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密级 ★ | 项目组公开

智能合约安全审计报告

审计结果

通过

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版本说明

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1. 综述

本次报告有效测试时间是从 2020 年 11 月 13 日开始到 2020 年 11 月 16 日结束，在此期间针对 MiMiReward2 智能合约代码的安全性和规范性进行审计并以此作为报告统计依据。

此次测试中，知道创宇工程师对智能合约的常见漏洞（见第三章节）进行了全面的分析，未发现中、高危安全风险，故综合评定为通过。

本次智能合约安全审计结果： 通过

由于本次测试过程在非生产环境下进行，所有代码均为最新备份，测试过程均与相关接口人进行沟通，并在操作风险可控的情况下进行相关测试操作，以规避测试过程中的生产运营风险、代码安全风险。

本次测试的目标信息：

项目名称	项目内容
Token 名称	MiMiReward2
代码类型	代币代码
代码语言	Solidity
代码地址	http://tronscan.org/#/contract/TKdRP28MiPyv1w6MLBhK5BCXfycCD7Zwhp

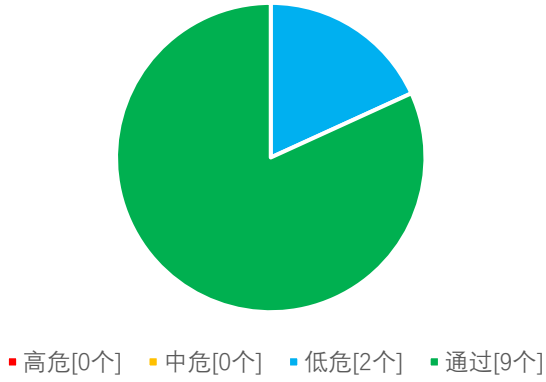
2. 代码漏洞分析

2.1. 漏洞等级分布

本次漏洞风险按等级统计:

漏洞风险等级个数统计表			
高危	中危	低危	通过
0	0	2	9

风险等级分布图



2.2. 审计结果汇总

（其他未知安全漏洞不包含在本次审计责任范围）

审计结果			
测试项目	测试内容	状态	描述
智能合约安全审计	重入攻击检测	低危	检查 call.value()函数使用安全
	数值溢出检测	通过	检查 add 和 sub 函数使用安全
	访问控制缺陷检测	通过	检查各操作访问权限控制
	未验证返回值的调用	通过	检查转币方法看是否验证返回值
	错误使用随机数检测	通过	检查是否具备统一的内容过滤器
	事务顺序依赖检测	通过	检查是否存在事务顺序依赖风险
	拒绝服务攻击检测	低危	检查代码在使用资源时是否存在资源滥用问题
	逻辑设计缺陷检测	通过	检查智能合约代码中与业务设计相关的安全问题
	假充值漏洞检测	通过	检查智能合约代码中是否存在假充值漏洞
	增发代币漏洞检测	通过	检查智能合约中是否存在增发代币的功能
	冻结账户绕过检测	通过	检查转移代币中是否存在未校验冻结账户的问题

3. 代码审计结果分析

3.1. 重入攻击检测【低危】

重入漏洞是最著名的区块链智能合约漏洞，曾导致了以太坊的分叉（The DAO hack）。

Solidity 中的 call.value()函数在被用来发送代币的时候会消耗它接收到的所有 gas，当调用 call.value()函数发送代币的操作发生在实际减少发送者账户的余额之前时，就会存在重入攻击的风险。

检测结果：经检测，智能合约代码中存在相关 call 外部合约调用。

```
471     function sendValue(address payable recipient, uint256 amount) internal {
472         require(address(this).balance >= amount, "Address: insufficient balance");
473
474         // solhint-disable-next-line avoid-call-value
475         (bool success, ) = recipient.call.value(amount)("");
476         require(success, "Address: unable to send value, recipient may have reverted");
477     }
```

```
535     function callOptionalReturn(IERC20 token, bytes memory data) private {
536         // We need to perform a low level call here, to bypass Solidity's return data size checking mechanism, since
537         // we're implementing it ourselves.
538
539         // A Solidity high level call has three parts:
540         //  1. The target address is checked to verify it contains contract code
541         //  2. The call itself is made, and success asserted
542         //  3. The return value is decoded, which in turn checks the size of the returned data.
543         // solhint-disable-next-line max-line-length
544         require(address(token).isContract(), "SafeERC20: call to non-contract");
545
546         // solhint-disable-next-line avoid-low-level-calls
547         (bool success, bytes memory returndata) = address(token).call(data);
548         require(success, "SafeERC20: low-level call failed");
549
550         if (returndata.length > 0) { // Return data is optional
551             // solhint-disable-next-line max-line-length
552             require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not succeed");
553         }
554     }
```

安全建议：

1.尽量使用 send()、transfer() 函数。

2.如果使用像 call() 函数这样的低级调用函数时，应该先执行内部状态的更改，然后再使用低级调用函数。

3.编写智能合约时尽量避免外部合约的调用。

3.2. 数值溢出检测【通过】

智能合约中的算数问题是指整数溢出和整数下溢。

Solidity 最多能处理 256 位的数字（2^256-1），最大数字增加 1 会溢出得到 0。同样，当数字为无符号类型时，0 减去 1 会下溢得到最大数字值。

