Cyberscope

Audit Report

Escrow

February 2023

SHA256 50f0af1a7b43e8facd9f2bf7508504ba78e16a1d375397deccebeec59d591cea

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Review

Contract Name	Escrow
Testing Deploy	https://testnet.bscscan.com/address/0x4305a395fc684e8048c3cd536071a1e29680edf0

Audit Updates

Initial Audit	13 Feb 2023

Source Files

Filename	SHA256
@chainlink/contracts/src/v0.8/interfaces/AggregatorV3Interface.sol	ab7e1f18f36b72e9ab184eb33933d4aa1b5de3f1ca359b56fc6cfabccad952d1
@openzeppelin/contracts/token/ERC20/extensions/IERC20Metadata.sol	af5c8a77965cc82c33b7ff844deb9826166689e55dc037a7f2f790d057811990
@openzeppelin/contracts/token/ERC20/IERC20.sol	94f23e4af51a18c2269b355b8c7cf4db8003d075c9c541019eb8dcf4122864d5
contracts/Escrow.sol	50f0af1a7b43e8facd9f2bf7508504ba78e16a1d375397deccebeec59d591cea

Introduction

The Escrow contract implements an escrow mechanism, which presents three distinct categories for escrow items: product, service, and crypto trade.

Escrow Items

Service and Product

The product and service items are similar, with the only difference being that the service item has a specified delivery duration. Only the buyer can request an escrow service for either items, and only the owner and a manager can resolve any conflicts that arise to ensure the completion of the service.

For the service and product categories to operate properly, they must follow to the same procedures.

1. The buyer has to create a trade.
2. The seller has to deliver the product.
3. The buyer has to check the product and then release the fund.

Product/Service States

The escrow categories consist of three states.

- AWAITING_DELIVERY
- AWAITING_FUND_RELEASE
- COMPLETE

Crypto Trade

The crypto trade category places a crypto asset for trade. A crypto trade has to follow two steps.

1. The token owner has to create the crypto trade.
2. Any buyer can buy the corresponding crypto trade in order to be completed.

Roles

The contract consists of the owner and the manager roles.

The `Owner` role has the authority to

- Set taxes.
- Grant or revoke the manager role.
- Manages ban addressed.
- Resolve an item appeal.

The `Manager` role has the authority to

- Resolve an item appeal

Diagnostics

Critical Medium Minor / Informative

Severity	Code	Description	Status
Critical	RAV	Reentrancy Attack Vulnerability	Unresolved
Medium	PTAI	Potential Transfer Amount Inconsistency	Unresolved
Minor / Informative	WFD	Wrong Function Description	Unresolved
Minor / Informative	DDS	Dublicate Data Structure	Unresolved
Minor / Informative	CO	Code Optimization	Unresolved
Minor / Informative	CR	Code Repetition	Unresolved
Minor / Informative	AAO	Accumulated Amount Overflow	Unresolved
Minor / Informative	TUU	Time Units Usage	Unresolved
Minor / Informative	DDP	Decimal Division Precision	Unresolved
Minor / Informative	BA	Ban Addresses	Unresolved
Minor / Informative	L18	Multiple Pragma Directives	Unresolved
Minor / Informative	L02	State Variables could be Declared Constant	Unresolved
Minor / Informative	L04	Conformance to Solidity Naming Conventions	Unresolved

●	L07	Missing Events Arithmetic	Unresolved
●	L14	Uninitialized Variables in Local Scope	Unresolved
●	L19	Stable Compiler Version	Unresolved
●	L20	Succeeded Transfer Check	Unresolved

RAV - Reentrancy Attack Vulnerability

Criticality	Critical
Location	contracts/Escrow.sol#L207,340
Status	Unresolved

Description

The contract is vulnerable to a reentrancy attack, which can occur if a buyer initiates a trade using a contract address as the seller or by initiating a crypto trade from a contract. For instance,

