KNOWNSEC

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Smart Contract Audit Report

Security status

Safe

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Principal tester: Knownsec blockchain security team

Version Summary

Content	Date	Version
Editing Document	20210413	V1.0

Report Information

Title	Version	Document Number	Type
Minions smart contract audit report	V1.0	afa3e9c9021e446f968c75b9e437d603	Open to project team

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1. Introduction

The effective test time of this report is from From April 12, 2021 to April 13, 2021 . During this period, the security and standardization of **Minions smart contract lockup reward** contract code will be audited and used as the statistical basis for the report.

The scope of this smart contract security audit does not include external contract calls, new attack methods that may appear in the future, and code after contract upgrades or tampering. (With the development of the project, the smart contract may add a new pool , New functional modules, new external contract calls, etc.), does not include front-end security and server security.

In this audit report, engineers conducted a comprehensive analysis of the common vulnerabilities of smart contracts (Chapter 3). There was a problem of not using a secure arithmetic library, but the actual business scenario is difficult to reach the point of numerical overflow .**The smart contract code of the Minions** is comprehensively assessed as **SAFE**.

Results of this smart contract security audit ： SAFE

Since the testing is under non-production environment, all codes are the latest version. In addition, the testing process is communicated with the relevant engineer, and testing operations are carried out under the controllable operational risk to avoid production during the testing process, such as: Operational risk, code security risk.

Report information of this audit:

Report Number： afa3e9c9021e446f968c75b9e437d603

Report query address link:

https://attest.im/attestation/searchResult?qurey=afa3e9c9021e446f968c75b9e437d603

Target information of the Minions audit:

Target information	
Token name	Minions

Contract address	FundRaising.sol	0x845eE867b10C5818c35656efe6D22C57a8091A69
Code type	DeFi protocol code, HECO / ETH smart contract code	
Code language	Solidity	

Contract documents and hash:

Contract documents	MD5
FundRaising.sol	ce9595681dfe959efae3634e105202c7

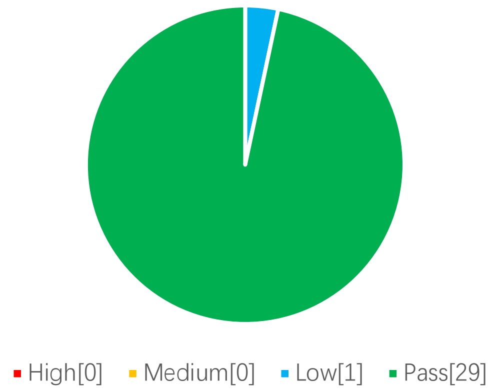
2. Code vulnerability analysis

2.1 Vulnerability Level Distribution

Vulnerability risk statistics by level：

Vulnerability risk level statistics table			
High	Medium	Low	Pass
0	0	1	29

Risk level distribution



2.2 Audit Result

Result of audit			
Audit Target	**Audit**	**Status**	**Audit Description**
Business security testing	**Calculation of lock-up rewards**	Pass	After testing, there is no such safety vulnerability.
	Administrator function	Pass	After testing, there is no such safety vulnerability.
	Purchase and withdrawal	Pass	After testing, there is no such safety vulnerability.
Basic code vulnerability detection	**Compiler version security**	Pass	After testing, there is no such safety vulnerability.
	Redundant code	Pass	After testing, there is no such safety vulnerability.
	Use of safe arithmetic library	Low（Pass）	After testing, this safety problem exists. However, the actual business scenario is difficult to achieve numerical overflow, so it is passed.
	Not recommended encoding	Pass	After testing, there is no such safety vulnerability.
	Reasonable use of require/assert	Pass	After testing, there is no such safety vulnerability.
	fallback function safety	Pass	After testing, there is no such safety vulnerability.
	tx.oriigin authentication	Pass	After testing, there is no such safety vulnerability.

