Cyberscope

Audit Report

Tea-Fi

July 2024

Files Presale.sol, PresaleToken.sol, Quoter.sol

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Review

Testing Deploy	https://testnet.bscscan.com/address/0x315250f50d3aeeb17a910cb653c3e134d5615233

Audit Updates

Initial Audit	28 Jun 2024

Source Files

Filename	SHA256
contracts/Quoter.sol	38f06ffff1e63b9eae7e9cf1ccb000635643add41669e6aee946cf01e8d79273
contracts/Presale.sol	0ee6ed6fb18025fc4317b52b4c5bf6bb79f094813206df19cf5845162b4d652d
contracts/token/PresaleToken.sol	8c593f185bae84c2d096ebeaab9660fd14323bb7f42b32ac0d5de2231c096eaf
contracts/token/IPresaleToken.sol	ce5cdd3388afc62d067d3d71460ddc5671498c662ec188d1506c1aae4b6555de
@openzeppelin/contracts/utils/Pausable.sol	6543160582b3c0319a180f31660faf6ba0a8444acbdb03357c09790a96256835
@openzeppelin/contracts/utils/Context.sol	847fda5460fee70f56f4200f59b82ae622bb03c79c77e67af010e31b7e2cc5b6
@openzeppelin/contracts/utils/Address.sol	b3710b1712637eb8c0df81912da3450da6ff67b0b3ed18146b033ed15b1aa3b9
@openzeppelin/contracts/token/ERC20/IERC20.sol	6f2faae462e286e24e091d7718575179644dc60e79936ef0c92e2d1ab3ca3cee

@openzeppelin/contracts/token/ERC20/ERC20.sol	ddff96777a834b51a08fec26c69bb6ca2d01d150a3142b3fdd8942e07921636a
@openzeppelin/contracts/token/ERC20/utils/SafeERC20.sol	471157c89111d7b9eab456b53ebe9042bc69504a64cb5cc980d38da9103379ae
@openzeppelin/contracts/token/ERC20/extensions/IERC20Permit.sol	912509e0e9bf74e0f8a8c92d031b5b26d2d35c6d4abf3f56251be1ea9ca946bf
@openzeppelin/contracts/token/ERC20/extensions/IERC20Metadata.sol	1d079c20a192a135308e99fa5515c27acfbb071e6cdb0913b13634e630865939
@openzeppelin/contracts/interfaces/draft-IERC6093.sol	4aea87243e6de38804bf8737bf86f750443d3b5e63dd0fd0b7ad92f77cdbd3e3
@openzeppelin/contracts/access/Ownable.sol	38578bd71c0a909840e67202db527cc6b4e6b437e0f39f0c909da32c1e30cb81

Overview

The Presale contract is designed to facilitate the sale of tokens before they are officially launched. This contract allows users to purchase tokens using different cryptocurrencies, including Ether (ETH), by interacting with various presale options. The contract manages the entire lifecycle of a presale, from creating new presale options to handling token purchases and withdrawals. The presale process involves several key functionalities:

Token Purchase

Users can buy presale tokens by providing the necessary payment in either ETH or other ERC20 tokens. The purchase functions (buyExactPresaleTokens and buyExactPresaleTokensETH) calculate the exact payment amount required and execute the token purchase, ensuring that the user receives the correct amount of presale tokens. The contract also supports referral tracking, where users can specify a referrer ID, and the system tracks sales attributed to each referrer.

Presale Options Management

The contract allows the owner to create, initialize, and delete presale options. Each presale option is associated with specific parameters, such as the price per token, the amount available at the Token Generation Event (TGE), and the vesting schedule.

Payment Token Management

The contract enables the owner to add and remove payment tokens, specifying whether they are pegged to USD and defining their conversion paths for decentralized exchanges.

Withdrawal

The owner can withdraw funds collected from the presale, either in ETH or other ERC20 tokens, ensuring that the contract's balance is transferred to a specified multisig wallet for secure fund management.

Price Quoting

The contract includes functions to retrieve price quotes for token swaps using Uniswap V2. These quotes are used to determine the amount of tokens required or received during the presale transactions.

The Presale contract interacts with two other key contracts :

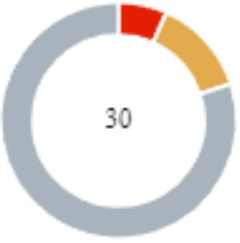
Quoter Contract

This contract is used to obtain price quotes for token swaps through Uniswap V2. It provides functions to get the expected amount of output tokens for a given input and vice versa, aiding in the accurate calculation of payment amounts during the presale.

PresaleToken Contract

This contract represents the tokens being sold in the presale. It includes functionalities for minting new tokens and burning tokens, which are crucial for managing the supply of presale tokens as users make purchases.

Findings Breakdown



Critical	2
Medium	4
Minor / Informative	24

Severity	Unresolved	Acknowledged	Resolved	Other
Critical	2	0	0	0
Medium	4	0	0	0
Minor / Informative	24	0	0	0

Diagnostics

Critical Medium Minor / Informative

Severity	Code	Description	Status
●	BT	Burns Tokens	Unresolved
●	IPC	Inconsistent Price Calculation	Unresolved
●	ITM	Immediate Token Minting	Unresolved
●	MT	Mints Tokens	Unresolved
●	OMS	Oracle Manipulation Susceptibility	Unresolved
●	PRE	Potential Reentrance Exploit	Unresolved
●	CCR	Contract Centralization Risk	Unresolved
●	DIS	Duplicate Import Statement	Unresolved
●	IRS	Incomplete Referral System	Unresolved
●	IMU	Incorrect Modifier Usage	Unresolved
●	IPQC	Incorrect Price Quote Calculation	Unresolved
●	IAA	Indexed Address Absence	Unresolved
●	IDTU	Inefficient Data Types Usage	Unresolved
●	IPU	Inefficient Parameter Usage	Unresolved

●	MMN	Misleading Modifier Naming	Unresolved
●	MCV	Missing Constructor Validation	Unresolved
●	MDC	Missing Decimal Checks	Unresolved
●	MTI	Missing Token Initialization	Unresolved
●	MV	Missing Validation	Unresolved
●	PDS	Potential Duplicate Salt	Unresolved
●	PTAI	Potential Transfer Amount Inconsistency	Unresolved
●	PZD	Potential Zero Division	Unresolved
●	REE	Redundant Event Emission	Unresolved
●	USM	Unused Struct Members	Unresolved
●	L04	Conformance to Solidity Naming Conventions	Unresolved
●	L09	Dead Code Elimination	Unresolved
●	L11	Unnecessary Boolean equality	Unresolved
●	L13	Divide before Multiply Operation	Unresolved
●	L16	Validate Variable Setters	Unresolved
●	L19	Stable Compiler Version	Unresolved

BT - Burns Tokens

Criticality	Critical
Location	contracts/token/PresaleToken.sol#L77
Status	Unresolved

Description

The contract owner has the authority to burn tokens from a specific address. The owner may take advantage of it by calling the `burn` function. As a result, the targeted address will lose the corresponding tokens.

```
function burn(address from, uint256 amount) external onlyOwner
{
    _burn(from, amount);
    emit Burned(from, amount);
}
```

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.

