Security Assessment

BLP

Sept 23rd, 2021

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Summary

This report has been prepared for BLP to discover issues and vulnerabilities in the source code of the BLP 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	BLP
Platform	BSC
Language	Solidity
Codebase	Private repository
Commit	

Audit Summary

Delivery Date	Sept 23, 2021
Audit Methodology	Static Analysis, Manual Review
Key Components	BullIdo, Bullpad, bullManager

Vulnerability Summary

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

Audit Scope

ID	File	SHA256 Checksum
ACK	Address.sol	7a6f9acee77ad6aa4db616c473d507a5726698c3bd9005d6c54d8258c3cb6480
BCC	BullContract.sol	1bafb5e9e839ea21da88e4d6d492d11082a99a75efb0cdf9179db990a1e880d2
BPC	BullPad.sol	f2f85c6106e78b6065b37bd8994911de158f5cd696bf145e65916c702e426067
CCK	Context.sol	9a3d1e5be0f0ace13e2d9aa1d0a1c3a6574983983ad5de94fc412f878bf7fe89
DCK	Deployer.sol	1ed09381c6cd1edc5d8a03eefb062534da31167b76ca150ed80d6c8a6d031951
IBU	IBULL.sol	e3d1820047b408f708cdb4495a0fa57f076d94fed35da82cb7b51a9526ad6510
IER	IERC20.sol	0573c2961569aa4906845d0cd428b5b7394956170054ceeaa8f8af96cd44875c
ICK	Initializable.sol	10e65b6da82eb95f819bc3bf11c9b6d273bd5b04dab1e557ddac92d2aacb13cd
OCK	Ownable.sol	2b9fdaa1b13c3faab4d4edf2e58db7bae15aef70093e8095f5ff510e87a5f190
RGC	ReentrancyGuard.sol	3fc7968f4a1937caf3c96dffbac350398f86faad96288502e02c3a2b9f245e39
SER	SafeERC20.sol	80948ccae971a844a6c39336f3c55047dbc6e431f131861b7bf44a97c135e5fc
SMC	SafeMath.sol	38e47d1b5299ce0d5e48db837ed9248449043c50d90ffa0ee2ceb58ffde942c2

Overview

External Dependencies

There are a few depending injection contracts or addresses in the current project:

- `offeringToken` and `rasingToken` in the `BullIdo` contract
- `_offeringToken`, `_rasingToken` and `masterContract` in the `bullManager` contract

We assume these contracts or addresses are valid and non-vulnerable actors and implementing proper logic to collaborate with the current project.

Privileged Functions

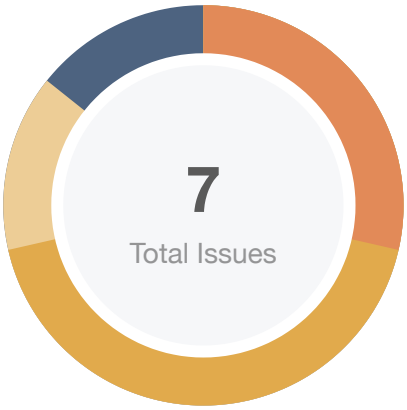
The contract contains the following privileged functions that are restricted by the `onlyOwner` modifier. They are used to modify the contract configurations and address attributes. We grouped these functions below.

The functions below have the `onlyOwner` modifier:

- `withdraw()`: The owner can transfer any amount from arbitrary `_token` or recipient.
- `setIdoBlock()`: The owner can update the ido or fcfs block time.
- `setReleaseBlock()`: The owner can update the release block and vesting block number.
- `setToken()`: The owner can change the token to an arbitrary address.
- `setFcfs()`: The owner can modify the remained allocation.
- `setAllocation()`: The owner can change any allocation, meaning that it might affect the price.
- `whitelistAddress()`: The owner allows to change arbitrary users as whitelist status to true.
- `removeAddress()`: The owner allows to change arbitrary users as whitelist status to false.
- `idoDeployment()`: The owner can set the `idoContract`.
- `newMasterContract()`: The owner can modify an arbitrary address as `masterContract` address.