整数溢出和下溢不是一种新类型的漏洞，但它们在智能合约中尤其危险。溢出情况会导致不正确的结果，特别是如果可能性未被预期，可能会影响程序的可靠性和安全性。

检测结果：经检测，智能合约代码中不存在该安全问题。

安全建议：无。

3.3. 访问控制检测【通过】

访问控制缺陷是所有程序中都可能存在的安全风险，智能合约也同样会存在类似问题，著名的 Parity Wallet 智能合约就受到过该问题的影响。

检测结果：经检测，智能合约代码中不存在该安全问题。

安全建议：无。

3.4. 返回值调用验证【通过】

此问题多出现在和转币相关的智能合约中，故又称作静默失败发送或未经检查发送。

在 Solidity 中存在 transfer()、send()、call.value()等转币方法，都可以用于向

某一地址发送代币

，其区别在于： transfer 发送失败时会 throw，并且进行状态回滚；只会传递 2300gas 供调用，防止重入攻击；send 发送失败时会返回 false；只会传递 2300gas 供调用，防止重入攻击；call.value 发送失败时会返回 false；传递所有可用 gas 进行调用（可通过传入 gas_value 参数进行限制），不能有效防止重入攻击。

如果在代码中没有检查以上 send 和 call.value 转币函数的返回值，合约会继续执行后面的代码，可能由于代币发送失败而导致意外的结果。

检测结果：经检测，智能合约代码中不存在相关漏洞。

安全建议：无。

3.5. 错误使用随机数【通过】

智能合约中可能需要使用随机数，虽然 Solidity 提供的函数和变量可以访问明显难以预测的值，如 block.number 和 block.timestamp，但是它们通常或者比看起来更公开，或者受到矿工的影响，即这些随机数载一定程度上是可预测的，所以恶意用户通常可以复制它并依靠其不可预知性来攻击该功能。

检测结果：经检测，智能合约代码中不存在该问题。

安全建议：无。

3.6. 事务顺序依赖【通过】

由于矿工总是通过代表外部拥有地址（EOA）的代码获取 gas 费用，因此用户可以指定更高的费用以便更快地开展交易。由于区块链是公开的，每个人都可

以看到其他人未决交易的内容。这意味着，如果某个用户提交了一个有价值的解决方案，恶意用户可以窃取该解决方案并以较高的费用复制其交易，以抢占原始解决方案。

检测结果：经检测，智能合约代码中不存在该问题。

安全建议：无。

3.7. 拒绝服务攻击【低危】

在区块链的世界中，拒绝服务是致命的，遭受该类型攻击的智能合约可能永远无法恢复正常工作状态。导致智能合约拒绝服务的原因可能有很多种，包括在作为交易接收方时的恶意行为，人为增加计算功能所需 gas 导致 gas 耗尽，滥用访问控制访问智能合约的 private 组件，利用混淆和疏忽等等。

检测结果：经检测，智能合约代码中存在因为对于用户 owner 访问控制策略出错，这里就会导致用户永久失去控制权。

```
286     function _transferOwnership(address newOwner) internal {
287         require(newOwner != address(0), "Ownable: new owner is the zero address");
288         emit OwnershipTransferred(_owner, newOwner);
289         _owner = newOwner;
290     }
```

安全建议：对于控制权限的转换需要注意对于用户所有权的确定，避免造成控制权的永久丢失。

3.8. 逻辑设计缺陷【通过】

检测智能合约代码中与业务设计相关的安全问题。

检测结果：经检测，智能合约代码中不存在相关漏洞。

安全建议：无。

3.9. 假充值漏洞【通过】

在代币合约的 transfer 函数对转账发起人(ABBT.sender)的余额检查用的是 if 判断方式，当 balances[ABBT.sender] < value 时进入 else 逻辑部分并 return false，最终没有抛出异常，我们认为仅 if/else 这种温和的判断方式在 transfer 这类敏感函数场景中是一种不严谨的编码方式。