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.

IPC - Inconsistent Price Calculation

Criticality	Critical
Location	contracts/Presale.sol#L327,701
Status	Unresolved

Description

The option struct's `price` field is used inconsistently in the functions getExactReceiveAmount and `_calculatePayAmount`, leading to potential incorrect calculations. In `getExactReceiveAmount`, the `price` is scaled with 1e14, while in `_calculatePayAmount`, it is divided by 100 and further scaled with 1e12. This discrepancy causes the functions to yield significantly different results when calculating the amount of tokens received or the payment amount required.

```
function getExactReceiveAmount(
        uint8 optionId,
        address tokenSell,
        uint256 payAmount
    )
    external
    view
    returns(uint256) {
        Option memory option = saleOptions[optionId];
        PaymentTokenType memory saleToken =
salePaymentTokens[tokenSell];

        if(option.presaleToken == address(0)) {
            return 0;
        }
        if(saleToken.allowed == false) {
            return 0;
        }



        if(saleToken.peggedToUsd == true) {
            return payAmount / option.price * 1e14;
        }

        uint8 decimals = tokenSell != address(0) ?
IERC20Metadata(tokenSell).decimals() : 18;
        uint256 quoteAmount = 10**decimals;


        uint256 tokenSellAmountInUsd = payAmount *
inputPriceQuote(tokenSell, quoteAmount);
        return tokenSellAmountInUsd != 0 ? tokenSellAmountInUsd
/ option.price * 1e14 / 10**decimals : 0;
    }

function _calculatePayAmount(
        uint8 optionId,
        address tokenSell,
        uint256 buyAmount
    ) private view returns (
        uint256 payAmount,
        uint256 optionTokenAmountInUsd,
        Option storage option
    ) {
        option = saleOptions[optionId];
        optionTokenAmountInUsd = buyAmount * option.price /
100;

        if(salePaymentTokens[tokenSell].peggedToUsd == true) {
```

```
            uint256 usdAmount = optionTokenAmountInUsd / 1e12;
            return (usdAmount, usdAmount, option);
        }

        uint8 decimals =
IERC20Metadata(option.presaleToken).decimals();
        uint8 stableTokenDecimals = 6;

        unchecked {
            optionTokenAmountInUsd /= 10**(decimals -
stableTokenDecimals);
        }

        payAmount = inputPriceQuoteReversed(tokenSell,
optionTokenAmountInUsd);
    }
```

Recommendation

It is recommended to align the scaling factors and ensure consistent handling of the `price` field across the contract. This alignment will ensure accurate and predictable calculations for users participating in the presale. Review and adjust the mathematical operations in both functions to use the same scaling and division logic for the `price` field.

ITM - Immediate Token Minting

Criticality	Medium
Location	contracts/Presale.sol#L760
Status	Unresolved

Description

The Presale contract mints and transfers tokens to the buyer immediately upon purchase. This approach allows users to instantly receive and potentially sell their presale tokens at a different price on secondary markets before the presale event concludes. This can lead to market manipulation and undermine the intended price stability and distribution strategy of the presale.

```
function _buyExactTokens(
        uint8 optionId,
        uint32 referrerId,
        address tokenSell,
        address sender,
        uint256 buyAmount,
        uint256 payAmount,
        uint256 amountInUsd,
        Option storage option
    ) private {
        Referral storage referrer = referrals[referrerId];

        unchecked {
            referrer.sold += buyAmount;
            referrer.soldInUsd += amountInUsd;
            ++referrer.referrals;
        }


        // No need to check because of first check in top
        unchecked {
            totalSold += buyAmount;
            totalSoldInUsd += amountInUsd;
            option.sold += buyAmount;
            option.soldInUsd += amountInUsd;
        }


        IPresaleToken(option.presaleToken).mint(sender, buyAmount);
        emit BuyTokens(
            sender,
            tokenSell,
            option.presaleToken,
            optionId,
            referrerId,
            amountInUsd,
            buyAmount,
            payAmount / amountInUsd,
            option.price,
            buyAmount
        );
    }
```

Recommendation

To mitigate this issue, it is recommended to implement a delayed token distribution mechanism. Instead of minting and transferring tokens immediately, the contract should store the purchase details and distribute the tokens only after the presale event ends. This can be achieved by introducing a `finalizePresale` function, which the owner can call to trigger the distribution of tokens to all buyers. This approach ensures that tokens are distributed fairly and in line with the presale's goals, preventing premature trading and price manipulation.

MT - Mints Tokens

Criticality	Medium
Location	contracts/token/PresaleToken.sol#L63
Status	Unresolved

Description

The operator of the PresaleToken that is a role managed by the contract owner has the authority to mint tokens. They may take advantage of it by calling the `mint` function. As a result, the contract tokens will be highly inflated.

```
function mint(address to, uint256 amount) external {
    if(_msgSender() != operator) {
        revert CallerIsNotOperator();
    }

    _mint(to, amount);

    emit Minted(to, amount);
}
```

Recommendation

The team should carefully manage the private keys of the owner’s account and the operator's. 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.

OMS - Oracle Manipulation Susceptibility

Criticality	Medium
Location	contracts/Quoter.sol#L31,40
Status	Unresolved

Description

The functions `getQuoteUniswapV2` and `getQuoteReverseUniswapV2` are used to obtain price quotes for swaps through Uniswap V2. However, these quotes can be easily manipulated because they rely on Uniswap's on-chain price feeds, which are vulnerable to price manipulation attacks. This can occur through flash loan attacks, where an attacker borrows a large amount of tokens to manipulate the price within a single transaction, or through trading in low liquidity pools, where significant trades can disproportionately affect the price. As a result, the price quotes returned by these functions may be inaccurate, potentially leading to financial loss for users relying on them for transactions.

```
function getQuoteUniswapV2(
        uint256 amountsIn,
        address[] memory path
    ) internal view returns(uint256) {
        return UNISWAP_V2_ROUTER.getAmountsOut(amountsIn,
path)[path.length - 1];
    }

function getQuoteReverseUniswapV2(
        uint256 amountsOut,
        address[] memory path
    ) internal view returns(uint256) {
        return UNISWAP_V2_ROUTER.getAmountsIn(amountsOut,
path)[0];
    }
```

Recommendation

It is recommended to mitigate this risk by employing strategies such as using a Time-Weighted Average Price (TWAP) instead of the current spot price from Uniswap. TWAP averages the price over a specified period, reducing the impact of short-term price manipulation. Another approach is to integrate more robust on-chain price oracles like Chainlink, which aggregate prices from multiple sources to provide a more reliable price feed. Additionally, implementing liquidity checks to ensure that the trading pairs have sufficient liquidity to withstand potential manipulation can further enhance the security and reliability of the price quotes used in the contract.

