Cyberscope

Audit Report

Tea-Fi presaleClaim

August 2024

SHA256 7a8f1e7cb44bc73638526c343f845f913aa6cc010857110b8447b4856ca83346

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Risk Classification

The criticality of findings in Cyberscope's smart contract audits is determined by evaluating multiple variables. The two primary variables are:

1. **Likelihood of Exploitation**: This considers how easily an attack can be executed, including the economic feasibility for an attacker.
2. **Impact of Exploitation**: This assesses the potential consequences of an attack, particularly in terms of the loss of funds or disruption to the contract's functionality.

Based on these variables, findings are categorized into the following severity levels:

1. **Critical**: Indicates a vulnerability that is both highly likely to be exploited and can result in significant fund loss or severe disruption. Immediate action is required to address these issues.
2. **Medium**: Refers to vulnerabilities that are either less likely to be exploited or would have a moderate impact if exploited. These issues should be addressed in due course to ensure overall contract security.
3. **Minor**: Involves vulnerabilities that are unlikely to be exploited and would have a minor impact. These findings should still be considered for resolution to maintain best practices in security.
4. **Informative**: Points out potential improvements or informational notes that do not pose an immediate risk. Addressing these can enhance the overall quality and robustness of the contract.

Severity	Likelihood / Impact of Exploitation
Critical	Highly Likely / High Impact
Medium	Less Likely / High Impact or Highly Likely/ Lower Impact
Minor / Informative	Unlikely / Low to no Impact

Review

Testing Deploy	https://testnet.bscscan.com/address/0x824CCda68950B8Eb1C5360bA3853bF8c4C7713f2

Audit Updates

Initial Audit	13 Aug 2024

Source Files

Filename	SHA256
ClaimEarningFees.sol	7a8f1e7cb44bc73638526c343f845f913aa6cc010857110b8447b4856ca83346

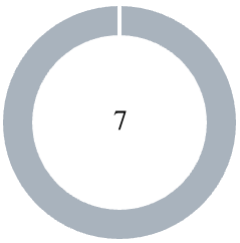
Overview

The `ClaimEarningFees` smart contract is designed to manage the distribution of funds to users based on a Merkle tree proof mechanism. The contract utilizes a role-based access control system, where specific roles such as DEFAULT_ADMIN_ROLE and OPERATOR_ROLE have distinct permissions to manage the contract's functionalities. The primary function of the contract is to allow eligible users to claim tokens or Ether based on a provided Merkle proof, which validates their entitlement to the specified amounts.

The contract includes mechanisms to pause and unpause the claiming process, either globally or for individual accounts. This ensures that the contract can be securely managed during its operation, allowing the administrator or operators to control the flow of claims. The unpause function also resets the claim period, establishing a new deadline for claims based on the current block timestamp.

Additionally, the contract provides functionality for administrators to withdraw Ether or ERC20 tokens held within the contract, directing the funds to a designated multisig wallet. This ensures that the contract can manage and distribute funds securely and efficiently. The contract also includes standard safeguards such as reentrancy protection and the ability to check if accounts are paused or have already claimed their entitled funds.

Findings Breakdown



Critical	0
Medium	0
Minor / Informative	7

Severity	Unresolved	Acknowledged	Resolved	Other
Critical	0	0	0	0
Medium	0	0	0	0
Minor / Informative	7	0	0	0

Diagnostics

Critical Medium Minor / Informative

Severity	Code	Description	Status
●	ICEV	Inconsistent Claim Eligibility Verification	Unresolved
●	CCR	Contract Centralization Risk	Unresolved
●	IHH	Incorrect Hardcoded Hash	Unresolved
●	MPC	Merkle Proof Centralization	Unresolved
●	MCM	Misleading Comment Messages	Unresolved
●	TUU	Time Units Usage	Unresolved
●	TSI	Tokens Sufficiency Insurance	Unresolved

ICEV - Inconsistent Claim Eligibility Verification

Criticality	Minor / Informative
Location	ClaimEarningFees.sol#L168
Status	Unresolved

Description

The method `isAccountAbleToClaim` is intended to determine if a specified account is eligible to make a claim. However, the logic within the `isAccountAbleToClaim` method calls another method, `isAccountClaimedByRootHash`, which checks whether the `_msgSender()` (the address initiating the call) has already claimed. As a result, when `isAccountAbleToClaim` is called with an account address that is different from `_msgSender()`, the function will return false, regardless of the actual eligibility of the specified account.

```
function isAccountAbleToClaim(
        address account,
        uint256 nonce,
        address[] calldata tokens,
        uint256[] calldata amounts,
        bytes32[] calldata proof
    ) public view returns (bool) {
        if (
            claimRoot == bytes32(0) ||
            paused() ||
            account == address(0) ||
            accountData[account].isPaused ||
            isAccountClaimedByRootHash(claimRoot)
        ) {
            return false;
        }

        ...
    }

    function isAccountClaimedByRootHash(
        bytes32 root
    ) public view returns (bool) {
        return accountData[_msgSender()].isClaimed[root];
    }
```

Recommendation

The contract logic should be refactored so that the isAccountAbleToClaim method directly checks the claim status of the account parameter rather than relying on the _msgSender() address. This change will ensure that the method returns accurate results based on the eligibility of the specified account, independent of the caller's identity.