1. A buyer creates an escrow request with a contract address as the seller's address.
2. An appeal occurs and the seller wins or the escrow service is successfully completed and waiting for release.
3. Then the seller will execute the functions `releaseFunds` or `withdrawFunds`, both of which internally call the `(seller).transfer(payAmount)` method.
4. A reentrance attack will occur if the seller implements a receive callback, they will have the ability to execute either the `releaseFunds` or the `withdrawFunds` method again within the same execution thread.

```
function releaseFunds(uint256 tradeId, uint256 category) external {
    require(category == 0 || category == 1, "invalid category value");
    if (category == 0) {
        ProductItem storage product = productTrades[tradeId];
        require(product.buyer == msg.sender, "You are not the buyer of
this trade");
        require(product.currentState == STATE.AWAITING_FUND_RELEASE,
"Invalid state");

        uint256 payAmount = payTax(product.price, true);
        (product.seller).transfer(payAmount);

        product.currentState = STATE.COMPLETE;
        product.fundsWithdrawn = true;
    } else {
        ServiceItem storage service = serviceTrades[tradeId];
        require(service.buyer == msg.sender, "You are not the buyer of
this trade");
        require(service.currentState == STATE.AWAITING_FUND_RELEASE,
"Invalid state");

        uint256 payAmount = payTax(service.price, true);
        (service.seller).transfer(payAmount);

        service.currentState = STATE.COMPLETE;
        service.fundsWithdrawn = true;
    }

    emit FundReleased(tradeId, category);
}


function buyCrypto (uint256 cryptoTradeId) external payable{
    CryptoItem storage cryptoProduct = cryptoTrades[cryptoTradeId];
    require(msg.value >= cryptoProduct.price, "Not enough paid");
    require(!cryptoProduct.completed, "Already completed");

    // tax policy
    (cryptoProduct.seller).transfer(cryptoProduct.price);
```

Recommendation

The contract could incorporate a mutex pattern modifier or disallow the use of contract addresses as the seller address.

PTAI - Potential Transfer Amount Inconsistency

Criticality	Medium
Location	contracts/Escrow.sol#L385
Status	Unresolved

Description

The `transfer()` and `transferFrom()` functions are used to transfer a specified amount of tokens to an address. The fee or tax is an amount that is charged to the sender of an ERC20 token when tokens are transferred to another address. According to the specification, the transferred amount could potentially be less than the expected amount. This may produce inconsistency between the expected and the actual behavior.

The following example depicts the diversion between the expected and actual amount.

Tax	Amount	Expected	Actual
No Tax	100	100	100
10% Tax	100	100	90

If a diversion occurs on the deposited amount the user will buy fewer tokens than the predefined crypto trade amount.

```
token.transferFrom(msg.sender, address(this), _amount);
```

Recommendation

The team is advised to take into consideration the actual amount that has been transferred instead of the expected.

It is important to note that an ERC20 transfer tax is not a standard feature of the ERC20 specification, and it is not universally implemented by all ERC20 contracts.

Therefore, the contract could produce the actual amount by calculating the difference between the transfer call.

```
Actual Transferred Amount = Balance After Transfer - Balance Before Transfer
```

WFD - Wrong Function Description

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L320
Status	Unresolved

Description

The function's `getFundsBack` description in the contract is incorrect, which may cause confusion and hinder the understanding of the contract's intended functionality. The description states that the seller withdraw funds, but the buyer withdraw the funds instead.

```
/**
* @dev The seller tries to withdraw funds
* @param tradeId Id of the trade in which the buyer and seller agreed
for the trade
*/
function getFundsBack(uint256 tradeId) external
```

Recommendation

It is recommended that the contract's function descriptions be thoroughly reviewed and corrected to accurately reflect the intended functionality. This can improve the contract's usability and reduce the potential for misunderstandings and errors.