PRE - Potential Reentrance Exploit

Criticality	Medium
Location	contracts/Presale.sol#L473
Status	Unresolved

Description

The `buyExactPresaleTokensETH` function in the Presale contract is susceptible to a potential reentrancy attack. The function uses the `checkTokensRemain` modifier to ensure that the total number of tokens sold does not exceed the available tokens for presale. However, this check is based on the `totalSold` variable, which is not updated until the `_buyExactTokens` function is called. This sequence of operations can be exploited by an attacker. The refund of excess ETH happens before the state variable `totalSold` is updated, allowing the possibility of manipulating the contract's state through reentrancy. An attacker could repeatedly call the function, manipulating the state before `totalSold` is correctly updated, potentially leading to a bypass of the `checkTokensRemain` check.

```
function buyExactPresaleTokensETH(
        uint8 optionId,
        uint32 referrerId,
        uint256 buyAmount
    )
    external
    payable
    whenNotPaused
    whenOptionCreated(optionId)
    whenTokenAllowed(address(0))
    checkTokensRemain(msg.value) {
        // get receive token price first
        (uint256 payAmount, uint256 optionTokenAmountInUsd, Option
storage option) = _calculatePayAmount(
            optionId,
            address(0),
            buyAmount
        );

        address sender = _msgSender();
        uint256 transferValue = msg.value;



        if(transferValue < payAmount) {
            revert InsufficientFunds();
        } else if(transferValue > payAmount) {
            // refund exceeded funds
            (bool succeed,) = payable(sender).call{value: transferValue
- payAmount}("");
            require(succeed, "Failed to withdraw Ether");
        }


        _buyExactTokens(
            optionId,
            referrerId,
            address(0),
            sender,
            buyAmount,
            payAmount,
            optionTokenAmountInUsd,
            option
        );
    }
```

Recommendation

The team is advised to prevent the potential re-entrance exploit as part of the solidity best practices. Some suggestions are:

- Add lockers/mutexes in the method scope. It is important to note that mutexes do not prevent cross-function reentrancy attacks.
- Do Not allow contract addresses to receive funds.
- Proceed with the external call as the last statement of the method, so that the state will have been updated properly during the re-entrance phase.

CCR - Contract Centralization Risk

Criticality	Minor / Informative
Location	contracts/Presale.sol#L527,532,542,629,645,665 contracts/token/PresaleToken.sol#L50,77
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 contract owners have the authority to make changes to key variables that heavily impact the functionality of the contracts. Furthermore, the contract owner of the Presale contract can withdraw any amount of tokens and Ether. Lastly, they can pause and unpause the purchase of tokens in the presale.

```
function withdraw(address token)
    external
    onlyOwner {
        uint256 balance;
        if(token == address(0)) {
            balance = address(this).balance;
            (bool succeed,) = MULTISIG_WALLET.call{value:
balance}("");
            require(succeed, "Failed to withdraw Ether");
        } else {
            balance = IERC20(token).balanceOf(address(this));
            IERC20(token).safeTransfer(MULTISIG_WALLET,
balance);
        }

        emit Withdraw(MULTISIG_WALLET, token, balance);
    }

function deleteOption(uint8 optionId)
    external
    onlyOwner
    whenOptionCreated(optionId) {
        // no need to check because of modifier check
        unchecked { --saleOptionsCount; }

        delete saleOptions[optionId];
        emit OptionDeleted(optionId);
    }

function pause() external onlyOwner {
        _pause();
    }

function unpause() external onlyOwner {
        _unpause();
    }

...
```

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.

DIS - Duplicate Import Statement

Criticality	Minor / Informative
Location	contracts/token/PresaleToken.sol#L8
Status	Unresolved

Description

The SafeERC20 library from OpenZeppelin is imported twice at the top of the Presale file. This duplication does not cause functional issues within the contract, as Solidity handles duplicate imports gracefully by merging them. However, it is a sign of redundant code that can lead to confusion and clutter in the codebase.

```
import { SafeERC20 } from
"@openzeppelin/contracts/token/ERC20/utils/SafeERC20.sol";
import { SafeERC20 } from
"@openzeppelin/contracts/token/ERC20/utils/SafeERC20.sol";
```

Recommendation

It is recommended to remove the redundant import statement and ensure that each library or contract is imported only once. This will enhance code readability, maintainability, and prevent potential confusion for developers who work on the code in the future. Simplifying the import statements will also contribute to a cleaner and more professional codebase.

IRS - Incomplete Referral System

Criticality	Minor / Informative
Location	contracts/Presale.sol#L161,760
Status	Unresolved

Description

The referral system in the Presale contract appears to be incomplete and ineffective. The `Referral` struct is defined to track the number of referrals made by a user, the amount of tokens sold through these referrals, and the total USD equivalent of these tokens. However, there are several issues with the current implementation. There is no functionality to add referrers to the system. Even if users buy the presale token, they are not iadded as referrers. The contract does not provide any mechanism to register a user as a referrer or to validate the existence of a referrer before making a purchase. Furthermore, users can call the `buyExactPresaleTokens` and `buyExactPresaleTokensETH` functions without providing a `referrerId` or by providing different `referrerId` values each time. This lack of consistency and validation makes the referral system unreliable. Lastly, the referral tracking is limited to incrementing the referrals count and updating the `sold` and `soldInUsd` fields within the `_buyExactTokens` function. However, this does not ensure that the referrer benefits from the referral.

```
struct Referral {
        /// @dev The number of referrals made by the user
        uint16 referrals;

        /// @dev The amount of tokens sold through referrals
        uint256 sold;

        /// @dev The total amount of USD equivalent of tokens
sold through referrals
        uint256 soldInUsd;
    }


function _buyExactTokens(
        uint8 optionId,
        uint32 referrerId,
        address tokenSell,
        address sender,
        uint256 buyAmount,
        uint256 payAmount,
        uint256 amountInUsd,
        Option storage option
    ) private {
        Referral storage referrer = referrals[referrerId];

        unchecked {
            referrer.sold += buyAmount;
            referrer.soldInUsd += amountInUsd;
            ++referrer.referrals;
        }


        ...
    }
```

Recommendation

To improve the referral system, it is recommended to implement a comprehensive and reliable mechanism for managing referrers. This should include functions to add and validate referrers, ensuring that users are registered as referrers before they can refer others. Additionally, the referral tracking logic should be enhanced to ensure consistency and accuracy. By addressing these issues, the referral system can become a valuable and effective feature of the presale contract, encouraging more users to participate and refer others.