	Owner permission control	Pass	After testing, there is no such safety vulnerability.
	Gas consumption detection	Pass	After testing, there is no such safety vulnerability.
	call injection attack	Pass	After testing, there is no such safety vulnerability.
	Low-level function safety	Pass	After testing, there is no such safety vulnerability.
	Vulnerability of additional token issuance	Pass	After testing, there is no such safety vulnerability.
	Access control defect detection	Pass	After testing, there is no such safety vulnerability.
	Numerical overflow detection	Pass	After testing, there is no such safety vulnerability.
	Arithmetic accuracy error	Pass	After testing, there is no such safety vulnerability.
	Wrong use of random number detection	Pass	After testing, there is no such safety vulnerability.
	Unsafe interface use	Pass	After testing, there is no such safety vulnerability.
	Variable coverage	Pass	After testing, there is no such safety vulnerability.
	Uninitialized storage pointer	Pass	After testing, there is no such safety vulnerability.
	Return value call verification	Pass	After testing, there is no such safety vulnerability.

	Transaction order dependency detection	Pass	After testing, there is no such safety vulnerability.
	Timestamp dependent attack	Pass	After testing, there is no such safety vulnerability.
	Denial of service attack detection	Pass	After testing, there is no such safety vulnerability.
	Fake recharge vulnerability detection	Pass	After testing, there is no such safety vulnerability.
	Reentry attack detection	Pass	After testing, there is no such safety vulnerability.
	Replay attack detection	Pass	After testing, there is no such safety vulnerability.
	Rearrangement attack detection	Pass	After testing, there is no such safety vulnerability.

3. Analysis of code audit results

3.1. Calculation of lock-up rewards【PASS】

Audit analysis: The reward calculation of the lock-up mechanism is implemented by the cliff, linear, getUnlockA, and getUnlockB functions in the contract. Two types of lock-up mechanisms are provided, and the gains are calculated for every 30 days of lock-up time. When the user purchases more than 20000usdt, the B lock-up mechanism is used, and the yield curve of the B lock-up mechanism is lower than that of A.

```
// ============ Lock Rules ============ //


// cliff
// n: now
// t: release ts
// a: total amount
// r: release rate
function cliff(uint256 n, uint256 t, uint256 a, uint256 r) internal pure returns(uint256) {//knownsec// Calculate the release
    uint256 total = a * r / 10**18;
    return n >= t ? total : 0;
}


// linear
// n: now
// t0: release start ts
// t1: release end ts
// s: step length
// a: total amount
// r: release rate
function linear(uint256 n, uint256 t0, uint256 t1, uint256 s, uint256 a, uint256 r) internal pure returns(uint256) {
    uint256 total = a * r / 10**18;
    if (n < t0) {//knownsec// Less than start time
        return 0;
    }
    else if (n >= t1) {//knownsec// More than the end time
        return total;
    }
    else {
        uint256 perStep = total / ((t1 - t0) / s);
        uint passedSteps = (n - t0) / s;
        return perStep * passedSteps;
    }
}

function getUnlockA(uint totalLocked, uint lockStartTs) internal view returns(uint) {//knownsec// Get the release amount A
    uint256 n = block.timestamp;
    uint256 t0 = lockStartTs + 1 * 30 * 86400;//knownsec// 1 month
    uint256 t1 = lockStartTs + 6 * 30 * 86400;//knownsec// 6 month
    uint256 r0 = 50 * 10**16;
    uint256 r1 = 50 * 10**16;
    uint256 s = 30 * 86400;
    return cliff(n, t0, totalLocked, r0) + linear(n, t0, t1, s, totalLocked, r1);
}

function getUnlockB(uint totalLocked, uint lockStartTs) internal view returns(uint) {//knownsec// Get the release amount B
    uint256 n = block.timestamp;
    uint256 t0 = lockStartTs;
    uint256 t1 = lockStartTs + 10 * 30 * 86400;//knownsec// 10 month
    uint256 r = 100 * 10**16;
    uint256 s = 30 * 86400;
    return linear(n, t0, t1, s, totalLocked, r);
}
```

Recommendation： nothing.