DDS - Duplicate Data Structure

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L10,25
Status	Unresolved

Description

The contract utilized two data structures `ProductItem` and `ServiceItem` to illustrate almost the same information.

```
struct ProductItem
{
    string chatRoomNumber;
    string productName;
    string productLink;
    address payable buyer;
    address payable seller;
    uint256 price;
    STATE currentState;
    uint256 createTime;
    uint256 deliverTime;
    bool fundsWithdrawn;
    bool appeal;
}

struct ServiceItem
{
    string chatRoomNumber;
    string serviceName;
    string serviceLink;
    address payable buyer;
    address payable seller;
    uint256 price;
    STATE currentState;
    uint256 createTime;
    uint256 duration;
    uint256 deliverTime;
    bool fundsWithdrawn;
    bool appeal;
}
```

Recommendation

The team is advised to merge the two data structures. That way it will enhance the efficiency, readability, and performance of the source code, while also decreasing the cost of executing it.

CO - Code Optimization

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L393
Status	Unresolved

Description

There are code segments that could be optimized. A segment may be optimized so that it becomes a smaller size, consumes less memory, executes more rapidly, or performs fewer operations.

Since the token address is saved on the currency variable the decimals variable is redundant.

```
cryptoProduct.currency = _currencyAddress;
cryptoProduct.decimals = token.decimals();
```

Recommendation

The team is advised to take into consideration these segments and rewrite them so the runtime will be more performant. That way it will improve the efficiency and performance of the source code and reduce the cost of executing it. It is recommended to avoid duplicating data that is already accessible from existing sources.

CR - Code Repetition

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L140,180,207,255,280
Status	Unresolved

Description

The contract contains repetitive code segments. The contract duplicates the same code segment for the two data structures `ServiceItem` and `ProductItem`. There are potential issues that can arise when using code segments in Solidity. Some of them can lead to issues like gas efficiency, complexity, readability, security, and maintainability of the source code. It is generally a good idea to try to minimize code repetition where possible.

```
function createNewTrade (string memory _chatRoomNumber, string memory
_productName, uint256 _price, address _seller, uint256 _duration,
uint256 category) external payable

function deliverProduct(uint256 tradeId, string memory _productLink,
uint256 category) external

function releaseFunds(uint256 tradeId, uint256 category) external

function appeal(uint256 tradeId, uint256 category) external

function resolveAppeal(uint256 tradeId, bool buyerWin, uint256
category) external onlyManager
```

Recommendation

The team is advised to avoid repeating the same code in multiple places, which can make the contract easier to read and maintain. The authors could try to reuse code wherever possible, as this can help to reduce the complexity and size of the contract. For instance, the contract could merge the two data structures in order to avoid repeating the same code in multiple places.

AAO - Accumulated Amount Overflow

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L64,65,66
Status	Unresolved

Description

The contract is using the variable `currentProductTradeId`, `currentServiceTradeId` and `currentCryptoTradeId` to accumulate values. The contract could lead to an overflow when the total value of a variable exceeds the maximum value that can be stored in that variable's data type. This can happen when an accumulated value is updated repeatedly over time, and the value grows beyond the maximum value that can be represented by the data type.

```
uint256 public currentProductTradeId;
uint256 public currentServiceTradeId;
uint256 public currentCryptoTradeId;
```

Recommendation

The team is advised to carefully investigate the usage of the variables that accumulate value. A suggestion is to add checks to the code to ensure that the value of a variable does not exceed the maximum value that can be stored in its data type.

TUU - Time Units Usage

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L167
Status	Unresolved

Description

The contract is using arbitrary numbers to form time-related values. As a result, it decreases the readability of the codebase and prevents the compiler to optimize the source code.

```
service.duration = _duration * 24 * 60 * 60;
```

Recommendation

It is a good practice to use the time units reserved keywords like `seconds`, `minutes`, `hours`, `days`, `weeks` and `years` to process time-related calculations.

It's important to note that these time units are simply a shorthand notation for representing time in seconds, and do not have any effect on the actual passage of time or the execution of the contract. The time units are simply a convenience for expressing time in a more human-readable form.

DDP - Decimal Division Precision

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L234
Status	Unresolved

Description

Division of decimal (fixed point) numbers can result in rounding errors due to the way that division is implemented in Solidity. Thus, it may produce issues with precise calculations with decimal numbers.