IMU - Incorrect Modifier Usage

Criticality	Minor / Informative
Location	contracts/Presale.sol#L275,473
Status	Unresolved

Description

The `checkTokensRemain` modifier is designed to ensure that there are sufficient tokens available for a transaction by checking if the total tokens sold plus the transaction amount exceed the tokens available for presale. This modifier is correctly used in the `buyExactPresaleTokens` function. However, in the `buyExactPresaleTokensETH` function, the modifier uses `msg.value` to determine the transaction amount. Using `msg.value` is inappropriate here because `msg.value` represents the amount of Ether sent in the transaction, not the number of tokens being purchased. This discrepancy can lead to incorrect checks and potentially allow transactions that should not be permitted if the tokens available for presale are insufficient.

```
modifier checkTokensRemain(uint256 amount) {
        if (totalSold + amount > TOKENS_AVAILABLE_FOR_PRESALE)
{
            revert NotEnoughTokensLeft(amount,
TOKENS_AVAILABLE_FOR_PRESALE - totalSold);
        }
        _;
    }

function buyExactPresaleTokensETH(
        uint8 optionId,
        uint32 referrerId,
        uint256 buyAmount
    )
    external
    payable
    whenNotPaused
    whenOptionCreated(optionId)
    whenTokenAllowed(address(0))
    checkTokensRemain(msg.value) {
        // get receive token price first
        (uint256 payAmount, uint256 optionTokenAmountInUsd,
Option storage option) = _calculatePayAmount(
            optionId,
            address(0),
            buyAmount
        );

        address sender = _msgSender();
        uint256 transferValue = msg.value;

        ...
}
```

Recommendation

It is recommended to modify the `buyExactPresaleTokensETH` function to use the correct amount of tokens being purchased for the `checkTokensRemain` modifier. This will ensure that the token availability checks are accurate and consistent with the intended logic of the presale contract. The logic should be revised to ensure the correct variable representing the token amount is passed to the modifier, preventing any potential issues related to incorrect token availability checks.

IPQC - Incorrect Price Quote Calculation

Criticality	Minor / Informative
Location	contracts/Presale.sol#L377
Status	Unresolved

Description

The `inputPriceQuote` function is designed to retrieve the price quote for a given input amount of tokens. However, the current implementation does not correctly handle stablecoins. When the payment token is a stablecoin, the function incorrectly returns 1 instead of the actual amount of stablecoins corresponding to the given `amountsIn`. For stablecoins, the function should return the input amount adjusted by the decimal places of the stablecoin. For instance, if `amountsIn` is given in USD with 6 decimals and the payment token is a stablecoin with 6 decimals, the return value should be `amountsIn`. If the payment token is a stablecoin with 18 decimals, the return value should be `amountsIn` adjusted by the difference between decimals.

```
function inputPriceQuote(
        address token,
        uint256 amountsIn
    )
    public
    view
    returns(uint256) {
        PaymentTokenType memory paymentToken =
salePaymentTokens[token];

        if(paymentToken.allowed == false) {
            return 0;
        } else if(paymentToken.peggedToUsd == true) {
            return 1;
        }

        return getQuoteUniswapV2(amountsIn, paymentToken.path);
    }
```

Recommendation

The function should be updated to correctly handle stablecoins by adjusting the return value based on the decimal places of the stablecoin. Instead of returning a fixed value of 1 for stablecoins pegged to USD, the function should return the actual amount of stablecoins that correspond to the given amountsIn. This adjustment ensures that the price quote accurately reflects the value of stablecoins and prevents potential miscalculations in transactions involving stablecoins. Implementing these changes will improve the accuracy and reliability of the price quote calculations for stablecoins in the presale contract.

IAA - Indexed Address Absence

Criticality	Minor / Informative
Location	contracts/token/PresaleToken.sol#L63
Status	Unresolved

Description

In the `Withdraw` event, the `token` address is not indexed. Indexing the token address in the `Withdraw` event would be beneficial for efficient filtering, since it allows for more efficient filtering and searching of withdrawal events based on the token address and consistency, since it maintains consistency with the other events in the contract, where relevant addresses are indexed.

```
event Withdraw(
        address indexed owner,
        address token,
        uint256 amount
    );
```

Recommendation

It is recommended to index the `token` address in the `Withdraw` event to improve the efficiency of event filtering and maintain consistency across the contract. This change will make it easier to track and query withdrawal events based on the token address, enhancing the overall usability and maintainability of the contract's event logs.

IDTU - Inefficient Data Types Usage

Criticality	Minor / Informative
Location	contracts/Presale.sol#L137,161,195
Status	Unresolved

Description

The `Presale` contract uses `uint8` data types for several variables, including `saleOptionsCount`, and members of the `Option` struct such as `tgeAmount`, `leftoverVesting`, and `price`. While using smaller data types like `uint8` can potentially save storage space by packing multiple values into a single 32-byte storage slot, it can also lead to higher gas usage. This is because the Ethereum Virtual Machine (EVM) operates on 32-byte words, and when dealing with elements smaller than 32 bytes, additional operations are required to handle the smaller sizes, leading to increased gas consumption. In scenarios where these variables are not read or written together frequently, the benefit of packing may be outweighed by the extra gas cost incurred from these additional operations.

```
struct Option {
        /// @dev The percentage of tokens available at the time
of TGE (Token Generation Event)
        uint8 tgeAmount;

        /// @dev The percentage of tokens that will be vested
over time after TGE
        uint8 leftoverVesting;

        /// @dev The price per token in the presale
        uint8 price;

        /// @dev The address of the token being sold in the
presale
        address presaleToken;

        /// @dev The amount of tokens that have been sold so
far
        uint256 sold;

        /// @dev The total amount of USD equivalent of tokens
sold
        uint256 soldInUsd;
    }

uint8 public saleOptionsCount;
```

Recommendation

It is recommended to use `uint256` instead of smaller data types like `uint8` for variables such as `saleOptionsCount` and struct members. This change will align with the EVM's native word size and can lead to more efficient gas usage during contract execution. The potential savings in storage should be carefully weighed against the gas cost implications to determine the best approach for optimizing the contract's performance and cost.

IPU - Inefficient Parameter Usage

Criticality	Minor / Informative
Location	contracts/Quoter.sol#L31,40
Status	Unresolved

Description

The functions `getQuoteUniswapV2` and `getQuoteReverseUniswapV2` of the Quoter contract utilize the memory keyword for their path parameters. These functions are declared as internal and are subsequently invoked by public functions in the `Presale` contract. When public functions are called externally, their parameters are stored in calldata. Using calldata instead of memory in internal functions can reduce gas consumption, as it avoids the need to copy data from calldata to memory.

```
function getQuoteUniswapV2(
        uint256 amountsIn,
        address[] memory path
    ) internal view returns(uint256) {
        return UNISWAP_V2_ROUTER.getAmountsOut(amountsIn,
path)[path.length - 1];
    }

function getQuoteReverseUniswapV2(
        uint256 amountsOut,
        address[] memory path
    ) internal view returns(uint256) {
        return UNISWAP_V2_ROUTER.getAmountsIn(amountsOut,
path)[0];
    }
```

Recommendation

To optimize gas efficiency, it is recommended to change the parameter type of path in the `getQuoteUniswapV2` and `getQuoteReverseUniswapV2` functions from memory to calldata. This change will allow the contract to handle external calls more efficiently by directly accessing data from calldata without unnecessary copying operations. Making this adjustment will contribute to lower transaction costs and improved overall performance of the contract.