To improve the trustworthiness of the project, dynamic runtime updates in the project should be notified to the community. Any plan to invoke the aforementioned functions should be also considered to move to the execution queue of the Timelock contract.

Findings



Critical	**0** (0.00%)
Major	**2** (28.57%)
Medium	**3** (42.86%)
Minor	**1** (14.29%)
Informational	**1** (14.29%)
Discussion	**0** (0.00%)

ID	Title	Category	Severity	Status
BCC-01	Centralization Risk	**Centralization / Privilege**	**Major**	Acknowledged
BCC-02	Incorrect Calculation	Mathematical Operations	Medium	Resolved
BCC-03	Discussion on Function `whiteListAllocation()`	Logical Issue	Medium	Acknowledged
BCC-04	Incompatibility With Deflationary Tokens	Volatile Code	Minor	Acknowledged
BPC-01	Missing Input Validation	Volatile Code	Informational	Resolved
DCK-01	Centralization Risk	**Centralization / Privilege**	**Major**	Partially Resolved
DCK-02	Lack of Access Control for Initialization	Volatile Code	Medium	Resolved

BCC-01 | Centralization Risk

Category	Severity	Location	Status
Centralization / Privilege	**Major**	BullContract.sol: 155, 161, 189, 194, 173, 183, 94, 103	Acknowledged

Description

In the contract `BullContract.sol`, the role `onlyOwner` has the authority over the following function:

- `withdraw()`: The owner can transfer any amount from arbitrary `_token` or recipient.
- `setIdoBlock()`: The owner can update the ido or fcfs block time.
- `setReleaseBlock()`: The owner can update the release block and vesting block number.
- `setToken()`: The owner can change the token to an arbitrary address.
- `setFcfs()`: The owner can modify the remained allocation.
- `setAllocation()`: The owner can change any allocation, meaning that it might affect the price.
- `whitelistAddress()`: The owner allows to change arbitrary users as whitelist status to true.
- `removeAddress()`: The owner allows to change arbitrary users as whitelist status to false.

Any compromise to the `onlyOwner` account may allow the hacker to take advantage of breaking the smart contract.

Recommendation

We advise the client to carefully manage the `onlyOwner` account's private key to avoid any potential risks of being hacked. In general, we strongly recommend centralized privileges or roles in the protocol to be improved via a decentralized mechanism or smart-contract-based accounts with enhanced security practices, e.g., Multisignature wallets.

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

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
- Assignment of privileged roles to multi-signature wallets to prevent a single point of failure due to the private key;
- Introduction of a DAO/governance/voting module to increase transparency and user involvement.

BCC-02 | Incorrect Calculation

Category	Severity	Location	Status
Mathematical Operations	Medium	BullContract.sol: 118	Resolved

Description

The code implementation in L118 is designed to avoid users participating more than the share.

```
 115         User[_user]=user(userDetails.whitelist,
(userDetails.participationAmount).add(_amount),block.number,false,0);
 116         rasingToken.safeTransferFrom(_msgSender(),address(this),_amount);
 117         //avoid user participate more than share
 118
whiteListAllocation().sub(userDetails.participationAmount).sub(_amount,"BullPad:Participa
tion Amount Overflow");
```

However, the state `userDetails.participationAmount` has already updated and added `_amount` (which is the amount that the user participates in) in L115. Therefore, the calculation in L118 is incorrect since it minus `_amount` by twice.

Recommendation

We advise correct the calculation in L118:

```
 118
whiteListAllocation().sub(userDetails.participationAmount,"BullPad:Participation Amount
Overflow");
```

Alleviation

The development team heeded our advice and resolve this issue by updating `User[_user]` after the division.

```
 117
whiteListAllocation().sub(userDetails.participationAmount).sub(_amount,"BullPad:Participa
tion Amount Overflow");
 118         User[_user]=user(userDetails.whitelist,
(userDetails.participationAmount).add(_amount),block.number,false,0);
```

BCC-03 | Discussion on Function `whiteListAllocation()`

Category	Severity	Location	Status
Logical Issue	Medium	BullContract.sol: 206	Acknowledged

Description

According to the implementation of the function `whiteListAllocation()`, `whiteListAllocation()` would return the maximum tokens that the whitelisted user can participant.

```
206      function whiteListAllocation() public view returns(uint256){
207         return totalAllocation.div(totalWhitelist);
208      }
```

However, the return value of `whiteListAllocation()` might change dynamically since the owner of the contract can call `whitelistAddress()`/`removeAddress()` at any time, which would increase/decrease the value of `totalWhitelist`.