3.2. Administrator function【PASS】

Audit analysis: The high authority functions of the administrator function are implemented by the deposit, withdraw, and updateRound functions in the contract. They are used by the administrator to deposit specified tokens into the contract, withdraw specified tokens from the contract, and update/add a new round of lock positions.

```
// ============ Admin ============ //

function deposit(address token, uint256 amount) public onlyOwner {//knownsec// Deposit specified tokens, only called by owner
    IERC20Metadata(token).transferFrom(msg.sender, address(this), amount);
}

function withdraw(address token, uint256 amount) public onlyOwner {//knownsec// Withdraw specified tokens, only called by owner
    IERC20Metadata(token).transfer(msg.sender, amount);
}

function updateRound(
    uint256 index,
    uint256 price,
    uint256 start,
    uint256 duration,
    uint256 usdtMin,
    uint256 usdtMax,
    uint256 supply
) public onlyOwner {//knownsec// Update/add round, only called by owner
    Round memory round = Round(price, start, duration, usdtMin, usdtMax, supply);
    if (index > 0 && index < rounds.length) {
        rounds[index] = round;
    }
    else {
        rounds.push(round);
    }
}
```

Recommendation： nothing.

3.3. Purchase and withdrawal【PASS】

Audit analysis: The purchase and withdrawal functions are jointly implemented by the buy, claim, and available functions in the contract, which are used by users to purchase through usdt to participate in the lock-up. After a period of lock-up time, the lock-up revenue mis tokens can be withdrawn.

```
// ============ Anyone ============ //

function _useUnlockPlanB(uint256 usdtAmount) public view returns(bool) {
        return usdtAmount >= 20000 * 10**IERC20Metadata(usdt).decimals();//knownsec// More than 20000usdt then B
}

function buy(uint256 roundId, uint256 usdtAmount) public {//knownsec// Buy lock

        require(roundId < rounds.length, "WRONG_ROUND_ID");
        require(!paid[roundId][msg.sender], "ALREADY_BOUGHT");//knownsec// Check unpurchased
        Round storage round = rounds[roundId];
        require(usdtAmount >= round.usdtMin, "LESS_THAN_MIN");
        require(usdtAmount <= round.usdtMax, "MORE_THAN_MAX");
        require(bought[roundId] + usdtAmount <= round.supply, "EXCEED_SUPPLY");
```

```
    // transfer
    IERC20Metadata(usdt).transferFrom(msg.sender, address(this), usdtAmount);//knownsec// Transfer to usdt

    // record

    records[msg.sender][recordsLen[msg.sender]] = Record(
        10**18 * usdtAmount / round.price,
        round.start + round.duration,
        _useUnlockPlanB(usdtAmount)
    );
    recordsLen[msg.sender] += 1;//knownsec// Update the number of user purchase records

    // post
    paid[roundId][msg.sender] = true;//knownsec// Update user's purchased status
    bought[roundId] += usdtAmount;//knownsec// Update the total purchased
}

mapping(address => uint256) public claimed;

function available(address account) public view returns(uint256) {//knownsec// Query current availability
    uint len = recordsLen[account];
    uint total = 0;
    for(uint256 i=0;i< len;i++) {//knownsec// Traverse purchased records
        Record storage record = records[account][i];
        if (record.useUnlockB) {
            total += getUnlockB(record.lockedAmount, record.lockStartTs);
        }
        else {
            total += getUnlockA(record.lockedAmount, record.lockStartTs);
        }
    }
```

```
        return total - claimed[account];
}

function claim() public {//knownsec// Extract mis
        uint a = available(msg.sender);
        require(a > 0, "NOTHING_TO_CLAIM");
        IERC20Metadata(mis).transfer(msg.sender, a);
        claimed[msg.sender] += a;
}
```

Recommendation： nothing.

