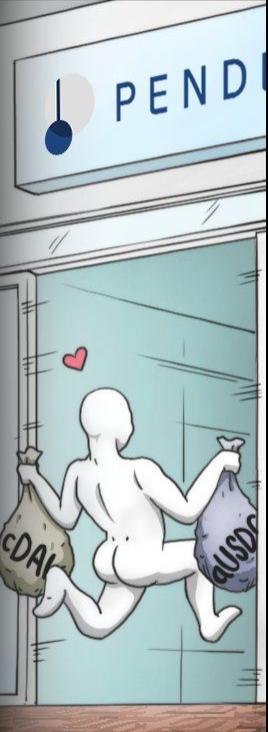
```
function tokenizeYield(
    bytes32 _forgeId,
    address _underlyingAsset,
    uint256 _expiry,
    uint256 _amountToTokenize,
    address _to
)
public
override
nonReentrant
returns (
    address ot,
    address xyt,
    uint256 amountTokenMinted
)
{
    require(data.isValidXYT(_forgeId, _underlyingAsset, _expiry), "INVALID_YT");
    require(block.timestamp < _expiry, "YIELD_CONTRACT_EXPIRED");
    require(_to != address(0), "ZERO_ADDRESS");
    require(_amountToTokenize != 0, "ZERO_AMOUNT");

    IPendleForge forge = IPendleForge(data.getForgeAddress(_forgeId));

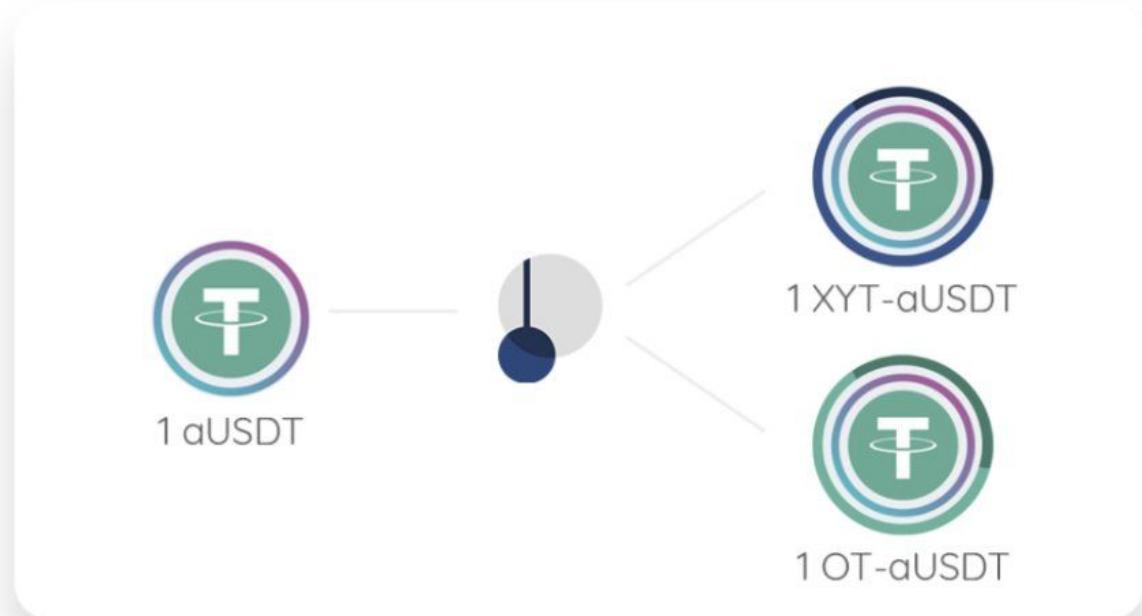
    IERC20 yieldToken = IERC20(forge.getYieldBearingToken(_underlyingAsset));

    yieldToken.safeTransferFrom(
        msg.sender,
        forge.yieldTokenHolders(_underlyingAsset, _expiry),
        _amountToTokenize
    );

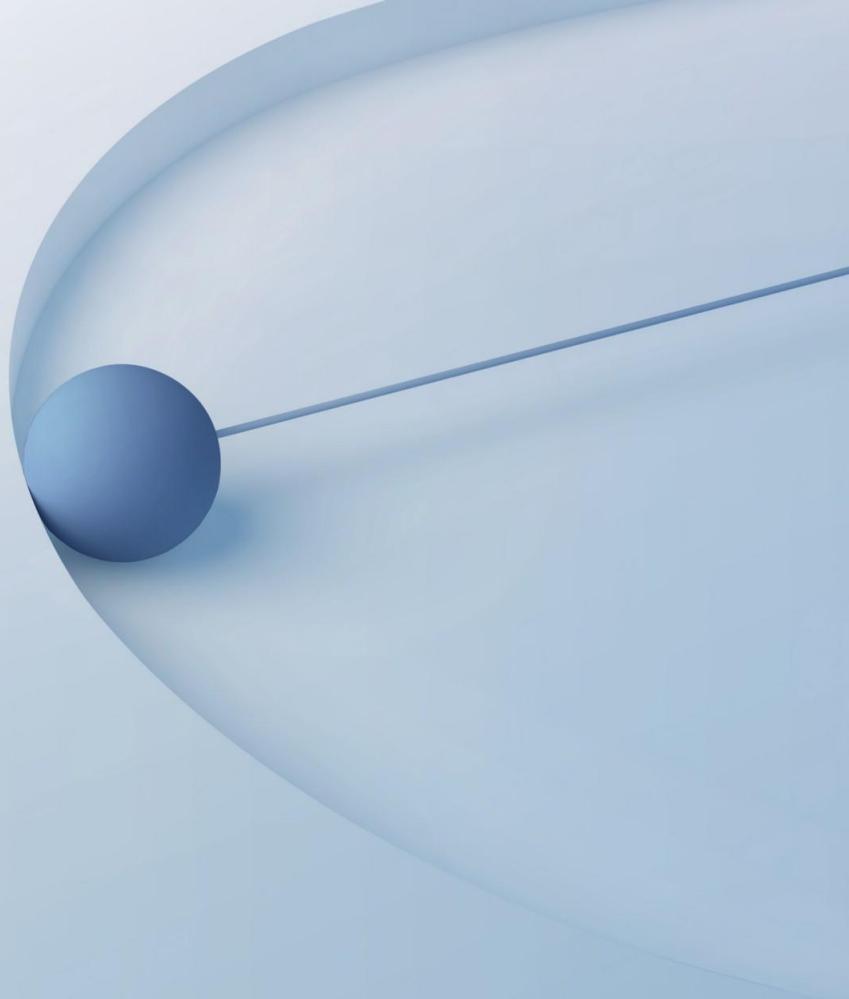
    // mint OT&XYT for users
    (ot, xyt, amountTokenMinted) = forge.mintOtAndXyt(
        _underlyingAsset,
        _expiry,
        _amountToTokenize,
        _to
    );
}
```



