



Cyberscope

Audit Report **eXchange1**

July 2025

Network ETH HOLESKY

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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

Network	ETH
Addresses	<p>0x30e52031898f5cf6b1b92abbc867cb226b83077e</p> <p>0xa4f530f2051dd89b9d95761551e8c2e82e300f24</p> <p>0xdfcafab250797ca6578e38c10c074a0c44242222</p> <p>0x6b1fdd1e4b2ae9de8c5764481a8b6d00070a3096</p> <p>0xc15513d2f7873d8b073467d6f4e271ec3b55ca77</p>
Explorer	<p>https://holesky.etherscan.io/address/0x30e52031898f5cf6b1b92abbc867cb226b83077e</p> <p>https://holesky.etherscan.io/address/0xa4f530f2051dd89b9d95761551e8c2e82e300f24</p> <p>https://holesky.etherscan.io/address/0xdfcafab250797ca6578e38c10c074a0c44242222</p> <p>https://holesky.etherscan.io/address/0x6b1fdd1e4b2ae9de8c5764481a8b6d00070a3096</p> <p>https://holesky.etherscan.io/address/0xc15513d2f7873d8b073467d6f4e271ec3b55ca77</p>

Audit Updates

Initial Audit	<p>18 Apr 2025</p> <p>https://github.com/cyberscope-io/audits/blob/main/ex1/v1/audit.pdf</p>
Corrected Phase 2	<p>13 Jun 2025</p> <p>https://github.com/cyberscope-io/audits/blob/main/ex1/v2/audit.pdf</p>
Corrected Phase 3	<p>14 Jul 2025</p>

Source Files

Filename	SHA256
ex1Token.sol	abe26b24b42b48ab925ffb4b369e2989b9d51e9ef01bce073060a7c5ea328302
ex1Staking.sol	c111864fc7cf22a39637ee8c8b808f3ee78da62203ed9f7cde767eca89b9ab37
ex1PrivateVesting.sol	f9ca9f7948377fea78334d834803c6f770f118a0f1b4cdc568b7e2d6c42189b4
ex1ICOv2.sol	3167f15dc4c650ba3ca04a6eddd84144a783165de7a0f5e3b458291a84071752
ex1ICOVesting.sol	2a956fba311a26bc78cd452fe282037a6ad45be2021a44f8731b14bc01ecf769

Overview

The suite of five smart contracts, EX1, Ex1ICO, ICOVesting, Ex1Staking, and PrivateVesting, collectively forms a comprehensive ecosystem for managing the issuance, sale, vesting, staking, and private allocation of the EX1 token, ensuring secure, transparent, and controlled token distribution. Built with OpenZeppelin libraries, the EX1 contract is a multi-signature ERC20 token with upgradeable functionality, enforcing restricted address transfers through a multi-approval process. The Ex1ICO contracts facilitate token sales with customizable ICO stages, price feeds, and purchase limits. The ICOVesting contract manages linear vesting of ICO-purchased tokens, allowing periodic claims, while the Ex1Staking contract incentivizes long-term holding by enabling users to stake ICO tokens for dynamic rewards before vesting begins. The PrivateVesting contract handles linear vesting for non-ICO participants, with flexible schedules and revocation options. Together, these contracts provide a robust, role-based, and upgradeable framework for token management, cross-chain sales, and incentivized holding, tailored for both public and private stakeholders.

ex1Token file

The EX1 contract is a multi-signature ERC20 token contract with upgradeable functionality, designed to ensure secure and controlled token transfers through a robust governance framework. Built on OpenZeppelin's Initializable, ERC20Upgradeable, AccessControlUpgradeable, and UUPSUpgradeable standards, it implements a multi-step process for proposing, approving, and executing transfers, particularly for restricted addresses, requiring a predefined number of approvals from designated approvers. It features three roles, `OWNER_ROLE` for managing restricted addresses and approvers, `APPROVER_ROLE` for voting on proposals, and `EXECUTOR_ROLE` for finalizing transfers, along with mechanisms to manage restricted address lists, update approver settings, and query pending proposals. This ensures transparent, secure, and decentralized token management, with flexibility for future upgrades.

ex1ICOv2 file

The Ex1ICO contract is an upgradeable, role-based smart contract designed to manage Initial Coin Offerings (ICOs) for the EX1 token, enabling secure token sales with support for

USDC, USDT, ETH, and BTC payments. Leveraging OpenZeppelin's Initializable, ReentrancyGuardUpgradeable, AccessControlUpgradeable, and UUPSUpgradeable contracts, it facilitates the creation and management of ICO stages with customizable parameters like token price and duration, while integrating Chainlink price feeds for real-time ETH and BTC pricing. The contract supports on-chain purchases with USDC/USDT/ETH, and off-chain BTC transactions recorded by authorized roles, and tracks tokens sold, funds raised, and buyer data, with purchase limits and administrative controls for setting parameters, ensuring a scalable, secure, and transparent token sale process.

ex1ICOVesting file

The ICOVesting contract is an upgradeable, role-based smart contract designed to manage the vesting and claiming of EX1 tokens purchased during an ICO, ensuring rewards are distributed over time on a linear basis. Built with OpenZeppelin libraries, it enables authorized users to create and update vesting schedules for specific ICO stages, defining start/end times, claim intervals, and slice periods for gradual token release. Token holders can claim their vested tokens based on these periodic schedules, with claimable amounts calculated linearly according to elapsed time, and reentrancy protection ensures security. Integrated with the Ex1ICO contract to verify user deposits, it supports role-based access (`OWNER` , `UPGRADER` , `VESTING_AUTHORISER`) for administrative tasks like updating schedules and interfaces, offering a secure and flexible vesting solution.

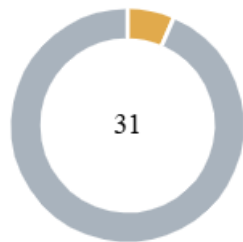
ex1Staking file

The Ex1Staking contract is an upgradeable smart contract designed to facilitate staking of EX1 tokens based on the amount purchased during an ICO and before the vesting period starts, incentivizing long-term holding through rewards. Built with OpenZeppelin libraries, it allows users to choose to stake their tokens, with staking parameters (percentage return, time period, and ICO stage) set by authorized roles. Rewards are calculated dynamically based on the staked amount and elapsed time, and users can claim them or unstake tokens at any point, with rewards adjusted accordingly. Integrated with the Ex1ICO and ICOVesting contracts to verify deposits and vesting schedules, it allows the staking of the user deposits before the vesting. It supports role-based access (`OWNER` , `UPGRADER` , `STAKING_AUTHORISER`) for administrative updates, ensuring secure and transparent staking operations.

ex1PrivateVesting file

The PrivateVesting contract is an upgradeable, role-based smart contract designed to manage token vesting schedules with role-based access control, specifically for addresses that do not participate in the ICO, ensuring controlled token distribution over time on a linear basis. Built with OpenZeppelin libraries, it allows authorized users to create, update, and revoke vesting schedules for beneficiaries, defining parameters like total amount, start/end times, claim intervals, cliff periods, and slice periods for gradual token release. Beneficiaries can claim vested tokens periodically after the cliff period, with claimable amounts calculated linearly based on elapsed time. The contract supports role-based access (OWNER , UPGRADER , VESTING_CREATOR) for administrative tasks, tracks vesting schedules and claim histories, and includes revocation options for revocable schedules, providing a secure and flexible vesting solution for private allocations.

