QuillAudits

Audit Report
February, 2022

For

XEGGO BETA STREAM

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Overview

Xeggo Stream

A one-stop solution for handling streamed subscriptions for any services like salaries, rewards, or anything.

Scope of the Audit

The scope of this audit was to analyze the Xeggo Stream smart contract's codebase for quality, security, and correctness.

Date: **February 2, 2022 - February 5, 2022**

Commit: 6b9f2bab457ed593db83ad4fb803aafce18b644c

Checked Vulnerabilities

We have scanned the smart contract for commonly known and more specific vulnerabilities. Here are some of the commonly known vulnerabilities that we considered:

- Re-entrancy
- Timestamp Dependence
- Gas Limit and Loops
- Exception Disorder
- Gasless Send
- Use of tx.origin
- Malicious libraries
- Compiler version not fixed
- Address hardcoded
- Divide before multiply
- Integer overflow/underflow
- ERC20 transfer() does not return boolean
- ERC20 approve() race
- Dangerous strict equalities
- Tautology or contradiction
- Return values of low-level calls
- Missing Zero Address Validation
- Private modifier
- Revert/require functions
- Using block.timestamp
- Multiple Sends
- Using SHA3
- Using suicide
- Using throw
- Using inline assembly

Techniques and Methods

Throughout the audit of smart contract, care was taken to ensure:

- The overall quality of code.
- Use of best practices.
- Code documentation and comments match logic and expected behaviour.
- Token distribution and calculations are as per the intended behaviour mentioned in the whitepaper.
- Implementation of ERC-20 token standards.
- Efficient use of gas.
- Code is safe from re-entrancy and other vulnerabilities.

The following techniques, methods and tools were used to review all the smart contracts.

Structural Analysis
In this step, we have analysed the design patterns and structure of smart contracts. A thorough check was done to ensure the smart contract is structured in a way that will not result in future problems.

Static Analysis
Static analysis of smart contracts was done to identify contract vulnerabilities. In this step, a series of automated tools are used to test the security of smart contracts.

Code Review / Manual Analysis
Manual analysis or review of code was done to identify new vulnerabilities or verify the vulnerabilities found during the static analysis. Contracts were completely manually analysed, their logic was checked and compared with the one described in the whitepaper. Besides, the results of the automated analysis were manually verified.

Gas Consumption
In this step, we have checked the behaviour of smart contracts in production. Checks were done to know how much gas gets consumed and the possibilities of optimization of code to reduce gas consumption.

Tools and Platforms used for Audit
Slither, MythX, Truffle, Remix, Ganache, Solidity Metrics

Issue Categories

Every issue in this report has been assigned to a severity level. There are four levels of severity, and each of them has been explained below.

Risk-level	Description
High	A high severity issue or vulnerability means that your smart contract can be exploited. Issues on this level are critical to the smart contract's performance or functionality, and we recommend these issues be fixed before moving to a live environment.
Medium	The issues marked as medium severity usually arise because of errors and deficiencies in the smart contract code. Issues on this level could potentially bring problems, and they should still be fixed.
Low	Low-level severity issues can cause minor impact and or are just warnings that can remain unfixed for now. It would be better to fix these issues at some point in the future.
Informational	These are severity issues that indicate an improvement request, a general question, a cosmetic or documentation error, or a request for information. There is low-to-no impact.

Number of issues per severity

Type	High	Medium	Low	Informational
Open	0	0	0	0
Acknowledged	0	0	0	1
Closed	0	0	0	0

Issues Found – Code Review / Manual Testing

High severity issues

No issues were found.

Medium severity issues

No issues were found.

Low severity issues

No issues were found.

Informational issues

1. **Inefficient use of balanceOf function that leads to high gas usage.**

   [#L247][#L281][#L282] calling balanceOf function which internally reads stream struct again while the parent function already reading stream struct before calling the balanceOf function that leads to multiple sloads which is unnecessary.

Recommendation

We recommend optimizing the function call. Instead of calling the public version of the balanceOf function creates an internal function of balanceOf function which takes Stream struct as the input param instead of reading it again.

```
function balanceOf(uint256 streamId, address who) public view streamExists(streamId)
returns (uint256 balance) {
        Types.Stream memory stream = streams[streamId];
return _balanceOf(streamId, who, stream);
```