# How Pendle works



# **Non-fungible Tokens**



Search items, collections, and accounts

Marketplace

Stats

Resources

Create



## Filter



1,001 results

All items

Sort by



## Status



Buy Now

On Auction

New

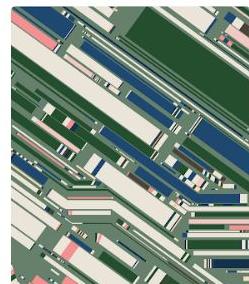
Has Offers

## Price

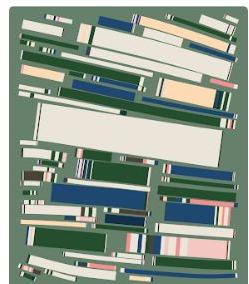
United States Dollar (USD) Min  to  Max

Apply

## Collections

All Fidenzas 

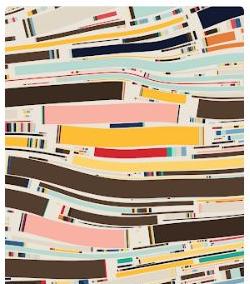
Art Blocks Curated Fidenza #573  
Price 300  
3 days left



Art Blocks Curated Fidenza #91  
Price 199.69  
3 days left



Art Blocks Curated Fidenza #369  
Price 220  
Last 0.3456



Art Blocks Curated Fidenza #473  
Price 167.5  
Last 135



Art Blocks Curated Fidenza #647  
Price 291  
Offer for 150,000



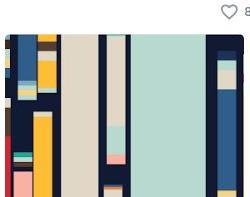
11



12



8



8



26

## On Sale In



## 27-Bit Digital





Dashboard

Marketplace

Login

Last 24h

7 days

30 days

TOTAL SALE  
56,762TOTAL VOLUME  
Ξ 4,875 \$16.38MAXIE SOLD  
56,697

## Recently listed

Axes	Lands	Items	Bundles	
	#23585580	37 50 31 46		Ξ 0.07 \$235.49 a few seconds ago
	#2369566	59 32 31 42		Ξ 0.12 \$403.70 a few seconds ago
	#5900073	61 31 31 41		Ξ 0.09 \$302.78 a few seconds ago
	#2572381	45 57 35 27		Ξ 0.149 \$501.26 a few seconds ago
	#1382964	49 51 35 29		Ξ 0.115 \$388.23 a few seconds ago
	#5536025	45 57 35 27		Ξ 0.076 \$255.68 a few seconds ago
				Ξ 0.088

## Recently sold

Axes	Lands	Items	Bundles	
	#5358754			BUYER Axie Scholar Ken J... (0x4c9...5a0e4c) SELLER ALONZO (0xb6...e858ee) Ξ 0.086 \$289.32 a minute ago
	#5761982			BUYER Social Ape (0x39d...f8d443) SELLER Juanjuan1 (0xaa7...f2363f) Ξ 0.054 \$182.90 a minute ago
	#5199350			BUYER Modified (0x5a0...9d48bc) SELLER Plant Master leaf (0xc11...8ccbd6) Ξ 0.056 \$187.67 2 minutes ago
	#3228641			BUYER Ardan #1582393 (0x308...iae6f8) SELLER Fardan   RFG (0x9b...e72ae6) Ξ 0.055 \$185.03 2 minutes ago
	#5711309			BUYER IKGP (0x785...ba4f97) SELLER Lunacian #2575672 (0x130...e45fd1) Ξ 0.055 \$185.95 2 minutes ago
	#5761409			BUYER Lunacian #1902195 (0x881...a956ec) SELLER Juraxiec Park (0xe61...799ec6) Ξ 0.046 \$154.56 2 minutes ago
				Ξ 0.057