Findings Breakdown



Critical	0
Medium	2
Minor / Informative	29

Severity	Unresolved	Acknowledged	Resolved	Other
Critical	0	0	0	0
Medium	2	0	0	0
Minor / Informative	9	20	0	0

Diagnostics

● Critical ● Medium ● Minor / Informative

Severity	Code	Description	Status
●	ACI	Approval Count Imbalance	Unresolved
●	MAV	Missing Allowance Validation	Unresolved
●	BC	Blacklists Addresses	Acknowledged
●	MC	Missing Check	Unresolved
●	CO	Code Optimization	Unresolved
●	CR	Code Repetition	Acknowledged
●	CCR	Contract Centralization Risk	Acknowledged
●	IDU	Inconsistent Data Updates	Acknowledged
●	IPA	Inconsistent Protocol Addresses	Unresolved
●	IEC	Incorrect ETH Calculations	Acknowledged
●	ITN	Incorrect Token Name	Acknowledged
●	IVS	Inefficient Vesting Setup	Acknowledged
●	MAL	Misleading Approvers List	Unresolved
●	MEM	Misleading Error Message	Unresolved

●	MCIC	Missing Claim Interval Check	Unresolved
●	MEE	Missing Events Emission	Acknowledged
●	MEC	Missing Existence Check	Acknowledged
●	MTDC	Missing Token Decimal Check	Acknowledged
●	MUV	Missing User Validation	Acknowledged
●	MU	Modifiers Usage	Acknowledged
●	MRI	Multiple Revoke Invocations	Unresolved
●	ODM	Oracle Decimal Mismatch	Acknowledged
●	OSET	Overlapping Start End Times	Acknowledged
●	POSD	Potential Oracle Stale Data	Acknowledged
●	PTRP	Potential Transfer Revert Propagation	Acknowledged
●	TSI	Tokens Sufficiency Insurance	Acknowledged
●	UR	Unclaimed Rewards	Unresolved
●	UIC	Unreachable If Condition	Acknowledged
●	L04	Conformance to Solidity Naming Conventions	Acknowledged
●	L13	Divide before Multiply Operation	Acknowledged
●	L19	Stable Compiler Version	Unresolved

ACI - Approval Count Imbalance

Criticality	Medium
Location	ex1Token.sol#L288
Status	Unresolved

Description

The contract implements the `approveTransfer` and `revokeApproval` methods, both of which update the `approvalCount` for a given `txIndex`. While `approveTransfer` increases the count, `revokeApproval` decreases it. However, if `revokeApproval` is called more times than `approveTransfer`, it can cause an underflow on `approvalCount`. This underflow can hinder the revocation process from completing as expected.

```
function revokeApproval(uint256 _txIndex) public onlyRole(APPROVER_ROLE)
    txExists(_txIndex) notExecuted(_txIndex) {
    require(!isRevoked[_txIndex], "Transaction status Revoked!");
    require(!hasVoted[_txIndex][_msgSender()], "Signer already Revoked!");
    transactions[_txIndex].revokeCount += 1;
    transactions[_txIndex].approvalCount -= 1;

    if (transactions[_txIndex].revokeCount > required) {
        transactions[_txIndex].approvalStatus = ApprovalStatus.revoked;
        isRevoked[_txIndex] = true;
    }

    emit ApprovalRevoked(_txIndex, _msgSender());
}
```

Recommendation

In the current implementation, users can either approve or revoke a proposal. It is therefore redundant to update the `approvalCount` during the revocation. `approvalCount` should be reduced only in the case users are allowed to revoke an already submitted vote for approval.

MAV - Missing Allowance Validation

Criticality	Medium
Location	ex1Token.sol#229
Status	Unresolved

Description

The contract is implementing a `transferFrom` function that bypasses the standard ERC-20 allowance check mechanism. Specifically, it does not verify whether the caller has been granted sufficient allowance to transfer tokens on behalf of `_from`. This omission deviates from the expected behaviour defined in the ERC-20 standard and will allow unauthorised token transfers, especially in contexts where dApps or users rely on allowance-based permissioning for delegated spending.

In particular the `approvers` are able to transfer balance from user addresses by passing any allowance control. The same is true for decentralized applications including liquidity pools and vaults.

```
function transferFrom(address _from, address _to, uint256 _value) public
virtual override returns (bool) {
    if (isAddressRestricted(_from) == true) {
        _proposeTransfer(_from, _to, _value);
    } else {
        address spender = _msgSender();
        _spendAllowance(_from, spender, _value);
        _transfer(_from, _to, _value);
    }
    return true;
}
```

Recommendation

It is recommended to implement an explicit allowance check within the `transferFrom` function to ensure the caller is permitted to spend the specified amount on behalf of the token owner. Additionally, the allowance should be decreased accordingly after a successful transfer to align with ERC-20 standards and prevent potential misuse.

BC - Blacklists Addresses

Criticality	Minor / Informative
Location	ex1Token.sol#L152,213
Status	Acknowledged

Description

The `OWNER_ROLE` has the authority to stop addresses from transactions. The owner may take advantage of it by calling the `addRestrictedAddress` function.

```
function addRestrictedAddress(address _address) external
onlyRole(OWNER_ROLE) {
    restrictedAddresses.add(_address);
}

function transfer(address _to, uint256 _value) public virtual override
returns (bool) {
    if (isAddressRestricted(_msgSender()) == true) {
        _proposeTransfer(_msgSender(), _to, _value);
    } else {
        _transfer(_msgSender(), _to, _value);
    }
    return true;
}

function transferFrom(address _from, address _to, uint256 _value) public
virtual override returns (bool) {
    if (isAddressRestricted(_from) == true) {
        _proposeTransfer(_from, _to, _value);
    } else {
        address spender = _msgSender();
        _spendAllowance(_from, spender, _value);
        _transfer(_from, _to, _value);
    }
    return true;
}
```


Recommendation

The team should carefully manage the private keys of the `OWNER_ROLE'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.

MC - Missing Check

Criticality	Minor / Informative
Location	ex1ICOv2.sol#L268,416
Status	Unresolved

Description

The contract is processing variables that have not been properly sanitized and checked that they form the proper shape. These variables may produce vulnerability issues.

Specifically the `calculatePrice` function in `EX1ICO` checks if the `_amount` is not greater than `MaxTokenLimitPerTransaction` and if `HoldersCumulativeBalance` is less than `MaxTokenLimitPerAddress` but it does not check if it will still be lower after the addition of the `_amount`.

```
function calculatePrice(uint256 _amount, uint256 _icoStageID) public view
returns (uint256) {
require(
_amount < MaxTokenLimitPerTransaction || HoldersCumulativeBalance[msg.sender]
< MaxTokenLimitPerAddress,
"Max Limit Reached!"
);
//...
}
```

A similar check like the above is missing from `purchasedViaBTC`

```
function purchasedViaBTC(uint256 _amount, uint256 _btcRecieved, uint256
_icoStageID, address _recipient)
external
checkSaleStatus(_icoStageID)
onlyRole(TXN_RECORDER_ROLE)
{...}
```

Recommendation

The team is advised to properly check the variables according to the required specifications.

