BirdOracle Smart Contract Preliminary Audit Report

Project Synopsis

Project Name	**Bird Oracle**
Platform	Ethereum, Solidity
Github Repo	https://github.com/bird-money/on-chain-oracle-v2
Deployed Contract	Not Deployed
Total Duration	4 Days
Timeline of Audit	**8th April 2021 to 12th April 2021**

Contract Details

Total Contract(s)	1
Name of Contract(s)	**BirdOracle**
Language	Solidity
Commit Hash	**a7bcb6490875daaf8c414d9189f40254ec489435**

Contract Vulnerabilities Synopsis

Issues	Open Issues	Closed Issues
Critical Severity	2	0
Medium Severity	4	0
Low Severity	6	0
Informational	0	0
Total Found	12	0

Detailed Results

The contract has gone through several stages of the audit procedure that includes structural analysis, automated testing, manual code review, etc.

All the issues have been explained and discussed in detail below. Along with the explanation of the issue found during the audit, the recommended way to overcome the issue or improve the code quality has also been mentioned.

A. Contract Name: BirdOracle

High Severity Issues

A.1 addProvider function allows passing an address with WAS_TRUSTED status as an argument

Line no: 83-91

Description:

The **addProvider** function is designed in a way that only allows the addresses with the status **NOT_TRUSTED** to be added as a Trusted provider address.

However, as per the current design of the function, an address with the status **WAS_TRUSTED** can be added as a trusted provider address as well. In other words, an address that has been removed from the trusted providers list(*using* ***removeProvider*** *function*) can once again be included as a trusted address.

IS THIS INTENDED?

```
83      function addProvider(address _provider) public onlyOwner {
84          require(statusOf[_provider] != TRUSTED, "Provider is already added.");
85
86          if (statusOf[_provider] == NOT_TRUSTED) providers.push(_provider);
87          statusOf[_provider] = TRUSTED;
88          ++birdNest;
```

Recommendation:

If the above-mentioned scenario is not intended, then the function should be updated to handle such cases.

If an address with a status **WAS_TRUSTED** is not supposed to be counted as a trusted provider again, then the addProvider function must include the following **require** statement within the function body:

require(statusOf[_provider] != WAS_TRUSTED, "Provider cannot be added again");

A.2 newChainRequest function allows Empty Strings to be passed as arguments

Line no: 102-121

Description:

The **newChainRequest** function doesn't validate the string input passed to it and hence allows empty strings(_key) to be passed as an argument.

```
102     function newChainRequest(address _ethAddress, string memory _key)
103         public
104         paymentApproved(_ethAddress)
105     {
106         onChainRequests.push(
107             BirdRequest({
108                 id: trackId,
109                 ethAddress: _ethAddress,
110                 key: _key,
111                 value: 0, // if resolved is true then read value
112                 resolved: false // if resolved is false then value do
113             })
114         );
```

If the **key** plays a significant role in the request, it might be difficult to track if empty strings are passed as ***keys***.

Recommendation:

In order to avoid this scenario, the function must include the following **require** statement to ensure that an empty string is not passed as an address:

require (bytes(_key).length>0,"String with ZERO length not allowed");

Medium Severity Issues

A.3 Loops are extremely costly

Line no - 169, 217

Description:

The ***for loops*** in the ***BirdOracle*** contract include state variables like **.length** of a non-memory array in the condition of the for loops.
As a result, these state variables consume a lot more extra gas for every iteration of the loop.

The following functions include such loops at the mentioned lines:

- ***getProviders()*** *at Line 169*
- ***rewardProviders()*** *at Line 217*

Recommendation:

It's quite effective to use a local variable instead of a state variable like .***length*** in a loop.