Recommendation

We advise the client to revisit the design and ensure it is intended.

BCC-04 | Incompatibility With Deflationary Tokens

Category	Severity	Location	Status
Volatile Code	Minor	BullContract.sol: 116, 132, 137	Acknowledged

Description

When transferring standard ERC20 deflationary tokens (i.e., `rasingToken` is a standard ERC20 deflationary token), the input amount may not be equal to the received amount due to the charged transaction fee. For example, if a user calls `_participate` to stake 100 deflationary tokens (with a 10% transaction fee) in `BullIdo` contract, only 90 tokens actually arrived in the contract. This might cause some tokenomic problems to the project.

Recommendation

We advise the client to regulate the set of `rasingToken` supported and add necessary mitigation mechanisms to keep track of accurate balances if there is a need to support deflationary tokens.

BPC-01 | Missing Input Validation

Category	Severity	Location	Status
Volatile Code	Informational	BullPad.sol: 15, 18	Resolved

Description

The given input `_user` is missing the sanity check to validate the existence of the user.

Recommendation

We advise adding the check for the passed-in values to prevent unexpected error.

Alleviation

The development team heeded our advice and resolved this issue.

DCK-01 | Centralization Risk

Category	Severity	Location	Status
Centralization / Privilege	**Major**	Deployer.sol: 55, 23	Partially Resolved

Description

In the contract `Deployer.sol`, the role `onlyOwner` has the authority over the following function:

- `idoDeployment()`: The owner can set the `idoContract`.
- `newMasterContract()`: The owner can modify an arbitrary address as `masterContract` address.

Any compromise to the `onlyOwner` account may allow the hacker to take advantage of breaking the smart contract.

Recommendation

We advise the client to carefully manage the `onlyOwner` account's private key to avoid any potential risks of being hacked. In general, we strongly recommend centralized privileges or roles in the protocol to be improved via a decentralized mechanism or smart-contract-based accounts with enhanced security practices, e.g., Multisignature wallets.

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

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
- Assignment of privileged roles to multi-signature wallets to prevent a single point of failure due to the private key;
- Introduction of a DAO/governance/voting module to increase transparency and user involvement.

Alleviation

The development team heeded our advice and set the visibility of the function `idoDeployment()` as `internal.

(**CertiK**)

We advise the client to solve centralization risk by applying a decentralized mechanism or smart-contract-based accounts with enhanced security practices and provide corresponding transactions/proof to the community.

DCK-02 | Lack of Access Control for Initialization

Category	Severity	Location	Status
Volatile Code	Medium	Deployer.sol: 26~38	Resolved

Description

In the `bullManager` contract, the function `initialize()` can be called by anyone to initialize the contract. Although the project deployer can discard incorrectly initialized contracts, it might still bring errors if the deployment is not properly processed. One of the possible scenarios is described as below:

1. The deployer writes a script to deploy and initialize the contract.
2. The attacker noticed the deployment and initialized the contract before the initialization by the deployer is committed.
3. The deployment script mistakenly ignores the error of initializing the contract (because `initialized` is `true` now, the transaction of calling `init()` will be reverted), and continues executing other transactions in the script.

In this way, the attacker can inject suspicious addresses into the contracts.

Recommendation

We recommend adding proper access control to the `initialize()` function in the aforementioned contracts or checking the status of initialization in the deployment process.

Alleviation

The development team heeded our advice and resolve this issue.

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.

Mathematical Operations

Mathematical Operation findings relate to mishandling of math formulas, such as overflows, incorrect operations etc.

Logical Issue

Logical Issue findings detail a fault in the logic of the linked code, such as an incorrect notion on how block.timestamp works.

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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