



Cyberscope

A *TAC Security* Company

Audit Report

Plutus escrow

June 2025

Repository : <https://github.com/PlutusDao/xPlutusToken>

Commit : 1059cb7307e0ceeb4e3a68b4225e3855fd92a41c

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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

| | |
|------------|---|
| Repository | https://github.com/PlutusDao/xPlutusToken |
| Commit | 1059cb7307e0ceeb4e3a68b4225e3855fd92a41c |

Audit Updates

| | |
|---------------|-------------|
| Initial Audit | 27 Jun 2025 |
|---------------|-------------|

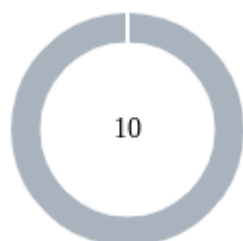
Source Files

| Filename | SHA256 |
|------------------------------|---|
| XPlutusToken.sol | 631ed4ae365d1fe8fefa9193b0dd7d3966d0e22422aaciaa00066e7e4b7e70881 |
| interfaces/IXPlutusToken.sol | c32e47797c94520bcc155a2890ef1ba11192338bf01e3c2b4d18d6d63f0eb528 |
| interfaces/IPlutusToken.sol | 6ea1f61b9b1cd7369cbf37ec69d31a140c7a1e48805dea50e6e43be006131db3 |

Overview

XPlutusToken is an upgradeable ERC20 token, designed to enable token conversion, vesting, and redemption for the xPLUTUS token in conjunction with the PLUTUS token. The contract allows users to convert PLUTUS tokens to xPLUTUS tokens and vest xPLUTUS tokens for a defined period to redeem PLUTUS tokens at a variable redemption ratio based on vesting duration. Vesting details, including ownership and status (active, redeemed, or canceled), are tracked efficiently. Users can cancel vesting to recover xPLUTUS tokens or redeem matured vests to receive PLUTUS tokens, with excess tokens sent to a designated receiver address. Token transfers are restricted to authorized addresses via a whitelist, managed by an admin role that also handles pausing, unpausing, and updating redemption settings.

Findings Breakdown



| | |
|-----------------------|----|
| ● Critical | 0 |
| ● Medium | 0 |
| ● Minor / Informative | 10 |

| Severity | Unresolved | Acknowledged | Resolved | Other |
|-----------------------|------------|--------------|----------|-------|
| ● Critical | 0 | 0 | 0 | 0 |
| ● Medium | 0 | 0 | 0 | 0 |
| ● Minor / Informative | 10 | 0 | 0 | 0 |

Diagnostics

● Critical ● Medium ● Minor / Informative

| Severity | Code | Description | Status |
|----------|------|--|------------|
| ● | CCR | Contract Centralization Risk | Unresolved |
| ● | MIM | Missing Incentivization Mechanism | Unresolved |
| ● | BC | Blacklists Addresses | Unresolved |
| ● | CO | Code Optimization | Unresolved |
| ● | MT | Mints Tokens | Unresolved |
| ● | MC | Missing Check | Unresolved |
| ● | PTAI | Potential Transfer Amount Inconsistency | Unresolved |
| ● | RARD | Redundant Admin Role Declaration | Unresolved |
| ● | ST | Stops Transactions | Unresolved |
| ● | L04 | Conformance to Solidity Naming Conventions | Unresolved |

CCR - Contract Centralization Risk

| | |
|-------------|---|
| Criticality | Minor / Informative |
| Location | XPlutusToken.sol#L84,91,104,114,118,311 |
| 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.

```
function updateExcessReceiver(address _excessReceiver) external
onlyRole(DEFAULT_ADMIN_ROLE) {...}
function updateRedeemSettings(RedeemSettings memory redeemSettings_) external
onlyRole(DEFAULT_ADMIN_ROLE) {...}
function updateWhitelist(address _account, bool _whitelisted) external
onlyRole(DEFAULT_ADMIN_ROLE) {...}
function updateWhitelist(address _account, bool _whitelisted) external
onlyRole(DEFAULT_ADMIN_ROLE) {...}
function pause() external onlyRole(DEFAULT_ADMIN_ROLE) {...}
function unpause() external onlyRole(DEFAULT_ADMIN_ROLE) {...}
function _authorizeUpgrade(address newImplementation) internal override
onlyRole(DEFAULT_ADMIN_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.

MIM - Missing Incentivization Mechanism

| | |
|-------------|-----------------------|
| Criticality | Minor / Informative |
| Location | XPlutusToken.sol#L156 |
| Status | Unresolved |

Description

The contract allows users to exchange Plutus tokens for xPlutus tokens at a 1:1 ratio through the `_convert` function. The minted xPlutus tokens can then be vested using the `vest` function, and later redeemed for Plutus tokens by calling the `redeem` function, which burns the xPlutus tokens. However, the amount of Plutus tokens received during redemption is always less than or equal to the amount of tokens initially deposited.

Therefore, the contract does not provide any economic incentive for users to convert their Plutus tokens into xPlutus. Economic incentives encourage participation in the protocol.