For instance,

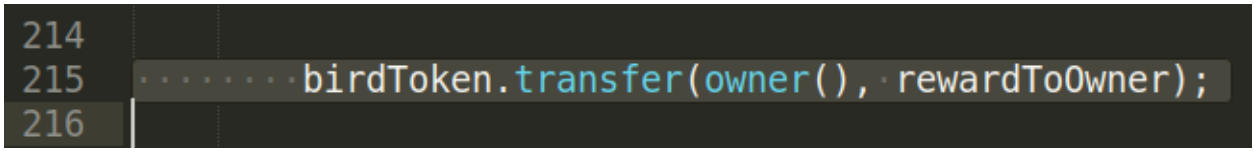
```
local_variable = providers.length
for (uint i = 0; i < local_variable; i ++) {
        if (statusOf[providers[i]] == TRUSTED) {
            trustedProviders[t_i] = providers[i];
            t_i++;
        }
}
```

A.4 Return Value of an External Call is Not used Effectively

Line no - 186, 215, 219

Explanation:

The external calls made in the above-mentioned lines do return a boolean value that indicates whether or not the external call made was successful.
These boolean return values can be used in the function as a check to ensure that the further execution of the function is only allowed if the external is successfully made.
However, the BirdOracle contract never uses these return values throughout the contract.



Recommendation:
Effective use of all the return values from external calls must be ensured within the contract.

A.5 setMinConsensus function doesn't emit any event

Line no - 232

Description:
The ***setMinConsensus*** *function* modifies the state of a very crucial arithmetic state variable, i.e. ***minConsensus,*** but doesn't emit any event after the updation of those variables.
Since there is no event emitted on updating this variable, it might be difficult to track it off-chain.

***Recommendation*:**
An event should be fired after changing the imperative arithmetic variables.

A. 6 State Variables updated after External Call

Line - 184-195, 199-222
Description:
The **BirdOracle** contract includes some functions that modify the state variables of the contract after making external calls.

- The ***sendPayment*** function makes an external call at Line 186 but updates the state of the **dueDateOf** mapping at Line 191 & 193, after the external call was made.
- Similarly, The ***rewardProviders*** function makes 2 external call at Line 215 and 219. However, it updates the state of the **lastTimeRewarded** state variable at Line 221, after the external call was made.

Although these external calls are made to the **Bird Token** contract itself, it is not considered a better practice in Solidity to update State Variables after making an External call. This violates the ***Check Effects Interaction Pattern*****.**

```
214
215         birdToken.transfer(owner(), rewardToOwner);
216
217         for (uint256 i = 0; i < providers.length; i++)
218             if (statusOf[providers[i]] == TRUSTED)
219                 birdToken.transfer(providers[i], rewardToEachProvider);
220
221         lastTimeRewarded = now;
```

Recommendation:
The ***Check Effects Interaction Pattern*** must be followed and State Variables should be updated before making any external call to another contract.

Low Severity Issues

A.7 External Visibility should be preferred

Explanation:

Those functions that are never called throughout the contract should be marked as ***external*** visibility instead of ***public*** visibility.
This will effectively result in Gas Optimization as well.

Therefore, the following function must be marked as **external** within the contract:

- ***addProvider***
- ***removeProvider***
- ***newChainRequest***
- ***updatedChainRequest***
- ***getRatingByAddress***
- ***getRating***
- ***getProviders***
- ***sendPayment***
- ***rewardProviders***
- ***isApproved*** *at Line 224*
- ***setMinConsensus***

A.8 Comparison to boolean Constant

Line no: 128

Description:

Boolean constants can directly be used in conditional statements or require statements.
Therefore, it's not considered a better practice to explicitly use **TRUE or FALSE** in the **require** statements.

```
127         require(
128             req.resolved == false,
129             "Error: Consensus is complete so you can not vote."
130         );
```

Recommendation:
The equality to boolean constants must be removed from the above-mentioned line.

A.9 Functions with similar names should be avoided

Line no - 23 and 52, 224 and 228

Description:
The BirdOracle contract includes a few functions with exactly similar names.
Since every function has different behavior, it is considered a better practice to avoid similar names for 2 different functions to eliminate any confusion and enhance the readability of the code.

Mentioned below are the functions with similar names but different behavior and arguments:

- ***statusOf*** *at Line 23*
- ***statusOf*** *at Line 52*
- ***isApproved()*** *at Line 224*
- ***isApproved()*** *at Line 228*

Recommended:
It is recommended to avoid using a similar name for different functions.

A.10 No visibility keyword assigned to statusOf Mapping

Line no: 23

Description:
The **statusOf** mapping has not been assigned any visibility keyword. If no visibility is assigned explicitly, the mapping will be assigned the default visibility. This might lead to unwanted difficulties while accessing this mapping from outside the contract.