Solidity represents decimal numbers as integers, with the decimal point implied by the number of decimal places specified in the type (e.g. decimal with 18 decimal places). When a division is performed with decimal numbers, the result is also represented as an integer, with the decimal point implied by the number of decimal places in the type. This can lead to rounding errors, as the result may not be able to be accurately represented as an integer with the specified number of decimal places.

Hence, the splitted shares will not have the exact precision and some funds may not be calculated as expected.

The tax `currentPrice * totalTax` may not be splitted as expected.

```
function payTax(uint256 price, bool success) internal returns(uint256
payAmount) {
    uint256 currentPrice = getLatestPrice();

    (teamWallet1).transfer(currentPrice * totalTax * 125 / 1000); //
12.5%
    (teamWallet2).transfer(currentPrice * totalTax * 125 / 1000); //
12.5%
    (teamWallet3).transfer(currentPrice * totalTax * 125 / 1000); //
12.5%
    (teamWallet4).transfer(currentPrice * totalTax * 20 / 100);   //
20%
    (teamWallet5).transfer(currentPrice * totalTax * 375 / 1000); //
37.5%
    (teamWallet6).transfer(currentPrice * totalTax * 5 / 100);    // 5%

    uint256 tax7;
    if (success)
        tax7 = price / 100;
    else
        tax7 = price / 200;
    payAmount = price - currentPrice * totalTax - tax7;
}
```

Recommendation

The contract could calculate the subtraction of the divided funds in the last calculation in order to avoid the division rounding issue.

BA - Ban Addresses

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L129
Status	Unresolved

Description

The contract owner has the authority to ban addresses from creating new Escrow requests. The owner can ban addresses by calling the `manageBannedAddress` function.

```
function manageBannedAddress(address illegalAddress, bool isAdd)
external onlyOwner {
    if (isAdd)
        bannedAddresses[illegalAddress] = true;
    else
        bannedAddresses[illegalAddress] = false;
}
```

Recommendation

The team should carefully manage the private keys of the owner's account. We strongly recommend a powerful security mechanism that will prevent a single user from accessing the contract admin functions. That risk can be prevented by temporarily locking the contract or renouncing ownership.

L18 - Multiple Pragma Directives

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L2 @openzeppelin/contracts/token/ERC20/IERC20.sol#L4 @openzeppelin/contracts/token/ERC20/extensions/IERC20Metadata.sol#L4 @chainlink/contracts/src/v0.8/interfaces/AggregatorV3Interface.sol#L2
Status	Unresolved

Description

If the contract includes multiple conflicting pragma directives, it may produce unexpected errors. To avoid this, it's important to include the correct pragma directive at the top of the contract and to ensure that it is the only pragma directive included in the contract.

```
pragma solidity ^0.8.0;
pragma solidity ^0.8.12;
```

Recommendation

It is important to include only one pragma directive at the top of the contract and to ensure that it accurately reflects the version of Solidity that the contract is written in.

By including all required compiler options and flags in a single pragma directive, the potential conflicts could be avoided and ensure that the contract can be compiled correctly.

L02 - State Variables could be Declared Constant

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L70,71,72,73,74,75
Status	Unresolved

Description

State variables can be declared as constant using the constant keyword. This means that the value of the state variable cannot be changed after it has been set. Additionally, the constant variables decrease gas consumption of the corresponding transaction.

```
address payable public teamWallet1 =
payable(0x4b4a0CBB2A7c971D51Ae7dE040a7a290498Df74E)
address payable public teamWallet2 =
payable(0xCb10616fDfd7a5f3e3e144Aad8e7D7821DFAb6A2)
address payable public teamWallet3 =
payable(0x936A0cA35971Fe8A48000829f952e41293ea0DC8)
address payable public teamWallet4 =
payable(0x595F21963feDbc4f5BA4A11b76359dEe916040c0)
address payable public teamWallet5 =
payable(0xd136EB70B571cEf8Db36FAd5be07cB4F76905B64)
address payable public teamWallet6 =
payable(0xd136EB70B571cEf8Db36FAd5be07cB4F76905B64)
```

Recommendation

Constant state variables can be useful when the contract wants to ensure that the value of a state variable cannot be changed by any function in the contract. This can be useful for storing values that are important to the contract's behavior, such as the contract's address or the maximum number of times a certain function can be called. The team is advised to add the constant keyword to state variables that never change.