```
function convert(uint256 _amount, address _to) external nonReentrant
{
    _convert(_amount, _to);
}
```

Recommendation

The team could consider introducing an economic incentive that encourages users to convert Plutus tokens into xPlutus. Providing such incentives for vesting will help increase participation and support the intended use of the mechanism.

BC - Blacklists Addresses

| | |
|-------------|-----------------------|
| Criticality | Minor / Informative |
| Location | XPlutusToken.sol#L104 |
| Status | Unresolved |

Description

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

```
function updateWhitelist(address _account, bool _whitelisted) external
onlyRole(DEFAULT_ADMIN_ROLE) {
    if (_account == address(this)) {
        revert XPlutusToken_InvalidWhitelistAddress();
    }
    if (_account == address(0)) revert XPlutusToken_InvalidAddress();
    whitelist[_account] = _whitelisted;
    emit WhitelistUpdated(_account, _whitelisted);
}
```

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.

CO - Code Optimization

| | |
|--------------------|-----------------------------------|
| Criticality | Minor / Informative |
| Location | XPlutusToken.sol#L262,269,274,290 |
| 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. In particular, the contract performs array operations in an inefficient approach, that hinders code readability and future maintenance.

```
function _addVestToOwnerEnumeration(address to, uint256 vestId) private {  
    ...  
}  
  
function _addVestToAllVestsEnumeration(uint256 vestId) private {  
    ...  
}  
  
function _removeVestFromOwnerEnumeration(address from, uint256 vestId) private  
{  
    ...  
}  
  
function _removeVestFromAllVestsEnumeration(uint256 vestId) private {  
    ...  
}
```

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.

MT - Mints Tokens

| | |
|-------------|-----------------------|
| Criticality | Minor / Informative |
| Location | XPlutusToken.sol#L223 |
| Status | Unresolved |

Description

The contract mints tokens. Tokens can be minted by calling the `_convert` function. As a result, the contract tokens will be inflated.

```
function _convert(uint256 _amount, address _to) internal {
    if (_amount == 0) revert XPlutusToken_AmountZero();
    if (_to == address(0)) revert XPlutusToken_InvalidAddress();
    plutus.safeTransferFrom(msg.sender, address(this), _amount);
    _mint(_to, _amount);
    emit Converted(msg.sender, _to, _amount);
}
```

Recommendation

The team should be aware that allowing tokens to be minted through the `_convert` function without any form of supply limitation introduces a significant risk of token inflation. Since this function mints tokens equivalent to the input amount, repeated use could drastically increase the total supply, potentially undermining the token's value.

MC - Missing Check

| | |
|-------------|--------------------------|
| Criticality | Minor / Informative |
| Location | XPlutusToken.sol#L91,122 |
| 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 contract permits `minDuration` to be equal to `maxDuration`. In that case, the execution of `getPlutusByVestingDuration` may revert due to a zero division.

```
function updateRedeemSettings(RedeemSettings memory redeemSettings_) external
onlyRole(DEFAULT_ADMIN_ROLE) {
    if (redeemSettings_.minRatio > redeemSettings_.maxRatio ||
        redeemSettings_.maxRatio > MAX_FIXED_RATIO) {
        revert XPlutusToken_WrongRatioValues();
    }

    if (redeemSettings_.minDuration > redeemSettings_.maxDuration) {
        revert XPlutusToken_WrongDurationValues();
    }

    _redeemSettings = redeemSettings_;
    emit RedeemSettingsUpdated(redeemSettings_);
}
```

Recommendation

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

PTAI - Potential Transfer Amount Inconsistency

| | |
|--------------------|-----------------------|
| Criticality | Minor / Informative |
| Location | XPlutusToken.sol#L223 |
| Status | Unresolved |

Description

The `transfer()` and `transferFrom()` functions are 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 |

```
function _convert(uint256 _amount, address _to) internal {
    if (_amount == 0) revert XPlutusToken_AmountZero();
    if (_to == address(0)) revert XPlutusToken_InvalidAddress();
    plutus.safeTransferFrom(msg.sender, address(this), _amount);
    _mint(_to, _amount);
    emit Converted(msg.sender, _to, _amount);
}
```

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
```