CO - Code Optimization

Criticality	Minor / Informative
Location	ex1ICov2.sol#L364
Status	Unresolved

Description

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

Specifically, the `purchasedViaEth` implements the `checkSaleStatus(_icoStageID)` modified while it also includes the following code segment.

```
require(  
    block.timestamp >= icoStages[_icoStageID].startTime && block.timestamp <=  
    icoStages[_icoStageID].endTime,  
    "Invalid Stage Paramaters"  
);
```

The latter is redundant, as the same conditional logic is already introduced through the applied modifier.

Recommendation

The team is advised to take these segments into consideration and rewrite them so the runtime will be more performant. That way it will improve the efficiency and performance of the source code and reduce the cost of executing it.

CR - Code Repetition

Criticality	Minor / Informative
Location	ex1ICOv2.sol#L362,404
Status	Acknowledged

Description

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

```
function purchasedViaEth(  
    uint256 _amount,  
    uint256 _ethRecieved,  
    uint256 _icoStageID,  
    address _recipient  
) external checkSaleStatus(_icoStageID) onlyRole(TXN_RECORDER_ROLE) {  
    ...  
}  
  
function purchasedViaBTC(  
    uint256 _amount,  
    uint256 _btcRecieved,  
    uint256 _icoStageID,  
    address _recipient  
) external checkSaleStatus(_icoStageID) onlyRole(TXN_RECORDER_ROLE) {  
    ...  
}
```

Recommendation

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

CCR - Contract Centralization Risk

Criticality	Minor / Informative
Location	ex1ICOv2.sol ex1Staking.sol ex1PrivateVesting.sol ex1ICOVesting.sol
Status	Acknowledged

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 is heavily reliant on centralized role authorities, such as `OWNER_ROLE`, `UPGRADER_ROLE`, and `ICO_AUTHORIZER_ROLE`, to configure, modify, and manage critical contract parameters. This centralization introduces a potential risk. If the individuals or entities holding these roles make an error, act maliciously, or fail to act in a timely manner, the entire contract and its associated processes can be compromised. Without proper checks and balances, the system's integrity depends on the correct and honest execution of these centralized roles, making it vulnerable to human error or abuse of power.

```
bytes32 public constant OWNER_ROLE = keccak256("OWNER_ROLE");  
bytes32 public constant UPGRADER_ROLE = keccak256("UPGRADER_ROLE");  
bytes32 public constant ICO_AUTHORIZER_ROLE =  
keccak256("ICO_AUTHORIZER_ROLE");
```

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.

IDU - Inconsistent Data Updates

Criticality	Minor / Informative
Location	ex1ICOv2.sol#L199 ex1ICOVesting.sol#L173 ex1Staking.sol#L100 ex1PrivateVesting.sol#L258
Status	Acknowledged

Description

The contract is managing multiple functionalities, presale, vesting, and staking, based on a shared `_icoStageID`. However, updates to variables such as the stage parameters (e.g. in ICO) occur independently within each contract, without a mechanism to propagate these changes across the related functionalities. For example, if the ICO stage parameters are modified in one contract, other contracts that depend on these parameters may not reflect the updated values. This disconnect can lead to inconsistencies, as calculations or conditions in one contract may no longer align with the updated data in another.

```
function updateICOStage(  
    uint256 _stageID,  
    uint256 _startTime,  
    uint256 _endTime,  
    uint256 _tokenPriceUSD,  
    bool active  
) external onlyRole(ICO_AUTHORISER_ROLE) {  
    ...  
}
```

```
function updateICOStage(  
    uint256 _stageID,  
    uint256 _startTime,  
    uint256 _endTime,  
    uint256 _tokenPriceUSD  
) external onlyRole(ICO_AUTHORISER_ROLE) {  
    ...  
}
```



```
function claimTokens(  
    uint256 _icoStageID  
) external nonReentrant {  
    ...  
    uint256 deposits = icoInterface.UserDepositsPerICOSTage( _icoStageID,  
_msgSender());  
    require(deposits > 0, "ex1Presale: No Tokens to Claim!");  
    ...  
}
```

```
function stake(  
    uint256 _icoStageID  
) external returns(bool) {  
    uint256 deposits = icoInterface.UserDepositsPerICOSTage(_icoStageID,  
_msgSender());  
    ( , uint256 startTime, , , ) =  
vestingInterface.claimSchedules(_icoStageID);  
    ...  
}
```

Recommendation

It is recommended to implement a decentralized mechanism or shared interface that ensures changes to ICO stage parameters are consistently applied across all related contracts. This could involve storing the parameters in a single source of truth or using events and callbacks to notify dependent contracts of updates. By aligning data and logic across all functionalities, the system can prevent inconsistencies, reduce maintenance overhead, and improve reliability.

IPA - Inconsistent Protocol Addresses

Criticality	Minor / Informative
Location	ex1Staking.sol#L64
Status	Unresolved

Description

The contract implements hardcoded values to specify protocol addresses; however, these values do not correspond to the addresses provided during the audit. This discrepancy may affect the overall functionality of the project.

```
icoInterface = Iex1ICO(0xfB7Dcb92988bCb55532D09Ca61E3fb6C36F1ef8D);  
vestingInterface =  
IVestingICO(0x4C9E1554ba3d726482f37D2be12c2c24a42E97F9);  
ex1Token = IERC20(0x47746b1a039826dcd41F7797a756A6cD353F239F);
```

Recommendation

It is advised that consistent addresses be used prior to deployment to ensure optimal system behavior and reliability.

IEC - Incorrect ETH Calculations

Criticality	Minor / Informative
Location	ex1ICOV2.sol#L243
Status	Acknowledged

Description

The contract contains a logic in the `getTokenPriceInETH` function, which determines the ETH equivalent for purchasing tokens. The issue stems from improper handling of decimal precision and inconsistent scaling between the ETH price and the USD-denominated token price. If the ETH price is not aligned with the expected scale used in the token pricing logic, it results in inaccurate conversions. This mismatch can significantly distort the ETH amount required for purchases, potentially leading to users being overcharged and undermining the reliability of the token sale mechanism.