CCR - Contract Centralization Risk

Criticality	Minor / Informative
Location	ClaimEarningFees.sol#L218,245,282,300
Status	Unresolved

Description

The contract's functionality and behavior are heavily dependent on external parameters or configurations. While external configuration can offer flexibility, it also poses several centralization risks that warrant attention. Centralization risks arising from the dependence on external configuration include Single Point of Control, Vulnerability to Attacks, Operational Delays, Trust Dependencies, and Decentralization Erosion. Specifically, the `pause` and `unpause` functions grant administrative roles the ability to pause or unpause the claims globally or for specific addresses. Furthermore, the `unpause` function also enables to modify the Merkle root used for claims. Additionally, the admin role has the authority to withdraw the contract's balance of both native currency (ETH) and ERC20 tokens.

```
function pause(address account) external
onlyAdminAndOperatorRoles {
    if (account == _msgSender()) {
        revert PauseYourselfError();
    } else if (account == address(0)) {
        _pause();
        emit ClaimPaused();
        return;
    }

    AccountData storage _accountData = accountData[account];

    if (_accountData.isPaused) {
        revert AccountHasAlreadyBeenPausedError();
    }

    accountData[account].isPaused = true;
    emit AccountIsPausedFromClaim(account);
}

function unpause(
    bytes32 newRoot,
    address account,
    uint256 customPeriod
) external onlyAdminAndOperatorRoles {
    if (account == address(0)) {
        uint256 durationNormal = customPeriod != 0
            ? customPeriod
            : CLAIM_PERIOD_DURATION;
        unchecked {
            claimPeriodDeadline = block.timestamp +
durationNormal;
        }

        if (paused()) {
            _unpause();
        }

        claimRoot = newRoot;

        emit ClaimUnpaused();
        return;
    }

    AccountData storage _accountData = accountData[account];

    if (!_accountData.isPaused) {
        revert AccountHasNotBeenPausedError();
    }
```

```
    _accountData.isPaused = false;
    emit AccountIsUnpausedFromClaim(account);
}
```

Recommendation

To address this finding and mitigate centralization risks, it is recommended to evaluate the feasibility of migrating critical configurations and functionality into the contract's codebase itself. This approach would reduce external dependencies and enhance the contract's self-sufficiency. It is essential to carefully weigh the trade-offs between external configuration flexibility and the risks associated with centralization.

IHH - Incorrect Hardcoded Hash

Criticality	Minor / Informative
Location	ClaimEarningFees.sol#L26
Status	Unresolved

Description

The smart contract contains a hardcoded `bytes32` value that represents the hash of the string "OPERATOR_ROLE". However, upon recalculating the hash using the standard `keccak256` hashing function, the resulting value does not match the hardcoded one. Further investigation reveals that the hardcoded value is actually the SHA-256 hash of the string "OPERATOR_ROLE", rather than the expected Keccak-256 hash. SHA-256 and Keccak-256 are distinct cryptographic hash functions, and using SHA-256 in place of Keccak-256 can lead to issues in role-based access control.

```
// keccak256("OPERATOR_ROLE")
bytes32 public constant OPERATOR_ROLE =

0xf5e4452d10345ef04dcf53bc79a78140af90eb5f4f7164dd2eea730ff5d16
e0c;
```

Recommendation

It is recommended that the development team replaces the hardcoded SHA-256 hash with the correct Keccak-256 hash of the string "OPERATOR_ROLE". This ensures that the role-based access control functions as expected within the blockchain environment, where Keccak-256 is the standard hashing algorithm.

