Security Assessment

Channels

Nov 15th, 2021

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Summary

This report has been prepared for Channels to discover issues and vulnerabilities in the source code of the Channels 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	Channels
Description	Channels
Platform	BSC
Language	Solidity
Codebase	https://github.com/ChannelsFinance/ChannelsProtocolV2
Commit	c1899219fac14a9ed6e4b67900d81986b160714b

Audit Summary

Delivery Date	Nov 15, 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	3	0	0	3	0	0
Medium	1	0	0	0	0	1
Minor	0	0	0	0	0	0
Informational	3	0	0	0	1	2
Discussion	0	0	0	0	0	0

Audit Scope

ID	File	SHA256 Checksum
CGE	CGatlingErc20Delegate.sol	3f220070d9c4cf8c8a85bcdd993046c8d3aa404f674c02f47a7ada819dd0a62c
CGD	CGatlingErc20Delegator.sol	1b582979988c8214865c2e77b0ec73c87fd616102aa640f4d6cc37e2a86ccb78
SSC	SpotSpell.sol	c4e5d9caa2bef44f6c76a4205ac8eb914b112fe8f18a6930614cd12a793cfc5b
WCC	WComptroller.sol	3a4d5dbcca9c24d19b7134fd3da74fd22b8aaf82a369cd2ec9c90d7c60019013

External Dependencies

The contract `SpotSpellV1` is serving as the underlying entity to interact with third party `UNISWAP` protocol.

The contract `CGatlingErc20Delegate` is serving as the underlying entity to interact with third party `MdexRouter`, `USDT`, `SwapMining`, `CoinWindGatling`, `MdxToken` and `CoinWindToken` protocols.

There are many files being imported for use but they are not in the scope of the audit. The scope of the audit treats these files as black boxes and assumes their functional correctness.

Details of the associated file import are as follows:

- contract `WComptroller`: `ERC1155.sol`, `IERC20.sol`, `SafeERC20.sol`, `ReentrancyGuard.sol`, `ChannelsMath.sol`, `IERC20Wrapper.sol`, `IComptroller.sol`, `ICErc20.sol`
- contract `SpotSpellV1`: `IERC20.sol`, `SafeMath.sol`, `WhitelistSpell.sol`, `ChannelsMath.sol`, `IUniswapV2Factory.sol`, `IUniswapV2Router02.sol`, `IUniswapV2Pair.sol`, `IWComptroller.sol`
- contract `CGatlingErc20Delegator`: `CTokenInterfaces.sol`
- contract `CGatlingErc20Delegate`: `CCapableErc20Delegate.sol`, `EIP20Interface.sol`

Details of the associated use are as follows:

- contract `WComptroller`: `comptroller.canSupplierIndex()`, `comptroller.claimCan()`,
- contract `SpotSpellV1`: `doTransmitBNB()`, `doTransmit()`, `doBorrow()`, `bank.getCurrentPositionInfo()`, `bank.takeCollateral()`, `bank.putCollatera()`, `doRefundBNB()`, `doRefund()`, `bank.borrowBalanceCurrent()`, `doRepay()`

We understand that the business logic of strategy and price oracle requires interaction with UNISWAP, etc. We encourage the team to constantly monitor the statuses of 3rd parties to mitigate the side effects when unexpected activities are observed.

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 lost or stolen assets. In addition, upgrades of 3rd parties can possibly create severe impacts, such as increasing fees of 3rd parties, migrating to new LP pools, etc.

Findings

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

ID	Title	Category	Severity	Status
GLOBAL-01	Incorrect naming convention utilization	Coding Style	Informational	Resolved
GLOBAL-02	Proper usage of “public” and “external” type	Coding Style	Informational	Partially Resolved
CGD-01	Centralization risk	**Centralization / Privilege**	**Major**	Acknowledged
CGE-01	Centralization risk	**Centralization / Privilege**	**Major**	Acknowledged
CGE-02	Potential subtraction overflow	Logical Issue	Medium	Resolved
CGE-03	Logical issue of `depositAmount`	Logical Issue	Informational	Resolved
WCC-01	Centralization risk	**Centralization / Privilege**	**Major**	Acknowledged

GLOBAL-01 | Incorrect naming convention utilization

Category	Severity	Location	Status
Coding Style	Informational	Global	Resolved

Description

Solidity defines a naming convention that should be followed. In general, the following naming conventions should be utilized in a Solidity file:

Constants should be named with all capital letters with underscores separating words UPPER_CASE_WITH_UNDERSCORES

refer to https://solidity.readthedocs.io/en/v0.5.17/style-guide.html#naming-conventions

Examples:

Constants like :

- contract `CGatlingErc20Delegate`: `mdexRouter`, `SwapMining`, `CoinWindGatling`, `mdx`, `cow`, `reInvestPeriod`,

Recommendation

The recommendations outlined here are intended to improve the readability, and thus they are not rules, but rather guidelines to try and help convey the most information through the names of things.