L04 - Conformance to Solidity Naming Conventions

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L104,140,180,379
Status	Unresolved

Description

The Solidity style guide is a set of guidelines for writing clean and consistent Solidity code. Adhering to a style guide can help improve the readability and maintainability of the Solidity code, making it easier for others to understand and work with.

The followings are a few key points from the Solidity style guide:

1. Use camelCase for function and variable names, with the first letter in lowercase (e.g., myVariable, updateCounter).
2. Use PascalCase for contract, struct, and enum names, with the first letter in uppercase (e.g., MyContract, UserStruct, ErrorEnum).
3. Use uppercase for constant variables and enums (e.g., MAX_VALUE, ERROR_CODE).
4. Use indentation to improve readability and structure.
5. Use spaces between operators and after commas.
6. Use comments to explain the purpose and behavior of the code.
7. Keep lines short (around 120 characters) to improve readability.

```
uint256 _totalTax
uint256 _price
string memory _chatRoomNumber
uint256 _duration
string memory _productName
address _seller
string memory _productLink
address _currencyAddress
uint256 _amount
```

Recommendation

By following the Solidity naming convention guidelines, the codebase increased the readability, maintainability, and makes it easier to work with.

Find more information on the Solidity documentation https://docs.soliditylang.org/en/v0.8.17/style-guide.html#naming-convention.

L07 - Missing Events Arithmetic

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L105
Status	Unresolved

Description

Events are a way to record and log information about changes or actions that occur within a contract. They are often used to notify external parties or clients about events that have occurred within the contract, such as the transfer of tokens or the completion of a task.

It's important to carefully design and implement the events in a contract, and to ensure that all required events are included. It's also a good idea to test the contract to ensure that all events are being properly triggered and logged.

```
totalTax = _totalTax
```

Recommendation

By including all required events in the contract and thoroughly testing the contract's functionality, the contract ensures that it performs as intended and does not have any missing events that could cause issues with its arithmetic.

L14 - Uninitialized Variables in Local Scope

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L146,160,387
Status	Unresolved

Description

Using an uninitialized local variable can lead to unpredictable behavior and potentially cause errors in the contract. It's important to always initialize local variables with appropriate values before using them.

```
ProductItem memory product
ServiceItem memory service
CryptoItem memory cryptoProduct
```

Recommendation

By initializing local variables before using them, the contract ensures that the functions behave as expected and avoid potential issues.

L19 - Stable Compiler Version

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L2
Status	Unresolved

Description

The `^` symbol indicates that any version of Solidity that is compatible with the specified version (i.e., any version that is a higher minor or patch version) can be used to compile the contract. The version lock is a mechanism that allows the author to specify a minimum version of the Solidity compiler that must be used to compile the contract code. This is useful because it ensures that the contract will be compiled using a version of the compiler that is known to be compatible with the code.

```
pragma solidity ^0.8.12;
```

Recommendation

The team is advised to lock the pragma to ensure the stability of the codebase. The locked pragma version ensures that the contract will not be deployed with an unexpected version. An unexpected version may produce vulnerabilities and undiscovered bugs. The compiler should be configured to the lowest version that provides all the required functionality for the codebase. As a result, the project will be compiled in a well-tested LTS (Long Term Support) environment.