4. Basic code vulnerability detection

4.1. Compiler version security【PASS】

Check whether a safe compiler version is used in the contract code implementation.

Audit result: After testing, the smart contract code has formulated the compiler version ^0.8.0 within the major version, and there is no such security problem.

Recommendation： nothing.

4.2. Redundant code【PASS】

Check whether the contract code implementation contains redundant code.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.3. Use of safe arithmetic library【LOW】

Check whether the SafeMath safe arithmetic library is used in the contract code implementation.

Audit result: After testing, the SafeMath safe arithmetic library is not used in the smart contract code, and there may be a potential safety hazard of value overflow.

Recommendation： Use the safe algorithm functions in the SafeMath safe arithmetic library to replace the original addition, subtraction, multiplication, and division operations.

4.4. Not recommended encoding【PASS】

Check whether there is an encoding method that is not officially recommended or abandoned in the contract code implementation

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.5. Reasonable use of require/assert【PASS】

Check the rationality of the use of require and assert statements in the contract code implementation.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.6. Fallback function safety【PASS】

Check whether the fallback function is used correctly in the contract code implementation.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.7. tx.origin authentication【PASS】

tx.origin is a global variable of Solidity that traverses the entire call stack and returns the address of the account that originally sent the call (or transaction). Using this variable for authentication in a smart contract makes the contract vulnerable to attacks like phishing.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation：nothing.

4.8. Owner permission control【PASS】

Check whether the owner in the contract code implementation has excessive authority. For example, arbitrarily modify other account balances, etc.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation：nothing.

4.9. Gas consumption detection【PASS】

Check whether the consumption of gas exceeds the maximum block limit.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation：nothing.

4.10. call injection attack【PASS】

When the call function is called, strict permission control should be done, or the function called by the call should be written dead.

Audit result: After testing, the smart contract does not use the call function, and this vulnerability does not exist.

Recommendation： nothing.

4.11. Low-level function safety【PASS】

Check whether there are security vulnerabilities in the use of low-level functions (call/delegatecall) in the contract code implementation

The execution context of the call function is in the called contract; the execution context of the delegatecall function is in the contract that currently calls the function.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.12. Vulnerability of additional token issuance【PASS】

Check whether there is a function that may increase the total amount of tokens in the token contract after initializing the total amount of tokens.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.13. Access control defect detection【PASS】

Different functions in the contract should set reasonable permissions.

Check whether each function in the contract correctly uses keywords such as public and private for visibility modification, check whether the contract is correctly defined and use modifier to restrict access to key functions to avoid problems caused by unauthorized access.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.14. Numerical overflow detection【PASS】

The arithmetic problems in smart contracts refer to integer overflow and integer underflow.

Solidity can handle up to 256-bit numbers (2^256-1). If the maximum number increases by 1, it will overflow to 0. Similarly, when the number is an unsigned type, 0 minus 1 will underflow to get the maximum digital value.

Integer overflow and underflow are not a new type of vulnerability, but they are especially dangerous in smart contracts. Overflow conditions can lead to incorrect results, especially if the possibility is not expected, which may affect the reliability and safety of the program.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation：nothing.

4.15. Arithmetic accuracy error【PASS】

As a programming language, Solidity has data structure design similar to ordinary programming languages, such as variables, constants, functions, arrays, functions, structures, etc. There is also a big difference between Solidity and ordinary programming languages-Solidity does not float Point type, and all the numerical calculation results of Solidity will only be integers, there will be no decimals, and it is not allowed to define decimal type data. Numerical calculations in the contract are indispensable, and the design of numerical calculations may cause relative errors. For example, the same level of calculations: 5/2*10=20, and 5*10/2=25, resulting in errors, which are larger in data The error will be larger and more obvious.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation：nothing.

