CERTIK

Code Security Assessment

Axes Metaverse

Feb 24th, 2022

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Summary

This report has been prepared for Axes Metaverse to discover issues and vulnerabilities in the source code of the Axes Metaverse project as well as any contract dependencies that were not part of an officially recognized library. A comprehensive examination has been performed, utilizing Static Analysis and Manual Review techniques.

The auditing process pays special attention to the following considerations:

- Testing the smart contracts against both common and uncommon attack vectors.
- Assessing the codebase to ensure compliance with current best practices and industry standards.
- Ensuring contract logic meets the specifications and intentions of the client.
- Cross referencing contract structure and implementation against similar smart contracts produced by industry leaders.
- Thorough line-by-line manual review of the entire codebase by industry experts.

The security assessment resulted in findings that ranged from critical to informational. We recommend addressing these findings to ensure a high level of security standards and industry practices. We suggest recommendations that could better serve the project from the security perspective:

- Enhance general coding practices for better structures of source codes;
- Add enough unit tests to cover the possible use cases;
- Provide more comments per each function for readability, especially contracts that are verified in public;
- Provide more transparency on privileged activities once the protocol is live.

Overview

Project Summary

Project Name	Axes Metaverse
Description	DEX
Platform	BSC
Language	Solidity
Codebase	https://ropsten.etherscan.io/address/0xECE4cD3b324C40144CA153F67B998C56E3De8BE2#code https://ropsten.etherscan.io/address/0x87FA9690b5817Dd90492272e659D2F3C3E079Ae7#code
Commit	N/A

Audit Summary

Delivery Date	Feb 24, 2022
Audit Methodology	Static Analysis, Manual Review

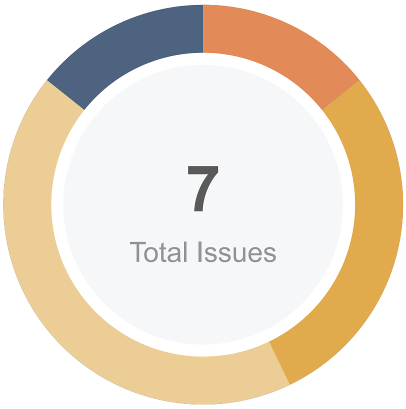
Vulnerability Summary

Vulnerability Level	Total	Pending	Declined	Acknowledged	Partially Resolved	Mitigated	Resolved
● Critical	0	0	0	0	0	0	0
● Major	1	0	0	1	0	0	0
● Medium	2	0	0	0	0	0	2
● Minor	3	0	0	0	0	0	3
● Informational	1	0	0	0	0	0	1
● Discussion	0	0	0	0	0	0	0

Audit Scope

ID	File	SHA256 Checksum
AMC	AMCmarketplace.sol	be979ea510f577f4df8dbb751d2b19fa9233f55c23060c98f600c0cfa1ef638b
M0X	m.sol	a1b03113dc3491d3acbbd8c5b629fe4df5d608a3f8ff86645bfca2cf6add8ef8

Findings



🟥	**Critical**	**0** (0.00%)
🟧	**Major**	**1** (14.29%)
🟨	**Medium**	**2** (28.57%)
🟨	**Minor**	**3** (42.86%)
🟦	**Informational**	**1** (14.29%)
🟩	**Discussion**	**0** (0.00%)

ID	Title	Category	Severity	Status
AMC-01	Fee Can Be Changed After Posting A Sale Request	Control Flow	● Medium	✓ Resolved
AMC-02	Ignore Return Values	Volatile Code	● Medium	✓ Resolved
AMC-03	Third Party Dependencies	Volatile Code	● Minor	✓ Resolved
AMC-04	No Upper Limit for `fee`	Control Flow	● Minor	✓ Resolved
AMC-05	Missing Input Validation	Control Flow	● Informational	✓ Resolved
AMC-06	Arbitrary External Call	Volatile Code	● Minor	✓ Resolved
M0X-01	Centralization Related Risks	**Centralization / Privilege**	● **Major**	ⓘ Acknowledged

AMC-01 | Fee Can Be Changed After Posting A Sale Request

Category	Severity	Location	Status
Control Flow	● Medium	AMCmarketplace.sol (1): 1650	✓ Resolved

Description

In function `buy()`:

```
1650        uint256 _fee = sale[_id].price.div(denominator).mul(fee);
```

When users put an ERC721 token on sale, the amount of ERC20 that they expect to receive is the sale price minus the current fee. However, if the fee is raised before someone buys the token, the seller will receive fewer ERC20 tokens than the amount when he listed it.

