SMART CONTRACT AUDIT FOR ERC-20 GOVERNANCE TOKEN. (GST)

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Abstract

The GST token is an ERC-20 token that implements several advanced features, including pausing, minting, voting, and role-based access control. This document provides an audit of the smart contract's code, the token's functionality and how to use it.

Keywords: Governance, ERC-20, Access Control

Pre-requisites

Before you can interact with the GST token, you must have a basic understanding of the following concepts:

1. ERC-20 tokens: A standard interface for fungible tokens on the Ethereum blockchain.
2. Pausable tokens: Tokens that can be paused by an authorized account, preventing transfers and other transactions.
3. Minting: The process of creating new tokens.
4. Voting: The process of casting votes on proposals.
5. Role-based access control: A mechanism for controlling access to different functions based on assigned roles.

Here, the libraries from OpenZeppelin have been made use of.

GST token smart contract audit

This will be the document to refer to for the detailed suit of the smart contract

Token Features

The GST token implements the following features:

- ➔ Pausing: The token can be paused by an account with the `PAUSER_ROLE`. When paused, transfers and other transactions are prevented.
- ➔ Minting: New tokens can be minted by an account with the `MINTER_ROLE`.
- ➔ Voting: Token holders can vote on proposals by calling the `vote` function.
- ➔ Role-based access control: The token uses role-based access control to control access to different functions.

The following roles are defined:

- `DEFAULT_ADMIN_ROLE`: Has full control over the token.
- `PAUSER_ROLE`: Can pause and unpause the token.
- `MINTER_ROLE`: Can mint new tokens.

Sepolia Etherscan link: GirlScriptToken (GST) | base-sepolia

Contract Address: 0xBEcABB09b7F19E24896f0dfcdC22B7122e0eB0e4

From: 0x0000000000000000000000000000000000000000

To: 0xad71560099fbC33D35c726e75f69aA66d6dbBE69

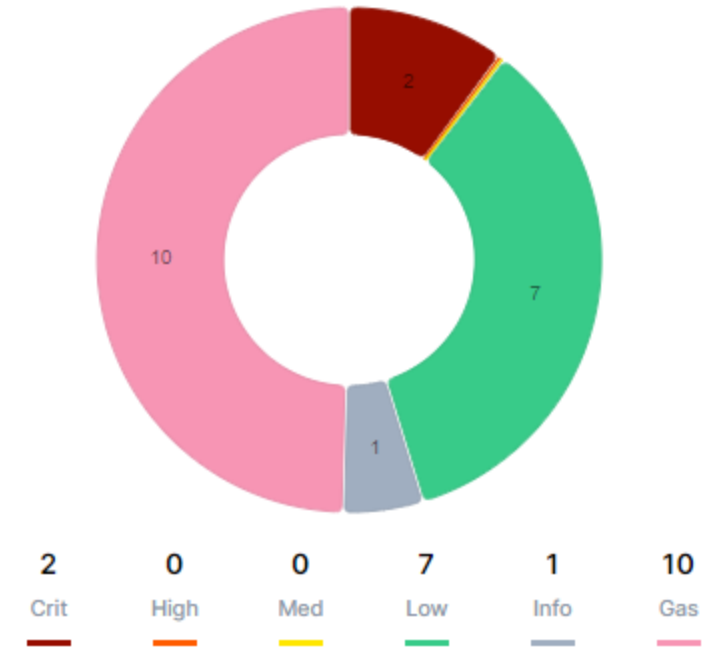
Quantity: 0.6942

Transaction hash of the contract deployment:

0xf2df080cde9d052e8ba43606965fa0db6da592164be96f1209f23342634e9a5c

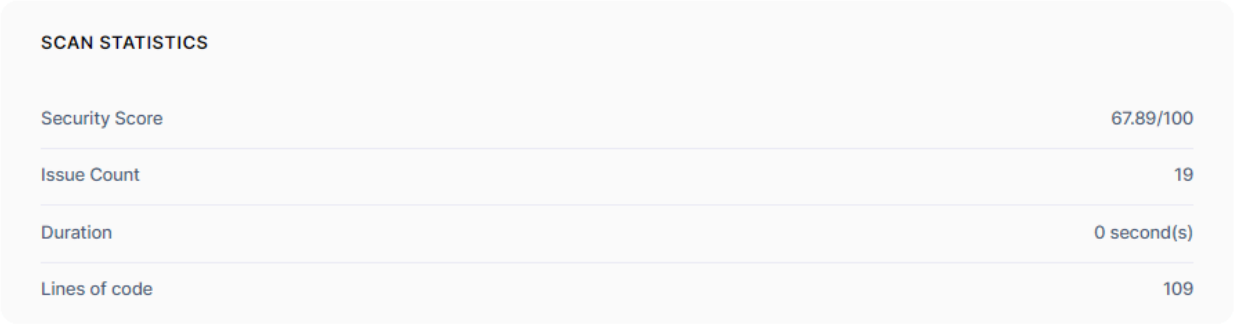
Tool used for Audit: https://solidityscan.com/

Fig 1: Pie Chart distribution of the vulnerabilities by types/level.



According to this figure we infer that the contract does not have good gas optimization practices.

Fig 2: Scan Statistics



We see that:

1. There are **109** lines of code in the smart contract.
2. Security rating is **~68%**.
3. The total count of issues/bugs are **19**.
4. The contract executes in 0 seconds/ the security scan was done in no time.

The gas vulnerabilities:

1. SSP_3986_2, SSP_3986_3, SSP_3986_4

   Description: FUNCTION SHOULD BE EXTERNAL

   A function with public visibility modifier was detected that is not called internally.

   public and external differs in terms of gas usage. The former use more than the latter

   when used with large arrays of data. This is due to the fact that Solidity copies arguments

   to memory on a public function while external read from calldata which a cheaper than

   memory allocation. Here are the vulnerable code snippets:

```
1.
function unpause() public onlyRole(PAUSER_ROLE) {
        _unpause(); }
```

```
2.
function mint(address to, uint256 amount) public
onlyRole(MINTER_ROLE) {
        _mint(to, amount);
    }
3.
function pause() public onlyRole(PAUSER_ROLE) {
        _pause();
    }
```

2. SSP_3986_7

   Description: DEFINE CONSTRUCTOR AS PAYABLE

   Developers can save around 10 opcodes and some gas if the constructors are defined as payable.

   However, it should be noted that it comes with risks because payable constructors can accept ETH during deployment. Here is the vulnerable code snippet:

```
    constructor(address defaultAdmin, address pauser, address
minter)
        ERC20("GirlScriptToken", "GST")
        ERC20Permit("GirlScriptToken")
    {
        _mint(msg.sender, 694200000000000000); // Set an initial
total supply and assign all initial tokens to the owner
        _grantRole(DEFAULT_ADMIN_ROLE, defaultAdmin);
        _grantRole(PAUSER_ROLE, pauser);
        _grantRole(MINTER_ROLE, minter);
    }
```

3. SSP_3986_9

   Description: LONG REQUIRE/REVERT STRINGS

   The require() and revert() functions take an input string to show errors if the validation fails.This strings inside these functions that are longer than 32 bytes require at least one additional MSTORE, along with additional overhead for computing memory offset, and other parameters. Here is the vulnerable code snippet:

```
        require(balanceOf(msg.sender) > 0, "Not enough tokens to
create a proposal");
```

4. SSP_3986_16

   Description: PUBLIC CONSTANTS CAN BE PRIVATE

   Public constant variables cost more gas because the EVM automatically creates getter functions for them and adds entries to the method ID table. The values can be read from the source code instead.

   The following variable is affected: PAUSER_ROLE. Vulnerable code snippet:

```
    bytes32 public constant PAUSER_ROLE = keccak256("PAUSER_ROLE");
```

5. SSP_3986_17

   Description: PUBLIC CONSTANTS CAN BE PRIVATE

   Public constant variables cost more gas because the EVM automatically creates getter functions for them and adds entries to the method ID table. The values can be read from the source code instead.The following variable is affected: MINTER_ROLE. :::

```
    bytes32 public constant MINTER_ROLE = keccak256("MINTER_ROLE");
```

6. SSP_3986_18

   Description: CHEAPER CONDITIONAL OPERATORS

   During compilation, x != 0 is cheaper than x > 0 for unsigned integers in solidity inside conditional statements. Vulnerable code :::

```
        require(balanceOf(msg.sender) > 0, "Not enough tokens to
create a proposal");
```

7. SSP_3986_19

   Description - 1 : STORAGE VARIABLE CACHING IN MEMORY

   The contract GST is using the state variable hasVoted multiple times in the function vote. SLOADs are expensive (100 gas after the 1st one) compared to MLOAD/MSTORE (3 gas each).

