Security Assessment

Decentraland

Oct 28th, 2021

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Summary

This report has been prepared for Decentraland to discover issues and vulnerabilities in the source code of the Decentraland 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	Decentraland
Platform	Ethereum
Language	Solidity
Codebase	https://github.com/decentraland/wearables-contracts/tree/feat/registries/contracts
Commit	3a7f42f15f84d145d54beeb33ef560ffeaae5628

Audit Summary

Delivery Date	Oct 28, 2021
Audit Methodology	Static Analysis, Manual Review
Key Components	

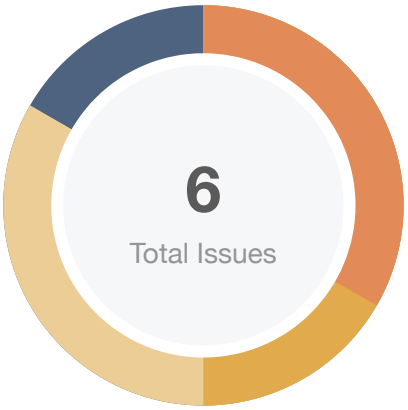
Vulnerability Summary

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

Audit Scope

ID	File	SHA256 Checksum
TIE	managers/Tiers.sol	51a28da7f517c413610e31041b66dfcc4b739e6d49187d8dfe6ca62bddf001fc
TPR	registries/ThirdPartyRegistry.sol	b304b05c4e5b68c8bfab2642e7c512436041c97a647639452aa013775a622327

Findings



Critical	**0** (0.00%)
Major	**2** (33.33%)
Medium	**1** (16.67%)
Minor	**2** (33.33%)
Informational	**1** (16.67%)
Discussion	**0** (0.00%)

ID	Title	Category	Severity	Status
TIE-01	Centralization Risk	**Centralization / Privilege**	**Major**	Acknowledged
TPR-01	Manager can remove/add other managers	Logical Issue	Medium	Acknowledged
TPR-02	Third Party Dependencies	Volatile Code	Minor	Acknowledged
TPR-03	Centralization Risk	**Centralization / Privilege**	**Major**	Acknowledged
TPR-04	Check-effects pattern not used	Logical Issue	Minor	Resolved
TPR-05	Users can buy itemSlots for any third parties	Control Flow	Informational	Acknowledged

TIE-01 | Centralization Risk

Category	Severity	Location	Status
Centralization / Privilege	**Major**	managers/Tiers.sol	Acknowledged

Description

In the contract `Tiers`, the role `owner` has the authority over the following function:

- `updatePrices()`, to update the prices of tiers.
- `addTiers()`, to add tiers.

Any compromise to the `owner` account may allow the hacker to take advantage of this,

Recommendation

We advise the client to carefully manage the `owner` 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 the issue and stated the following.

The owner will be a gnosis multisig or a DAO.

TPR-01 | Manager can remove/add other managers

Category	Severity	Location	Status
Logical Issue	Medium	registries/ThirdPartyRegistry.sol: 254	Acknowledged

Description

The function `updateThirdParties` allows the managers of the `thirdParty` to add others as managers or remove other managers. If untrusted users become the manager of the `thirdParty`, the `thirdParty` team may lose the control of it.

Recommendation

We recommend the team add a third-party owner role to manage managers roles.

Alleviation

The team acknowledged this issue and they will leave it as it is for now.

TPR-02 | Third Party Dependencies

Category	Severity	Location	Status
Volatile Code	Minor	registries/ThirdPartyRegistry.sol	Acknowledged

Description

The contract is serving as the underlying entity to interact with third party `committee`, `acceptedToken`, `itemTier` protocols. The scope of the audit treats 3rd party entities as black boxes and assume 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.

Recommendation

We understand that the business logic of `ThirdPartyRegistry` requires interaction with `committee`, `acceptedToken`, `itemTier`, etc. We encourage the team to constantly monitor the statuses of 3rd parties to mitigate the side effects when unexpected activities are observed.

Alleviation

The team acknowledged this issue and they will leave it as it is for now.

TPR-03 | Centralization Risk

Category	Severity	Location	Status
Centralization / Privilege	**Major**	registries/ThirdPartyRegistry.sol	Acknowledged

Description

In the contract `ThirdPartyRegistry`, the role `owner` has the authority over the following functions:

- `setThirdPartyAgregator()`, to set `thirdPartyAgregator`.
- `setFeesCollector()`, to set `feesCollector`.
- `setCommittee()`, to set `committee`.
- `setAcceptedToken()`, to set `acceptedToken`.
- `setItemTiers()`, to set `itemTiers`.
- `setInitialThirdPartyValue()`, to set `initialThirdPartyValue`.
- `setInitialItemValue()`, to set `initialItemValue`.

The role `thirPartyAgregator` has the authority over the following functions:

- `addThirdParties()`, to register a new third-party in the contract.
- `updateThirdParties()`, to update the info of third parties.

The role `committee` has the authority over the following function:

- `reviewThirdParties()`, to review third parties.

Any compromise to the `owner`, `committee`, `thirPartyAgregator` account may allow the hacker to take advantage of this.

Recommendation

We advise the client to carefully manage the `owner`, `committee`, `thirPartyAgregator` accounts' private keys 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 the issue and stated the following.

The committee is a smart contract as well, `thirdPartyAgregator` and owner are a multisig or DAO.

TPR-04 | Check-effects pattern not used

Category	Severity	Location	Status
Logical Issue	Minor	registries/ThirdPartyRegistry.sol: 321~328	Resolved

Description

State variables are changed after the transfer or external call, which might leads to a re-entrancy issue.

Recommendation

It is recommended to follow checks-effects-interactions pattern for cases like this. It shields public functions from re-entrancy attacks. It's always a good practice to follow this pattern. `checks-effects-interactions` pattern also applies to ERC20 tokens as they can inform the recipient of a transfer in certain implementations.

Refer https://docs.soliditylang.org/en/develop/security-considerations.html?highlight=check-effects%23use-the-checks-effects-interactions-pattern

Alleviation

The team heeded our advice and fixed the issue in commit 4e6f5198af72445d0fdddbe3dcf9ff7670bb511f.

TPR-05 | Users can buy itemSlots for any third parties

Category	Severity	Location	Status
Control Flow	Informational	registries/ThirdPartyRegistry.sol: 310	Acknowledged

Description

The function `buyItemSlots()` does not require the caller is the manager of the third party. We would like to confirm with the client if the current implementation aligns with the original project design.

Recommendation

We recommend the team only allow managers of the third parties to buy item slots.

Alleviation

The team stated the following:

"This implementation aligns with the project design. Hence no fixes needed here."

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.

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.

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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