This means that the ETH price must be in a specific scaling format that matches the USD value calculation to ensure the token-to-ETH conversion is accurate.

```
function getTokenPriceInETH(
    uint256 amount,
    uint256 _icoStageID
) public view returns (uint256 ethAmount) {
    uint256 usdPrice = calculatePrice(amount, _icoStageID);
    uint256 latestEthPrice = getLatestETHPrice() * (10 ** 10);
    uint256 _ethAmount = (usdPrice * (10 ** 18)) / latestEthPrice;
    return _ethAmount;
}

function calculatePrice(uint256 _amount, uint256 _icoStageID) public view
returns (uint256) {
    require(
        _amount < MaxTokenLimitPerTransaction ||
        HoldersCumulativeBalance[msg.sender] < MaxTokenLimitPerAddress,
        "Max Limit Reached!"
    );
    require(icoStages[_icoStageID].isActive, "Stage does not exist or is
inactive!");
    uint256 tokenValue = icoStages[_icoStageID].tokenPrice;
    uint256 usdValueUnscaled = (_amount * tokenValue) / (10 ** 18);
    return usdValueUnscaled;
}

function purchasedViaEth(uint256 _amount, uint256 _icoStageID)
    external
    payable
    nonReentrant
    checkSaleStatus(_icoStageID)
{
    require(
        block.timestamp >= icoStages[_icoStageID].startTime &&
        block.timestamp <= icoStages[_icoStageID].endTime,
        "Invalid Stage Paramaters"
    );
    uint256 ethAmount = getTokenPriceInETH(_amount, _icoStageID);
    require(msg.value >= ethAmount, "Insufficient Eths Value signed!");
    ...
}
```

Recommendation

It is recommended to revise the `getTokenPriceInETH` function to ensure accurate ETH calculations by correcting the decimal scaling and precision handling. The function should properly convert the USD value of tokens to ETH, accounting for all decimal places in the ETH price and token amounts. Implementing thorough unit tests to validate the function's output across various token quantities and ETH prices is crucial. Additionally, adding a refund mechanism in the `purchasedViaEth` function to return excess ETH sent by users will enhance fairness and user trust. These measures will align the contract's pricing logic with the intended token sale economics, preventing overcharges and ensuring accurate financial operations.

Team Update

The team has acknowledged that this is not a security issue and states:

The `_tokenPriceUSD` will follow 10^{18} format (with 18 decimals). The issue was raised due to 10^6 usage; using 10^{18} resolves the concern as intended.

ITN - Incorrect Token Name

Criticality	Minor / Informative
Location	ex1ICOV2.sol#L285,301,320
Status	Acknowledged

Description

The contract is designed to allow token purchases using either USDC or USDT by passing the respective token address and a hardcoded name string to an internal function. However, this setup permits a user to call `buyWithUSDC` while providing the address of the USDT token, or vice versa. In such cases, the event emitted (`TokensBoughtUSD`) will include an incorrect token name, as the name is based on the function called rather than the actual token used. This leads to misleading event logs, which may affect off-chain monitoring, auditing, or user interfaces that depend on accurate event data.

```
function buyWithUSDC(uint256 _amount, uint256 _icoStageID, IERC20 _token)
    external
    checkSaleStatus(_icoStageID)
    returns (bool)
{
    string memory _usdName = "USDC";
    bool success = _buyWithUSD(_amount, _icoStageID, _token, _usdName);
    return success;
}

function buyWithUSDT(uint256 _amount, uint256 _icoStageID, IERC20 _token)
    external
    checkSaleStatus(_icoStageID)
    returns (bool)
{
    string memory _usdName = "USDT";
    bool success = _buyWithUSD(_amount, _icoStageID, _token, _usdName);
    return success;
}

function _buyWithUSD(uint256 _amount, uint256 _icoStageID, IERC20 _token,
string memory _usdName)
    internal
    checkSaleStatus(_icoStageID)
    returns (bool)
{
    require(_token == USDCAddress || _token == USDTAddress, "ex1Sale:
Token Invalid!");
    uint256 usdValue = calculatePrice(_amount, _icoStageID);

    ...
    return true;
}
```

Recommendation

It is recommended to enforce a strict correlation between the token address and its associated name within the contract logic. Specifically, the contract should internally determine the correct token name based on the provided token address rather than relying on user-defined or function-specific naming, thereby ensuring accurate and trustworthy event emissions.

IVS - Inefficient Vesting Setup

Criticality	Minor / Informative
Location	ex1PrivateVesting.sol#L147
Status	Acknowledged

Description

The current approach requires a central role (VESTING_CREATOR_ROLE) to manually set the vesting schedules for all participating users. This centralized process is inefficient and gas-intensive, especially when the number of beneficiaries increases. Additionally, handling multiple user entries in this manner increases the risk of errors or incorrect data entries, potentially causing mismanagement of vesting schedules and related funds.


```
function setVestingSchedule(  
    address _beneficiary,  
    uint256 _totalAmount,  
    uint256 _startTime,  
    uint256 _endTime,  
    uint256 _claimInterval,  
    uint256 _cliffPeriod,  
    uint256 _slicePeriod,  
    bool _isRevocable  
) external onlyRole(VESTING_CREATOR_ROLE) {  
    ...  
    latestVestingScheduleID ++;  
  
    vestingSchedules[latestVestingScheduleID] =  
    VestingSchedule({  
        beneficiary: _beneficiary,  
        vestingScheduleID: latestVestingScheduleID,  
        totalAmount: _totalAmount,  
        startTime: _startTime,  
        endTime: _endTime,  
        claimInterval: _claimInterval,  
        cliffPeriod: _cliffPeriod,  
        slicePeriod: _slicePeriod,  
        releasedAmount: 0,  
        isRevocable: _isRevocable,  
        isRevoked: false  
    });  
  
    ...  
}
```

Recommendation

It is recommended to consider a more decentralized approach to vesting schedule creation and validation. By allowing users or their authorized agents to initiate their own vesting schedules—while still adhering to contract-defined rules and checks—this would reduce the gas cost per action and minimize the administrative overhead for a single role. Implementing self-service or automated validation mechanisms can enhance efficiency and reduce the likelihood of incorrect data entries.

Team Update

The team has acknowledged that this is not a security issue and states:

Allocation targets specific wallets (treasury, liquidity, marketing), only ~8 beneficiaries.

MAL - Misleading Approvers List

Criticality	Minor / Informative
Location	ex1Token.sol#L123
Status	Unresolved

Description

The `removeApprovers` list is used to revoke approver rights from an address. However, the revoked address is not removed from the approvers array. As a result, view functions such as `checkApprovers` and `checkApproversList` may return a misleading array that includes inactive approvers.

```
function removeApprovers(address[] memory _approver) external
onlyRole(DEFAULT_ADMIN_ROLE) {
    for (uint256 i = 0; i < _approver.length; i++) {
        bool isApproverStatus = checkApprovers(_approver[i]);
        require(isApproverStatus, "Approver not found!");
        _revokeRole(APPROVER_ROLE, _approver[i]);
        isApprover[_approver[i]] = false;
    }
}
```

Recommendation

The team is advised to remove revoked addresses from the `approvers` array to ensure the returned approvers list accurately reflects active permissions and prevents misleading outputs.

MEM - Misleading Error Message

Criticality	Minor / Informative
Location	ex1Token.sol#L290
Status	Unresolved

Description

Error messages can be misleading if they do not accurately reflect the source of the error or the purpose they serve. The contract uses error messages that are too generic or do not clearly convey the necessary information. Misleading error messages can lead to confusion, making the code more difficult to read and understand.

```
require(!hasVoted[_txIndex][_msgSender()], "Signer already Revoked!");
```

Recommendation

It's always a good practice for the contract to contain error messages that are specific and descriptive. The team is advised to keep in mind the readability of the code.