Recommendation

We recommend the team be transparent regarding the behavior. One potential solution is adding the current `denominator` and `fee` to the `Sales` struct when a user calls `sell()`.

Alleviation

The team heeded our advice and resolved the issue in the new version.

AMC-02 | Ignore Return Values

Category	Severity	Location	Status
Volatile Code	● Medium	AMCmarketplace.sol (1): 1651~1652	✓ Resolved

Description

In function `buy()`:

```
1651        IERC20(sale[_id].c20).transferFrom(_msgSender(), sale[_id].seller, sale[_id].price.sub(_fee));
1652        IERC20(sale[_id].c20).transferFrom(_msgSender(), feeAddr, _fee);
```

Function `buy()` ignores return values by the function calls of `transferFrom()`.

Several tokens do not revert in case of failure and return false. The buyer could get the ERC721 token without paying ERC20 tokens.

Recommendation

We recommend handling the return values.

Alleviation

The team heeded our advice and resolved the issue in the new version.

AMC-03 | Third Party Dependencies

Category	Severity	Location	Status
Volatile Code	● Minor	AMCmarketplace.sol (1): 1563	✓ Resolved

Description

```
1555     interface IQbeinlicensing {
1556        function checkLicense(address _contract) external view returns (bool active);
1557     }
1558
1559     contract Qbeinlicensing {
1560         address public licensingContract;
1561
1562         constructor(address _license) {
1563             licensingContract = _license;
1564         }
1565
1566         modifier isRunning {
1567             require(IQbeinlicensing(licensingContract).checkLicense(address(this)),
'License not active.');
1568             _;
1569         }
1570     }
```

The contract is serving as the underlying entity to interact with third party contract `licensingContract`. The scope of the audit treats 3rd party entities as black boxes and assumes their functional correctness. However, in the real world, 3rd parties can be compromised and this may lead to transaction failure since major functions in contract `AMCmarketplace` are guarded by the modifier `isRunning`.

Recommendation

We understand that the business logic of `AMCmarketplace` requires interaction with the contract that implements interface `IQbeinlicensing`. We encourage the team to constantly monitor the statuses of the 3rd party to mitigate the side effects when unexpected activities are observed.

Alleviation

The team removed the code related to the third party in the new version.

AMC-04 | No Upper Limit For `fee`

Category	Severity	Location	Status
Control Flow	● Minor	AMCmarketplace.sol (1): 1674~1681	✓ Resolved

Description

```
    function changeFee(uint256 _fee, uint256 _denominator, address _feeAddr) external isRunning {
        require(hasRole(DEFAULT_ADMIN_ROLE, _msgSender()), "You must have admin role to change fee.");
        require(_denominator >= _fee, "Fee is more than denominator.");
        fee = _fee;
        denominator = _denominator;
        feeAddr = _feeAddr;
        emit ChangeFee(_fee, _denominator, _feeAddr);
    }
```

There is no upper limit restricting parameter `_fee` of `changeFee()` potentially enabling up to 100% fees on transactions.

Recommendation

We recommend setting an upper limit for the fee variable.

Alleviation

The team heeded our advice and set a maximum 30% fee in the new version.

AMC-05 | Missing Input Validation

Category	Severity	Location	Status
Control Flow	● Informational	AMCmarketplace.sol (1): 1679	✓ Resolved

Description

Function `ChangeFee()` does not check if address `_feeAddr` is 0.

Recommendation

We recommend adding zero-address check for address `_feeAddr`.

Alleviation

The team heeded our advice and resolved the issue in the new version.

AMC-06 | Arbitrary External Call

Category	Severity	Location	Status
Volatile Code	● Minor	AMCmarketplace.sol (1): 1625	✓ Resolved

Description

```
  1624      function sell(address _contract721, address _contract20, uint256 _tokenId, address
_from, uint256 _price) external isRunning returns (uint256 _id) {
  1625          IERC721(_contract721).safeTransferFrom(_from, address(this), _tokenId);
  1626          require(_price != 0, "Price cannot be zero.");
  1627          require(_price % denominator == 0, "Price in wei must be a multiple of
denominator. Remember the decimals.");
  1628          require(contractsWhitelist.contains(_contract721), "ERC721 contract is not in
whitelist.");
  1629          require(contractsWhitelist.contains(_contract20), "ERC20 contract is not in
whitelist.");
  1630          sellId = sellId.add(1);
  1631          onSale = onSale.add(1);
  1632          idByToken[_contract721][_tokenId] = sellId;
  1633          sale[sellId] = Sales(_msgSender(), address(0), _contract721, _contract20,
_tokenId, _price, true);
  1634          emit Sell(sellId, _tokenId, _price, _from, _contract721, _contract20);
  1635          return sellId;
  1636      }
```

The function `sell()` calls external function `IERC721(_contract721).safeTransferFrom()` before checking if `contractsWhitelist` contains `_contract721`.

