

Ekta

LinearPool, Mintable & AirDrop

Smart Contract Audit Report



ekta

December 17, 2021

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Introduction

1. About Ekta

Ekta's vision is to create a world where blockchain technology is used to give everyone a chance to live a better life. A new ecosystem is needed, one where people from different backgrounds and socio-economic circumstances can participate freely, without the barriers and inefficiencies introduced by centralized governing bodies.

Ekta's mission is to bridge the blockchain world with the world we live in, and to create value in both. This is accomplished through various branches of the Ekta ecosystem, which include:

- The tokenization of real-world assets through Ekta Chain and Ekta's self-developed NFT Marketplace
- Ekta's decentralized credit platform that allows all users to participate
- Physical spaces such as the island chain currently being developed in Indonesia, where physical land and real estate assets will be brought on-chain
- Ekta's startup incubator and innovation center open to retail investment

Visit <https://ekta.io/> to know more about it.

2. About ImmuneBytes

ImmuneBytes is a security start-up to provide professional services in the blockchain space. The team has hands-on experience in conducting smart contract audits, penetration testing, and security consulting. ImmuneBytes's security auditors have worked on various A-league projects and have a great understanding of DeFi projects like AAVE, Compound, 0x Protocol, Uniswap, dydx.

The team has been able to secure 105+ blockchain projects by providing security services on different frameworks. ImmuneBytes team helps start-ups with a detailed analysis of the system ensuring security and managing the overall project.

Visit <http://immunebytes.com/> to know more about the services.

Documentation Details

The Ekta team has provided the following doc for the purpose of audit:

1. <https://whitepaper.ektaworld.io/>

This audit does not provide a security or correctness guarantee of the audited smart contract. Securing smart contracts is a multistep process, therefore running a bug bounty program as a complement to this audit is strongly recommended.

Audit Process & Methodology

ImmuneBytes team has performed thorough testing of the project starting with analyzing the code design patterns in which we reviewed the smart contract architecture to ensure it is structured and safe use of third-party smart contracts and libraries.

Our team then performed a formal line-by-line inspection of the Smart Contract in order to find any potential issues like Signature Replay Attacks, Unchecked External Calls, External Contract Referencing, Variable Shadowing, Race conditions, Transaction-ordering dependence, timestamp dependence, DoS attacks, and others.

In the Unit testing phase, we run unit tests written by the developer in order to verify the functions work as intended. In Automated Testing, we tested the Smart Contract with our in-house developed tools to identify vulnerabilities and security flaws.

The code was audited by a team of independent auditors which includes -

1. Testing the functionality of the Smart Contract to determine proper logic has been followed throughout.
2. Analyzing the complexity of the code by thorough, manual review of the code, line-by-line.
3. Deploying the code on testnet using multiple clients to run live tests.
4. Analyzing failure preparations to check how the Smart Contract performs in case of bugs and vulnerabilities.
5. Checking whether all the libraries used in the code are on the latest version.
6. Analyzing the security of the on-chain data.

Audit Details

- Project Name: Ekta
- Contracts Name: AirDrop.sol, Mintable.sol
- Languages: Solidity(Smart contract)
- Github commit/Smart Contract Address for audit: [Null](#)
- Platforms and Tools: Remix IDE, Truffle, Truffle Team, Ganache, Solhint, VScode, Contract Library, Slither, SmartCheck

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Audit Goals

The focus of the audit was to verify that the smart contract system is secure, resilient, and working according to its specifications. The audit activities can be grouped into the following three categories:

1. Security: Identifying security-related issues within each contract and within the system of contracts.
2. Sound Architecture: Evaluation of the architecture of this system through the lens of established smart contract best practices and general software best practices.
3. Code Correctness and Quality: A full review of the contract source code. The primary areas of focus include
 - a. Correctness
 - b. Readability
 - c. Sections of code with high complexity
 - d. Quantity and quality of test coverage

Security Level Reference

Every issue in this report was assigned a severity level from the following:

High severity issues will bring problems and should be fixed.

Medium severity issues could potentially bring problems and should eventually be fixed.

Low severity issues are minor details and warnings that can remain unfixed but would be better fixed at some point in the future.

Issues	<u>High</u>	<u>Medium</u>	<u>Low</u>
Open	-	-	1
Closed	1	3	8

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Contract: LinearPool.sol

High Severity Issues

1. Inadequate implementation of **delayDuration** feature found in the **LinearPool** contract.

Explanation:

The **LinearPool** contract includes a specific parameter named **delayDuration** while adding a new pool in the protocol.