MCIC - Missing Claim Interval Check

Criticality	Minor / Informative
Location	ex1PrivateVesting.sol#L147
Status	Unresolved

Description

The contract is missing a validation check in the `setVestingSchedule` function to prevent the `_claimInterval` from being set to zero. While the `updateVesting` function includes a condition that ensures `_claimInterval` is greater than zero, this safeguard is not present in `setVestingSchedule`. As a result, it is possible to set an invalid `_claimInterval` in an updated schedule, potentially causing unexpected or incorrect behavior.

```
function setVestingSchedule(
    address _beneficiary,
    uint256 _totalAmount,
    uint256 _startTime,
    uint256 _endTime,
    uint256 _claimInterval,
    uint256 _cliffPeriod,
    uint256 _slicePeriod,
    bool _isRevocable
) external onlyRole(VESTING_CREATOR_ROLE) {
    ...ivateVesting: Invalid Cliff Period"
};
require(
    _claimInterval <= (_endTime - _cliffPeriod),
    "Private: Invalid Claim Interval"
);
...

vestingSchedules[latestVestingScheduleID] =
VestingSchedule({
    beneficiary: _beneficiary,
    vestingScheduleID: latestVestingScheduleID,
    totalAmount: _totalAmount,
    startTime: _startTime,
    endTime: _endTime,
    claimInterval: _claimInterval,
    ...
})
```

Recommendation

It is recommended to add a validation step in the `setVestingSchedule` function to ensure that `_claimInterval` is greater than zero. By including this check, the contract will maintain consistent standards for schedule intervals and prevent unintended configurations that could disrupt the vesting process.

MEE - Missing Events Emission

Criticality	Minor / Informative
Location	ex1Token.sol#L123,136 ex1ICOv2.sol#L463
Status	Acknowledged

Description

The contract performs actions and state mutations from external methods that do not result in the emission of events. Emitting events for significant actions is important as it allows external parties, such as wallets or dApps, to track and monitor the activity on the contract. Without these events, it may be difficult for external parties to accurately determine the current state of the contract.

```
function removeApprovers(address[] memory _approver) external  
onlyRole(DEFAULT_ADMIN_ROLE) {  
    ...  
}  
  
function addApprover(address[] memory _approver) external  
onlyRole(DEFAULT_ADMIN_ROLE) {  
    ...  
}
```

```
function setReceiverWallet(address _wallets) external onlyRole(OWNER_ROLE) {
    require(
        _wallets != address(0),
        "ex1Presale: Invalid Wallet Address!"
    );
    recievingWallet = _wallets;
}

function setTokenReleasable() external onlyRole(OWNER_ROLE) {
    isTokenReleasable = !isTokenReleasable;
}

function setIAggregatorInterfaceETH(IAggregator _aggregator) external
onlyRole(OWNER_ROLE) {
    require(
        address(_aggregator) != address(0),
        "ex1Presale: Invalid Aggregator Address!"
    );
    aggregatorInterfaceETH = _aggregator;
}
```

Recommendation

It is recommended to include events in the code that are triggered each time a significant action is taking place within the contract. These events should include relevant details such as the user's address and the nature of the action taken. By doing so, the contract will be more transparent and easily auditable by external parties. It will also help prevent potential issues or disputes that may arise in the future.

MEC - Missing Existence Check

Criticality	Minor / Informative
Location	ex1ICOVesting.sol#L116
Status	Acknowledged

Description

The `updateClaimSchedule` function does not validate whether a claim schedule already exists for the provided `_icoStageID` before attempting to update it. Without this check, it is possible for the contract to update a non-existent claim schedule, potentially resulting in undefined or unexpected behavior.

```
function updateClaimSchedule(  
    uint256 _icoStageID,  
    uint256 _startTime,  
    uint256 _endTime,  
    uint256 _claimInterval,  
    uint256 _slicePeriod  
) external onlyRole(VESTING_AUTHORISER_ROLE) {  
    ...  
}
```

Recommendation

It is recommended to add a validation step that ensures a claim schedule exists for the given `_icoStageID` before proceeding with updates. By confirming that the relevant claim schedule is already defined, the contract can prevent accidental or unintended updates to uninitialized claim schedules, improving both security and reliability.

MTDC - Missing Token Decimal Check

Criticality	Minor / Informative
Location	ex1ICOV2.sol#L482,487
Status	Acknowledged

Description

The contract does not validate that the newly assigned token addresses have matching decimals. Since the functions `setUSDTAddress` and `setUSDCAddress` allow changing the token address without verifying the decimals, any subsequent calculations that depend on consistent token units may produce incorrect results. This issue can cause unintended behavior and may lead to problems if the tokens differ in decimal precision.

```
function setUSDTAddress(IERC20 _USDTTokenAddress) external
onlyRole(OWNER_ROLE) {
    require(
        address(_USDTTokenAddress) != address(0),
        "EX1Presale: Invalid USDT Address!"
    );
    USDTAddress = _USDTTokenAddress;
}

function setUSDCAddress(IERC20 _USDCTokenAddress) external
onlyRole(OWNER_ROLE) {
    require(
        address(_USDCTokenAddress) != address(0),
        "EX1Presale: Invalid USDC Address!"
    );
    USDCAddress = _USDCTokenAddress;
}
```

Recommendation

It is recommended to include a check to ensure that the newly set token address has the same decimal value as the previous token. This can be done by verifying the `decimals()` function of the ERC20 token contract before assigning the new address. Adding this validation will help maintain consistent unit calculations and prevent errors caused by differing token decimals.

MUV - Missing User Validation

Criticality	Minor / Informative
Location	ex1ICov2.sol#L347
Status	Acknowledged

Description

The contract relies on the user providing approval for the transfer of USDT and USDC tokens. If the user has not already approved the required amount, the `safeTransferFrom` call will fail. However, the current implementation does not include a check to verify that the required approval is in place before attempting the transfer. As a result, the user may encounter a transaction failure without a clear error message indicating the need for token approval, which can lead to confusion and a poor user experience.

```
IERC20(_token).safeTransferFrom(_msgSender(), receivingWallet,  
    usdValue);
```

Recommendation

It is recommended to implement a validation step that ensures the user has approved the required amount of USDT and USDC tokens prior to executing the transfer. If no approval is detected, the contract should provide a specific error message that clearly explains the issue. This enhancement will help users understand why the transaction failed and what action they need to take, improving the overall usability and transparency of the contract.

MU - Modifiers Usage

Criticality	Minor / Informative
Location	ex1Token.sol#L272 ex1ICOv2.sol#L130 ex1Staking.sol#L123
Status	Acknowledged

Description

The contract is using repetitive statements on some methods to validate some preconditions. In Solidity, the form of preconditions is usually represented by the modifiers. Modifiers allow you to define a piece of code that can be reused across multiple functions within a contract. This can be particularly useful when you have several functions that require the same checks to be performed before executing the logic within the function.

```
require(!isRevoked[_txIndex], "Transaction status Revoked!");  
require(!hasVoted[_txIndex][_msgSender()], "Approver already  
Voted");
```

```
require((_startTime < _endTime), "Invalid Schedule or  
Parameters!");  
require(_startTime > block.timestamp, "Invalid Start Time!");  
require(_endTime > block.timestamp, "Invalid End Time!");  
  
...  
require(  
    address(_aggregator) != address(0),  
    "Invalid Aggregator Address!"  
);
```

```
require(_startTime > endTime, "ex1Presale: Token Sale not Ended  
yet!");  
  
...
```

```
`require(isStaked[_icoStageID][_msgSender()], "ex1Staking: Not Staked Yet!");
```

Recommendation

The team is advised to use modifiers since it is a useful tool for reducing code duplication and improving the readability of smart contracts. By using modifiers to perform these checks, it reduces the amount of code that is needed to write, which can make the smart contract more efficient and easier to maintain.