Alleviation

The team heeded our advice and resolved this issue in commit `2ff45ad0a664a14600e78555dde55534e262892d`.

GLOBAL-02 | Proper usage of “public” and “external” type

Category	Severity	Location	Status
Coding Style	Informational	Global	Partially Resolved

Description

“public” functions that are never called by the contract should be declared “external”. When the inputs are arrays, “external” functions are more efficient than “public” functions.

Examples:

Functions like :

- contract `CGatlingErc20Delegator`: `emergencyWithdraw()`, `borrowBalanceStored()`, `exchangeRateCurrent()`, `exchangeRateStored()`, `accrueInterest()`, `_setComptroller()`, `_setInterestRateModel()`,
- contract `WComptroller`: `getUnderlyingToken()`, `balanceOfBatch()`, `setApprovalForAll()`, `safeTransferFrom()`, `safeBatchTransferFrom()`, `supportsInterface()`,

Recommendation

We recommend using the “external” attribute for functions never called from the contract.

Alleviation

The team heeded our advice and partially resolved this issue in commit `fdd5a639b7d5708dfdc31dbe259b7e59b77db9f2`.

CGD-01 | Centralization risk

Category	Severity	Location	Status
Centralization / Privilege	**Major**	channels/CGatlingErc20Delegator.sol (83c4de8): 60~73	Acknowledged

Description

In the contract `CGatlingErc20Delegator`, the role `admin` has the authority over the functions shown in the diagram below.

- `_setImplementation()`: change the address of implementation to any addresses,
- `_setComptroller()`: change the address of comptroller to any addresses,
- `_setPendingAdmin()/_acceptAdmin()`: change the address of admin to any addresses,
- `_setInterestRateModel()`: update the interest rate model`,
- `_setReserveFactor()`: set a new reserve factor for the protocol,

Any compromise to the privileged account which has access to `admin` may allow the hacker to take advantage of this.

Recommendation

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 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 team acknowledged this issue and they will use a time-lock contract to help control the risk on their own timeframe.

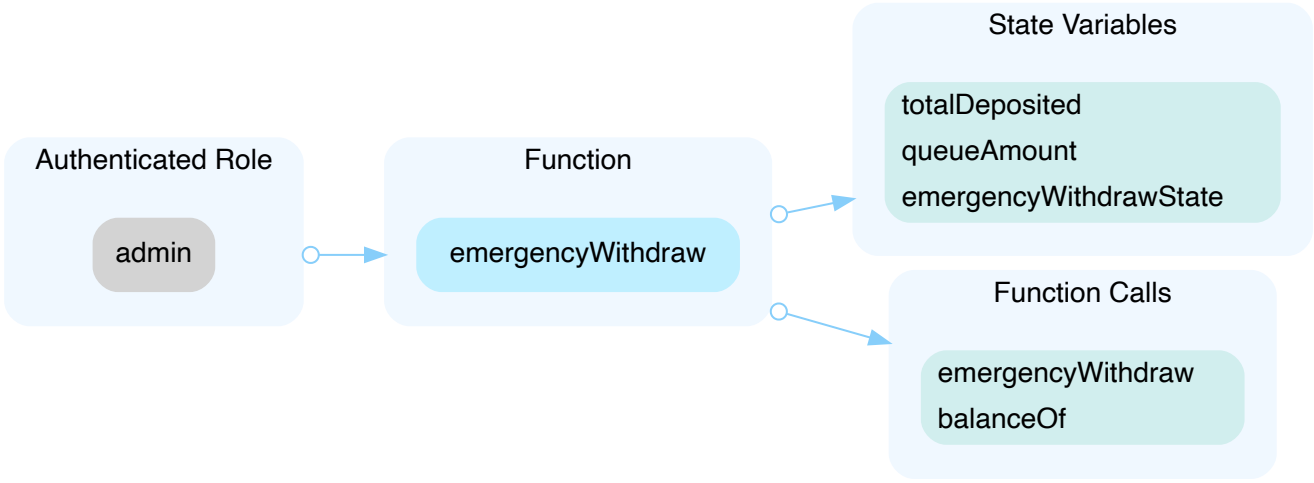
CGE-01 | Centralization risk

Category	Severity	Location	Status
Centralization / Privilege	Major	channels/CGatlingErc20Delegate.sol (83c4de8): 269~280	Acknowledged

Description

In the contract `CGatlingErc20Delegate`, the role `admin` has the authority over the functions shown in the diagram below.