MMN - Misleading Modifier Naming

Criticality	Minor / Informative
Location	contracts/Presale.sol#L255
Status	Unresolved

Description

The `whenOptionCreated` modifier in the `Presale` contract is used to check if a presale option with the specified ID exists by verifying if the `presaleToken` address is not zero. However, the name of the modifier, `whenOptionCreated`, can be misleading as it suggests that the modifier checks whether an option has been created rather than verifying its existence based on the `presaleToken` address. This discrepancy can lead to misunderstandings about the actual functionality of the modifier.

```
modifier whenOptionCreated(uint8 optionId) {
        if (saleOptions[optionId].presaleToken == address(0)) {
            revert OptionNotCreated(optionId);
        }
        _;
    }
```

Recommendation

The modifier name should be changed to accurately reflect its purpose. A more descriptive name, such as `optionExists`, would clearly indicate that the modifier checks for the existence of a presale option based on the presence of a non-zero presaleToken address. Renaming the modifier to accurately represent its functionality will improve the readability and maintainability of the code, reducing the likelihood of misunderstandings and errors.

MCV - Missing Constructor Validation

Criticality	Minor / Informative
Location	contracts/Presale.sol#L228
Status	Unresolved

Description

The constructor of the `Presale` contract initializes the `saleOptions` without performing any validation checks to ensure that the options are created correctly. This lack of validation can lead to incorrect or unintended configuration of the presale options, which cannot be modified later due to the absence of functions to modify them post-deployment. In contrast, the `createNewOption` function, which allows the owner to create new presale options, includes comprehensive checks to ensure the validity of the options. These checks prevent issues such as duplicate option creation and incorrect option configuration.

```
constructor(
        address _multisigWallet,
        IUniswapV2Router02 _uniswapRouterV2,
        uint256 tokensAvailableForPresale,
        Option[] memory options
    ) Ownable(msg.sender) Quoter(_uniswapRouterV2) {
        MULTISIG_WALLET = _multisigWallet;
        TOKENS_AVAILABLE_FOR_PRESALE =
tokensAvailableForPresale;

        // init options
        for(uint256 i = 0; i < options.length;) {
            saleOptions[uint8(i)] = options[i];
            unchecked { ++i; }
        }

        saleOptionsCount = uint8(options.length);
    }
```

Recommendation

It is recommended to incorporate similar validation checks in the constructor as those used in the `createNewOption` function. Alternatively, the constructor can utilize the `createNewOption` function to ensure that the presale options are validated correctly during initialization. Implementing these checks will ensure that the presale options are configured correctly and consistently, preventing potential issues and ensuring the integrity of the contract's setup.

MDC - Missing Decimal Checks

Criticality	Minor / Informative
Location	contracts/Presale.sol#L542
Status	Unresolved

Description

The function `addPaymentToken` lacks checks to verify the decimals of tokens when `peggedToUsd` is set to true and when handling tokens in the provided path. Specifically, when `peggedToUsd` is true, it should be ensured that the token has 6 decimals. Similarly, in other parts of the contract, there are calculations involving token decimals that do not verify the actual decimals of the involved tokens. This can lead to incorrect calculations and potential errors during token transfers and conversions.

```
function addPaymentToken(
        bool peggedToUsd,
        address token,
        address[] memory path
    )
    external
    onlyOwner {
        if (salePaymentTokens[token].allowed == true) {
            revert PaymentTokenAlreadyAuthorized(token);
        }
        if(peggedToUsd == true) {
            salePaymentTokens[token] = PaymentTokenType(true,
true, new address[](0));
        } else {
            salePaymentTokens[token] = PaymentTokenType(false,
true, path);
        }

        emit AddPaymentToken(token);
    }
```

Recommendation

Introduce checks to ensure that tokens pegged to USD have 6 decimals when peggedToUsd is set to true. Additionally, verify the decimals of all tokens in the path to ensure consistency and correctness in calculations. Implement these checks within the addPaymentToken function and other relevant parts of the contract where token decimals are used. This will ensure accurate token conversions and prevent potential issues arising from incorrect decimal assumptions.

MTI - Missing Token Initialization

Criticality	Minor / Informative
Location	contracts/Presale.sol#L473
Status	Unresolved

Description

The function `buyExactPresaleTokensETH` assumes that `address(0)` is present in the salePaymentTokens list and represents WETH. However, the constructor does not initialize `address(0)` in the `salePaymentTokens` list, leading to potential issues during execution. This oversight can cause the function to fail when users attempt to purchase presale tokens using ETH, as the required checks and configurations for `address(0)` are not set up.

```
function buyExactPresaleTokensETH(
        uint8 optionId,
        uint32 referrerId,
        uint256 buyAmount
    )
    external
    payable
    whenNotPaused
    whenOptionCreated(optionId)
    whenTokenAllowed(address(0))
    checkTokensRemain(msg.value) {
        // get receive token price first
        (uint256 payAmount, uint256 optionTokenAmountInUsd,
Option storage option) = _calculatePayAmount(
            optionId,
            address(0),
            buyAmount
        );

        address sender = _msgSender();
        uint256 transferValue = msg.value;



        if(transferValue < payAmount) {
            revert InsufficientFunds();
        } else if(transferValue > payAmount) {
            // refund exceeded funds
            (bool succeed,) = payable(sender).call{value:
transferValue - payAmount}("");
            require(succeed, "Failed to withdraw Ether");
        }


        _buyExactTokens(
            optionId,
            referrerId,
            address(0),
            sender,
            buyAmount,
            payAmount,
            optionTokenAmountInUsd,
            option
        );
    }
```

Recommendation

Ensure that `address(0)`, representing WETH, is properly initialized in the salePaymentTokens list during the contract's initialization. This can be done in the constructor or through a dedicated setup function. Proper initialization will ensure that all necessary checks and configurations for WETH are in place, allowing the function buyExactPresaleTokensETH to operate correctly. Implementing this change will prevent potential failures and ensure that users can reliably use ETH to participate in the presale.