MRI - Multiple Revoke Invocations

Criticality	Minor / Informative
Status	Unresolved

Description

The `revokeApproval` method allows a voter to invoke the revoke action multiple times for the same proposal. As a result, a malicious or rogue voter could undermine the intended design by repeatedly revoking and potentially overriding the approvals of other voters.

```
function revokeApproval(uint256 _txIndex) public onlyRole(APPROVER_ROLE)
txExists(_txIndex) notExecuted(_txIndex) {
    require(!isRevoked[_txIndex], "Transaction status Revoked!");
    require(!hasVoted[_txIndex][_msgSender()], "Signer already Revoked!");

    transactions[_txIndex].revokeCount += 1;
    transactions[_txIndex].approvalCount -= 1;

    if (transactions[_txIndex].revokeCount > required) {
        transactions[_txIndex].approvalStatus = ApprovalStatus.revoked;
        isRevoked[_txIndex] = true;
    }

    emit ApprovalRevoked(_txIndex, _msgSender());
}
```

Recommendation

The contract should align with its current design by allowing a voter to perform either an approval or a revocation only once per proposal. This will help ensure a robust voting system that reflects the original design intent.

ODM - Oracle Decimal Mismatch

Criticality	Minor / Informative
Location	ex1ICOv2.sol#L243
Status	Acknowledged

Description

The contract relies on data retrieved from an external Oracle to make critical calculations. However, the contract does not include a verification step to align the decimal precision of the retrieved data with the precision expected by the contract's internal calculations. This mismatch in decimal precision can introduce substantial errors in calculations involving decimal values.

```
function getLatestETHPrice() public view returns (uint256) {
    (, int256 price, , , ) =
    aggregatorInterfaceETH.latestRoundData();
    return uint256(price);
}

function getTokenPriceInETH(
    uint256 amount,
    uint256 _icoStageID
) public view returns (uint256 ethAmount) {
    uint256 usdPrice = calculatePrice(amount, _icoStageID);
    uint256 latestEthPrice = getLatestETHPrice() * (10 ** 10);
    uint256 _ethAmount = (usdPrice * (10 ** 18)) / latestEthPrice;
    return _ethAmount;
}
```

Recommendation

The team is advised to retrieve the decimals precision from the Oracle API in order to proceed with the appropriate adjustments to the internal decimals representation.

OSET - Overlapping Start End Times

Criticality	Minor / Informative
Location	ex1ICOV2.sol#L199
Status	Acknowledged

Description

The `updateICOSTage` function currently verifies that the new start time does not overlap with the end time of the previous stage and that the new end time does not overlap with the start time of the next stage. However, it does not ensure that the new start time does not precede the start time of the previous stage, nor does it confirm that the new end time does not occur before the end time of the previous stage. These missing checks could lead to inconsistencies in the timeline of ICO stages, potentially causing confusion or unintended behavior.

```
function updateICOSTage(  
    uint256 _stageID,  
    uint256 _startTime,  
    uint256 _endTime,  
    uint256 _tokenPriceUSD,  
    bool active  
) external onlyRole(ICO_AUTHORISER_ROLE) {  
    require(_stageID <= latestICOSTageID, "Stage does not exist");  
    require((_startTime < _endTime) && _endTime > block.timestamp,  
        "Invalid time range!");  
    uint256 prevID = _stageID - 1;  
    uint256 nextID = _stageID + 1;  
    if(_stageID > 1) {  
        require(  
            _startTime > icoStages[prevID].endTime,  
            "ICO: Start Time Overlapping with previous ICO end Time!"  
        );  
    }  
    if(_stageID < latestICOSTageID) {  
        require(  
            _endTime < icoStages[nextID].startTime,  
            "ICO: End Time Overlapping with next ICO startTime!"  
        );  
    }  
    ...  
}
```

Recommendation

It is recommended to include checks ensuring that the new start time is not before the start time of the previous stage, and that the new end time is not before the end time of the previous stage. This will help maintain a logical and consistent timeline of ICO stages, reducing the risk of overlapping or misaligned stage intervals.

POSD - Potential Oracle Stale Data

Criticality	Minor / Informative
Location	ex1ICOV2.sol#L243
Status	Acknowledged

Description

The contract relies on retrieving price data from an oracle. However, it lacks proper checks to ensure the data is not stale. The absence of these checks can result in outdated price data being trusted, potentially leading to significant financial inaccuracies.

```
function getLatestETHPrice() public view returns (uint256) {
    (, int256 price, , , ) =
    aggregatorInterfaceETH.latestRoundData();
    return uint256(price);
}

function getTokenPriceInETH(
    uint256 amount,
    uint256 _icoStageID
) public view returns (uint256 ethAmount) {
    uint256 usdPrice = calculatePrice(amount, _icoStageID);
    uint256 latestEthPrice = getLatestETHPrice() * (10 ** 10);
    uint256 _ethAmount = (usdPrice * (10 ** 18)) / latestEthPrice;
    return _ethAmount;
}
```

Recommendation

To mitigate the risk of using stale data, it is recommended to implement checks on the round and period values returned by the oracle's data retrieval function. The value indicating the most recent round or version of the data should confirm that the data is current. Additionally, the time at which the data was last updated should be checked against the current interval to ensure the data is fresh. For example, consider defining a threshold value, where if the difference between the current period and the data's last update period exceeds this threshold, the data should be considered stale and discarded, raising an appropriate error.

For contracts deployed on Layer-2 solutions, an additional check should be added to verify the sequencer's uptime. This involves integrating a boolean check to confirm the sequencer is operational before utilizing oracle data. This ensures that during sequencer downtimes, any transactions relying on oracle data are reverted, preventing the use of outdated and potentially harmful data.

By incorporating these checks, the smart contract can ensure the reliability and accuracy of the price data it uses, safeguarding against potential financial discrepancies and enhancing overall security.

PTRP - Potential Transfer Revert Propagation

Criticality	Minor / Informative
Location	ex1ICOV2.sol#L393
Status	Acknowledged

Description

The contract sends funds to a `marketingWallet` as part of the transfer flow. This address can either be a wallet address or a contract. If the address belongs to a contract then it may revert from incoming payment. As a result, the error will propagate to the token's contract and revert the transfer.

```
(bool successful,) = payable(receivingWallet).call{value:
ethAmount}("");
require(successful, "Transfer of ETH failed");
```

Recommendation

The contract should tolerate the potential revert from the underlying contracts when the interaction is part of the main transfer flow. This could be achieved by not allowing set contract addresses or by sending the funds in a non-revertable way.