# ERC721

```
interface IERC721 {
    event Transfer(address indexed from, address indexed to, uint256 indexed tokenId);

    event Approval(address indexed owner, address indexed approved, uint256 indexed tokenId);

    event ApprovalForAll(address indexed owner, address indexed operator, bool approved);

    function name() external view returns (string _name);

    function symbol() external view returns (string _symbol);

    function tokenURI(uint256 _tokenId) external view returns (string);

    function balanceOf(address owner) external view returns (uint256 balance);

    function ownerOf(uint256 tokenId) external view returns (address owner);

    function safeTransferFrom(
        address from,
        address to,
        uint256 tokenId
    ) external;

    function transferFrom(
        address from,
        address to,
        uint256 tokenId
    ) external;

    function approve(address to, uint256 tokenId) external;

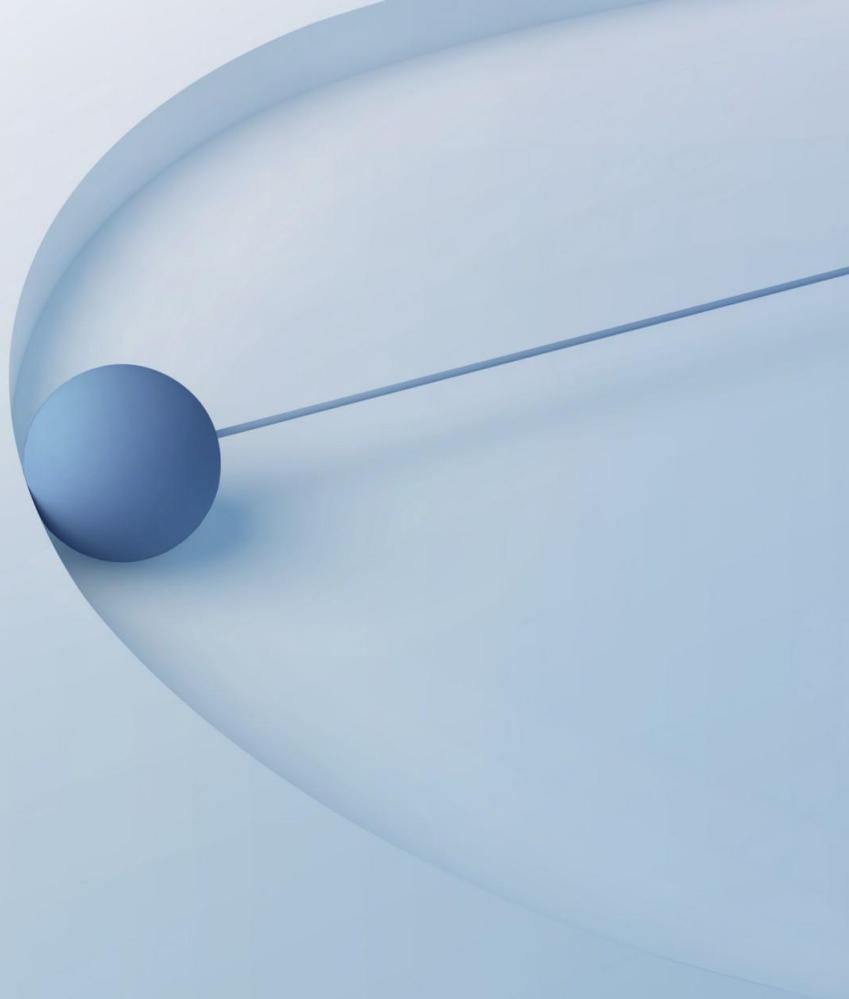
    function getApproved(uint256 tokenId) external view returns (address operator);

    function setApprovalForAll(address operator, bool _approved) external;

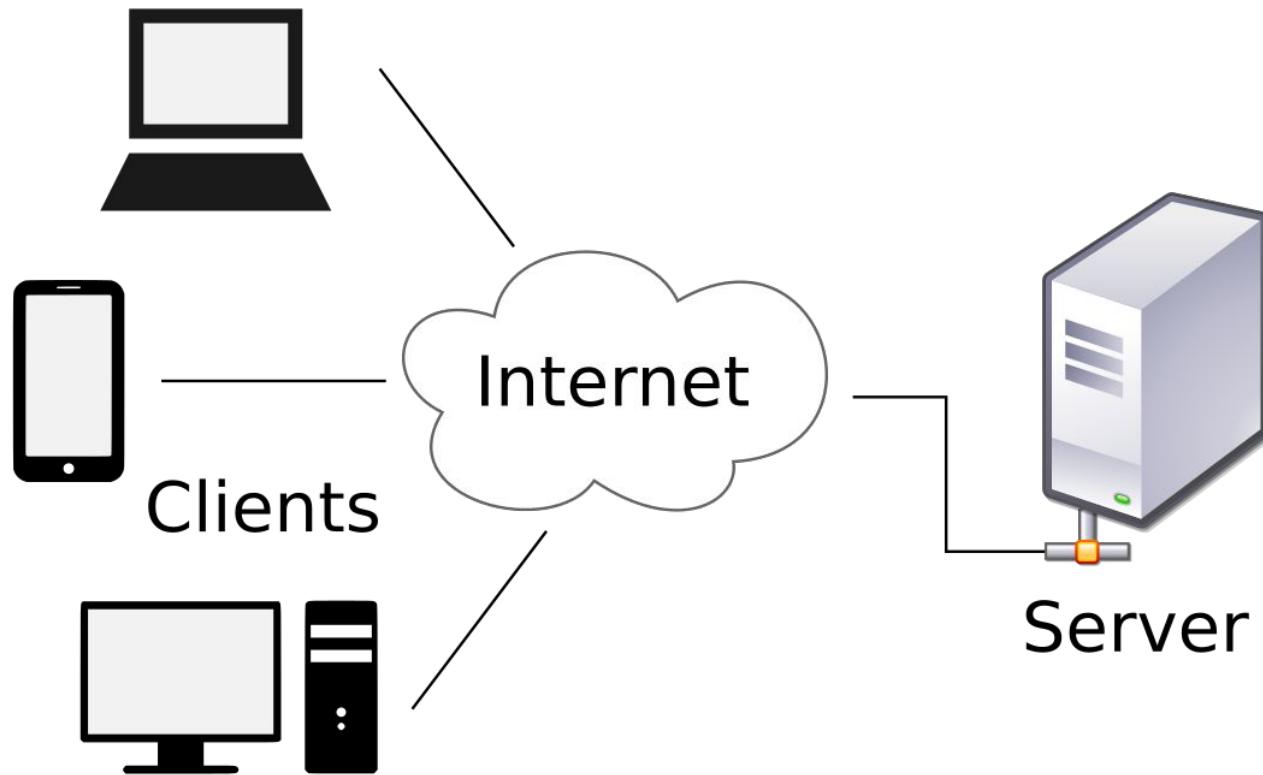
    function isApprovedForAll(address owner, address operator) external view returns (bool);

    function safeTransferFrom(
        address from,
        address to,
        uint256 tokenId,
        bytes calldata data
    ) external;
}
```

