Token contracts for VNX

Tezos Foundation

Independent security assessment report

inference

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Version / Date	Description
1.0 / 25.03.2024	Final version.

Summary

Inference AG was engaged by the Tezos Foundation to perform an independent security assessment of VNX's token smart contracts.

Inference AG performed the security assessment based on the agreed scope, following our approach and activities as outlined in the "Project overview" chapter between the 9th of November 2023 and the 22th of March 2024. Feedback from VNX was received and Inference performed a follow-up assessment.

Based on our scope and our performed activities, our security assessment highlighted some findings which, if resolved with appropriate actions, may improve the quality of VNX.

This report only shows remaining open or partly resolved issues and observations.

Overview on issues and observations

At Inference AG we separate the findings that we identify in our security assessments in two categories:

- Security issues represent risks to either users of the platform, owners of the contract, the environment of the blockchain, or one or more of these. For example, the possibility to steal funds from the contract, or to lock them in the contract, or to set the contract in a state that renders it unusable are all potential security issues;
- Observations represent opportunities to create a better performing contract, saving gas fees, integrating more efficiently into the existing environment, and creating a better user experience overall. For example, code optimizations that save execution time (and thus gas fees),better compliance to existing standards, and following secure coding best practices are all examples of observations.

Details for each reported issue or observation can be obtained from the "Security issues" and "Observations" sections.

	Severity / Status
Security issues	
There are no open, known security issues.	
Observations	
There are no open, known observations.	

Project overview

Scope

Smart contracts within the scope of this security assessment include the following files and any files necessary for compiling these contracts:

- Permit: contracts/permits.arl & michelson_code/permits.tz
- Role Based Access Control: contracts/rbac.arl & michelson_code/rbac.tz
- FA2:
  - contracts/dgr.arl & michelson_code/dgr.tz
  - contracts/frt.arl & michelson_code/frt.tz
- Proxy:
  - contracts/dgr_proxy.arl & michelson_code/dgr_proxy.tz
  - contracts/frt_proxy.arl & michelson_code/frt_proxy.tz

All files in scope were made available via a source code repo: https://gitlab.com/vnx/tezos-smartcontracts and our initial security assessment considered commit “e129e15a00d81dd7c4812d7c5c23146496d78e2a”.

Our reassessment considered commit “5901cb010960307dd74af63f70125bb2e9e7317f”.

We also reviewed the Michelson code for the following deployed smart contracts on the Tezos mainnet:

- Permit: KT1XE9fqpWKfFnLvLAbiFjku13TV6nztqADq
- Role Based Access Control: KT1KL1zq1BG4UHSagHDqXDhRuNtYnCY6u3qd
- FA2:
  - KT1AT3k4NuZgjYpnCuETDyCykACNiSrHY8dp
  - KT1SU44cZ3Jobc4tVA87TZa5JZVVY8CrdmXd
- Proxy
  - KT1FenS7BCUjn1otfFyfrfxguiGnL4UTF3aG
  - KT1LssxZqfQtRFv1CRkzX9E9gzap9iFrtWmq
  - KT1LSH97386CURN9FgRNqdQJoHaHY6e1vxUv

Scope limitations

Our security assessment is based on the following key assumptions and scope limitations:

- Any potential adversarial activities conducted by the administrator of the contract or operational errors by administrators were out of scope.
- The key management of associated secret keys has not been assessed.

Methodology

Inference's methodology for smart contract security assessments on Tezos is a combination of a source code review of the smart contract source code in the high-level language (e.g. Ligo or SmartPy), and the resulting compiled code in Michelson. This approach provides additional assurance that the compiler producing the Michelson code is correct, and does not introduce any security issues. Furthermore, this approach fosters a better understanding for smart contract users of what has been reviewed and what has been effectively deployed on-chain.

In order to ensure a high quality in our security assessments, Inference is using subject matter experts having a high adversarial scenario mindset to spot potential issues in smart contracts under review. Additionally, we apply checklists derived from good practices and commonly known issues based on the Tezos smart contract assessment checklist to document our work and to ensure good issue coverage.

Furthermore, Inference maintains regular communications with the smart contract development team to ensure a correct understanding of the smart contract solution and environment, but also to make teams aware of any observations as soon as possible.

Inference's internal quality assurance procedures ensure that results of security assessments are challenged for completeness and appropriateness by a second independent expert.

Objectives

The objectives are the identification of security issues with regards to the assessed smart contracts and their conceptual design and specification. The security assessment also focuses on adversarial scenarios on specific use cases which have been listed in appendix "Adversarial scenarios". These were identified together with the VNX team and checked during our security assessment.