RARD - Redundant Admin Role Declaration

| | |
|-------------|----------------------|
| Criticality | Minor / Informative |
| Location | XPlutusToken.sol#L55 |
| Status | Unresolved |

Description

The contract sets the `DEFAULT_ADMIN_ROLE` as the admin of itself using the `_setRoleAdmin` function. However, according to the OpenZeppelin specification, all roles are administered by `DEFAULT_ADMIN_ROLE` by default. As such, this declaration is redundant and does not alter the contract's behavior. Maintaining unnecessary role configuration may introduce confusion and increase code complexity.

```
_setRoleAdmin(DEFAULT_ADMIN_ROLE, DEFAULT_ADMIN_ROLE);
```

Recommendation

It is recommended to remove redundant declarations. Eliminating unnecessary statements improves code readability and reduces maintenance overhead.

ST - Stops Transactions

| | |
|-------------|---------------------------|
| Criticality | Minor / Informative |
| Location | XPlutusToken.sol#L114,118 |
| Status | Unresolved |

Description

The contract owner has the authority to stop transactions for all users. The owner may take advantage of it by calling the `pause` function.

```
function pause() external onlyRole(DEFAULT_ADMIN_ROLE) {
    _pause();
}

function unpause() external onlyRole(DEFAULT_ADMIN_ROLE) {
    _unpause();
}
```

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.

L04 - Conformance to Solidity Naming Conventions

| | |
|--------------------|-------------------------|
| Criticality | Minor / Informative |
| Location | XPlutusToken.sol#L41,48 |
| 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.

```
uint256[50] private __gap
address _plutus
address _initialAuthority
```

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

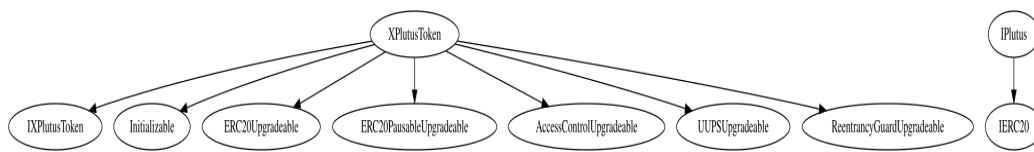
<https://docs.soliditylang.org/en/stable/style-guide.html#naming-conventions>.

Functions Analysis

| Contract | Type | Bases | | |
|--------------|----------------------|---|------------|-------------|
| | Function Name | Visibility | Mutability | Modifiers |
| | | | | |
| XPlutusToken | Implementation | IXPlutusToken, Initializable, ERC20Upgradable, ERC20PauseableUpgradable, AccessControlUpgradable, UUPSUpgradable, ReentrancyGuardUpgradable | | |
| | | Public | ✓ | - |
| | initialize | Public | ✓ | initializer |
| | vestCount | Public | | - |
| | tokenOfOwnerByIndex | Public | | - |
| | totalVests | Public | | - |
| | vestByIndex | Public | | - |
| | updateExcessReceiver | External | ✓ | onlyRole |
| | updateRedeemSettings | External | ✓ | onlyRole |
| | updateWhitelist | External | ✓ | onlyRole |
| | pause | External | ✓ | onlyRole |
| | unpause | External | ✓ | onlyRole |

| | | | | |
|--|------------------------------------|----------|---|--------------|
| | getPlutusByVestingDuration | Public | | - |
| | getAccountVests | External | | - |
| | convert | External | ✓ | nonReentrant |
| | vest | External | ✓ | nonReentrant |
| | redeem | External | ✓ | nonReentrant |
| | cancelVest | External | ✓ | nonReentrant |
| | _convert | Internal | ✓ | |
| | _redeem | Internal | ✓ | |
| | _update | Internal | ✓ | |
| | _addVestToOwnerEnumeration | Private | ✓ | |
| | _addVestToAllVestsEnumeration | Private | ✓ | |
| | _removeVestFromOwnerEnumeration | Private | ✓ | |
| | _removeVestFromAllVestsEnumeration | Private | ✓ | |
| | vests | External | | - |
| | redeemSettings | External | | - |
| | _authorizeUpgrade | Internal | ✓ | onlyRole |

Inheritance Graph



Flow Graph



Summary

XPlutusToken contract implements a token and vesting mechanism. This audit investigates security issues, business logic concerns and potential improvements.

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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.



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The Cyberscope team

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