This parameter is supposed to ensure that the users of a particular pool where the **delay duration** is greater than zero, must wait for a specific amount of time, as per the duration value, before receiving their payments while withdrawing their staked tokens from that pool.

However, during the manual code review of the contract, it was found that the **withdraw()** functions in the contract doesn't implement any effective logic to impose this delay of payment.

```
361     if (pool.delayDuration == 0) {  
362         linearAcceptedToken.safeTransfer(account, _amount);  
363         emit LinearWithdraw(_poolId, account, _amount);  
364         return;  
365     }  
366  
367     linearAcceptedToken.safeTransfer(account, _amount);  
368 }  
369
```

For instance, as can be seen in the code snippet above, the if statement at line 361 is executed if the **delayDuration** is exactly Zero. In this case, since there is no delay in payment, the tokens are transferred to the user right away, as expected.

However, if the **delayDuration** is greater than zero, there should have been some delay in the payments to the user, as per the intended behavior of the contract. However, no such implementation was found in any of the **withdraw()** functions. This might lead to an unwanted scenario where pools with a significant delay duration won't have any impact on the token transfer during the withdrawal procedure.

Recommendation:

If the **LinearPool** contract is not supposed to use the **delayDuration** parameter significantly, then it shall be removed from the contract. Otherwise, the delay feature should be implemented in the withdrawal functions of the contract.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

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Medium Severity Issues

1. Improper require statement found in withdraw(uint256) function

Line no: 395-398

Explanation:

The linearWithdraw(uint256) function in the LinearPool Contract at line 374, allows a specific user to withdraw all his Staked Balance from the contract after the given **lockPeriod** is over.

```
394  
395     require(  
396         stakingData.balance >= stakingData.balance,  
397         "LinearStakingPool: invalid withdraw amount"  
398     );  
399
```

However, the function includes an inadequate require statement at the above-mentioned line number which indicates that the function shall only be called when the staked balance is either greater than or equal to itself.

This doesn't represent a strong checkpoint as it leads to a scenario where users with ZERO balance staked are also being allowed to call this function, which should not be an intended scenario.

Recommendation:

An effective way to implement this require statement is to ensure that the staked balance is greater than ZERO.

This ensures that the caller of the function has some staked balance and should be able to withdraw that entire staked balance through this function.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

Low Severity Issues

1. **withdraw()** functions in the contract doesn't ensure appropriate emission of **LinearWithdraw()** event

Line no: 363, 422

Explanation:

As per the current architecture of the contract, the **LinearWithdraw()** event is supposed to be emitted whenever a user is able to successfully withdraw their staked balance from the contract.

However, the design of the withdraw functions in the contract (Line 316, 374) indicates that the **LinearWithdraw()** event is only emitted if the delay duration of a specific pool is strictly equal to ZERO. Additionally, if a specific pool has a **delayDuration** greater than zero, then the withdrawable amount of token is simply transferred to the user without any event emission.

```
420 ~         if (pool.delayDuration == 0) {  
421             linearAcceptedToken.safeTransfer(account, withdrawBalance);  
422             emit LinearWithdraw(_poolId, account, withdrawBalance);  
423             return;  
424         }  
425  
426         linearAcceptedToken.safeTransfer(account, withdrawBalance);  
427     }
```

While this breaks the standard practice of emitting out imperative events on crucial state changes in the contract, it also makes it difficult to track correct details off-chain.

Recommendation:

It's highly recommended to ensure proper emission of events at crucial state-changing instances in the contract.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

2. **Absence of input validations while adding a new pool**

Line no: 165-207

Explanation:

The **linearAddPool()** doesn't include adequate input validations for some crucial arguments being passed to the function.

While the functions impose checks on the `_endJoinTime` or `_delayDuration` arguments, it doesn't validate the `_maxInvestment`, `lockDuration` which are equally critical parameters for a pool.

Recommendation:

Adequate require statements for the above-mentioned parameters will not just filter out only valid arguments but also ensure that the uint values being passed are within a pre-defined range.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

3. External Visibility should be preferred

Explanation:

Functions that are never called throughout the contract should be marked as **external** visibility instead of **public** visibility.

This will effectively result in Gas Optimization as well.