MV - Missing Validation

Criticality	Minor / Informative
Location	contracts/Presale.sol#L665
Status	Unresolved

Description

The `initOptions` function in the Presale contract initializes multiple presale options at once without performing any validation checks to ensure the correctness of these options. This lack of validation can lead to issues such as the creation of duplicate options or incorrect configuration of the presale options, which could compromise the integrity of the presale process. In contrast, the `createNewOption` function, which allows the owner to create new presale options, includes comprehensive checks to prevent issues such as duplicate option creation and incorrect configuration. These checks ensure that the options are set up correctly and consistently.

```
function initOptions(uint8[] memory optionIds)
    external
    onlyOwner {
        address operator = address(this);
        address owner = owner();

        for(uint256 i = 0; i < optionIds.length;) {
            uint8 optionId = optionIds[i];

            address presaleToken =
_deployPresaleTokenForOption(
                optionId,
                owner,
                operator
            );

            saleOptions[optionId].presaleToken = presaleToken;

            unchecked { ++i; }
        }
    }
```

Recommendation

It is recommended to incorporate similar validation checks in the initOptions function as those used in the createNewOption function. This will ensure that all presale options initialized using the initOptions function are validated correctly. Implementing these checks will help prevent potential issues and ensure the integrity and consistency of the presale options configuration.

PDS - Potential Duplicate Salt

Criticality	Minor / Informative
Location	contracts/Presale.sol#L665,735
Status	Unresolved

Description

The function initOptions contains a for loop that calls `_deployPresaleTokenForOption` to deploy presale tokens. If the same `optionId` is provided multiple times within the same block, the salt generated for the `create2` opcode will be identical, leading to potential conflicts or failures in token deployment. This issue arises because the salt is derived from the `optionId` and the current block number, which remains constant within the same block.

```
function initOptions(uint8[] memory optionIds)
    external
    onlyOwner {
        address operator = address(this);
        address owner = owner();

        for(uint256 i = 0; i < optionIds.length;) {
            uint8 optionId = optionIds[i];

            address presaleToken =
_deployPresaleTokenForOption(
                optionId,
                owner,
                operator
            );

            saleOptions[optionId].presaleToken = presaleToken;

            unchecked { ++i; }
        }
    }

function _deployPresaleTokenForOption(
        uint8 optionId,
        address owner,
        address operator
    )
    private
    returns(address) {
        bytes32 salt = keccak256(abi.encodePacked(optionId,
block.number));
        address presaleToken = address(new PresaleToken{salt:
salt}(owner, operator));

        emit PresaleTokenCreated(presaleToken);
        return presaleToken;
    }
```

Recommendation

It is recommended to implement additional checks or unique identifiers to ensure that each `optionId` is processed only once per block. This can be achieved by validating the uniqueness of `optionId` before deploying the presale token or by modifying the salt generation logic to include an additional unique component. This will prevent the deployment of multiple presale tokens with the same `optionId` in the same block, ensuring the integrity and uniqueness of each deployment.

PTAI - Potential Transfer Amount Inconsistency

Criticality	Minor / Informative
Location	contracts/Presale.sol#L449
Status	Unresolved

Description

The `safeTransferFrom()` function is 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

```
IERC20(tokenSell).safeTransferFrom(
                sender,
                address(this),
                payAmount
            );
```

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
```

PZD - Potential Zero Division

Criticality	Minor / Informative
Location	contracts/Presale.sol#L797
Status	Unresolved

Description

The function `buyExactPresaleTokens` and `buyExactPresaleTokensETH` allows users to purchase an exact amount of presale tokens with a specified token and native currency. It calls the internal function `_buyExactTokens`, which emits an event at the end. This event includes a division operation (payAmount / amountInUsd). If the amount of tokens the user wants to buy (buyAmount) or the equivalent USD amount (amountInUsd) is zero, this will result in a division by zero error. There are no checks in place to ensure that buyAmount or amountInUsd is greater than zero before performing this division.

```
function _buyExactTokens(
        uint8 optionId,
        uint32 referrerId,
        address tokenSell,
        address sender,
        uint256 buyAmount,
        uint256 payAmount,
        uint256 amountInUsd,
        Option storage option
    ) private {
        Referral storage referrer = referrals[referrerId];

        unchecked {
            referrer.sold += buyAmount;
            referrer.soldInUsd += amountInUsd;
            ++referrer.referrals;
        }


        // No need to check because of first check in top
        unchecked {
            totalSold += buyAmount;
            totalSoldInUsd += amountInUsd;
            option.sold += buyAmount;
            option.soldInUsd += amountInUsd;
        }


        IPresaleToken(option.presaleToken).mint(sender,
buyAmount);
        emit BuyTokens(
            sender,
            tokenSell,
            option.presaleToken,
            optionId,
            referrerId,
            amountInUsd,
            buyAmount,
            payAmount / amountInUsd,
            option.price,
            buyAmount
        );
    }
```

Recommendation

It is recommended to implement checks in the `buyExactPresaleTokens` and `_buyExactTokens` functions to ensure that `buyAmount` and `amountInUsd` are greater than zero before proceeding with the transaction. This validation should occur early in the function logic to prevent any subsequent calculations or operations that rely on these values. By ensuring that `buyAmount` and `amountInUsd` are non-zero, the risk of division by zero errors will be mitigated, enhancing the contract's robustness and reliability.

REE - Redundant Event Emission

Criticality	Minor / Informative
Location	contracts/token/PresaleToken.sol#L63,77
Status	Unresolved

Description

The `mint` and `burn` functions emit custom `Minted` and `Burned` events respectively, in addition to the standard `Transfer` event emitted by the ERC20 `_mint` and `_burn` functions from OpenZeppelin's implementation. This leads to redundant event emissions for the same actions, which can cause unnecessary clutter in the event logs.

```
function mint(address to, uint256 amount) external {
    if(_msgSender() != operator) {
        revert CallerIsNotOperator();
    }

    _mint(to, amount);

    emit Minted(to, amount);
}

function burn(address from, uint256 amount) external onlyOwner
{
    _burn(from, amount);
    emit Burned(from, amount);
}
```

Recommendation

It is recommended to remove the redundant `Minted` and `Burned` event emissions from the `mint` and `burn` functions. The standard `Transfer` events emitted by the `_mint` and `_burn` functions are sufficient to indicate the minting and burning of tokens. This change will simplify the event logs associated with emitting multiple events for the same actions.

USM - Unused Struct Members

Criticality	Minor / Informative
Location	contracts/token/PresaleToken.sol#L139,142
Status	Unresolved

Description

The `Option` struct in the `Presale` contract includes two members, `tgeAmount` and `leftoverVesting`, which are not utilized anywhere in the contract. The presence of these unused members can lead to confusion, suggesting incomplete implementation or future features that were not fully integrated. Additionally, unused variables occupy unnecessary storage space and can clutter the codebase, reducing its readability and maintainability.