4.16. Incorrect use of random numbers【PASS】

Smart contracts may need to use random numbers. Although the functions and variables provided by Solidity can access values that are obviously unpredictable, such as block.number and block.timestamp, they are usually more public than they appear or are affected by miners. These random numbers are predictable to a certain extent, so malicious users can usually copy it and rely on its unpredictability to attack the function.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.17. Unsafe interface usage【PASS】

Check whether unsafe interfaces are used in the contract code implementation.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.18. Variable coverage【PASS】

Check whether there are security issues caused by variable coverage in the contract code implementation.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.19. Uninitialized storage pointer【PASS】

In solidity, a special data structure is allowed to be a struct structure, and the local variables in the function are stored in storage or memory by default.

The existence of storage (memory) and memory (memory) are two different concepts. Solidity allows pointers to point to an uninitialized reference, while uninitialized local storage will cause variables to point to other storage variables, leading to variable coverage, or even more serious As a consequence, you should avoid initializing struct variables in functions during development.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.20. Return value call verification【PASS】

This problem mostly occurs in smart contracts related to currency transfer, so it is also called silent failed delivery or unchecked delivery.

In Solidity, there are transfer(), send(), call.value() and other currency transfer methods, which can all be used to send Ether to an address. The difference is: When the transfer fails, it will be thrown and the state will be rolled back; Only 2300gas will be passed for calling to prevent reentry attacks; false will be returned when send fails; only 2300gas will be passed for calling to prevent reentry attacks; false will be returned when call.value fails to be sent; all available gas will be passed for calling (can be Limit by passing in gas_value parameters), which cannot effectively prevent reentry attacks.

If the return value of the above send and call.value transfer functions is not checked in the code, the contract will continue to execute the following code, which may lead to unexpected results due to Ether sending failure.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.21. Transaction order dependency【PASS】

Since miners always get gas fees through codes that represent externally owned addresses (EOA), users can specify higher fees for faster transactions. Since the Ethereum blockchain is public, everyone can see the content of other people's pending transactions. This means that if a user submits a valuable solution, a malicious user can steal the solution and copy its transaction at a higher fee to preempt the original solution.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.22. Timestamp dependency attack【PASS】

The timestamp of the data block usually uses the local time of the miner, and this time can fluctuate in the range of about 900 seconds. When other nodes accept a new block, it only needs to verify whether the timestamp is later than the previous block and The error with local time is within 900 seconds. A miner can profit from it by setting the timestamp of the block to satisfy the conditions that are beneficial to him as much as possible.

Check whether there are key functions that depend on the timestamp in the contract code implementation.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.23. Denial of service attack【PASS】

In the world of Ethereum, denial of service is fatal, and a smart contract that has suffered this type of attack may never be able to return to its normal working state. There may be many reasons for the denial of service of the smart contract, including malicious behavior as the transaction recipient, artificially increasing the gas required for computing functions to cause gas exhaustion, abusing access control to access the private component of the smart contract, using confusion and negligence, etc. Wait.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation： nothing.

4.24. Fake recharge vulnerability【PASS】

The transfer function of the token contract uses the if judgment method to check the balance of the transfer initiator (msg.sender). When balances[msg.sender] <value, enter the else logic part and return false, and finally no exception is thrown. We believe

that only if/else this kind of gentle judgment method is an imprecise coding method in sensitive function scenarios such as transfer.

Audit result: After testing, the security problem does not exist in the smart contract code.

Recommendation：nothing.

4.25. Reentry attack detection【PASS】

Re-entry vulnerability is the most famous Ethereum smart contract vulnerability, which caused the fork of Ethereum(The DAO hack).

The **call.value()** function in Solidity consumes all the gas it receives when it is used to send Ether. When the **call.value()** function to send Ether occurs before the actual reduction of the sender's account balance, There is a risk of reentry attacks.

Audit results：After auditing, the vulnerability does not exist in the smart contract code.

Recommendation：nothing.