MPC - Merkle Proof Centralization

Criticality	Minor / Informative
Location	ClaimEarningFees.sol#L174,245
Status	Unresolved

Description

The contract uses a Merkle Proof mechanism in order to define many applicable addresses. The verification process is based on an off-chain configuration. The contract owner is responsible for updating the in-chain “Merkle Root” in order to validate correctly the provided message.

```
MerkleProof.verify(
    proof,
    claimRoot,
    keccak256(abi.encodePacked(account, nonce, tokens,
amounts))
);

function unpause(
    bytes32 newRoot,
    address account,
    uint256 customPeriod
) external onlyAdminAndOperatorRoles {
    if (account == address(0)) {
        uint256 durationNormal = customPeriod != 0
            ? customPeriod
            : CLAIM_PERIOD_DURATION;
        unchecked {
            claimPeriodDeadline = block.timestamp +
durationNormal;
        }

        if (paused()) {
            _unpause();
        }

        claimRoot = newRoot;

        emit ClaimUnpaused();
        return;
    }

...
```

Recommendation

We state that the Merkle Proof algorithm is required for proper protocol operations and gas consumption decrease. Thus, we emphasize that the Merkle proof algorithm is based on an off-chain mechanism. Any off-chain mechanism could potentially be compromised and affect the on-chain state unexpectedly. 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.

Temporary Solutions:

These measurements do not decrease the severity of the finding

- Introduce a time-locker mechanism with a reasonable delay.
- Introduce a multi-signature wallet so that many addresses will confirm the action.
- Introduce a governance model where users will vote about the actions.

Permanent Solution:

- Renouncing the ownership, which will eliminate the threats but it is non-reversible.

MCM - Misleading Comment Messages

Criticality	Minor / Informative
Location	ClaimEarningFees.sol#L106
Status	Unresolved

Description

The contract is using misleading comment messages. These comment messages do not accurately reflect the actual implementation, making it difficult to understand the source code. As a result, the users will not comprehend the source code's actual implementation. Specifically, the comment mentioning two identical claims suggests that the contract explicitly allows for or handles the execution of duplicate claims, which is not supported by the actual implementation.

```
/**
     * @dev Claims the tokens of the account.
     * @param nonce The nonce of the claim, which enables the execution
of two identical claims.
     * @param tokens The addresses of the tokens to claim.
     * @param amounts The amounts of the tokens to claim.
     * @param proof The Merkle proof of the claim.
     */
    function claim(
        uint256 nonce,
        address[] calldata tokens,
        uint256[] calldata amounts,
        bytes32[] calldata proof
    ) external whenNotPaused nonReentrant {
        address sender = _msgSender();

        if (block.timestamp > claimPeriodDeadline) {
            revert ClaimPeriodFinished();
        }
        if (tokens.length != amounts.length) {
            revert LengthDiffer();
        }
        if (!isAccountAbleToClaim(sender, nonce, tokens, amounts,
proof)) {
            revert AccountIsNotAbleToClaim();
        }

        // save that account is claimed
        accountData[sender].isClaimed[claimRoot] = true;

        for (uint256 i = 0; i < tokens.length; i++) {
            if (amounts[i] == 0) {
                continue;
            }
            if (tokens[i] != address(0)) {
                IERC20(tokens[i]).safeTransfer(sender, amounts[i]);
            } else {
                _transferEther(sender, amounts[i]);
            }

            emit Claimed(sender, tokens[i], amounts[i]);
        }
    }
```

Recommendation

The team is advised to carefully review the comment in order to reflect the actual implementation. To improve code readability, the team should use more specific and descriptive comment messages.

TUU - Time Units Usage

Criticality	Minor / Informative
Location	ClaimEarningFees.sol#L23
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.

```
uint256 public constant CLAIM_PERIOD_DURATION = 259_200;
```

Recommendation

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

TSI - Tokens Sufficiency Insurance

Criticality	Minor / Informative
Location	ClaimEarningFees.sol#L136
Status	Unresolved

Description

The tokens and native currency are not held within the contract itself. Instead, the contract is designed to provide them from an external administrator. While external administration can provide flexibility, it introduces a dependency on the administrator's actions, which can lead to various issues and centralization risks.

```
if (tokens[i] != address(0)) {
    IERC20(tokens[i]).safeTransfer(sender, amounts[i]);
} else {
    _transferEther(sender, amounts[i]);
}
```

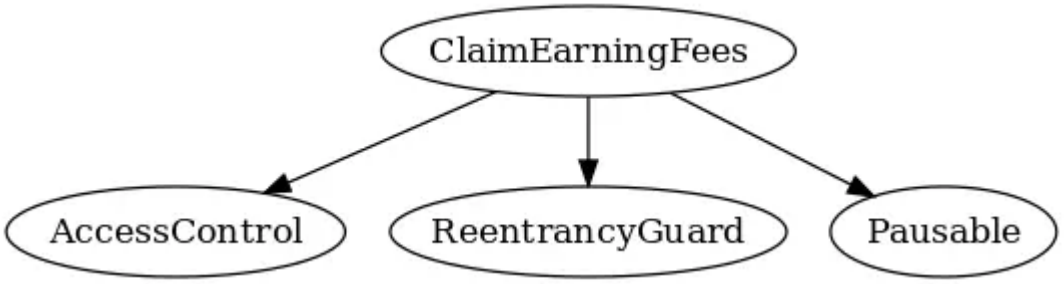
Recommendation

It is recommended to consider implementing a more decentralized and automated approach for handling the contract tokens and native currency. One possible solution is to hold them the contract itself. If the contract guarantees the process it can enhance its reliability, security, and participant trust, ultimately leading to a more successful and efficient process.