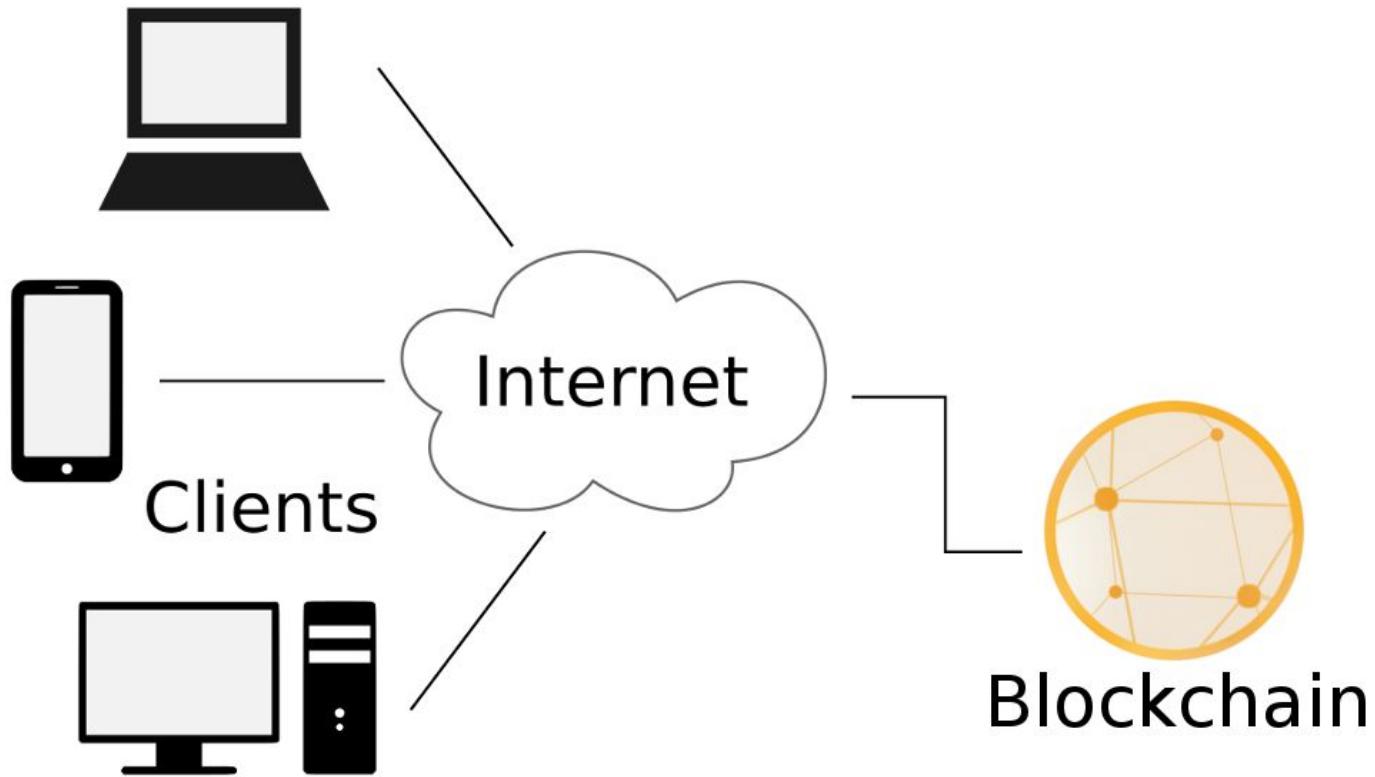
# DApp Architecture



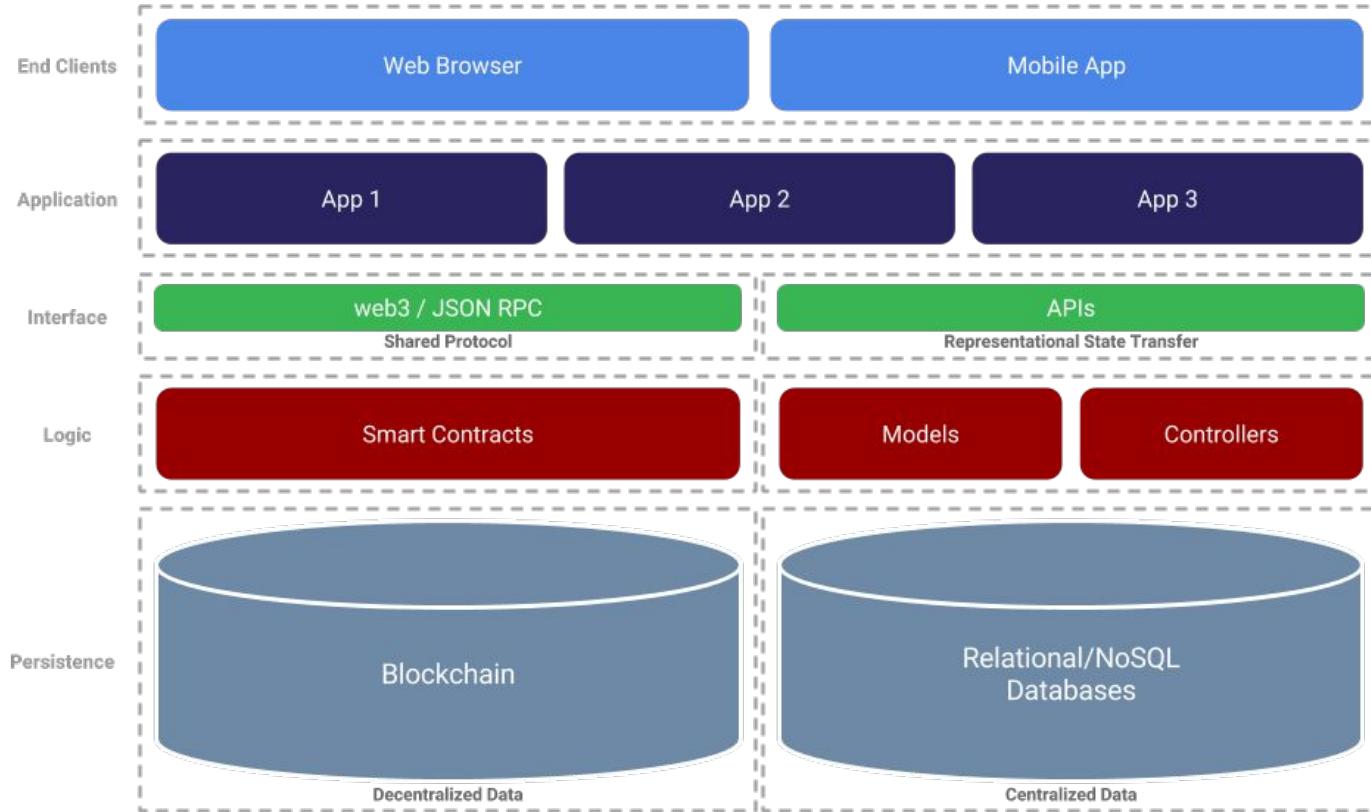
# Client-Server Architecture



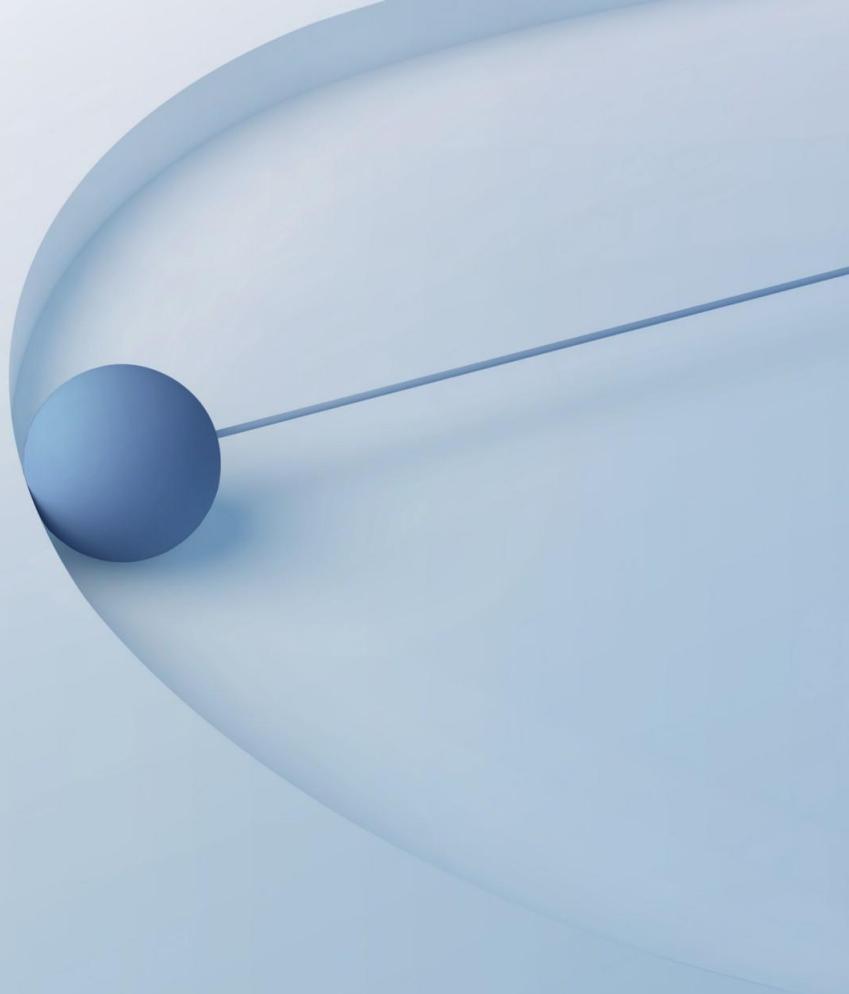
# Client-Blockchain Architecture



# (De)-centralization Stack



# Crypto Ecosystem



# Exchange



Matcha



paraswap



UNISWAP



1inch



Kyber Swap



DODO



HEGIC



TOTLE



OpenSea



SWERVE



Rarible



liquidity



DeversFi



WBTC.Cafe



Dolomite



DEX.AG



DDEX

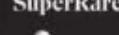


AIRSWAP



Curve

SuperRare



atomex



MyCrypto



FURUCOMB



Huobi Wallet



Centrifuge



CARBON



Fabr(x)



bZx



blocknative



HARBOR



Groundhog



TOKENLON



IDEX



deltaY/deltaX



Oasis



Jelly Swap



dex.blue