检测结果：经检测，智能合约代码中不存在相关漏洞。

安全建议：无。

3.10. 增发代币漏洞【通过】

检测在初始化代币总量后，代币合约中是否存在可能使代币总量增加的函数。

检测结果：经检测，智能合约代码中不存在该问题。

安全建议：无。

3.11. 冻结账户绕过【通过】

检测代币合约中在转移代币时，是否存在未校验代币来源账户、发起账户、目标账户是否被冻结的操作。

检测结果：经检测，智能合约代码中不存在该问题。

安全建议：无。

4. 附录 A：合约代码

```
pragma solidity ^0.5.8;

/**
 * @dev Standard math utilities missing in the Solidity language.
 */
library Math {
    /**
     * @dev Returns the largest of two numbers.
     */
    function max(uint256 a, uint256 b) internal pure returns (uint256) {
        return a >= b ? a : b;
    }

    /**
     * @dev Returns the smallest of two numbers.
     */
    function min(uint256 a, uint256 b) internal pure returns (uint256) {
        return a < b ? a : b;
    }

    /**
     * @dev Returns the average of two numbers. The result is rounded towards
     * zero.
     */
    function average(uint256 a, uint256 b) internal pure returns (uint256) {
        // (a + b) / 2 can overflow, so we distribute
        return (a / 2) + (b / 2) + ((a % 2 + b % 2) / 2);
    }
}

contract Context {
    // Empty internal constructor, to prevent people from mistakenly deploying
    // an instance of this contract, which should be used via inheritance.
    constructor () internal { }
    // solhint-disable-previous-line no-empty-blocks

    function _msgSender() internal view returns (address payable) {
        return msg.sender;
    }

    function _msgData() internal view returns (bytes memory) {
        this; // silence state mutability warning without generating bytecode - see
https://github.com/ethereum/solidity/issues/2691
        return msg.data;
    }
}

contract Ownable is Context {
    address private _owner;

    event OwnershipTransferred(address indexed previousOwner, address indexed
newOwner);

    /**
     * @dev Initializes the contract setting the deployer as the initial owner.
     */
    constructor () internal {
        address msgSender = _msgSender();
        _owner = msgSender;
        emit OwnershipTransferred(address(0), msgSender);
    }

    /**
     * @dev Returns the address of the current owner.
     */
    function owner() public view returns (address) {
        return _owner;
    }

    /**
     * @dev Throws if called by any account other than the owner.
```

```
     */
    modifier onlyOwner() {
        require(isOwner(), "Ownable: caller is not the owner");
        _;
    }

    /**
     * @dev Returns true if the caller is the current owner.
     */
    function isOwner() public view returns (bool) {
        return _msgSender() == _owner;
    }

    /**
     * @dev Leaves the contract without owner. It will not be possible to call
     * `onlyOwner` functions anymore. Can only be called by the current owner.
     *
     * NOTE: Renouncing ownership will leave the contract without an owner,
     * thereby removing any functionality that is only available to the owner.
     */
    function renounceOwnership() public onlyOwner {
        emit OwnershipTransferred(_owner, address(0));
        _owner = address(0);
    }

    /**
     * @dev Transfers ownership of the contract to a new account (`newOwner`).
     * Can only be called by the current owner.
     */
    function transferOwnership(address newOwner) public onlyOwner {
        _transferOwnership(newOwner);
    }

    /**
     * @dev Transfers ownership of the contract to a new account (`newOwner`).
     */
    function _transferOwnership(address newOwner) internal {
        require(newOwner != address(0), "Ownable: new owner is the zero address");
        emit OwnershipTransferred(_owner, newOwner);
        _owner = newOwner;
    }
}


library DegoMath {
    /**
     * Calculate sqrt (x) rounding down, where x is unsigned 256-bit integer
     * number.
     *
     * @param x unsigned 256-bit integer number
     * @return unsigned 128-bit integer number
     */
    function sqrt(uint256 x) public pure returns (uint256 y)  {
        uint256 z = (x + 1) / 2;
        y = x;
        while (z < y) {
            y = z;
            z = (x / z + z) / 2;
        }
    }

}

interface IPool {
    function totalSupply( ) external view returns (uint256);
    function balanceOf( address player ) external view returns (uint256);
}

interface IPlayerBook {
    function settleReward( address from,uint256 amount ) external returns (uint256);
    function bindRefer( address from,string calldata  affCode )  external returns
(bool);
    function hasRefer(address from) external returns(bool);
}

interface IPowerStrategy {
    function lpIn(address sender, uint256 amount) external;
```

```
    function lpOut(address sender, uint256 amount) external;
    function getPower(address sender) view  external returns (uint256);
}

contract Governance {

    address public _governance;

    constructor() public {
        _governance = tx.origin;
    }

    event GovernanceTransferred(address indexed previousOwner, address indexed
newOwner);

    modifier onlyGovernance {
        require(msg.sender == _governance, "not governance");
        _;
    }

    function setGovernance(address governance)  public  onlyGovernance
    {
        require(governance != address(0), "new governance the zero address");
        emit GovernanceTransferred(_governance, governance);
        _governance = governance;
    }
}


/**
 * @dev Wrappers over Solidity's arithmetic operations with added overflow
 * checks.
 *
 * Arithmetic operations in Solidity wrap on overflow. This can easily result
 * in bugs, because programmers usually assume that an overflow raises an
 * error, which is the standard behavior in high level programming languages.
 * `SafeMath` restores this intuition by reverting the transaction when an
 * operation overflows.
 *
 * Using this library instead of the unchecked operations eliminates an entire
 * class of bugs, so it's recommended to use it always.
 */
library SafeMath {
    /**
     * @dev Returns the addition of two unsigned integers, reverting on
     * overflow.
     *