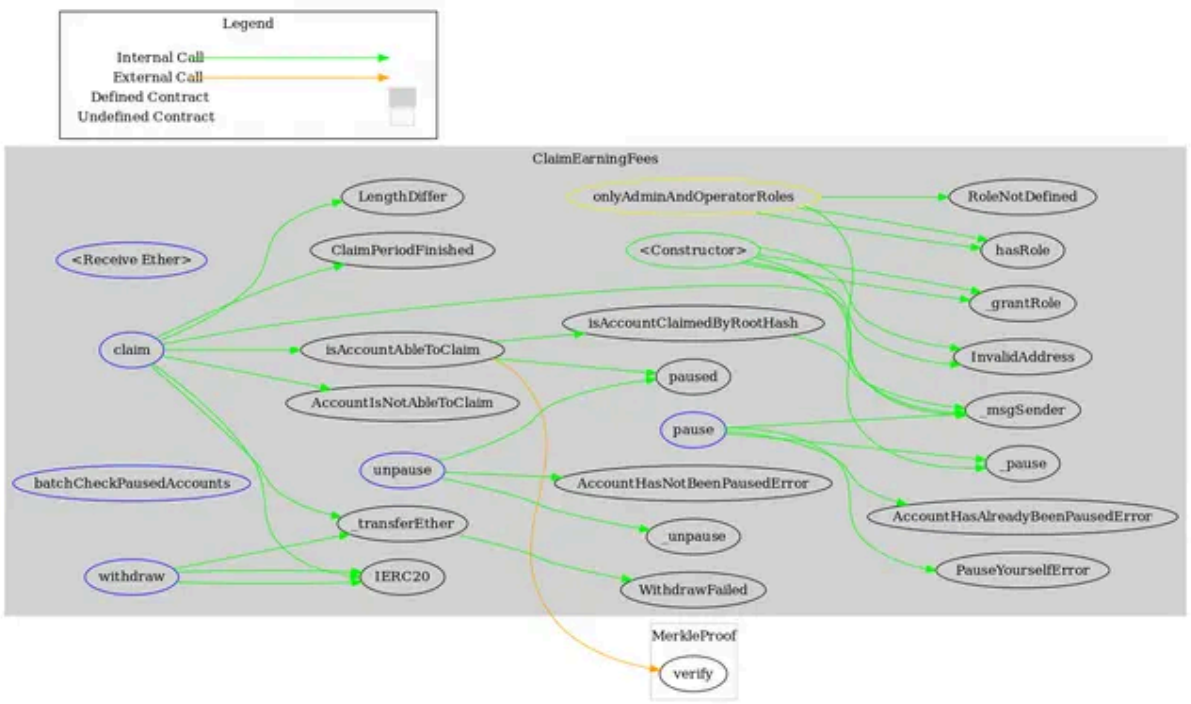
Functions Analysis

Contract	Type	Bases		
	Function Name	**Visibility**	**Mutability**	**Modifiers**
ClaimEarningFees	Implementation	AccessControl, ReentrancyGuard, Pausable		
		Public	✓	-
		External	Payable	-
	claim	External	✓	whenNotPaused nonReentrant
	isAccountAbleToClaim	Public		-
	isAccountClaimedByRootHash	Public		-
	batchCheckPausedAccounts	External		-
	pause	External	✓	onlyAdminAndOperatorRoles
	unpause	External	✓	onlyAdminAndOperatorRoles
	withdraw	External	✓	onlyRole
	_transferEther	Private	✓	

Inheritance Graph



Flow Graph


Legend
Internal Call
External Call
Defined Contract
Undefined Contract
ClaimEarningFees
LengthDiffer
ClaimPeriodFinished
<Receive Ether>
claim
isAccountAbleToClaim
AccountIsNotAbleToClaim
batchCheckPausedAccounts
unpause
transferEther
withdraw
IERC20
onlyAdminAndOperatorRoles
<Constructor>
isAccountClaimedByRootHash
paused
pause
AccountHasNotBeenPausedError
unpause
WithdrawFailed
RoleNotDefined
hasRole
_grantRole
InvalidAddress
_msgSender
_pause
AccountHasAlreadyBeenPausedError
PauseYourselfError
MerkleProof
verify

Summary

Tea-Fi ClaimEarningFees contract implements a presale claim mechanism. This audit investigates security issues, business logic concerns and potential improvements.

Disclaimer

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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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