L20 - Succeeded Transfer Check

Criticality	Minor / Informative
Location	contracts/Escrow.sol#L385,412
Status	Unresolved

Description

According to the ERC20 specification, the transfer methods should be checked if the result is successful. Otherwise, the contract may wrongly assume that the transfer has been established.

```
token.transferFrom(msg.sender, address(this), _amount)
token.transfer(msg.sender, cryptoProduct.amount)
```

Recommendation

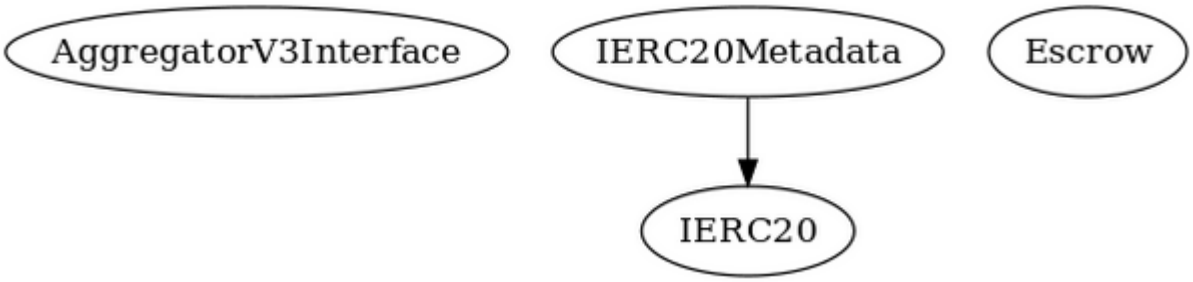
The contract should check if the result of the transfer methods is successful. The team is advised to check the SafeERC20 library from the Openzeppelin library.

Functions Analysis

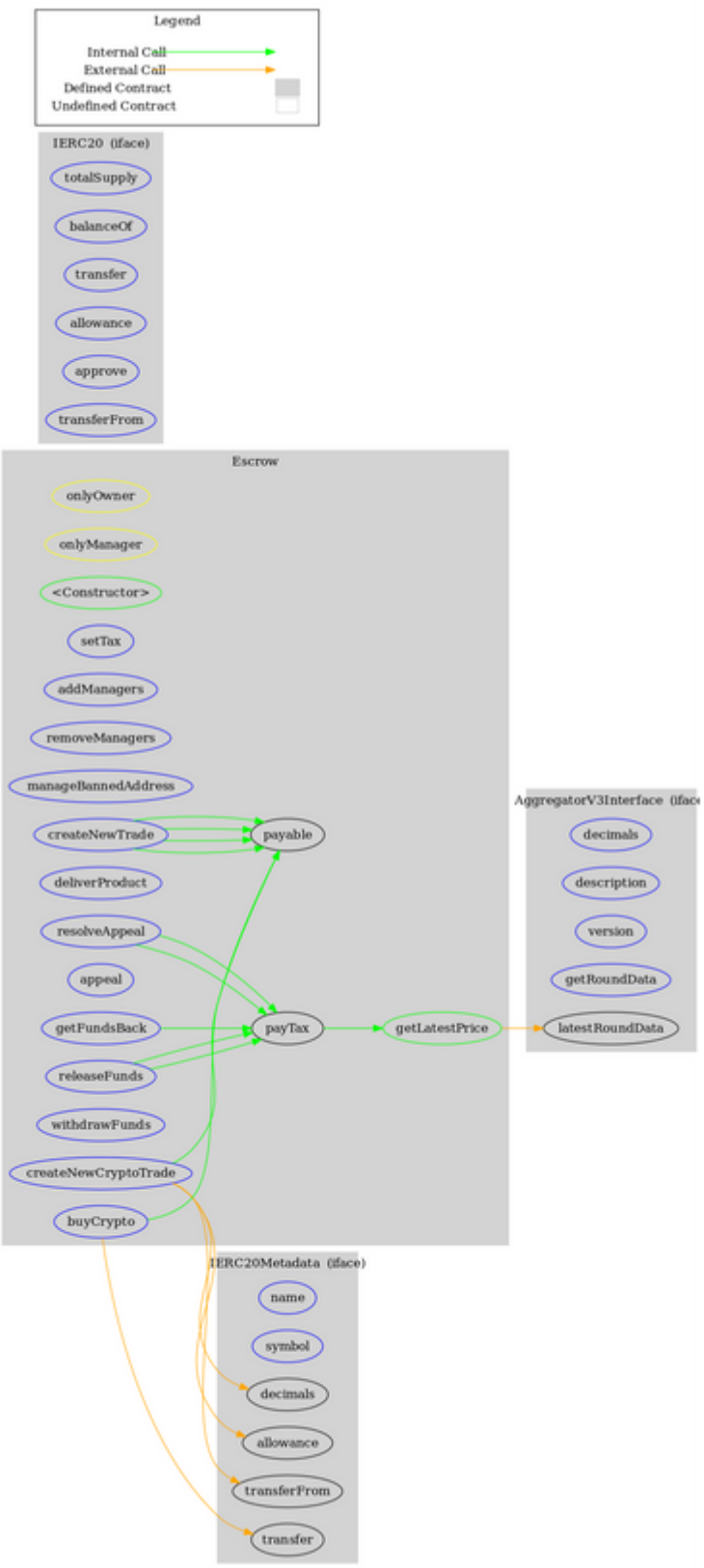
Contract	Type	Bases		
	Function Name	**Visibility**	**Mutability**	**Modifiers**
AggregatorV3Interface	Interface			
	decimals	External		-
	description	External		-
	version	External		-
	getRoundData	External		-
	latestRoundData	External		-
IERC20Metadata	Interface	IERC20		
	name	External		-
	symbol	External		-
	decimals	External		-
IERC20	Interface			
	totalSupply	External		-
	balanceOf	External		-
	transfer	External	✓	-
	allowance	External		-
	approve	External	✓	-
	transferFrom	External	✓	-
Escrow	Implementation			
		Public	✓	-
	setTax	External	✓	onlyOwner

