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DeHacker

Code Security Assessment

Balancer

July 30th, 2022



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Summary

DeHacker's objective was to evaluate the repository for security-related issues, code quality, and adherence to specification and best practices.

Possible issues we looked for included (but are not limited to):

- 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 code base 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.



Issue Categories

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

Critical severity issues

A vulnerability that can disrupt the contract functioning in a number of scenarios or creates a risk that the contract may be broken.

Major severity issues

A vulnerability that affects the desired outcome when using a contract or provides the opportunity to use a contract in an unintended way.

Medium severity issues

A vulnerability that could affect the desired outcome of executing the contract in a specific scenario.

Minor severity issues

A vulnerability that does not have a significant impact on possible scenarios for the use of the contract and is probably subjective.

Informational

A vulnerability that has informational character but is not affecting any of the code.



Overview

Project Summary

Project Name	Balancer
Platform	Ethereum
website	https://balancer.fi/
Type	Others
Deployed contract	https://etherscan.io/token/0xba100000625a3754423978a60c9317c58a424e3d
Language	Solidity

Audit Summary

Delivery Date	July 30th 2022
Audit Methodology	Manual Review, Static Analysis



Vulnerability Summary

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

Audit scope

ID	File	SHA256 Checksum
BGT	BalancerGovernanceToken.sol	5bbcae8aa02509fe1e41796d55e76ab49c2415efecd9d4e1210e5d81b32ca3f



Privileged Functions

The project contains the following privileged functions that are restricted by some roles. They are used to mint tokens and make snapshots. We grouped these functions below:

The MINTER_ROLE role:

- function mint(address to, uint256 amount)

The SNAPSHOT_ROLE role:

- function snapshot()



Findings

ID	Title	Category	Severity	Status
BGT-01	Privileged Ownership	Centralization / Privilege	Major	Acknowledged
BGT-02	Unlocked Compiler Version Declaration	Language Specific	Informational	Pending
BGT-03	Function Visibility Optimization	Gas Optimization	Informational	Pending
BGT-04	Missing Mutability Specifier	Gas Optimization	Informational	Pending



Major

BGT-01 | Privileged Ownership

Category	Severity	Location	Status
Centralization / Privilege	Major	BalancerGovernanceToken.sol: 1477~1480, 1493~1496	Acknowledged

Description

In contract Balancer, the contract creator, who is the only one that is granted MINTER_ROLE, can mint any amount of BalancerGovernanceToken to any account by calling the mint() function. If the contract creator is hacked, the hacker may have unlimited mint capabilities and manipulate the entire tokens of the project eventually.

In contract Balancer, the contract creator, who is the only one that is granted SNAPSHOT_ROLE, can create a contract snapshot. If the contract creator is hacked, the hacker may have unlimited ability to create contract snapshots. Hence, the gas costs of transfer and retrieval of values from snapshots will be increased maliciously.

Recommendation

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

Some feasible security solutions:

- Time-lock with reasonable latency, i.e. 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

Minter and Snapshot role is GnosisSafe

<https://etherscan.io/address/0xCDcEBF1f28678eb4A1478403BA7f34C94F7dDBc5#code>



Informational

BGT-02 | Unlocked Compiler Version Declaration

Category	Severity	Location	Status
Language Specific	Informational	BalancerGovernanceToken.sol: 9, 254, 316, 346, 551, 705, 738, 786, 827, 906, 1214, 1399	Pending

Description

An unlocked compiler version in the source code of the contract permits the user to compile it at or above a particular version. This, in turn, leads to differences in the generated bytecode between compilations due to differing compiler version numbers. This can also lead to an ambiguity when debugging as compiler-specific bugs may occur in the codebase that would be hard to identify over a span of multiple compiler versions rather than a specific one.

Recommendation

It is a general practice to instead lock the compiler at a specific version rather than allow a range of compiler versions to be utilized to avoid compiler-specific bugs and be able to identify ones more easily. We recommend locking the compiler at the higher stable version that supports all the capabilities wished by the codebase.



Informational

BGT-03 | Function Visibility Optimization

Category	Severity	Location	Status
Gas Optimization	Medium	BalancerGovernanceToken.sol: 1477, 1482, 1486, 1493	Pending

Description

The following functions are declared as public and are not invoked in any of the contracts contained within the project's scope. The functions that are never called internally within the contract should have external visibility.

- mint()
- burn()
- burnFrom()
- snapshot()

Recommendation

We advise that the functions' visibility specifiers are set to external and the array-based arguments change their data location from memory to calldata, optimizing the gas cost of the function.



Informational

BGT-04 | Missing Mutability Specifier

Category	Severity	Location	Status
Gas Optimization	Informational	BalancerGovernanceToken.sol: 1411	Pending

Description

The linked variable is assigned only once during their contract-level declaration.

Recommendation

We advise that the constant keyword is introduced in the variable declaration to greatly optimize the gas cost involved in utilizing the variable, and declare the PERMIT_TYPEHASH to constant :

```
1411 bytes32 public constant PERMIT_TYPEHASH =  
0x6e71edae12b1b97f4d1f60370fef10105fa2faae0126114a169c64845d6126c9;
```



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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.

Coding Style

Coding Style findings usually do not affect the generated bytecode but rather comment on how to make the codebase more legible and, as a result, easily maintainable.

Volatile Code

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

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.

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.



About

DeHacker is a team of auditors and white hat hackers who perform security audits and assessments. With decades of experience in security and distributed systems, our experts focus on the ins and outs of system security. Our services follow clear and prudent industry standards. Whether it's reviewing the smallest modifications or a new platform, we'll provide an in-depth security survey at every stage of your company's project. We provide comprehensive vulnerability reports and identify structural inefficiencies in smart contract code, combining high-end security research with a real-world attacker mindset to reduce risk and harden code.

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July 2022