Any compromise to the privileged account which has access to `admin` may allow the hacker to take advantage of this.



Recommendation

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 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 team acknowledged this issue and they will use a time-lock contract to help control the risk on their own timeframe.

CGE-02 | Potential subtraction overflow

Category	Severity	Location	Status
Logical Issue	Medium	channels/CGatlingErc20Delegate.sol (83c4de8): 226	Resolved

Description

According to the following codes, the comments "If limit = 0 , then there is no limit" explains `poolInfo.totalAmountLimit` is 0 when there is no limit.

```
226         uint depositAmount = add_(amount, queueAmount);
227         uint depositAllowed = sub_(poolInfo.totalAmountLimit, poolInfo.totalAmount);
228         if (depositAllowed >= 1){
229             depositAllowed = sub_(depositAllowed, 1);
230         }
231 
232         // If limit = 0 , then there is no limit
233         if(poolInfo.totalAmountLimit !=0 && depositAmount > depositAllowed){
234             depositAmount = depositAllowed;
235         }
```

As a result, the subtraction `sub_(poolInfo.totalAmountLimit, poolInfo.totalAmount)` may overflow and lead the call to fail.

Recommendation

We recommend adding logic to handle this condition.

Alleviation

The team heeded our advice and resolved this issue in commit `2ff45ad0a664a14600e78555dde55534e262892d`.

CGE-03 | Logical issue of `depositAmount`

Category	Severity	Location	Status
Logical Issue	Informational	channels/CGatlingErc20Delegate.sol (83c4de8): 226~243	Resolved

Description

According to the following codes, the `depositAmount` will be calculated by the `depositAllowed` when `poolInfo.totalAmountLimit` is not 0.

```
226         uint depositAmount = add_(amount, queueAmount);
227         uint depositAllowed = sub_(poolInfo.totalAmountLimit, poolInfo.totalAmount);
228         if (depositAllowed >= 1){
229             depositAllowed = sub_(depositAllowed, 1);
230         }
231
232         // If limit = 0 , then there is no limit
233         if(poolInfo.totalAmountLimit !=0 && depositAmount > depositAllowed){
234             depositAmount = depositAllowed;
235         }
236
237         if (depositAmount > 0){
238             uint beforeDeposit =
ICoinWind(CoinWindGatling).getDepositAsset(underlying, address(this));
239             ICoinWind(CoinWindGatling).deposit(underlying, depositAmount);
240             uint afterDeposit =
ICoinWind(CoinWindGatling).getDepositAsset(underlying, address(this));
241
242             require(sub_(afterDeposit, beforeDeposit) == depositAmount, "unexpected
error occurred during deposit to CoinWind");
243         }
```

The `depositAllowed` will minus 1 when `sub_(poolInfo.totalAmountLimit, poolInfo.totalAmount)` is over 0. As `ICoinWind(CoinWindGatling)` is not in the scope of this audit. Whether this calculation is correct is unknown.

We would like to confirm with the client if the current implementation aligns with the original project design.

Recommendation

We recommend stating for this.

Alleviation

The team heeded our advice and resolved this issue in commit `2ff45ad0a664a14600e78555dde55534e262892d`.

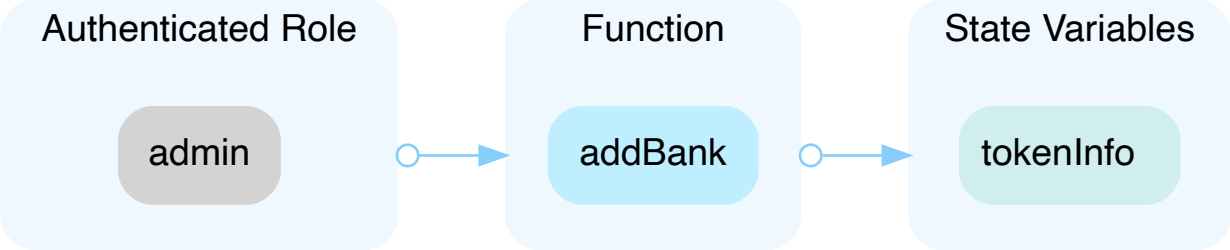
WCC-01 | Centralization risk

Category	Severity	Location	Status
Centralization / Privilege	Major	channels/WComptroller.sol (83c4de8): 68~74	Acknowledged

Description

In the contract `WComptroller`, the role `admin` has the authority over the functions shown in the diagram below.

Any compromise to the privileged account which has access to `admin` may allow the hacker to take advantage of this.



Recommendation

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 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 team acknowledged this issue and they will use a time-lock contract to help control the risk on their own timeframe.

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.

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.

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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