     * Counterpart to Solidity's `+` operator.
     *
     * Requirements:
     * - Addition cannot overflow.
     */
    function add(uint256 a, uint256 b) internal pure returns (uint256) {
        uint256 c = a + b;
        require(c >= a, "SafeMath: addition overflow");

        return c;
    }

    /**
     * @dev Returns the subtraction of two unsigned integers, reverting on
     * overflow (when the result is negative).
     *
     * Counterpart to Solidity's `-` operator.
     *
     * Requirements:
     * - Subtraction cannot overflow.
     */
    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
        return sub(a, b, "SafeMath: subtraction overflow");
    }

    /**
     * @dev Returns the subtraction of two unsigned integers, reverting with custom
message on
     * overflow (when the result is negative).
     *
```

```
     * Counterpart to Solidity's `-` operator.
     *
     * Requirements:
     * - Subtraction cannot overflow.
     *
     * _Available since v2.4.0._
     */
    function sub(uint256 a, uint256 b, string memory errorMessage) internal pure
returns (uint256) {
        require(b <= a, errorMessage);
        uint256 c = a - b;

        return c;
    }

    /**
     * @dev Returns the multiplication of two unsigned integers, reverting on
     * overflow.
     *
     * Counterpart to Solidity's `*` operator.
     *
     * Requirements:
     * - Multiplication cannot overflow.
     */
    function mul(uint256 a, uint256 b) internal pure returns (uint256) {
        // Gas optimization: this is cheaper than requiring 'a' not being zero, but the
        // benefit is lost if 'b' is also tested.
        // See: https://github.com/OpenZeppelin/openzeppelin-contracts/pull/522
        if (a == 0) {
            return 0;
        }

        uint256 c = a * b;
        require(c / a == b, "SafeMath: multiplication overflow");

        return c;
    }

    /**
     * @dev Returns the integer division of two unsigned integers. Reverts on
     * division by zero. The result is rounded towards zero.
     *
     * Counterpart to Solidity's `/` operator. Note: this function uses a
     * `revert` opcode (which leaves remaining gas untouched) while Solidity
     * uses an invalid opcode to revert (consuming all remaining gas).
     *
     * Requirements:
     * - The divisor cannot be zero.
     */
    function div(uint256 a, uint256 b) internal pure returns (uint256) {
        return div(a, b, "SafeMath: division by zero");
    }

    /**
     * @dev Returns the integer division of two unsigned integers. Reverts with custom
message on
     * division by zero. The result is rounded towards zero.
     *
     * Counterpart to Solidity's `/` operator. Note: this function uses a
     * `revert` opcode (which leaves remaining gas untouched) while Solidity
     * uses an invalid opcode to revert (consuming all remaining gas).
     *
     * Requirements:
     * - The divisor cannot be zero.
     *
     * _Available since v2.4.0._
     */
    function div(uint256 a, uint256 b, string memory errorMessage) internal pure
returns (uint256) {
        // Solidity only automatically asserts when dividing by 0
        require(b > 0, errorMessage);
        uint256 c = a / b;
        // assert(a == b * c + a % b); // There is no case in which this doesn't hold

        return c;
    }
```

```
    /**
     * @dev Returns the remainder of dividing two unsigned integers. (unsigned integer
modulo),
     * Reverts when dividing by zero.
     *
     * Counterpart to Solidity's `%` operator. This function uses a `revert`
     * opcode (which leaves remaining gas untouched) while Solidity uses an
     * invalid opcode to revert (consuming all remaining gas).
     *
     * Requirements:
     * - The divisor cannot be zero.
     */
    function mod(uint256 a, uint256 b) internal pure returns (uint256) {
        return mod(a, b, "SafeMath: modulo by zero");
    }

    /**
     * @dev Returns the remainder of dividing two unsigned integers. (unsigned integer
modulo),
     * Reverts with custom message when dividing by zero.
     *
     * Counterpart to Solidity's `%` operator. This function uses a `revert`
     * opcode (which leaves remaining gas untouched) while Solidity uses an
     * invalid opcode to revert (consuming all remaining gas).
     *
     * Requirements:
     * - The divisor cannot be zero.
     *
     * _Available since v2.4.0._
     */
    function mod(uint256 a, uint256 b, string memory errorMessage) internal pure
returns (uint256) {
        require(b != 0, errorMessage);
        return a % b;
    }
}


pragma solidity ^0.5.8;

/**
 * @dev Interface of the ERC20 standard as defined in the EIP. Does not include
 * the optional functions; to access them see {ERC20Detailed}.
 */
interface IERC20 {
    /**
     * @dev Returns the amount of tokens in existence.
     */
    function totalSupply() external view returns (uint256);

    /**
     * @dev Returns the amount of tokens owned by `account`.
     */
    function balanceOf(address account) external view returns (uint256);

    /**
     * @dev Moves `amount` tokens from the caller's account to `recipient`.
     *
     * Returns a boolean value indicating whether the operation succeeded.
     *
     * Emits a {Transfer} event.
     */
    function transfer(address recipient, uint256 amount) external returns (bool);
    function mint(address account, uint amount) external;
    /**
     * @dev Returns the remaining number of tokens that `spender` will be
     * allowed to spend on behalf of `owner` through {transferFrom}. This is
     * zero by default.
     *
     * This value changes when {approve} or {transferFrom} are called.
     */
    function allowance(address owner, address spender) external view returns (uint256);

    /**
     * @dev Sets `amount` as the allowance of `spender` over the caller's tokens.
     *
     * Returns a boolean value indicating whether the operation succeeded.
```

```
