CERTIK

Security Assessment

Sperax

Nov 18th, 2021

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Summary

This report has been prepared for Sperax to discover issues and vulnerabilities in the source code of the Sperax 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	Sperax
Platform	Ethereum
Language	Solidity
Codebase	https://etherscan.io/address/0xb4a3b0faf0ab53df58001804dda5bfc6a3d59008#code
Commit	

Audit Summary

Delivery Date	Nov 18, 2021
Audit Methodology	Static Analysis, Manual Review
Key Components	

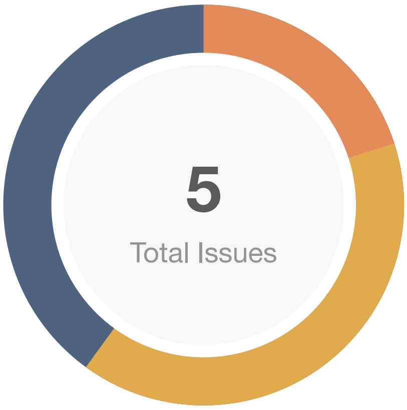
Vulnerability Summary

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

Audit Scope

ID	File	SHA256 Checksum
SPA	SPA_ERC20_new.sol	ef6dbca19d209378a8c5e21fe9364c2f5db07b47af4a1b8139c570e4344e5b78

Findings



🟥 **Critical**	**0** (0.00%)
🟧 **Major**	**1** (20.00%)
🟨 **Medium**	**2** (40.00%)
Minor	**0** (0.00%)
🟦 **Informational**	**2** (40.00%)
🟩 **Discussion**	**0** (0.00%)

ID	Title	Category	Severity	Status
SPA-01	Proper Usage of `public` and `external` Type	Gas Optimization	● Informational	ⓘ Acknowledged
SPA-02	Comparison with boolean	Coding Style	● Informational	✓ Resolved
SPA-03	Initial token distribution	Control Flow	● Medium	✓ Resolved
SPA-04	No limit of SPA totalSupply	Logical Issue	● Medium	ⓘ Acknowledged
SPA-05	Centralization Risk on `mintForUSDs`	Logical Issue	● Major	Partially Resolved

SPA-01 | Proper Usage of `public` and `external` Type

Category	Severity	Location	Status
Gas Optimization	● Informational	contracts/Spa/SPA_ERC20_new.sol (Spa): 800~807	ⓘ Acknowledged

Description

`public` functions that are never called by the contract could be declared `external`. When the inputs are arrays `external` functions are more efficient than `public` functions.

Recommendation

The function `batchTransfer()` could be declared `external`.

Alleviation

The team acknowledged the finding, and decided to retain the code base unchanged.

SPA-02 | Comparison with boolean

Category	Severity	Location	Status
Coding Style	● Informational	contracts/Spa/SPA_ERC20_new.sol (Spa): 650	✓ Resolved

Description

Performs comparison with a boolean literal false which can be replaced with the negation of the expression to increase the legibility of the codebase. Moreover, the input parameter `account` lacks a zero-address check.

Recommendation

Consider modifying like below:

```
function setUSDsAddr(address account) onlyOwner external {
    require(!USDsAddrSet, "address already set");
    require(account != address(0), "ERC20: setUSDsAddr to zero address");
    USDsAddr = account;
    USDsAddrSet = true;
}
```

Alleviation

Sperax team removed function `setUSDsAddr` when this contact deployed in address `0xb4a3b0faf0ab53df58001804dda5bfc6a3d59008` of ETH chain.

SPA-03 | Initial token distribution

Category	Severity	Location	Status
Control Flow	● Medium	contracts/Spa/SPA_ERC20_new.sol (Spa): 659	✓ Resolved

Description

All of the `SPA` tokens are sent to the contract deployer when deploying the contract. This could be a centralization risk as the deployer can distribute `SPA` tokens without obtaining the consensus of the community.

Recommendation

We recommend the team to be transparent regarding the initial token distribution process.