```
struct Option {
        /// @dev The percentage of tokens available at the time
of TGE (Token Generation Event)
        uint8 tgeAmount;

        /// @dev The percentage of tokens that will be vested
over time after TGE
        uint8 leftoverVesting;

        /// @dev The price per token in the presale
        uint8 price;

        /// @dev The address of the token being sold in the
presale
        address presaleToken;

        /// @dev The amount of tokens that have been sold so
far
        uint256 sold;

        /// @dev The total amount of USD equivalent of tokens
sold
        uint256 soldInUsd;
    }
```

Recommendation

It is recommended to either remove the `tgeAmount` and `leftoverVesting` members from the `Option` struct if they are not intended to be used, or implement their functionality if they are meant to play a role in the presale process. This will help in maintaining a clean and efficient codebase, reducing potential confusion, and ensuring that all struct members serve a purpose in the contract.

L04 - Conformance to Solidity Naming Conventions

Criticality	Minor / Informative
Location	contracts/Quoter.sol#L18 contracts/Presale.sol#L198,201
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.

```
IUniswapV2Router02 private UNISWAP_V2_ROUTER
address public immutable MULTISIG_WALLET
uint256 public immutable TOKENS_AVAILABLE_FOR_PRESALE
```

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.

L09 - Dead Code Elimination

Criticality	Minor / Informative
Location	contracts/Quoter.sol#L25
Status	Unresolved

Description

In Solidity, dead code is code that is written in the contract, but is never executed or reached during normal contract execution. Dead code can occur for a variety of reasons, such as:

- Conditional statements that are always false.
- Functions that are never called.
- Unreachable code (e.g., code that follows a return statement).

Dead code can make a contract more difficult to understand and maintain, and can also increase the size of the contract and the cost of deploying and interacting with it.

```
function getUniswapV2Router() internal view
returns(IUniswapV2Router02) {
        return UNISWAP_V2_ROUTER;
    }
```

Recommendation

To avoid creating dead code, it's important to carefully consider the logic and flow of the contract and to remove any code that is not needed or that is never executed. This can help improve the clarity and efficiency of the contract.

L11 - Unnecessary Boolean equality

Criticality	Minor / Informative
Location	contracts/Presale.sol#L306,341,347,386,388,410,412,549,552,713
Status	Unresolved

Description

Boolean equality is unnecessary when comparing two boolean values. This is because a boolean value is either true or false, and there is no need to compare two values that are already known to be either true or false.

it's important to be aware of the types of variables and expressions that are being used in the contract's code, as this can affect the contract's behavior and performance. The comparison to boolean constants is redundant. Boolean constants can be used directly and do not need to be compared to true or false.

```
saleToken.allowed == false
saleToken.peggedToUsd == true
paymentToken.allowed == false
paymentToken.peggedToUsd == true
salePaymentTokens[token].allowed == true
peggedToUsd == true
salePaymentTokens[tokenSell].peggedToUsd == true
```

Recommendation

Using the boolean value itself is clearer and more concise, and it is generally considered good practice to avoid unnecessary boolean equalities in Solidity code.

L13 - Divide before Multiply Operation

Criticality	Minor / Informative
Location	contracts/Presale.sol#L348,356
Status	Unresolved

Description

It is important to be aware of the order of operations when performing arithmetic calculations. This is especially important when working with large numbers, as the order of operations can affect the final result of the calculation. Performing divisions before multiplications may cause loss of prediction.

```
return payAmount / option.price * 1e14
```

Recommendation

To avoid this issue, it is recommended to carefully consider the order of operations when performing arithmetic calculations in Solidity. It's generally a good idea to use parentheses to specify the order of operations. The basic rule is that the multiplications should be prior to the divisions.

L16 - Validate Variable Setters

Criticality	Minor / Informative
Location	contracts/token/PresaleToken.sol#L35 contracts/Presale.sol#L234,500
Status	Unresolved

Description

The contract performs operations on variables that have been configured on user-supplied input. These variables are missing of proper check for the case where a value is zero. This can lead to problems when the contract is executed, as certain actions may not be properly handled when the value is zero.

```
operator = _operator
MULTISIG_WALLET = _multisigWallet
(bool succeed,) = payable(sender).call{value: transferValue -
payAmount}("")
```

Recommendation

By adding the proper check, the contract will not allow the variables to be configured with zero value. This will ensure that the contract can handle all possible input values and avoid unexpected behavior or errors. Hence, it can help to prevent the contract from being exploited or operating unexpectedly.

L19 - Stable Compiler Version

Criticality	Minor / Informative
Location	contracts/token/PresaleToken.sol#L2 contracts/token/IPresaleToken.sol#L2 contracts/Quoter.sol#L2 contracts/Presale.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 ^0.8.25;
```

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.

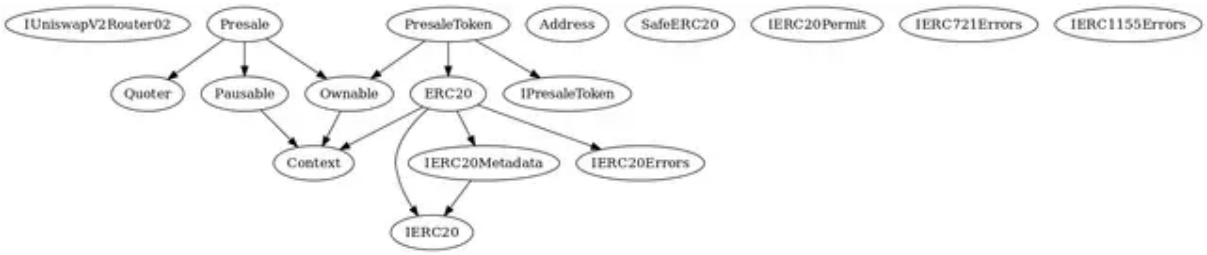
Functions Analysis

Contract	Type	Bases		
	Function Name	**Visibility**	**Mutability**	**Modifiers**
IUniswapV2Router02	Interface			
	getAmountsIn	External		-
	getAmountsOut	External		-
Quoter	Implementation			
		Public	✓	-
	getUniswapV2Router	Internal		
	getQuoteUniswapV2	Internal		
	getQuoteReverseUniswapV2	Internal		
Presale	Implementation	Ownable, Pausable, Quoter		
		Public	✓	Ownable Quoter
	getExactPayAmount	External		-
	getExactReceiveAmount	External		-
	getOptionInfo	External		-
	inputPriceQuote	Public		-
	inputPriceQuoteReversed	Public		-