Harvest



FinNexus



mSTABLE



Idle



opyn



PieDAO



SYNTHETIX



yearn.finance



swap.rate



SynLev



fulcrum



airswap



TOKEN POCKET



ZenGo



ZERION



alchemy



8x



Set



Chainlink



dfuse



UMA



Ren



LoanScan



Dune Analytics



DeFi Explore



Bloxy



TokenTerminal



Croco Finance



infinito wallet

## Asset Management Tools



METAMASK

DeBank  
Your DeFi Wallet

nansen



DEFI PULSE



chainbeat



Zapper.fi



Pools



Ren



LoanScan



wyre



PayTrie



Request



Ramp



Provable



MoonPay



kyber network



SECURITIZE



hummingbot



connect



hydro

## Infrastructure & Dev Tooling



zkSync



StablePay



Matic



OMG NETWORK



Ampleforth



GEMINI dollar



NEUFUND



DIGIX



POLYMATHE



WBTC



PAXOS



connect



hydro



infinito wallet



imToken



InstaDApp



MULTIS



blocknative



TrueUSD



USD Coin



openfinance



HARBOR



Groundhog



Matcha



paraswap



UNISWAP



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alchemy



8x



Set



Chainlink



dfuse



UMA



Ren



LoanScan

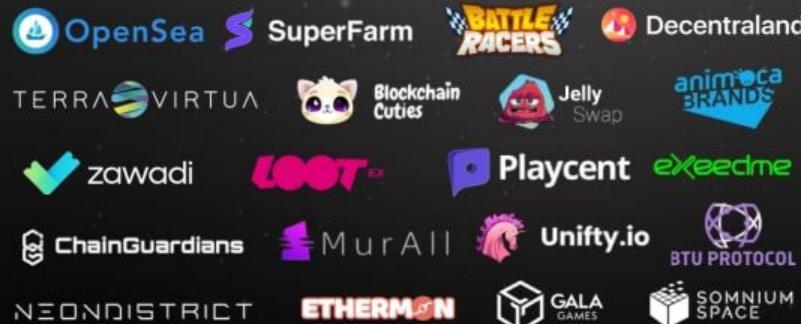


Dune Analytics



# polygon ECOSYSTEM

## NFT + Gaming



## Wallets



## Oracles



## DAO



## B2B



## DeFi



## DEV Tooling



# DEFI+NFT LANDSCAPE

Dec.09 2020

## DEFI

### WALLETS

Binance Chain Wallet

BitKeep

MathWallet

MyEtherWallet

ONTO Wallet

SafePal

Trust Wallet

TokenPocket

### STABLECOINS

BUSD

PAX

QIAN

VAI (Venus Stablecoin)