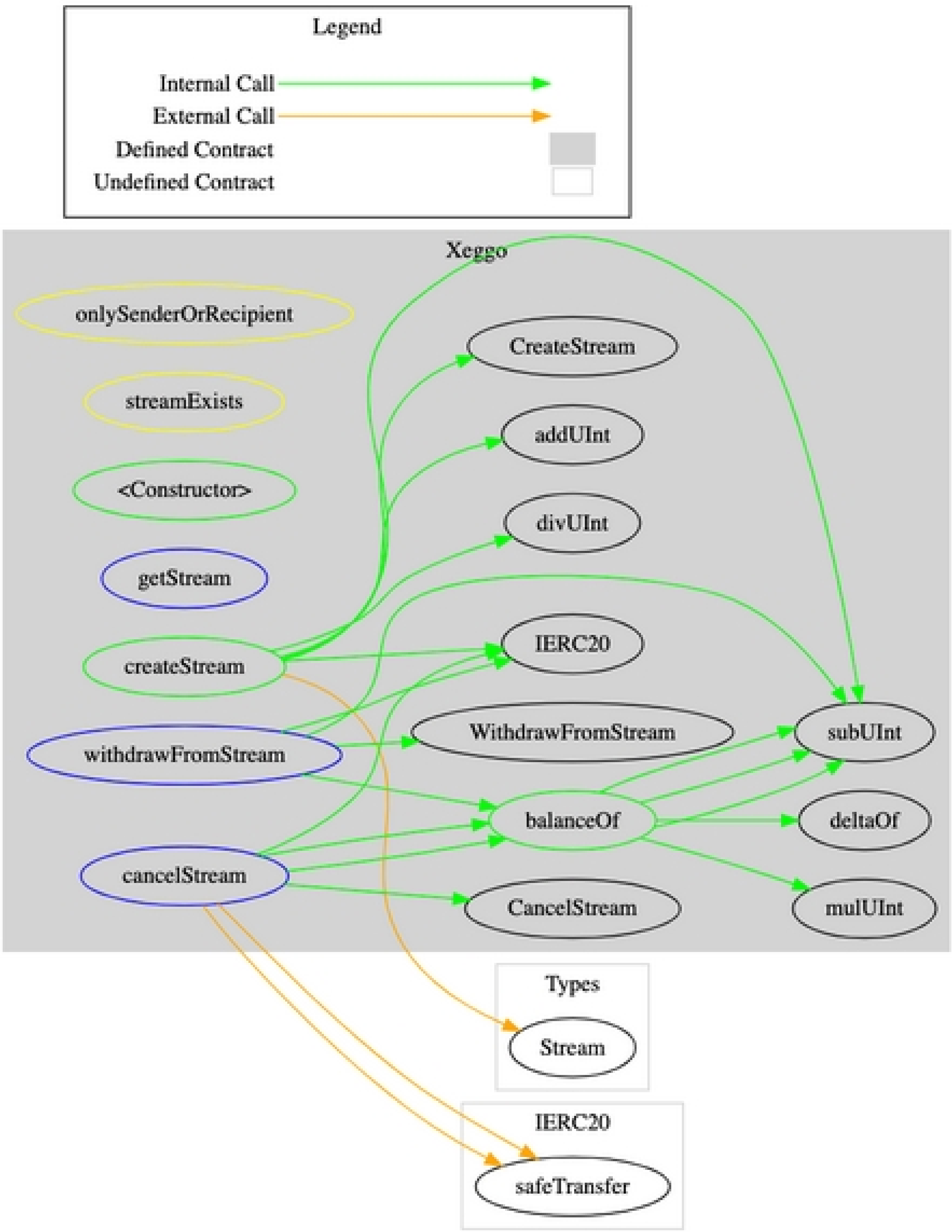
While _balanceOf() definition will be something like this.

```
function _balanceOf(uint256 streamId, address who, Types.Stream memory stream)
internal view streamExists(streamId) returns (uint256 balance) {
        BalanceOfLocalVars memory vars;

        uint256 delta = deltaOf(streamId);
        (vars.mathErr, vars.recipientBalance) = mulUInt(delta, stream.ratePerSecond);
        require(vars.mathErr == MathError.NO_ERROR, "recipient balance calculation error");

        /*
         * If the stream `balance` does not equal `deposit`, it means there have been
withdrawals.
         * We have to subtract the total amount withdrawn from the amount of money that
has been
         * streamed until now.
         */
        if (stream.deposit > stream.remainingBalance) {
            (vars.mathErr, vars.withdrawalAmount) = subUInt(stream.deposit,
stream.remainingBalance);
            assert(vars.mathErr == MathError.NO_ERROR);
            (vars.mathErr, vars.recipientBalance) = subUInt(vars.recipientBalance,
vars.withdrawalAmount);
            /* `withdrawalAmount` cannot and should not be bigger than `recipientBalance`.
*/
            assert(vars.mathErr == MathError.NO_ERROR);
        }

        if (who == stream.recipient) return vars.recipientBalance;
        if (who == stream.sender) {
            (vars.mathErr, vars.senderBalance) = subUInt(stream.remainingBalance,
vars.recipientBalance);
            /* `recipientBalance` cannot and should not be bigger than `remainingBalance`. */
            assert(vars.mathErr == MathError.NO_ERROR);
            return vars.senderBalance;
        }
        return 0;
    }
```

And use _balanceOf() at [#L247][#L281][#L282] instead of balanceOf.