Recommendation

We recommend checking if `contractsWhitelist` contains the ERC721 contract before calling its function.

Alleviation

The team heeded our advice and resolved the issue in the new version.

M0X-01 | Centralization Related Risks

Category	Severity	Location	Status
Centralization / Privilege	● **Major**	m.sol (2): 1634~1654	ⓘ Acknowledged

Description

```
  1634      function addToWhitelist(address _contract) external {
  1635          require(hasRole(DEFAULT_ADMIN_ROLE, _msgSender()), "You must have admin role to
add contract to whitelist.");
  1636          require(_contract.isContract(), "Address is not a contract.");
  1637          require(contractsWhitelist.add(_contract), "Contact is already in whitelist.");
  1638          emit ChangeContractWhiteList(_contract, true);
  1639      }
  1640
  1641      function removeFromWhitelist(address _contract) external {
  1642          require(hasRole(DEFAULT_ADMIN_ROLE, _msgSender()), "You must have admin role to
remove contract from whitelist.");
  1643          require(contractsWhitelist.remove(_contract), "Where is no such contract in
whitelist.");
  1644          emit ChangeContractWhiteList(_contract, false);
  1645      }
  1646
  1647      function changeFee(uint256 _fee, address _feeAddr) external {
  1648          require(hasRole(DEFAULT_ADMIN_ROLE, _msgSender()), "You must have admin role to
change fee.");
  1649          require(_fee <= 300, "Fee cannot be more than 30%.");  // 30%, denominator is
constant 1000
  1650          require(_feeAddr != address(0), "Wrong fee address.");
  1651          fee = _fee;
  1652          feeAddr = _feeAddr;
  1653          emit ChangeFee(_fee, _feeAddr);
  1654      }
```

In the contract `AMCmarketplace` the role `DEFAULT_ADMIN_ROLE` has authority over the functions above.

Any compromise to the `DEFAULT_ADMIN_ROLE` account may allow a hacker to take advantage of this authority, remove contracts from the white list, change fee rates, and/or change the fee receiver.

Recommendation

The risk describes the current project design and potentially makes iterations to improve in the security operation and level of decentralization, which in most cases cannot be resolved entirely at the present stage. We advise the client to carefully manage the privileged account's private key to avoid any potential risks of being hacked. In general, we strongly recommend centralized privileges or roles in the protocol be improved via a decentralized mechanism or smart-contract-based accounts with enhanced security practices, e.g., multi-signature wallets.

Indicatively, here are some feasible suggestions that would also mitigate the potential risk at a different level in terms of short-term, long-term and permanent:

Short Term:

Timelock and Multi sign (⅔, ⅗) combination *mitigate* by delaying the sensitive operation and avoiding a single point of key management failure.

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
  AND
- Assignment of privileged roles to multi-signature wallets to prevent a single point of failure due to the private key compromised;
  AND
- A medium/blog link for sharing the timelock contract and multi-signers addresses information with the public audience.

Long Term:

Timelock and DAO, the combination, *mitigate* by applying decentralization and transparency.

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
  AND
- Introduction of a DAO/governance/voting module to increase transparency and user involvement;
  AND
- A medium/blog link for sharing the timelock contract, multi-signers addresses, and DAO information with the public audience.

Permanent:

Renouncing the ownership or removing the function can be considered *fully resolved*.

- Renounce the ownership and never claim back the privileged roles;
  OR
- Remove the risky functionality.

Noted: Recommend considering the long-term solution or the permanent solution. The project team shall make a decision based on the current state of their project, timeline, and project resources.

Alleviation

[Axes Metaverse]: We plan to use multisig wallet as admin to mitigate this risk

Appendix

Finding Categories

Centralization / Privilege

Centralization / Privilege findings refer to either feature logic or implementation of components that act against the nature of decentralization, such as explicit ownership or specialized access roles in combination with a mechanism to relocate funds.

Control Flow

Control Flow findings concern the access control imposed on functions, such as owner-only functions being invoke-able by anyone under certain circumstances.

Volatile Code

Volatile Code findings refer to segments of code that behave unexpectedly on certain edge cases that may result in a vulnerability.

Checksum Calculation Method

The "Checksum" field in the "Audit Scope" section is calculated as the SHA-256 (Secure Hash Algorithm 2 with digest size of 256 bits) digest of the content of each file hosted in the listed source repository under the specified commit.

The result is hexadecimal encoded and is the same as the output of the Linux "sha256sum" command against the target file.

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