### INFRASTRUCTURE

ANKR

Band Protocol

BSCscan

ChainLink

Gas Station Network

MyWish

Snapshot

### BTC

anyBTC

Binance BTC

renBTC

### DERIVATIVES

Hedget

Mettalax

### EXCHANGE & LIQUIDITY

BakerySwap

Bounce.Finance

bStable.finance

BurgerSwap

DODO

Equator.Finance

PancakeSwap

Spartan Protocol

StableXSwap

Thugs.Fi

UniFi

Unisave

### KYC & IDENTITY

Ontology

### CREDIT & LENDING

7up.Finance

Cream.finance

ForTube

Venus

CokeFinance

### EARN & AGGREGATORS

BeefyFinance

Defi.money (YFI)

Dego

dForce

fry.World

OpenOcean

Xend Finance

### ANALYTICS

BitQuery

CoinMarketCap

DefiStation

DappRadar

PARSIQ

### CROSS CHAIN

Anyswap

Binance Bridge

NerveNetwork

renVM

### INSURANCE

Certik

### PAYMENT

SWFT

## NFT & GAMES

### WALLETS

BitKeep

Mathwallet

SafePal

TokenPocket

### DEFI NFT

BakerySwap

Bounce

Dego

NFT For Good

Pancakeswap

Thugs.Fi

### GAMES

BambooSwap

Blink

RocketGame

### MARKETPLACE

BCA

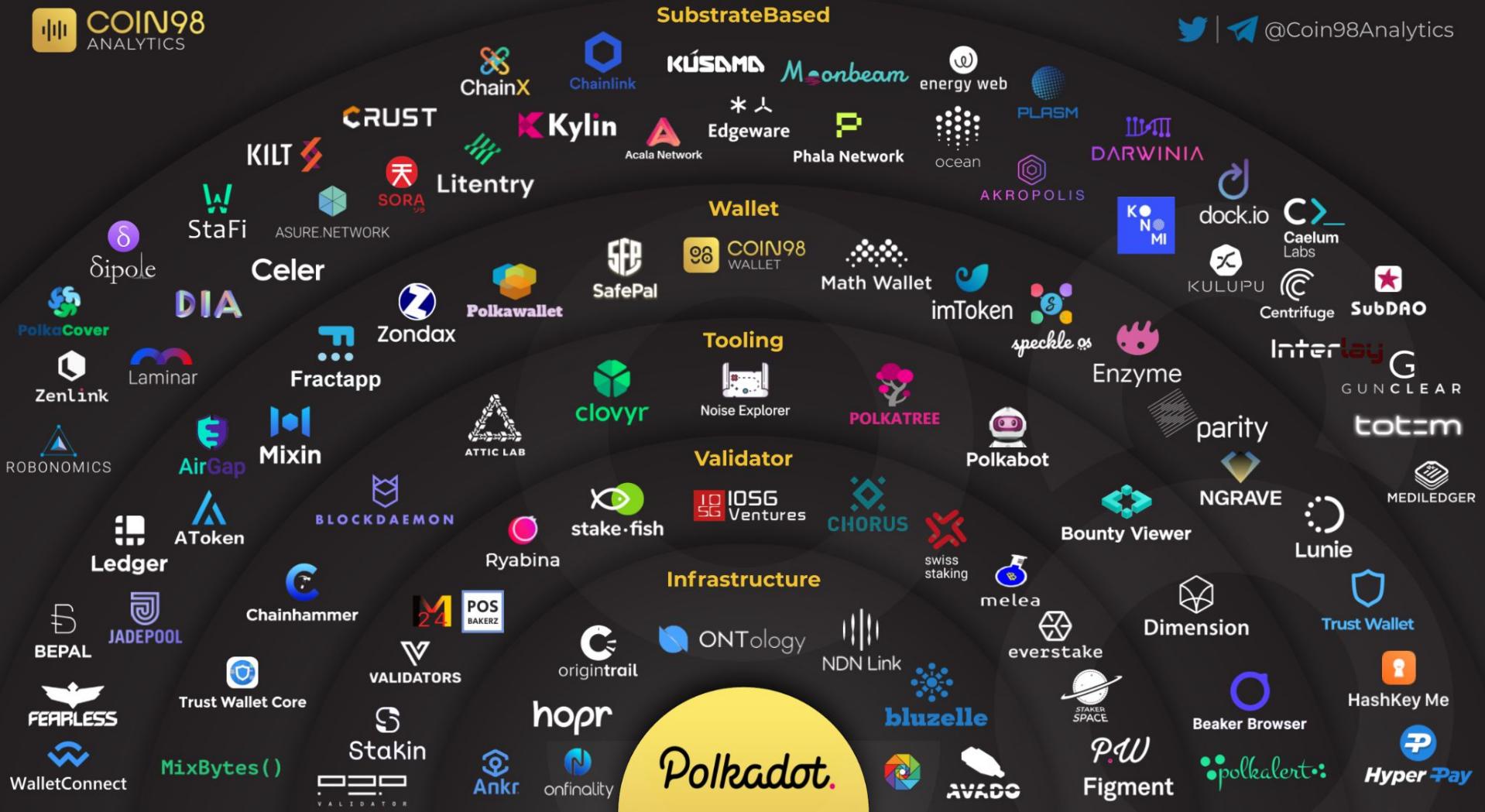
Lootex

### COLLECTIBLES

Alpaca City



**BINANCE  
SMART CHAIN**



# CRYPTO ECOSYSTEM

## Exchange



## Wallet



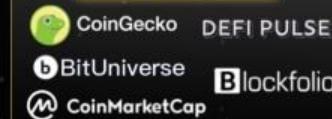
## Blockchain Platform



## Stablecoin



## Tooling



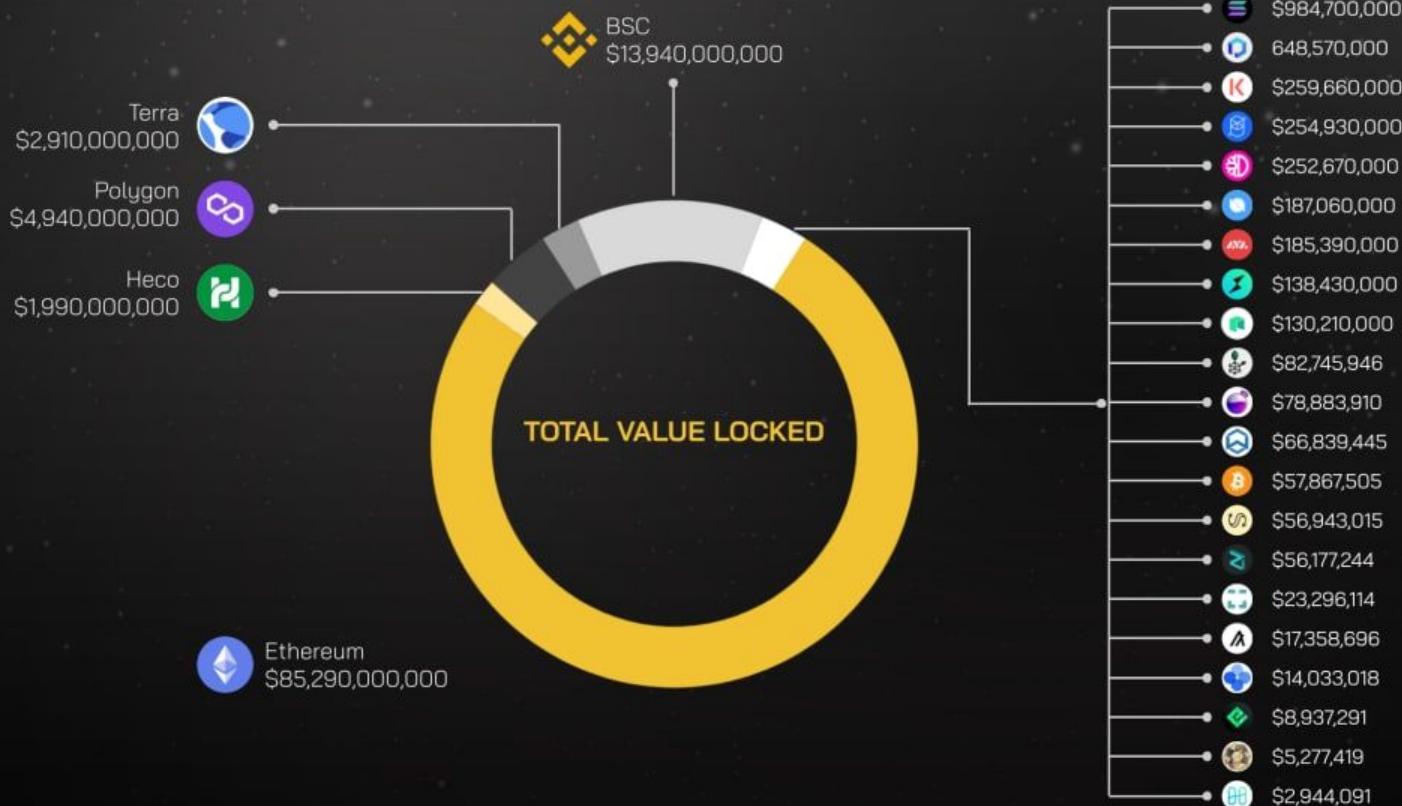
## DeFi



## Gaming + NFT



# TVL ON MULTIPLE BLOCKCHAINS OVERVIEW



A bright, curved light trail, resembling a comet's path or a meteor's streak, arches across the upper portion of the image. It is composed of a thick, glowing yellow-orange line that tapers at both ends, set against a dark, speckled background of numerous small stars.

Thank You