Therefore, the following function must be marked as **external** within the contract:

- **unpauseContract()**

Recommendation:

If the **PUBLIC** visibility of the above-mentioned functions is not intended, then the **EXTERNAL** Visibility keyword should be preferred.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

Recommendations / Informational

1. Contract includes functions with similar names

Line no: 316, 374

Explanation:

During the audit procedure, it was found that the LinearPool includes functions with exactly similar names.

For instances, the contract includes withdraw functions with exactly similar names, i.e., **linearWithdraw()**.

While this affects the readability of the code, it isn't considered a better practice to name two or more functions with an exactly similar name.

Recommendation:

- Avoid using similar names for different functions.
- The **linearWithdraw(uint256 _poolId)** function allows a user to withdraw the total staked balance. Therefore, it could be renamed as **linearWithdrawAll()** or **linearTotalWithdraw()**.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

Contract: Mintable.sol

High Severity Issues

No issues were found.

Medium Severity Issues

1. Total Supply of the token will never reach its full capacity

Line no: 61-64

Explanation:

The **mint()** function of the contract includes a **require** statement to check that the number of tokens being minted never exceeds the **cap** limit, that is set during the contract initialization.

However, as per the current design of the function, the **require** statement ensures that the **total supply** of the token, after minting, should be strictly less than the **cap limit**.

For instance, if the maximum capacity set for the token (**cap value**) is **10000**, the total supply shall never exceed **9999**.

```
60
61     function mint(address user, uint256 amount) public whenNotPaused onlyMinter {
62         require(totalSupply() + amount < cap, "EKTA: FULL CAPACITY");
63         _mint(user, amount);
64     }
```

This is due to the fact that the condition in the **require** statement includes a strict comparison sign (**<**) instead of (**<=**).

Therefore, it leads to an unwanted scenario where the total supply of the token will never really reach its true capacity but will always be lesser than the **cap** value in the contract.

Recommendation:

If the above-mentioned scenario is not intentional, the condition in the **require** statement of the **mint()** function should include a greater than or equal to sign (**<=**) instead of a strictly greater than sign (**<**).

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

Low Severity Issues

1. Redundant comparison to boolean constants

Line no: 106, 118

Explanation:

Boolean constants can directly be used in conditional statements or require statements.

```
101     function _beforeTokenTransfer(  
102         address from,  
103         address to,  
104         uint256 amount  
105     ) internal whenNotPaused override {  
106         require(blacklist[from] == false, "BLACKLIST CANNOT TRANSFER");  
107     }  
108
```

Therefore, it's not considered a better practice to explicitly use **TRUE** or **FALSE** in the **require** statements.

Recommendation:

The equality to boolean constants could be removed from the above-mentioned lines.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

2. Absence of Zero Address Validation

Line no- 74-77 & 79-82

Explanation:

The **MintableToken** Contract includes a few functions that update some of the imperative addresses in the contract like **minter**, **owner**, etc.

However, during the code review of the contract it was found that no Zero Address Validation is implemented on the following functions while updating the address state variables of the contract:

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- `changeMinter()`
- `changeOwner()`

Recommendation:

A **require** statement should be included in such functions to ensure no zero address is passed in the arguments.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

3. No Events emitted after imperative State Variable modification

Line no - 56-59

Explanation:

Functions that update an imperative arithmetic state variable contract should emit an event after the update.

The **setCapacity()** function in the contract modifies the **cap** value, which is a crucial arithmetic state variable in the protocol.

However, the function doesn't emit any event for this variable update.

Since there is no event emitted on updating these variables, it might be difficult to track it off-chain.

Recommendation:

An event should be fired after changing crucial arithmetic state variables.

Not Considered (Dec 17th, 2021)

4. External Visibility should be preferred**Explanation:**

Functions that are never called throughout the contract should be marked as **external** visibility instead of **public** visibility. This will effectively result in Gas Optimization as well.

Therefore, the following function must be marked as external within the contract:

- `mint()`
- `burn()`
- `pauseContract()`
- `unpauseContract()`
- `changeMinter()`
- `changeOwner()`

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- `addBlacklist()`
- `removeBlacklist()`
- `getOwner()`
- `getMinter()`
- `isBlacklisted()`

Recommendation:

If the **PUBLIC** visibility of the above-mentioned functions is not intended, then the **EXTERNAL** Visibility keyword should be preferred.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

Recommendations / Informational

1. Constructor keyword could be removed in an Upgradeable Contract

Explanation:

As per the standard practice, while writing upgradeable contracts, it's imperative to use a one-time setter function, i.e., **initialize** function instead of the constructor.