Status: Acknowledged

Call Graphs


Legend
Internal Call
External Call
Defined Contract
Undefined Contract
Xeggo
onlySenderOrRecipient
streamExists
<Constructor>
getStream
createStream
withdrawFromStream
cancelStream
CreateStream
addUInt
divUInt
IERC20
WithdrawFromStream
balanceOf
CancelStream
subUInt
deltaOf
mulUInt
Types
Stream
IERC20
safeTransfer

Functional Testing Results

Complete functional testing report has been attached below:
Xeggo test case

- [x] should be able to create a stream.
- [x] should be able to withdraw from the stream by the sender.
- [x] should be able to withdraw from the stream by the recipient.
- [x] should be able to cancel the stream by the sender.
- [x] should be able to cancel the stream by the recipient.
- [x] should be able to correctly get the balance using balanceOf.
- [x] should be able to retrieve the stream details using the getStream
- [x] should be able to retrieve the delta using the deltaOf.

Automated Testing

Slither Analysis Results

SLITHER

ANALYSIS

- High (0)
- Medium (16)
  - CarefulMath.divUInt(uint256,uint256) uses a dangerous strict equality:
  - CarefulMath.mulUInt(uint256,uint256) uses a dangerous strict equality:
  - Xeggo.balanceOf(uint256,address) uses a dangerous strict equality:
  - Xeggo.balanceOf(uint256,address) uses a dangerous strict equality:
  - Xeggo.balanceOf(uint256,address) uses a dangerous strict equality:
  - Xeggo.balanceOf(uint256,address) uses a dangerous strict equality:
  - Xeggo.balanceOf(uint256,address) uses a dangerous strict equality:
  - Xeggo.balanceOf(uint256,address) uses a dangerous strict equality:
  - Xeggo.balanceOf(uint256,address).vars is a local variable never initialized
  - Xeggo.createStream(address,uint256,address,uint256,uint256) uses a dangerous strict equality:
  - Xeggo.createStream(address,uint256,address,uint256,uint256) uses a dangerous strict equality:
  - Xeggo.createStream(address,uint256,address,uint256,uint256) uses a dangerous strict equality:
  - Xeggo.createStream(address,uint256,address,uint256,uint256) uses a dangerous strict equality:
  - Xeggo.createStream(address,uint256,address,uint256,uint256).vars is a local variable never initialized
  - Xeggo.onlySenderOrRecipient(uint256) uses a dangerous strict equality:
  - Xeggo.withdrawFromStream(uint256,uint256) uses a dangerous strict equality:
- Low (9)
  - Modifier Migrations.restricted() does not always execute _; or revert
  - Reentrancy in Xeggo.cancelStream(uint256):
  - Reentrancy in Xeggo.createStream(address,uint256,address,uint256,uint256):
  - Reentrancy in Xeggo.withdrawFromStream(uint256,uint256):
  - Xeggo.balanceOf(uint256,address) uses timestamp for comparisons
  - Xeggo.cancelStream(uint256) uses timestamp for comparisons
  - Xeggo.createStream(address,uint256,address,uint256,uint256) uses timestamp for comparisons
  - Xeggo.deltaOf(uint256) uses timestamp for comparisons
  - Xeggo.withdrawFromStream(uint256,uint256) uses timestamp for comparisons
- Informational (13)
  - Address.isContract(address) uses assembly
  - CarefulMath.addThenSubUInt(uint256,uint256,uint256) is never used and should be removed
  - Different versions of Solidity is used:
  - Low level call in Address.sendValue(address,uint256):
  - Low level call in SafeERC20.callOptionalReturn(IERC20,bytes):
  - Parameter Migrations.setCompleted(uint256)._completed is not in mixedCase
  - Parameter Migrations.upgrade(address)._newAddress is not in mixedCase
  - Pragma version^0.5.0 allows old versions
  - Pragma version^0.5.0 allows old versions
  - Pragma version^0.5.0 allows old versions
  - Pragma version^0.5.0 allows old versions
  - Pragma version^0.5.5 is known to contain severe issues (https://solidity.readthedocs.io/en/latest/bugs.html)
  - Xeggo.constructor() uses literals with too many digits:

MythX Analysis Results

Issues

These were the issues detected in the scan. You can use the toggles to filter by severity and display or hide ignored issues.

Severity **Low (1)** **Medium (0)** **High (0)**

Ignored Issues Hidden (0)

ID	Severity	Name	File	Location
SWC-116	Low	A control flow decision is made based on The block.timestamp environment variable.	Address.sol	L: 71 C: 4276

No issues as issue above is in a dependency and not relevant.

Closing Summary

One issue of Informational severity was found,which has been Acknowledged by the Auditee.

Disclaimer

Quillhash audit is not a security warranty, investment advice, or an endorsement of the Xeggo. This audit does not provide a security or correctness guarantee of the audited smart contracts. The statements made in this document should not be interpreted as investment or legal advice, nor should its authors be held accountable for decisions made based on them. Securing smart contracts is a multistep process. One audit cannot be considered enough. We recommend that the Xeggo team put in place a bug bounty program to encourage further analysis of the smart contract by other third parties.

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