4.26. Replay attack detection【PASS】

If the contract involves the need for entrusted management, attention should be paid to the non-reusability of verification to avoid replay attacks

In the asset management system, there are often cases of entrusted management. The principal assigns assets to the trustee for management, and the principal pays a certain fee to the trustee. This business scenario is also common in smart contracts.

Audit results： After testing, the smart contract does not use the call function, and this vulnerability does not exist.

Recommendation： nothing.

4.27. Rearrangement attack detection【PASS】

A rearrangement attack refers to a miner or other party trying to "compete" with smart contract participants by inserting their own information into a list or mapping, so that the attacker has the opportunity to store their own information in the contract. in.

Audit results： After auditing, the vulnerability does not exist in the smart contract code.

Recommendation： nothing.

5. Appendix A：Contract code

Source code：

FundRaising.sol

```
// SPDX-License-Identifier: MIT

pragma solidity ^0.8.0;

import { IERC20Metadata } from './IERC20Metadata.sol';
import { Ownable } from './Ownable.sol';

contract FundRaising is Ownable {

    // use mantissa (ori * 10**18) to reserve precision
    // price means x usdt per token
    mapping(uint256 => uint256) public prices;

    address public usdt;
    address public mis;

    struct Round {
        uint256 price;
        uint start;//knownsec//  起始时间
        uint duration;//knownsec//  筹资时间
        uint usdtMin;
        uint usdtMax;
        uint supply;
    }

    struct Record {
        uint256 lockedAmount;
        uint256 lockStartTs;
        bool useUnlockB;
    }
    // user => record amount
    mapping(address => uint256) public recordsLen;
    mapping(address => mapping(uint256 => Record)) public records;
    // round, account => paid
    mapping(uint => mapping(address => bool)) public paid;
    Round[] public rounds;
    // round => bought
    mapping(uint256 => uint256) public bought;

    // ============ Init ============ //

    constructor(address usdt_, address mis_) {
        usdt = usdt_;
        mis = mis_;

        uint256 usdtDecimals = IERC20Metadata(usdt).decimals();
        uint256 misDecimals = IERC20Metadata(mis).decimals();

        // 150 * 10**16 means 1.5 * 10**18

        rounds.push(Round(
            150 * 10**(16 + usdtDecimals - misDecimals),
            block.timestamp, // start
            72 * 3600,//knownsec// 3 天开放筹资时间
            20000 * 10**usdtDecimals,
            50000 * 10**usdtDecimals,
            270000 * 10**usdtDecimals // token supply in usdt
        ));
        rounds.push(Round(
            200 * 10**(16 + usdtDecimals - misDecimals),
            block.timestamp + 72 * 3600, // start
            72 * 3600,
            100 * 10**usdtDecimals,
            1000 * 10**usdtDecimals,
            216000 * 10**usdtDecimals // token supply in usdt
        ));
        rounds.push(Round(
            250 * 10**(16 + usdtDecimals - misDecimals),
            block.timestamp + 2 * 72 * 3600, // start
            72 * 3600,
            100 * 10**usdtDecimals,
            1000 * 10**usdtDecimals,
            180000 * 10**usdtDecimals // token supply in usdt
        ));
    }
    // ============ Lock Rules ============ //

    // cliff
    // n: now
    // t: release ts
    // a: total amount
    // r: release rate
    function cliff(uint256 n, uint256 t, uint256 a, uint256 r) internal pure returns(uint256) {//knownsec// 计算释放量
        uint256 total = a * r / 10**18;
        return n >= t ? total : 0;
    }

    // linear
    // n: now
    // t0: release start ts
    // t1: release end ts
    // s: step length
    // a: total amount
    // r: release rate
    function linear(uint256 n, uint256 t0, uint256 t1, uint256 s, uint256 a, uint256 r) internal pure returns(uint256) {
        uint256 total = a * r / 10**18;
        if (n < t0) {//knownsec// 小于起始时间
            return 0;
        }
        else if (n >= t1) {//knownsec// 超过终止时间