While the contract includes and uses an **initialize function** to set the imperative state variables, it also includes a constructor keyword in the contract which doesn't seem to have any significant usage.

Recommendation:

If the use of the constructor is not intentional, it can be removed from the contract.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

Contract: AirDrop.sol

High Severity Issues

No issues were found.

Medium Severity Issues

1. Inadequate ETH transfer function found in the contract

Line no: 175-180

Explanation:

The Airdrop contract includes a **_transfer()** function which initiates a transfer of to the given recipient address.

```
175     function _transfer(address _to, uint256 _amount) private {
176         address payable payableAddress = payable(address(uint160(_to)));
177         // solhint-disable-next-line
178         (bool success, ) = payableAddress.call{ value: _amount }("");
179         require(success, "POOL::TRANSFER_FEE_FAILED");
180     }
181
```

This transfer of ether is supposed to happen from the contract to the given recipient address. However, the Airdrop contract includes **fallback** functions with **revert()** statements which technically indicates that the contract is not supposed to receive any ETHER.

```
42     // solhint-disable-next-line
43     fallback() external {
44         // solhint-disable-next-line
45         revert();
46     }
47
48     receive() external payable {
49         // solhint-disable-next-line
50         revert();
51     }
```

Moreover, during the review, it was found that no functions in the contract are allowed to receive ETHER. This indicates that the contract will never have enough ETHER to initiate an ether transfer to any address.

Recommendation:

The **_transfer** function should either be modified adequately or the contract should be allowed to receive ether in order to initiate eth transfers.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

Low Severity Issues

1. External Visibility should be preferred

Explanation:

Functions that are never called throughout the contract should be marked as **external** visibility instead of **public** visibility.

This will effectively result in Gas Optimization as well.

Therefore, the following function must be marked as **external** within the contract:

- **claimTokens()**
- **claimAndStakeTokens()**

Recommendation:

If the **PUBLIC** visibility of the above-mentioned functions is not intended, then the **EXTERNAL** Visibility keyword should be preferred.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

2. Unused private functions

Line no: 175-180

Explanation:

During the review of the Airdrop contract, it was found that the **_transfer** function has been assigned **private** visibility which makes the function inaccessible from outside the contract.

However, the **_transfer** function is never used throughout the contract as well.

Recommendation:

If the function has no significant usage in the contract, it must be removed.

Amended (Dec 17th, 2021): The issue was fixed by the **Ekta** team and is no longer present.

Recommendations / Informational

--

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Test cases

```

Distribution V2
~ file: distribution-v2.spec.ts ~ line 30 ~ it ~ value 100000
  ✓ test
acc1: 0x70997970C51812dc3A010C7d01b50e0d17dc79C8
beforeBalance 0
afterBalance 5
  ✓ test claim token (62ms)
acc1: 0x70997970C51812dc3A010C7d01b50e0d17dc79C8
beforeBalance 0
afterBalance 3
  ✓ test claim and stake token (281ms)
acc1: 0x70997970C51812dc3A010C7d01b50e0d17dc79C8
  ✓ test claim and stake token - revert LinearStakingPool: still locked (126ms)
acc1: 0x70997970C51812dc3A010C7d01b50e0d17dc79C8
  ✓ test claim and stake token: lock time large (179ms)
acc1: 0x70997970C51812dc3A010C7d01b50e0d17dc79C8
  ✓ test claim and stake token - POOL::NOT_ALLOW_TO_CLAIM
> c1: 0x70997970C51812dc3A010C7d01b50e0d17dc79C8
  ✓ test claim and stake token - incorrect signature
deployer: 0xf39Fd6e51aad88F6F4ce6aB8827279cFfFb92266
beforeSigner 0x81B11E04348f4271B163dB51138704F3Dec0c128
afterSigner 0x8C5771FA2e7FecF53dfaf869EA6Ac666aE4890A5
  ✓ test set new signer
deployer: 0xf39Fd6e51aad88F6F4ce6aB8827279cFfFb92266
  ✓ test set new signer - POOL::SIGNER_INVALID
deployer: 0xf39Fd6e51aad88F6F4ce6aB8827279cFfFb92266
beforeStakePool 0x82EdA215Fa92B45a3a76837C65Ab862b6C7564a8
afterStakePool 0x87006e75a5B6bE9D1bbF61AC8Cd84f05D9140589
  ✓ test change stake pool
deployer: 0xf39Fd6e51aad88F6F4ce6aB8827279cFfFb92266
beforeToken 0x8bEe2037448F096900Fd9affc427d38aE6CC0350
afterToken 0xcC4c41415fc68B2fBf70102742A83cDe435e0Ca7
  ✓ test change sale token
acc1: 0x70997970C51812dc3A010C7d01b50e0d17dc79C8
  ✓ Should not able to claim

12 passing (7s)