	getLatestPrice	Public		-
	addManagers	External	✓	onlyOwner
	removeManagers	External	✓	onlyOwner
	manageBannedAddress	External	✓	onlyOwner
	createNewTrade	External	Payable	-
	deliverProduct	External	✓	-
	releaseFunds	External	✓	-
	payTax	Internal	✓	
	appeal	External	✓	-
	resolveAppeal	External	✓	onlyManager
	getFundsBack	External	✓	-
	withdrawFunds	External	✓	-
	createNewCryptoTrade	External	✓	-
	buyCrypto	External	Payable	-

Inheritance Graph



Flow Graph


Legend
Internal Call
External Call
Defined Contract
Undefined Contract
IERC20 (iface)
totalSupply
balanceOf
transfer
allowance
approve
transferFrom
Escrow
onlyOwner
onlyManager
<Constructor>
setTax
addManagers
removeManagers
manageBannedAddress
createNewTrade
payable
deliverProduct
resolveAppeal
appeal
getFundsBack
payTax
releaseFunds
withdrawFunds
createNewCryptoTrade
buyCrypto
getLatestPrice
AggregatorV3Interface (iface
decimals
description
version
getRoundData
latestRoundData
IERC20Metadata (iface)
name
symbol
decimals
allowance
transferFrom
transfer

Summary

Escrow contract implements a utility and financial mechanism. This audit investigates security issues, business logic concerns, and potential improvements.

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Blockchain technology and cryptographic assets present a high level of ongoing risk Cyberscope’s position is that each company and individual are responsible for their own due diligence and continuous security Cyberscope’s goal is to help reduce the attack vectors and the high level of variance associated with utilizing new and consistently changing technologies and in no way claims any guarantee of security or functionality of the technology we agree to analyze. The assessment services provided by Cyberscope are subject to dependencies and are under continuing development. You agree that your access and/or use including but not limited to any services reports and materials will be at your sole risk on an as-is where-is and as-available basis Cryptographic tokens are emergent technologies and carry with them high levels of technical risk and uncertainty. The assessment reports could include false positives false negatives and other unpredictable results. The services may access and depend upon multiple layers of third parties.

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Cyberscope is one of the leading smart contract audit firms in the crypto space and has built a high-profile network of clients and partners.

The Cyberscope team

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