     *
     * IMPORTANT: Beware that changing an allowance with this method brings the risk
     * that someone may use both the old and the new allowance by unfortunate
     * transaction ordering. One possible solution to mitigate this race
     * condition is to first reduce the spender's allowance to 0 and set the
     * desired value afterwards:
     * https://github.com/ethereum/EIPs/issues/20#issuecomment-263524729
     *
     * Emits an {Approval} event.
     */
    function approve(address spender, uint256 amount) external returns (bool);

    /**
     * @dev Moves `amount` tokens from `sender` to `recipient` using the
     * allowance mechanism. `amount` is then deducted from the caller's
     * allowance.
     *
     * Returns a boolean value indicating whether the operation succeeded.
     *
     * Emits a {Transfer} event.
     */
    function transferFrom(address sender, address recipient, uint256 amount) external
returns (bool);

    /**
     * @dev Emitted when `value` tokens are moved from one account (`from`) to
     * another (`to`).
     *
     * Note that `value` may be zero.
     */
    event Transfer(address indexed from, address indexed to, uint256 value);

    /**
     * @dev Emitted when the allowance of a `spender` for an `owner` is set by
     * a call to {approve}. `value` is the new allowance.
     */
    event Approval(address indexed owner, address indexed spender, uint256 value);
}

// File: @openzeppelin/contracts/utils/Address.sol

pragma solidity ^0.5.8;

/**
 * @dev Collection of functions related to the address type
 */
library Address {
    /**
     * @dev Returns true if `account` is a contract.
     *
     * [IMPORTANT]
     * ====
     * It is unsafe to assume that an address for which this function returns
     * false is an externally-owned account (EOA) and not a contract.
     *
     * Among others, `isContract` will return false for the following
     * types of addresses:
     *
     *  - an externally-owned account
     *  - a contract in construction
     *  - an address where a contract will be created
     *  - an address where a contract lived, but was destroyed
     * ====
     */
    function isContract(address account) internal view returns (bool) {
        // According to EIP-1052, 0x0 is the value returned for not-yet created
accounts
        // and 0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470 is
returned
        // for accounts without code, i.e. `keccak256('')`
        bytes32 codehash;
        bytes32 accountHash =
0xc5d2460186f7233c927e7db2dcc703c0e500b653ca82273b7bfad8045d85a470;
        // solhint-disable-next-line no-inline-assembly
        assembly { codehash := extcodehash(account) }
        return (codehash != accountHash && codehash != 0x0);
    }
```

```
    /**
     * @dev Converts an `address` into `address payable`. Note that this is
     * simply a type cast: the actual underlying value is not changed.
     *
     * _Available since v2.4.0._
     */
    function toPayable(address account) internal pure returns (address payable) {
        return address(uint160(account));
    }

    /**
     * @dev Replacement for Solidity's `transfer`: sends `amount` wei to
     * `recipient`, forwarding all available gas and reverting on errors.
     *
     * https://eips.ethereum.org/EIPS/eip-1884[EIP1884] increases the gas cost
     * of certain opcodes, possibly making contracts go over the 2300 gas limit
     * imposed by `transfer`, making them unable to receive funds via
     * `transfer`. {sendValue} removes this limitation.
     *
     * https://diligence.consensys.net/posts/2019/09/stop-using-soliditys-transfer-
now/[Learn more].
     *
     * IMPORTANT: because control is transferred to `recipient`, care must be
     * taken to not create reentrancy vulnerabilities. Consider using
     * {ReentrancyGuard} or the
     * https://solidity.readthedocs.io/en/v0.5.11/security-considerations.html#use-the-
checks-effects-interactions-pattern[checks-effects-interactions pattern].
     *
     * _Available since v2.4.0._
     */
    function sendValue(address payable recipient, uint256 amount) internal {
        require(address(this).balance >= amount, "Address: insufficient balance");

        // solhint-disable-next-line avoid-call-value
        (bool success, ) = recipient.call.value(amount)("");
        require(success, "Address: unable to send value, recipient may have reverted");
    }
}


/**
 * @title SafeERC20
 * @dev Wrappers around ERC20 operations that throw on failure (when the token
 * contract returns false). Tokens that return no value (and instead revert or
 * throw on failure) are also supported, non-reverting calls are assumed to be
 * successful.
 * To use this library you can add a `using SafeERC20 for ERC20;` statement to your
contract,
 * which allows you to call the safe operations as `token.safeTransfer(...)`, etc.
 */
library SafeERC20 {
    using SafeMath for uint256;
    using Address for address;

    bytes4 private constant SELECTOR =
bytes4(keccak256(bytes('transfer(address,uint256)')));

    function safeTransfer(IERC20 token, address to, uint256 value) internal {
        (bool success, bytes memory data) =
address(token).call(abi.encodeWithSelector(SELECTOR, to, value));
        require(success && (data.length == 0 || abi.decode(data, (bool))), 'SafeERC20:
TRANSFER_FAILED');
    }
    // function safeTransfer(IERC20 token, address to, uint256 value) internal {
    //     callOptionalReturn(token, abi.encodeWithSelector(token.transfer.selector,
to, value));
    // }

    function safeTransferFrom(IERC20 token, address from, address to, uint256 value)
internal {
        callOptionalReturn(token, abi.encodeWithSelector(token.transferFrom.selector,
from, to, value));
    }

    function safeApprove(IERC20 token, address spender, uint256 value) internal {
        // safeApprove should only be called when setting an initial allowance,
```

```