```

```

Staking Pool
  ✓ Get User staking data (62ms)
  With fixed pool
    ✓ should distribute pkfs properly for each staker (370ms)

2 passing (4s)

```

```

Blacklisted
account1 0x70997970C51812dc3A010C7d01b50e0d17dc79C8
account2 0x3C44CdDdB6a900fa2b585dd299e03d12FA4293BC
~ mintableToken amount BigNumber { _hex: '0x056bc75e2d63100000', _isBigNumber: true }
  ✓ blacklisted fixed token (93ms)
  ✓ blacklisted mintable token
  ✓ Pause token: block transfer, mint, burn and change minter

3 passing (4s)

```

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Automated Audit Result

1. Airdrop Contract

```

Compiled with solc
Number of lines: 1118 (+ 0 in dependencies, + 0 in tests)
Number of assembly lines: 0
Number of contracts: 12 (+ 0 in dependencies, + 0 tests)

Number of optimization issues: 9
Number of informational issues: 62
Number of low issues: 4
Number of medium issues: 1
Number of high issues: 2
ERCs: ERC20

```

Name	# functions	ERCs	ERC20 info	Complex code	Features
IERC20	6	ERC20	No Minting Approve Race Cond.	No	
ILinearPool	5			No	
TransferHelper	3			No	
SafeMath	10			No	
ECDSA	9			No	Ecrecover Assembly
Airdrop	35			No	Receive ETH Send ETH Ecrecover Tokens interaction Assembly Upgradeable

```

INFO:Slither:airDropFlat.sol analyzed (12 contracts)

```

2. MintableToken Contract

```

Compiled with solc
Number of lines: 740 (+ 0 in dependencies, + 0 in tests)
Number of assembly lines: 0
Number of contracts: 7 (+ 0 in dependencies, + 0 tests)

Number of optimization issues: 22
Number of informational issues: 23
Number of low issues: 5
Number of medium issues: 0
Number of high issues: 2
ERCs: ERC20

```

Name	# functions	ERCs	ERC20 info	Complex code	Features
MintableToken	53	ERC20	∞ Minting Approve Race Cond.	No	Upgradeable

```

INFO:Slither:mintableFlat.sol analyzed (7 contracts)

```

This audit does not provide a security or correctness guarantee of the audited smart contract. Securing smart contracts is a multistep process, therefore running a bug bounty program as a complement to this audit is strongly recommended.

3. LinearPool Contract

```

Compiled with solc
Number of lines: 1919 (+ 0 in dependencies, + 0 in tests)
Number of assembly lines: 0
Number of contracts: 11 (+ 0 in dependencies, + 0 tests)

Number of optimization issues: 4
Number of informational issues: 110
Number of low issues: 16
Number of medium issues: 2
Number of high issues: 2
ERCs: ERC20

```

Name	# functions	ERCs	ERC20 info	Complex code	Features
IERC20	6	ERC20	No Minting Approve Race Cond.	No	
Address	11			No	Send ETH Delegatecall Assembly
SafeERC20	6			No	Send ETH Tokens interaction
SafeCastUpgradeable	14			No	
EnumerableSetUpgradeable	24			No	Assembly
LinearPool	39			No	Send ETH Upgradeable

```

INFO:Slither:LinearPoolFlat.sol analyzed (11 contracts)

```

This audit does not provide a security or correctness guarantee of the audited smart contract. Securing smart contracts is a multistep process, therefore running a bug bounty program as a complement to this audit is strongly recommended.

Concluding Remarks

While conducting the audits of the Ekta smart contracts, it was observed that the contracts contain Medium and Low severity issues.

Our auditors suggest that Medium and Low severity issues should be resolved by the developers. The recommendations given will improve the operations of the smart contract.

Disclaimer

ImmuneBytes's audit does not provide a security or correctness guarantee of the audited smart contract. Securing smart contracts is a multistep process, therefore running a bug bounty program as a complement to this audit is strongly recommended.

Our team does not endorse the Ekta platform or its product nor this audit is investment advice.

Notes:

- Please make sure contracts deployed on the mainnet are the ones audited.
- Check for the code refactor by the team on critical issues.

ImmuneBytes