TSI - Tokens Sufficiency Insurance

Criticality	Minor / Informative
Location	ex1ICOV2.sol#L372,426 ex1ICOVesting.sol#L170 ex1Staking.sol#L126,260 ex1Token.sol#L330
Status	Acknowledged

Description

The tokens are not held within the contract itself. Instead, the contract is designed to provide the tokens 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.

```
ERC20(ex1Token).safeTransfer(msg.sender, _amount);  
...  
bool success = IERC20(ex1Token).transfer(_recipient, _amount);  
require(  
    success,  
    "Token Transfer Failed!"  
);
```

```
ex1Token.safeTransfer(_msgSender(), claimableAmount);
```

```
bool success = IERC20(ex1Token).transfer(_msgSender(), reward);
```

Recommendation

It is recommended to consider implementing a more decentralized and automated approach for handling the contract tokens. One possible solution is to hold the tokens within 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.

UR - Unclaimed Rewards

Criticality	Minor / Informative
Location	ex1Staking.sol#L
Status	Unresolved

Description

The `stake` method implements a `stakeTimestamp` mapping to record the timestamp of the most recent staking action. If the method is invoked multiple times, the `stakeTimestamp` is overwritten, effectively canceling the previous stake period for the purpose of reward calculation. As a result, users will be unable to claim rewards for the time periods during which they were previously staked.

```
stakeTimestamp[_icoStageID][_msgSender()] = block.timestamp;
```

Recommendation

The `stake` method should support multiple deposit instances while handling reward calculations gracefully. In particular, the team could consider implementing a mechanism to claim any pending rewards prior to accepting a new deposit.

UIC - Unreachable If Condition

Criticality	Minor / Informative
Location	ex1ICOVesting.sol#L179 ex1PrivateVesting.sol#L291
Status	Acknowledged

Description

The contract includes an `if` condition that checks whether the number of elapsed vesting slices is equal to the total number of slices (`if (elapsedSlices == totalNumberOfSlices)`) in order to unlock the full deposit. However, this condition is logically unreachable due to a preceding check: `if (block.timestamp >= schedule.endTime)` , which is triggered before the slice comparison is evaluated. Since reaching the total number of slices implies that the current timestamp is equal to or beyond the schedule's `endTime` , the earlier `if` condition will always be satisfied first. This makes the later check redundant and introduces ambiguity about the intended logic, potentially leading to confusion or maintenance issues in future updates.

```
function calculateClaimableAmount(address _caller, uint256 _icoStageID) public
view returns (uint256) {
    ...

    uint256 totalNumberOfSlices = (schedule.endTime - schedule.startTime)
/ schedule.slicePeriod;

    if (block.timestamp >= schedule.endTime) {
        return totalDeposits - claimedAmount[_icoStageID][_caller];
    }

    uint256 elapsedSlices = prevClaimTimestamp[_icoStageID][_caller] == 0
        ? (block.timestamp - schedule.startTime) / schedule.slicePeriod
        : (block.timestamp - prevClaimTimestamp[_icoStageID][_caller]) /
schedule.slicePeriod;

    uint256 unlocked = totalDeposits * elapsedSlices /
totalNumberOfSlices;

    if (elapsedSlices == totalNumberOfSlices) {
        unlocked = totalDeposits;
    }

    return unlocked - claimedAmount[_icoStageID][_caller];
}
```

```
function calculateClaimableAmount(uint256 _vestingScheduleID)
public
view
onlyValidSchedule(_vestingScheduleID)
notRevoked(_vestingScheduleID)
returns (uint256)
{
    ...
    if (elapsed == totalSlices) {
        unlocked = schedule.totalAmount;
    }

    return unlocked - schedule.releasedAmount;
}
```

Recommendation

It is recommended to reconsider the code structure and remove the unreachable `if (elapsedSlices == totalNumberOfSlices)` condition. This will simplify the logic and clarify the intended flow, ensuring that all conditions contribute meaningfully to the function's behaviour.

L04 - Conformance to Solidity Naming Conventions

Criticality	Minor / Informative
Location	ex1Token.sol#L94,123,136,152,160,169,198,213,229,265,288,319,354 ex1Staking.sol#L77,78,79,102,122,136,194,238,248,267,271,275 ex1PrivateVesting.sol#L148,149,150,151,152,153,154,155,208,209,210,211,212,213,214,215,258,291,330,355,381,395,403 ex1ICOVesting.sol#L30,86,87,88,89,90,117,118,119,120,121,143,179,213,235,249,257 ex1ICOv2.sol#L19,20,38,39,55,56,57,59,60,123,199,243,255,268,285,301,358,416,451,455,459,463,472,477,482,487
Status	Acknowledged

Description

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

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

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

```
uint256 _required
address[] memory _approver
address _address
uint256 _value
address _to
address _from
uint256 _txIndex
uint256 _percentageReturn
uint256 _timePeriodInSeconds
uint256 _icoStageID
address _caller
Iex1ICO _icoInterface
IVestingICO _vestingInterface
IERC20 _tokenAddress

...
```

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/stable/style-guide.html#naming-conventions>.

L13 - Divide before Multiply Operation

Criticality	Minor / Informative
Location	ex1Staking.sol#L141,162,166,172,178,201,220,223,228,231 ex1PrivateVesting.sol#L312,317 ex1ICOVesting.sol#L194,198
Status	Acknowledged

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 precision.

```
uint256 userRewardPerSecond = userPercentage /
stakingParameters[_icoStageID].timePeriodInSeconds
reward =
((stakingEndTime - previousStakingRewardClaimTimestamp[_icoStageID][_caller])
* userRewardPerSecond)

uint256 elapsed = (block.timestamp - schedule.startTime) /
schedule.slicePeriod
uint256 unlocked = (schedule.totalAmount * elapsed) / totalSlices

uint256 unlocked = totalDeposits * elapsedSlices / totalNumberOfSlices
uint256 elapsedSlices = prevClaimTimestamp[_icoStageID][_caller] == 0
? (block.timestamp - schedule.startTime) / schedule.slicePeriod
: (block.timestamp - prevClaimTimestamp[_icoStageID][_caller]) /
schedule.slicePeriod
```

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.