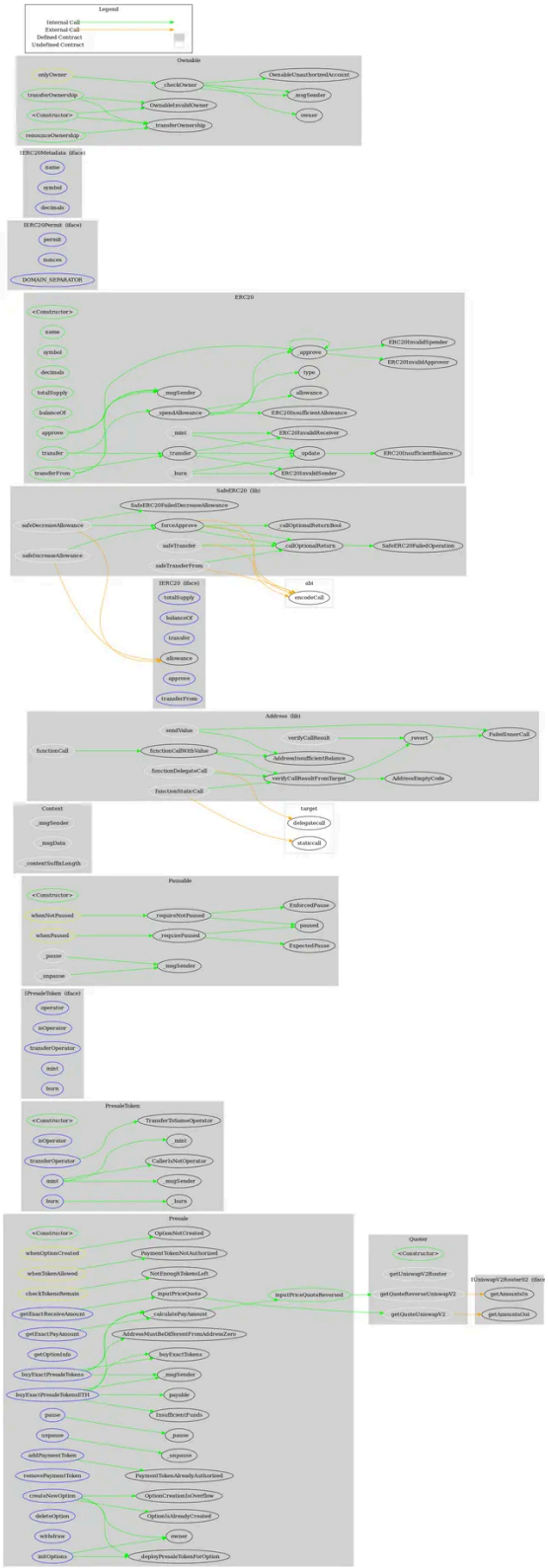
	buyExactPresaleTokens	External	✓	whenNotPaused whenOptionCreated whenTokenAllowed checkTokensRemain
	buyExactPresaleTokensETH	External	Payable	whenNotPaused whenOptionCreated whenTokenAllowed checkTokensRemain
	pause	External	✓	onlyOwner
	unpause	External	✓	onlyOwner
	addPaymentToken	External	✓	onlyOwner
	removePaymentToken	External	✓	onlyOwner whenTokenAllowed
	createNewOption	External	✓	onlyOwner
	deleteOption	External	✓	onlyOwner whenOptionCreated
	withdraw	External	✓	onlyOwner
	initOptions	External	✓	onlyOwner
	_calculatePayAmount	Private		
	_deployPresaleTokenForOption	Private	✓	
	_buyExactTokens	Private	✓	
PresaleToken	Implementation	ERC20, Ownable, IPresaleToken		
		Public	✓	Ownable

	isOperator	External		-
	transferOperator	External	✓	onlyOwner
	mint	External	✓	-
	burn	External	✓	onlyOwner
IPresaleToken	Interface			
	operator	External		-
	isOperator	External		-
	transferOperator	External	✓	-
	mint	External	✓	-
	burn	External	✓	-

Inheritance Graph



Flow Graph


Legend
Internal Call
External Call
Defined Contract
Undefined Contract
Ownable
onlyOwner
checkOwner
OwnableUnauthorizedAccount
transferOwnership
OwnableInvalidOwner
_msgSender
<Constructor>
transferOwnership
owner
renounceOwnership
IERC20Metadata (iface)
name
symbol
decimals
IERC20Permit (iface)
permit
nonces
DOMAIN_SEPARATOR
ERC20
<Constructor>
name
symbol
decimals
totalSupply
balanceOf
approve
transfer
transferFrom
approve
ERC20InvalidSpender
ERC20InvalidApprover
_msgSender
spendAllowance
type
allowance
ERC20InsufficientAllowance
_mint
ERC20InvalidReceiver
_transfer
_update
ERC20InsufficientBalance
_burn
ERC20InvalidSender
SafeERC20 (lib)
safeDecreaseAllowance
safeIncreaseAllowance
SafeERC20FailedDecreaseAllowance
forceApprove
safeTransfer
safeTransferFrom
callOptionalReturnBool
callOptionalReturn
SafeERC20FailedOperation
abi
encodeCall
IERC20 (iface)
totalSupply
balanceOf
transfer
allowance
approve
transferFrom
Address (lib)
functionCall
sendValue
functionCallWithValue
functionDelegateCall
functionStaticCall
verifyCallResult
AddressInsufficientBalance
verifyCallResultFromTarget
revert
FailedInnerCall
AddressEmptyCode
Context
_msgSender
_msgData
_contextSuffixLength
target
delegatecall
staticcall
Pausable
<Constructor>
whenNotPaused
whenPaused
_pause
_unpause
_requireNotPaused
_requirePaused
_msgSender
_paused
EnforcedPause
ExpectedPause
IPresaleToken (iface)
operator
isOperator
transferOperator
mint
burn
PresaleToken
<Constructor>
isOperator
transferOperator
mint
burn
TransferToIsNotOperator
_mint
CallerIsNotOperator
_msgSender
_burn
Presale
<Constructor>
whenOptionCreated
whenTokensAllowed
checkTokensRemain
getExactReceiveAmount
getExactPayAmount
getOptionInfo
buyExactPresaleTokens
buyExactPresaleTokensETH
pause
unpause
addPaymentToken
removePaymentToken
createNewOption
deleteOption
withdraw
initOptions
OptionNotCreated
PaymentTokenNotAuthorized
NotEnoughTokensLeft
inputPriceQuote
calculatePayAmount
AddressMustBeDifferentFromAddressZero
buyExactTokens
_msgSender
payable
InsufficientFunds
_pause
_unpause
PaymentTokenAlreadyAuthorized
OptionCreationIsOverflow
OptionIsAlreadyCreated
owner
_deployPresaleTokenForOption
inputPriceQuoteReversed
Quoter
<Constructor>
getUniswapV2Router
getQuoteReverseUniswapV2
getQuoteUniswapV2
IUniswapV2Router02 (iface)
getAmountsIn
getAmountsOut

Summary

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

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Cyberscope is a blockchain cybersecurity company that was founded with the vision to make web3.0 a safer place for investors and developers. Since its launch, it has worked with thousands of projects and is estimated to have secured tens of millions of investors' funds.

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