Alleviation

[Sperax]: Allocation of `SPA` from the private sale (15% of total supply) has begun under a strict vesting schedule. Vesting for the team and advisors (10% of total supply) vests linearly over 2 years with a 6-month cliff. Foundation funds (25% of total supply) are used to make markets in the early stages and for future protocol development. The SPA treasury will vest linearly over a 4-year time-lock, beginning from the launch date of governance protocol.

The 5 billion `SPA` tokens are distributed as the below list:

- 5% Public sale
- 10% Team & Advisor
- 10% Bootstrap Liquidity
- 10% Staking Rewards
- 15% Private Sale
- 25% Foundation
- 25% Treasury

For more information, please refer to the link: https://medium.com/sperax/sperax-multi-sig-the-road-to-decentralization-3044ea841836

Since the below-listed reasons, the development team thinks it is necessary to mint the new `SPA` token after deployment:

1. `USDs` stable-coin protocol, the flagship product of Sperax, requires the minting function of SPA. The economic system of USDs is a dual-token system of USDs and SPA. Especially, it means that when the user redeems USDs, the new SPA must be minted so that the user can always obtain a one-dollar-worth package of tokens. Hence, in order for `USDs` stable-coin protocol to work properly, SPA must be elastic. In other words, SPA must have the minting function. For the details of the dual-token system of USDs, please check section 2 of the `USDs` whitepaper.
2. SPA Arbitrum custom cross-chain gateway requires the minting function of SPA. Since USDs is launched on Arbitrum Layer-2, SPA resides on both Arbitrum Layer-2 and Ethereum Layer-1. The `USDs` protocol requires that the SPA cross-chain gateway must adopt a custom gateway. This custom gateway, in turn, requires that SPA must be elastic on Layer-1. In other words, SPA must have the minting function.

SPA-04 | No limit of SPA totalSupply

Category	Severity	Location	Status
Logical Issue	● Medium	contracts/Spa/SPA_ERC20_new.sol (Spa)	ⓘ Acknowledged

Description

There is no limit of the tokens totalSupply.

Recommendation

We recommend that the team limit the totalSupply of `SPA` tokens

Alleviation

The team responded that this is the intention of the design.

SPA-05 | Centralization Risk on `mintForUSDs`

Category	Severity	Location	Status
Logical Issue	● Major	contracts/Spa/SPA_ERC20_new.sol (Spa): 691~693	Partially Resolved

Description

The function `mintForUSDs()` is merely called by the user in `mintableGroup`, and it allows the caller to mint any amount of tokens to any specified recipient. To improve the trustworthiness of this protocol, any plan to the mint token is better to move to the execution queue of `Timelock` and also add an `emit event`, or make the owner Multi-sig.

```
691   function mintForUSDs(address account, uint256 amount) whenMintNotPaused
onlyMintableGroup external {
692       _mint(account, amount);
693   }
```

Recommendation

We advise the client to carefully manage the `mintableGroup` 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

Currently, Sperax token is deployed at address `0xB4A3B0Faf0Ab53df58001804DdA5Bfc6a3D59008` on ETH.

The owner of this contract is a multi-sig `GnosisSafeProxy` contract at address `0x86c87113dc3497361b7c5bad66d67303ddf4611f`, and the implementation of this proxy is deployed at address `0xd9db270c1b5e3bd161e8c8503c55ceabee709552`.

Now there are below three owner addresses manage this multisig contract:

1. 0xc28c6970d8a345988e8335b1c229dea3c802e0a6
2. 0x42d2f9f84eeb86574aa4e9fcccfd74066d809600
3. 0x4f987b24bd2194a574bb3f57b4e66b7f7ed36196

[Sperax]: Next Steps Towards Decentralization

1. Move funds to wallets managed by multi-sig
2. Add time lock based on the proposed vesting schedule
3. Add protocol upgrade delay
4. Burn admin keys and transfer ownership to governance contracts

Refer to the official announcement about decentralization: https://medium.com/sperax/sperax-multi-sig-the-road-to-decentralization-3044ea841836

Appendix

Finding Categories

Gas Optimization

Gas Optimization findings do not affect the functionality of the code but generate different, more optimal EVM opcodes resulting in a reduction on the total gas cost of a transaction.

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.

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.

Coding Style

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

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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