        // or when resetting it to zero. To increase and decrease it, use
        // 'safeIncreaseAllowance' and 'safeDecreaseAllowance'
        // solhint-disable-next-line max-line-length
        require((value == 0) || (token.allowance(address(this), spender) == 0),
            "SafeERC20: approve from non-zero to non-zero allowance"
        );
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector,
spender, value));
    }

    function safeIncreaseAllowance(IERC20 token, address spender, uint256 value)
internal {
        uint256 newAllowance = token.allowance(address(this), spender).add(value);
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector,
spender, newAllowance));
    }

    function safeDecreaseAllowance(IERC20 token, address spender, uint256 value)
internal {
        uint256 newAllowance = token.allowance(address(this), spender).sub(value,
"SafeERC20: decreased allowance below zero");
        callOptionalReturn(token, abi.encodeWithSelector(token.approve.selector,
spender, newAllowance));
    }

    /**
     * @dev Imitates a Solidity high-level call (i.e. a regular function call to a
contract), relaxing the requirement
     * on the return value: the return value is optional (but if data is returned, it
must not be false).
     * @param token The token targeted by the call.
     * @param data The call data (encoded using abi.encode or one of its variants).
     */
    function callOptionalReturn(IERC20 token, bytes memory data) private {
        // We need to perform a low level call here, to bypass Solidity's return data
size checking mechanism, since
        // we're implementing it ourselves.

        // A Solidity high level call has three parts:
        //  1. The target address is checked to verify it contains contract code
        //  2. The call itself is made, and success asserted
        //  3. The return value is decoded, which in turn checks the size of the
returned data.
        // solhint-disable-next-line max-line-length
        require(address(token).isContract(), "SafeERC20: call to non-contract");

        // solhint-disable-next-line avoid-low-level-calls
        (bool success, bytes memory returndata) = address(token).call(data);
        require(success, "SafeERC20: low-level call failed");

        if (returndata.length > 0) { // Return data is optional
            // solhint-disable-next-line max-line-length
            require(abi.decode(returndata, (bool)), "SafeERC20: ERC20 operation did not
succeed");
        }
    }
}

contract LPTokenWrapper is IPool,Governance {
    using SafeMath for uint256;
    using SafeERC20 for IERC20;

    IERC20 public _lpToken = IERC20(0x41D9D94803BF0BFED2A39F8DAB6E24DA32C05E0396);
//trx-mimi

    address public _playerBook = address(0x41C3AB05CB8E1A03DF5DB942AB34CEF0477926E27D);

    uint256 private _totalSupply;
    mapping(address => uint256) private _balances;

    uint256 private _totalPower;
    mapping(address => uint256) private _powerBalances;

    address public _powerStrategy = address(0x0);


    function totalSupply() public view returns (uint256) {
```

```
        return _totalSupply;
    }

    function setPowerStragegy(address strategy)  public  onlyGovernance{
        _powerStrategy = strategy;
    }

    function balanceOf(address account) public view returns (uint256) {
        return _balances[account];
    }

    function balanceOfPower(address account) public view returns (uint256) {
        return _powerBalances[account];
    }



    function totalPower() public view returns (uint256) {
        return _totalPower;
    }


    function stake(uint256 amount, string memory affCode) public {
        _totalSupply = _totalSupply.add(amount);
        _balances[msg.sender] = _balances[msg.sender].add(amount);

        if( _powerStrategy != address(0x0)){
            _totalPower = _totalPower.sub(_powerBalances[msg.sender]);
            IPowerStrategy(_powerStrategy).lpIn(msg.sender, amount);

            _powerBalances[msg.sender] =
IPowerStrategy(_powerStrategy).getPower(msg.sender);
            _totalPower = _totalPower.add(_powerBalances[msg.sender]);
        }else{
            _totalPower = _totalSupply;
            _powerBalances[msg.sender] = _balances[msg.sender];
        }

        _lpToken.safeTransferFrom(msg.sender, address(this), amount);


        if (!IPlayerBook(_playerBook).hasRefer(msg.sender)) {
            IPlayerBook(_playerBook).bindRefer(msg.sender, affCode);
        }


    }

    function withdraw(uint256 amount) public {
        require(amount > 0, "amout > 0");

        _totalSupply = _totalSupply.sub(amount);
        _balances[msg.sender] = _balances[msg.sender].sub(amount);

        if( _powerStrategy != address(0x0)){
            _totalPower = _totalPower.sub(_powerBalances[msg.sender]);
            IPowerStrategy(_powerStrategy).lpOut(msg.sender, amount);
            _powerBalances[msg.sender] =
IPowerStrategy(_powerStrategy).getPower(msg.sender);
            _totalPower = _totalPower.add(_powerBalances[msg.sender]);

        }else{
            _totalPower = _totalSupply;
            _powerBalances[msg.sender] = _balances[msg.sender];
        }

        _lpToken.transfer(msg.sender, amount);
    }
}

contract MiMiReward2 is LPTokenWrapper{
    using SafeERC20 for IERC20;

    IERC20 public _dego = IERC20(0x41A78DC061D1BBA58C4771B87494FC7D0012D78380);
    address public _teamWallet ;
    address public _rewardPool ;
```

```
uint256 public constant DURATION = 1 days;

uint256 public _initReward = 2000 * 1e18;
uint256 public addreward = 2000*1e17;
uint256 public loop = 1;

uint256 public _startTime =  now + 365 days;
uint256 public _periodFinish = 0;
uint256 public _rewardRate = 0;
uint256 public _lastUpdateTime;
uint256 public _rewardPerTokenStored;

uint256 public _teamRewardRate = 500;
uint256 public _poolRewardRate = 1500;
uint256 public _baseRate = 10000;
uint256 public _punishTime = 2 days;

mapping(address => uint256) public _userRewardPerTokenPaid;