            return total;
        }
        else {
            uint256 perStep = total / ((t1 - t0) / s);
            uint passedSteps = (n - t0) / s;
            return perStep * passedSteps;
        }
    }

    function getUnlockA(uint totalLocked, uint lockStartTs) internal view returns(uint) {//knownsec// 获取释放量A
        uint256 n = block.timestamp;
        uint256 t0 = lockStartTs + 1 * 30 * 86400;//knownsec// 1 月
        uint256 t1 = lockStartTs + 6 * 30 * 86400;//knownsec// 6 月
        uint256 r0 = 50 * 10**16;
        uint256 r1 = 50 * 10**16;
        uint256 s = 30 * 86400;//knownsec// 步长 1 月
        return cliff(n, t0, totalLocked, r0) + linear(n, t0, t1, s, totalLocked, r1);
    }

    function getUnlockB(uint totalLocked, uint lockStartTs) internal view returns(uint) {//knownsec// 获取释放量B
        uint256 n = block.timestamp;
        uint256 t0 = lockStartTs;
        uint256 t1 = lockStartTs + 10 * 30 * 86400;//knownsec// 10 月
        uint256 r = 100 * 10**16;
        uint256 s = 30 * 86400;
        return linear(n, t0, t1, s, totalLocked, r);
    }

    // ============ Admin ============ //

    function deposit(address token, uint256 amount) public onlyOwner {//knownsec// 存入指定代币,仅 owner 调用
        IERC20Metadata(token).transferFrom(msg.sender, address(this), amount);
    }

    function withdraw(address token, uint256 amount) public onlyOwner {//knownsec// 提取指定代币,仅 owner 调用
        IERC20Metadata(token).transfer(msg.sender, amount);
    }

    function updateRound(
        uint256 index,
        uint256 price,
        uint256 start,
        uint256 duration,
        uint256 usdtMin,
        uint256 usdtMax,
        uint256 supply
    ) public onlyOwner {//knownsec// 更新/添加轮,仅 owner 调用
        Round memory round = Round(price, start, duration, usdtMin, usdtMax, supply);
        if (index > 0 && index < rounds.length) {
            rounds[index] = round;
        }
        else {
            rounds.push(round);
        }
    }
    // ============ Anyone ============ //

    function _useUnlockPlanB(uint256 usdtAmount) public view returns(bool) {
        return usdtAmount >= 20000 * 10**IERC20Metadata(usdt).decimals();//knownsec// 超过 20000usdt 则 B
    }

    function buy(uint256 roundId, uint256 usdtAmount) public {//knownsec// 购买锁仓

        require(roundId < rounds.length, "WRONG_ROUND_ID");
        require(!paid[roundId][msg.sender], "ALREADY_BOUGHT");//knownsec// 校验未购
        Round storage round = rounds[roundId];
        require(usdtAmount >= round.usdtMin, "LESS_THAN_MIN");
        require(usdtAmount <= round.usdtMax, "MORE_THAN_MAX");
        require(bought[roundId] + usdtAmount <= round.supply, "EXCEED_SUPPLY");

        // transfer
        IERC20Metadata(usdt).transferFrom(msg.sender, address(this), usdtAmount);//knownsec// 转入 usdt

        // record

        records[msg.sender][recordsLen[msg.sender]] = Record(
            10**18 * usdtAmount / round.price,
            round.start + round.duration,
            _useUnlockPlanB(usdtAmount)
        );
        recordsLen[msg.sender] += 1;//knownsec// 更新用户已购记录次数

        // post
        paid[roundId][msg.sender] = true;//knownsec// 更新用户已购状态
        bought[roundId] += usdtAmount;//knownsec// 更新已购总量
    }

    mapping(address => uint256) public claimed;

    function available(address account) public view returns(uint256) {//knownsec// 查询当前可获得量
        uint len = recordsLen[account];
        uint total = 0;
        for(uint256 i=0;i< len;i++) {//knownsec// 遍历已购记录
            Record storage record = records[account][i];
            if (record.useUnlockB) {
                total += getUnlockB(record.lockedAmount, record.lockStartTs);
            }
            else {
                total += getUnlockA(record.lockedAmount, record.lockStartTs);
            }
        }
        return total - claimed[account];
    }

    function claim() public {//knownsec// 提取 mis
        uint a = available(msg.sender);
        require(a > 0, "NOTHING_TO_CLAIM");
        IERC20Metadata(mis).transfer(msg.sender, a);
        claimed[msg.sender] += a;
    }
}
```