   Description - 2 : STORAGE VARIABLE CACHING IN MEMORY

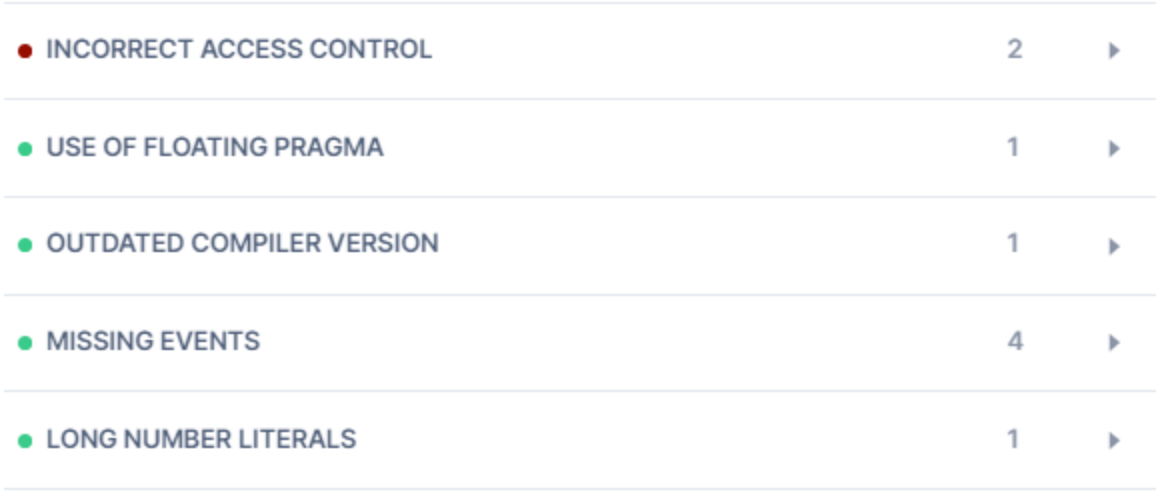
   The contract GST is using the state variable proposals multiple times in the function vote. SLOADs are expensive (100 gas after the 1st one) compared to MLOAD/MSTORE (3 gas each).

   Here is the vulnerable code snippet:

```
    function vote(uint256 proposalId, bool inSupport) external {
        require(!hasVoted[msg.sender], "Already voted");
        require(proposalId < proposals.length, "Invalid
proposalId");

        hasVoted[msg.sender] = true;
        Proposal storage proposal = proposals[proposalId];

        if (inSupport) {
```

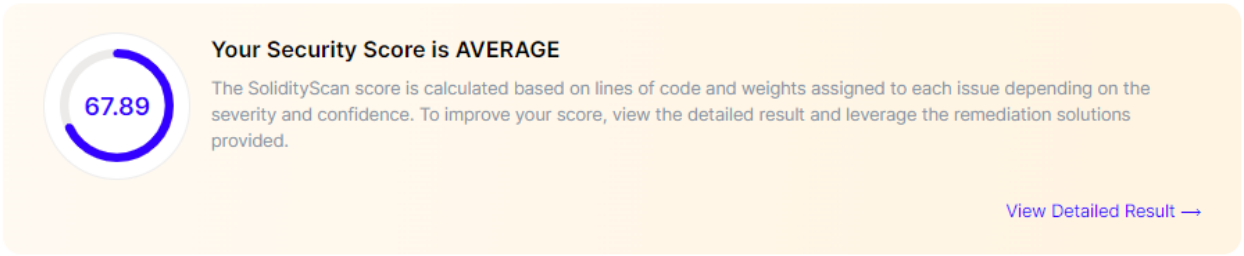
```
            proposal.votesFor += balanceOf(msg.sender);
        } else {
            proposal.votesAgainst += balanceOf(msg.sender);
        }

        emit Voted(msg.sender, inSupport);
    }
```

Fig 3: The remaining vulnerabilities



- INCORRECT ACCESS CONTROL
- USE OF FLOATING PRAGMA
- OUTDATED COMPILER VERSION
- MISSING EVENTS
- LONG NUMBER LITERALS

Fig 4: The scan summary



Note: I haven’t used any paid services for auditing.