mapping(address => uint256) public _rewards;
mapping(address => uint256) public _lastStakedTime;

bool public _hasStart = false;

event RewardAdded(uint256 reward);
event Staked(address indexed user, uint256 amount);
event Withdrawn(address indexed user, uint256 amount);
event RewardPaid(address indexed user, uint256 reward);


constructor(address teamWallet,address poolWallet)
public
{
    _teamWallet = teamWallet;
    _rewardPool = poolWallet;
}


modifier updateReward(address account) {
    _rewardPerTokenStored = rewardPerToken();
    _lastUpdateTime = lastTimeRewardApplicable();
    if (account != address(0)) {
        _rewards[account] = earned(account);
        _userRewardPerTokenPaid[account] = _rewardPerTokenStored;
    }
    _;
}

/* Fee collection for any other token */
function seize(IERC20 token, uint256 amount) external onlyGovernance{
    require(token != _dego, "reward");
    require(token != _lpToken, "stake");
    token.transfer(_governance, amount);
}

function setTeamRewardRate( uint256 teamRewardRate ) public onlyGovernance{
    _teamRewardRate = teamRewardRate;
}

function setPoolRewardRate( uint256  poolRewardRate ) public onlyGovernance{
    _poolRewardRate = poolRewardRate;
}

function setWithDrawPunishTime( uint256  punishTime ) public onlyGovernance{
    _punishTime = punishTime;
}

function lastTimeRewardApplicable() public view returns (uint256) {
    return Math.min(block.timestamp, _periodFinish);
}

function rewardPerToken() public view returns (uint256) {
    if (totalPower() == 0) {
        return _rewardPerTokenStored;
    }
    return
        _rewardPerTokenStored.add(
            lastTimeRewardApplicable()
```

```
                .sub(_lastUpdateTime)
                .mul(_rewardRate)
                .mul(1e18)
                .div(totalPower())
        );
    }

    function earned(address account) public view returns (uint256) {
        return
            balanceOfPower(account)
                .mul(rewardPerToken().sub(_userRewardPerTokenPaid[account]))
                .div(1e18)
                .add(_rewards[account]);
    }

    // stake visibility is public as overriding LPTokenWrapper's stake() function
    function stake(uint256 amount, string memory affCode)
        public
        updateReward(msg.sender)
        checkHalve
        checkStart
    {
        require(amount > 0, "Cannot stake 0");
        super.stake(amount, affCode);

        _lastStakedTime[msg.sender] = now;

        emit Staked(msg.sender, amount);
    }

    function withdraw(uint256 amount)
        public
        updateReward(msg.sender)
        checkHalve
        checkStart
    {
        require(amount > 0, "Cannot withdraw 0");
        super.withdraw(amount);
        emit Withdrawn(msg.sender, amount);
    }

    function exit() external {
        withdraw(balanceOf(msg.sender));
        getReward();
    }

    function getReward() public updateReward(msg.sender) checkHalve checkStart {
        uint256 reward = earned(msg.sender);
        if (reward > 0) {
            _rewards[msg.sender] = 0;

            uint256 fee = IPlayerBook(_playerBook).settleReward(msg.sender, reward);

            uint256 leftReward = reward;
            uint256 poolReward = 0;
            uint256 teamReward = 0;
            if(now  < (_lastStakedTime[msg.sender] + _punishTime) ){
                poolReward = leftReward.mul(_poolRewardRate).div(_baseRate);
                teamReward = reward.mul(_teamRewardRate).div(_baseRate);
            }
            if(poolReward>0){
                _dego.transfer(_rewardPool, poolReward);
                leftReward = leftReward.sub(poolReward);
            }
            if(teamReward>0){
                _dego.transfer(_teamWallet, teamReward);
                leftReward = leftReward.sub(teamReward);
            }

            if(leftReward>0){
                _dego.transfer(msg.sender, leftReward );
            }

            emit RewardPaid(msg.sender, leftReward);
        }
    }
```

```
    modifier checkHalve() {
        if (block.timestamp >= _periodFinish) {
            if(_initReward != 0){
                addreward = _initReward.mul(10).div(100);
                _initReward = _initReward.add(addreward);
            }
            _rewardRate = _initReward.div(DURATION);
            _periodFinish = block.timestamp.add(DURATION);
            loop = loop +1;
            if(loop >43){
                _rewardRate = 0;
            }

          /*  _initReward = _initReward.mul(50).div(100);
            _rewardRate = _initReward.div(DURATION);
            _periodFinish = block.timestamp.add(DURATION);*/
            emit RewardAdded(_initReward);
        }
        _;
    }

    modifier checkStart() {
        require(block.timestamp > _startTime, "not start");
        _;
    }

    // set fix time to start reward
    function startReward(uint256 startTime)
        external
        onlyGovernance
        updateReward(address(0))
    {
        require(_hasStart == false, "has started");
        _hasStart = true;

        _startTime = startTime;

        _rewardRate = _initReward.div(DURATION);

        _lastUpdateTime = _startTime;
        _periodFinish = _startTime.add(DURATION);

        emit RewardAdded(_initReward);
    }

    //

    //for extra reward
    function notifyRewardAmount(uint256 reward)
        external
        onlyGovernance
        updateReward(address(0))
    {
        IERC20(_dego).safeTransferFrom(msg.sender, address(this), reward);
        if (block.timestamp >= _periodFinish) {
            _rewardRate = reward.div(DURATION);
        } else {
            uint256 remaining = _periodFinish.sub(block.timestamp);
            uint256 leftover = remaining.mul(_rewardRate);
            _rewardRate = reward.add(leftover).div(DURATION);
        }
        _lastUpdateTime = block.timestamp;
        _periodFinish = block.timestamp.add(DURATION);
        emit RewardAdded(reward);
    }
}
```