Recommendation:
The mapping should be assigned a visibility keyword.

A.11 Order of layout

Description:

The order of functions as well as the rest of the code layout does not follow the solidity style guide.

Layout contract elements in the following order:

a. Pragma statements

b. Import statements

c. Interfaces

d. Libraries

e. Contracts

Inside each contract, library or interface, use the following order:

a. Type declarations

b. State variables

c. Events

d. Functions

Please read the following documentation links to understand the correct order: - https://docs.soliditylang.org/en/v0.6.12/style-guide.html#order-of-layout

https://docs.soliditylang.org/en/v0.6.12/style-guide.html#order-of-functions

A.12 NatSpec Annotations must be included

Description:

Smart contract does not include the NatSpec annotations adequately.

Recommendation:

Cover by NatSpec all Contract methods.

Automated Test Results

```
BirdOracle.sendPayment() (contracts/flatOracle.sol#523-534) ignores return value by birdToken.transferFrom(buyer,address(this),priceToAccessO
ontracts/flatOracle.sol#525)
BirdOracle.rewardProviders() (contracts/flatOracle.sol#538-561) ignores return value by birdToken.transfer(owner(),rewardToOwner) (contracts/
e.sol#554)
BirdOracle.rewardProviders() (contracts/flatOracle.sol#538-561) ignores return value by birdToken.transfer(providers[i],rewardToEachProvider)
ts/flatOracle.sol#558)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#unused-return
```

```
BirdOracle.sendPayment() (contracts/flatOracle.sol#523-534) uses timestamp for comparisons
        Dangerous comparisons:
        - now < dueDate (contracts/flatOracle.sol#529)
BirdOracle.rewardProviders() (contracts/flatOracle.sol#538-561) uses timestamp for comparisons
        Dangerous comparisons:
        - require(bool,string)(timeAfterRewarded > 86400,You can call reward providers once in
BirdOracle.isApproved(address) (contracts/flatOracle.sol#563-565) uses timestamp for comparisor
        Dangerous comparisons:
        - now < dueDateOf[_addr] (contracts/flatOracle.sol#564)
BirdOracle.isApproved() (contracts/flatOracle.sol#567-569) uses timestamp for comparisons
        Dangerous comparisons:
        - now < dueDateOf[msg.sender] (contracts/flatOracle.sol#568)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#block-timestamp
```

```
renounceOwnership() should be declared external:
        - Ownable.renounceOwnership() (contracts/flatOracle.sol#162-165)
transferOwnership(address) should be declared external:
        - Ownable.transferOwnership(address) (contracts/flatOracle.sol#171-175)
addProvider(address) should be declared external:
        - BirdOracle.addProvider(address) (contracts/flatOracle.sol#422-430)
removeProvider(address) should be declared external:
        - BirdOracle.removeProvider(address) (contracts/flatOracle.sol#432-439)
newChainRequest(address,string) should be declared external:
        - BirdOracle.newChainRequest(address,string) (contracts/flatOracle.sol#441-460)
updatedChainRequest(uint256,uint256) should be declared external:
        - BirdOracle.updatedChainRequest(uint256,uint256) (contracts/flatOracle.sol#463-489)
getRatingByAddress(address) should be declared external:
        - BirdOracle.getRatingByAddress(address) (contracts/flatOracle.sol#491-498)
getRating() should be declared external:
        - BirdOracle.getRating() (contracts/flatOracle.sol#500-502)
getProviders() should be declared external:
        - BirdOracle.getProviders() (contracts/flatOracle.sol#505-515)
sendPayment() should be declared external:
        - BirdOracle.sendPayment() (contracts/flatOracle.sol#523-534)
rewardProviders() should be declared external:
        - BirdOracle.rewardProviders() (contracts/flatOracle.sol#538-561)
isApproved(address) should be declared external:
        - BirdOracle.isApproved(address) (contracts/flatOracle.sol#563-565)
setMinConsensus(uint256) should be declared external:
        - BirdOracle.setMinConsensus(uint256) (contracts/flatOracle.sol#571-573)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#public-function-that-could-be-declared-external
```