Activities

Our security assessment activities for the defined scope were:

- Source code review of smart contract code written in Archetype
- Source code review of the smart contract in Michelson

We applied the checklist for smart contract security assessments on Tezos, version 2.0 obtained from https://github.com/InferenceAG/TezosSecurityAssessmentChecklist. We applied the following security checklist tables:

- System / Platform
- Storage
- Gas issues and efficiency
- Code issues
- Transactions
- Entrypoint
- On-chain views
- Admin / Operator functions
- Other topics & test cases

Our activities for the follow-up assessment were:

- Source code review of changes in the smart contract code in Archetype
- Source code review of changes in the smart contracts in Michelson
- Reassessing security issues and observations from initial assessment in case they are claimed to be resolved

Security issues

There are no open known security issues.

Observations

There are no open known observations.

Disclaimer

This security assessment report (“Report”) by Inference AG (“Inference”) is solely intended for Tezos Foundation (“Client”) with respect to the Report’s purpose as agreed by the Client. The Report may not be relied upon by any other party than the Client and may only be distributed to a third party or published with the Client’s consent. If the Report is published or distributed by the Client or Inference (with the Client’s approval) then it is for information purposes only and Inference does not accept or assume any responsibility or liability for any other purpose or to any other party.

Security assessments of a software or technology cannot uncover all existing vulnerabilities. Even an assessment in which no weaknesses are found is not a guarantee of a secure system. Generally, code assessments enable the discovery of vulnerabilities that were overlooked during development and show areas where additional security measures are necessary. Within the Client’s defined time frame and engagement, Inference has performed an assessment in order to discover as many vulnerabilities of the technology or software analysed as possible. The focus of the Report’s security assessment was limited to the general items and code parts defined by the Client. The assessment shall reduce risks for the Client but in no way claims any guarantee of security or functionality of the technology or software that Inference agreed to assess. As a result, the Report does not provide any warranty or guarantee regarding the defect-free or vulnerability-free nature of the technology or software analysed.

In addition, the Report only addresses the issues of the system and software at the time the Report was produced. The Client should be aware that blockchain technology and cryptographic assets present a high level of ongoing risk. Given the fact that inherent limitations, errors or failures in any software development process and software product exist, it is possible that even major failures or malfunctions remain undetected by the Report. Inference did not assess the underlying third party infrastructure which adds further risks. Inference relied on the correct performance and execution of the included third party technology itself.

Appendix

Adversarial scenarios

The following adversarial scenarios have been identified and checked during our security assessment.

Scenario	Assessment result
As a normal user, add myself as an admin.	**Ok** Nothing identified that could circumvent the checks in the smart contract.
Bypass frozen address restriction by adding an operator.	**Ok** Nothing identified that could circumvent the checks in the smart contract.
Bypass frozen address restriction by a gasless transfer.	**Ok** Nothing identified that could circumvent the checks in the smart contract.
Bypass frozen address restriction by performing a badged transaction.	**Ok** Nothing identified that could circumvent the checks in the smart contract.
Mint or burn tokens with invalid IDs.	**Ok** Nothing identified that could circumvent the checks in the smart contract.
Bypass caller source restrictions to interact with sensitive entrypoints.	**Ok** Nothing identified that could circumvent the checks in the smart contract.
Change operator allowances for other users of the platform.	**Ok** Nothing identified that could circumvent the checks in the smart contract.

Risk rating definition for smart contracts

Severities are quantified with two dimensions, roughly defined as follows, whereas the examples have to be regarded as indication only:

Probability of occurrence / materialisation of an issue
(bullets for a category are linked with each other with “and/or” condition.)

- Low:
  - A trusted / privileged role is required.
  - Contract may end up in the issue if other conditions, which are also unlikely to happen, are required.
- Medium:
  - A specific role or contract state is required to trigger the issue.
  - Contract may end up in the issue if another condition is fulfilled as well.
- High:
  - Anybody can trigger the issue.
  - Contract’s state will over the short or long term end up in the issue.

Impact:
(bullets for a category are linked with each other with “and/or” condition.)

- Low:
  - Non-compliance with TZIP standards
  - Unclear error messages
  - Confusing structures
- Medium:
  - A minor amount of assets can be withdrawn or destroyed.
- High:
  - Not inline with the specification
  - A non-minor amount of assets can be withdrawn or destroyed.
  - Entire or part of the contract becomes unusable.

Severity:

	Low impact	Medium impact	High impact
High probability	**High**	**Critical**	**Critical**
Medium probability	**Medium**	**High**	**Critical**
Low probability	**Low**	**Medium**	**High**

Glossary

Term	Description
Ligo	High level smart contract language. Website: https://ligolang.org/
Origination	Deployment of a smart contract
SmartPy	High level smart contract language. Website: https://smartpy.io/
TZIP	Tezos Improvement Proposal
FA2	Token standard on Tezos