5. 附录 B：漏洞风险评级标准

智能合约漏洞评级标准	
漏洞评级	**漏洞评级说明**
高危漏洞	能直接造成代币合约或用户资金损失的漏洞，如：能造成代币价值归零的数值溢出漏洞、能造成交易所损失代币的假充值漏洞、能造成合约账户损失 ETH 或代币的重入漏洞等； 能造成代币合约归属权丢失的漏洞，如：关键函数的访问控制缺陷、call 注入导致关键函数访问控制绕过等； 能造成代币合约无法正常工作的漏洞，如：因向恶意地址发送 ETH 导致的拒绝服务漏洞、因 gas 耗尽导致的拒绝服务漏洞。
中危漏洞	需要特定地址才能触发的高风险漏洞，如代币合约拥有者才能触发的数值溢出漏洞等；非关键函数的访问控制缺陷、不能造成直接资金损失的逻辑设计缺陷等。
低危漏洞	难以被触发的漏洞、触发之后危害有限的漏洞，如需要大量 ETH 或代币才能触发的数值溢出漏洞、触发数值溢出后攻击者无法直接获利的漏洞、通过指定高 gas 触发的事务顺序依赖风险等。

6. 附录 C：漏洞测试工具简介

6.1. MaABBTicore

MaABBTicore 是一个分析二进制文件和智能合约的符号执行工具，MaABBTicore 包含一个符号区块链虚拟机（EVM），一个 EVM 反汇编器/汇编器以及一个用于自动编译和分析 Solidity 的方便界面。它还集成了 Ethersplay，用于 EVM 字节码的 Bit of Traits of Bits 可视化反汇编程序，用于可视化分析。 与二进制文件一样，MaABBTicore 提供了一个简单的命令行界面和一个用于分析 EVM 字节码的 Python API。

6.2. OyeABBTe

OyeABBTe 是一个智能合约分析工具，OyeABBTe 可以用来检测智能合约中常见的 bug，比如 reeABBTrancy、事务排序依赖等等。更方便的是，OyeABBTe 的设计是模块化的，所以这让高级用户可以实现并插入他们自己的检测逻辑，以检查他们的合约中自定义的属性。

6.3. securify.sh

Securify 可以验证区块链智能合约常见的安全问题，例如交易乱序和缺少输入验证，它在全自动化的同时分析程序所有可能的执行路径，此外，Securify 还具有用于指定漏洞的特定语言，这使 Securify 能够随时关注当前的安全性和其他可靠性问题。

6.4. Echidna

Echidna 是一个为了对 EVM 代码进行模糊测试而设计的 Haskell 库。

6.5. MAIAN

MAIAN 是一个用于查找区块链智能合约漏洞的自动化工具，Maian 处理合约的字节码，并尝试建立一系列交易以找出并确认错误。

6.6. ethersplay

ethersplay 是一个 EVM 反汇编器，其中包含了相关分析工具。

6.7. ida-evm

ida-evm 是一个针对区块链虚拟机（EVM）的 IDA 处理器模块。

6.8. Remix-ide

Remix 是一款基于浏览器的编译器和 IDE，可让用户使用 Solidity 语言构建区块链合约并调试交易。

6.9. 知道创宇渗透测试人员专用工具包

知道创宇渗透测试人员专用工具包，由知道创宇渗透测试工程师研发，收集和使用，包含专用于测试人员的批量自动测试工具，自主研发的工具、脚本或利用工具等。