L19 - Stable Compiler Version

Criticality	Minor / Informative
Location	ex1Token.sol#L2 ex1PrivateVesting.sol#L3
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 ^0.8.23;
```

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
EX1	Implementation	Initializable, ERC20Upgradable, AccessControlUpgradeable, UUPSUpgradeable		
		Public	✓	-
	initialize	Public	✓	initializer
	removeApprovers	External	✓	onlyRole
	addApprover	External	✓	onlyRole
	addRestrictedAddress	External	✓	onlyRole
	removeRestrictedAddress	External	✓	onlyRole
	isAddressRestricted	Public		-
	checkRestrictedAddress	Public		-
	checkApproversList	Public		-
	checkApprovers	Public		-
	transfer	Public	✓	-
	transferFrom	Public	✓	-
	_proposeTransfer	Internal	✓	
	approveTransfer	Public	✓	onlyRole txExists notExecuted

	revokeApproval	Public	✓	onlyRole txExists notExecuted
	_executeTransfer	Internal	✓	txExists notExecuted
	executeTransfer	External	✓	txExists notExecuted onlyRole
	getAllPendingProposals	External		-
	updateRequiredApprovers	External	✓	onlyRole
	_authorizeUpgrade	Internal	✓	onlyRole
Ex1Staking	Implementation	Initializable, ReentrancyGuardUpgradeable, AccessControlUpgradeable, UUPSUpgradeable		
		Public	✓	-
	initialize	Public	✓	initializer
	createStakingRewardsParamaters	External	✓	onlyRole
	stake	External	✓	-
	claimStakingRewards	External	✓	nonReentrant
	calculateStakeReward	Internal	✓	
	viewClaimableRewards	External		-
	getEligibleStakableToken	Public		-
	unstake	External	✓	-
	updateIcolInterface	External	✓	onlyRole
	updateVestingInterface	External	✓	onlyRole

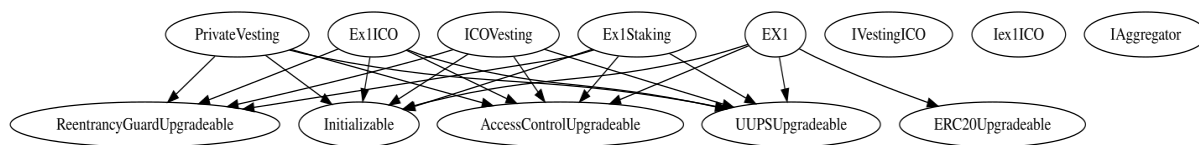
	updateEX1Token	External	✓	onlyRole
	_authorizeUpgrade	Internal	✓	onlyRole
PrivateVesting	Implementation	Initializable, AccessContr olUpgradeab le, ReentrancyG uardUpgrade able, UUPSUpgra deable		
		Public	✓	-
	initialize	Public	✓	initializer
	setVestingSchedule	External	✓	onlyRole
	updateVesting	External	✓	onlyValidSched ule onlyRole
	claimTokens	External	✓	nonReentrant onlyValidSched ule notRevoked
	calculateClaimableAmount	Public		onlyValidSched ule notRevoked
	revokeSchedule	External	✓	onlyRole onlyValidSched ule notRevoked
	nextClaimTime	Public		onlyValidSched ule notRevoked
	getBalanceLeftToClaim	Public		-
	getAllVestingSchedules	Public		-
	getBeneficiarySchedules	External		-
	setEx1TokenSaleContract	External	✓	onlyRole
	_authorizeUpgrade	Internal	✓	onlyRole

Ex1ICO	Implementation	Initializable, ReentrancyGuardUpgradeable, AccessControlUpgradeable, UUPSUpgradeable		
		Public	✓	-
	initialize	Public	✓	initializer
	_authorizeUpgrade	Internal	✓	onlyRole
	createICOStage	External	✓	onlyRole
	getAllICOSTages	External		-
	nextICOSTageID	External		-
	getCurrentOrNextActiveICOSTage	External		-
	updateICOSTage	External	✓	onlyRole
	getLatestETHPrice	Public		-
	getLatestBTCPrice	Public		-
	getTokenPriceInETH	Public		-
	getTokenPriceInBTC	External		-
	calculatePrice	Public		-
	buyWithUSDC	External	✓	checkSaleStatus
	buyWithUSDT	External	✓	checkSaleStatus
	_buyWithUSD	Internal	✓	checkSaleStatus
	purchasedViaEth	External	Payable	nonReentrant checkSaleStatus
	purchasedViaBTC	External	✓	checkSaleStatus onlyRole

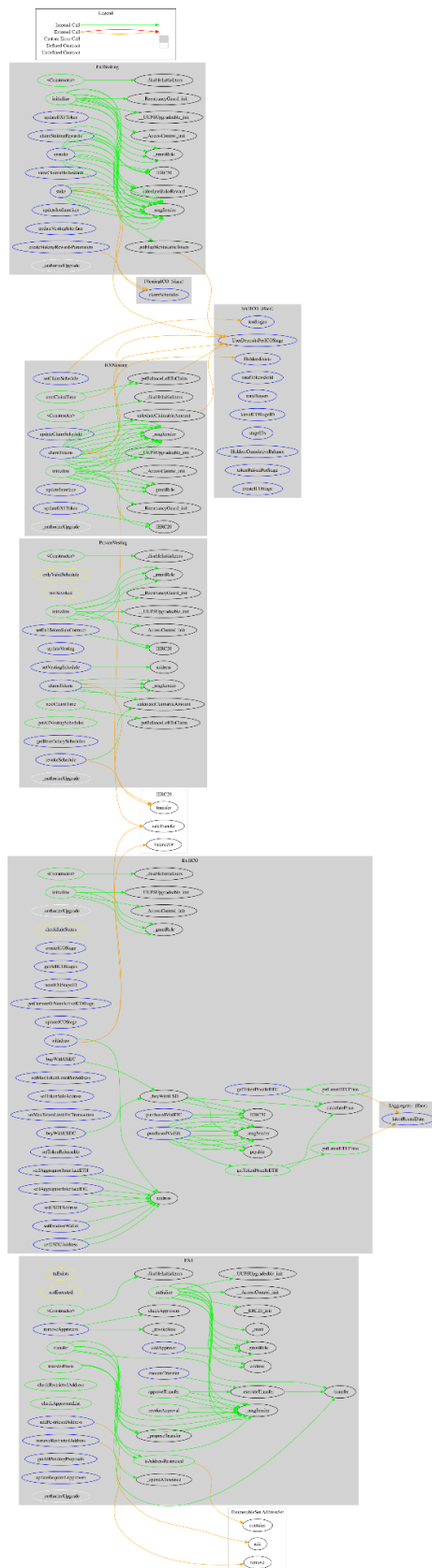
	setMaxTokenLimitPerAddress	External	✓	onlyRole
	setTokenSaleAddress	External	✓	onlyRole
	setMaxTokenLimitPerTransaction	External	✓	onlyRole
	setReceiverWallet	External	✓	onlyRole
	setTokenReleasable	External	✓	onlyRole
	setIAggregatorInterfaceETH	External	✓	onlyRole
	setIAggregatorInterfaceBTC	External	✓	onlyRole
	setUSDTAddress	External	✓	onlyRole
	setUSDCAddress	External	✓	onlyRole
	withdraw	External	✓	onlyRole
ICOVesting	Implementation	Initializable, AccessControlUpgradeable, ReentrancyGuardUpgradeable, UUPSUpgradeable		
		Public	✓	-
	initialize	Public	✓	initializer
	setClaimSchedule	External	✓	onlyRole
	updateClaimSchedule	External	✓	onlyRole
	claimTokens	External	✓	nonReentrant
	calculateClaimableAmount	Public		-
	nextClaimTime	Public		-
	getBalanceLeftToClaim	Public		-
	updateInterface	External	✓	onlyRole

	updateEX1Token	External	✓	onlyRole
	_authorizeUpgrade	Internal	✓	onlyRole

Inheritance Graph



Flow Graph



Summary

The eXchange1 suite of smart contracts implements a comprehensive, role-based, and upgradeable ecosystem for secure EX1 token issuance, cross-chain ICO sales, linear vesting, staking, and private allocations, leveraging OpenZeppelin libraries and price feeds. This audit investigates security vulnerabilities, business logic inconsistencies, and potential optimizations across the EX1, Ex1ICO, ICOVesting, Ex1Staking, and PrivateVesting contracts to ensure robust and transparent token management.

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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.

About Cyberscope

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.

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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