6. Appendix B： Vulnerability rating standard

Smart contract vulnerability rating standards	
Level	**Level Description**
High	Vulnerabilities that can directly cause the loss of token contracts or user funds, such as: value overflow loopholes that can cause the value of tokens to zero, fake recharge loopholes that can cause exchanges to lose tokens, and can cause contract accounts to lose ETH or tokens. Access loopholes, etc.; Vulnerabilities that can cause loss of ownership of token contracts, such as: access control defects of key functions, call injection leading to bypassing of access control of key functions, etc.; Vulnerabilities that can cause the token contract to not work properly, such as: denial of service vulnerability caused by sending ETH to malicious addresses, and denial of service vulnerability caused by exhaustion of gas.
Medium	High-risk vulnerabilities that require specific addresses to trigger, such as value overflow vulnerabilities that can be triggered by token contract owners; access control defects for non-critical functions, and logical design defects that cannot cause direct capital losses, etc.
Low	Vulnerabilities that are difficult to be triggered, vulnerabilities with limited damage after triggering, such as value overflow vulnerabilities that require a large amount of ETH or tokens to trigger, vulnerabilities where attackers cannot directly profit after triggering value overflow, and the transaction sequence triggered by specifying high gas depends on the risk Wait.

7. Appendix C： Introduction to auditing tools

7.1 Manticore

Manticore is a symbolic execution tool for analyzing binary files and smart contracts. Manticore includes a symbolic Ethereum Virtual Machine (EVM), an EVM disassembler/assembler and a convenient interface for automatic compilation and analysis of Solidity. It also integrates Ethersplay, Bit of Traits of Bits visual disassembler for EVM bytecode, used for visual analysis. Like binary files, Manticore provides a simple command line interface and a Python for analyzing EVM bytecode API.

7.2 Oyente

Oyente is a smart contract analysis tool. Oyente can be used to detect common bugs in smart contracts, such as reentrancy, transaction sequencing dependencies, etc. More convenient, Oyente's design is modular, so this allows advanced users to implement and Insert their own detection logic to check the custom attributes in their contract.

7.3 securify.sh

Securify can verify common security issues of Ethereum smart contracts, such as disordered transactions and lack of input verification. It analyzes all possible execution paths of the program while fully automated. In addition, Securify also has a specific language for specifying vulnerabilities, which makes Securify can keep an eye on current security and other reliability issues at any time.

7.4 Echidna

Echidna is a Haskell library designed for fuzzing EVM code.

7.5 MAIAN

MAIAN is an automated tool for finding vulnerabilities in Ethereum smart contracts. Maian processes the bytecode of the contract and tries to establish a series of transactions to find and confirm the error.

7.6 ethersplay

ethersplay is an EVM disassembler, which contains relevant analysis tools.

7.7 ida-evm

ida-evm is an IDA processor module for the Ethereum Virtual Machine (EVM).

7.8 Remix-ide

ida-evm is an IDA processor module for the Ethereum Virtual Machine (EVM).

7.9 Knownsec Penetration Tester Special Toolkit

Pen-Tester tools collection is created by KnownSec team. It contains plenty of

Pen-Testing tools such as automatic testing tool, scripting tool, Self-developed tools etc.

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