METATRUST

Security Assessment for

NodeDAO 3

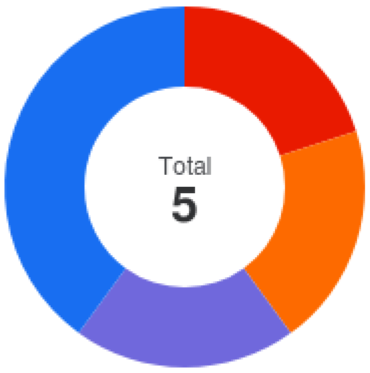
May 5, 2023

Executive Summary

Overview	
Project Name	NodeDAO 3
Codebase URL	https://github.com/NodeDAO/NodeDAO-Protocol
Scan Engine	Security Analyzer
Scan Time	2023/05/5 18:24:36
Commit Id	commit:3d0a9c42

Critical Issues	The issue can cause large economic losses, large-scale data disorder, loss of control of authority management, failure of key functions, or indirectly affect the correct operation of other smart contracts interacting with it.
High Risk Issues	The issue puts a large number of users' sensitive information at risk or is reasonably likely to lead to catastrophic impacts on clients' reputations or serious financial implications for clients and users.
Medium Risk Issues	The issue puts a subset of users' sensitive information at risk, would be detrimental to the client's reputation if exploited, or is reasonably likely to lead to moderate financial impact.
Low Risk Issues	The risk is relatively small and could not be exploited on a recurring basis, or is a risk that the client has indicated is low-impact in view of the client's business circumstances.
Informational Issue	The issue does not pose an immediate risk but is relevant to security best practices or Defence in Depth.

Total	
Critical Issues	1
High risk Issues	1
Medium risk Issues	0
Low risk Issues	1
Informational Issues	2



Critical Issues	20%	1
High risk Issues	20%	1
Medium risk Issues	0%	0
Low risk Issues	20%	1
Informational Issues	40%	2

Summary of Findings

MetaScan security assessment was performed on **May 5, 2023 18:24:36** on project **NodeDAO 3** with the repository **https://github.com/NodeDAO/NodeDAO-Protocol** on branch **main**. The assessment was carried out by scanning the project's codebase using the scan engine **Security Analyzer**. There are in total **5** vulnerabilities / security risks discovered during the scanning session, among which **1** critical vulnerabilities, **1** high risk vulnerabilities, **0** medium risk vulnerabilities, **1** low risk vulnerabilities, **2** informational issues.

ID	Description	Severity	Alleviation
MSA-001	The wrong value passed to validatorNumber of the _delaySlash function	Critical	Fixed
MSA-002	Lack of validate `number` in the `setNftExitBlockNumbers` function	High risk	Fixed
MSA-003	Missing emit event	Low risk	Fixed
MSA-004	Typo	Informational	Fixed
MSA-005	Gas Optimization	Informational	Fixed

Findings

Critical (1)

1. The wrong value passed to validatorNumber of the _delaySlash function — Critical — Security Analyzer

In the `OperatorSlash` contract, the `slashOfExitDelayed` function punishes operators who fail to exit on time. The `slashOfExitDeplayed` function gets `claimEthAmount` for the specified `requestId`, then calls the `_delaySlash` function to do the slash, but the value passed to the validatorNumber parameter of the `_delaySlash` function is `claimEthAmount % 32 ether`, instead of `claimEthAmount / uint256(32 ether)`. Per the definition of the `_delaySlash` function as shown below:

```
function _delaySlash(uint256 _operatorId, uint256 _startNumber, uint256 validatorNumber) internal {
    ...
}
```

We can also infer that the intended value passed to`validatorNumber` should not be `claimEthAmount % 32 ether`.

File(s) Affected

src/OperatorSlash.sol #134-147

```
        for (uint256 i = 0; i < _largeExitDelayedRequestIds.length; ++i) {
            uint256 requestId = _largeExitDelayedRequestIds[i];
            uint256 operatorId = 0;
            uint256 withdrawHeight = 0;
            uint256 claimEthAmount = 0;
            (operatorId, withdrawHeight,,, claimEthAmount,,) =
                withdrawalRequestContract.getWithdrawalOfRequestId(requestId);
            uint256 startNumber = withdrawHeight;
            if (largeExitDelayedSlashRecords[requestId] != 0) {
                startNumber = largeExitDelayedSlashRecords[requestId];
            }
            largeExitDelayedSlashRecords[requestId] = block.number;
            _delaySlash(operatorId, startNumber, claimEthAmount % 32 ether);
        }
```

Recommendation

Recommend passing the right value to the parameter validatorNumber of the `_delaySlash` function.

Alleviation Fixed

The development team resolved this issue in the commit https://github.com/NodeDAO/NodeDAO-Protocol/commit/418e010e63a996ca50c91b11abc9ae29539c56c2

High risk (1)

1. Lack of validate `number` in the `setNftExitBlockNumbers` function

High risk

Security Analyzer

In the `setNftExitBlockNumbers` function, the number will be stored in the `userNftExitBlockNumbers` map for `tokenId`, that exited. Meanwhile, the corresponding map `operatorExitButNoBurnNftCounts` for `operatorId` and `totalExitButNoBurnNftCounts` will increase by 1. Correspondingly, in the `whiteListBurn` function, the corresponding `operatorExitButNoBurnNftCounts` map for the `operatorId` and `totalExitButNoBurnNftCounts` need to be decreased by 1 if the burnt token is an exited token.

However, if the number assigned to `userNftExitBlockNumbers` for `tokenId` is zero with the `setNftExitBlockNumbers` function, it will still result in the increment of `operatorExitButNoBurnNftCounts` and `totalExitButNoBurnNftCounts`, but, as a result, the `whiteListBurn` function fails to decrease the `operatorExitButNoBurnNftCounts` and `totalExitButNoBurnNftCounts` since the `userNftExitBlockNumbers[_tokenId]` is zero.

File(s) Affected

src/tokens/VNFT.sol #460-460

```
460              if (number > block.number) revert InvalidBlockHeight();
```

Recommendation

Recommend adding a check to prevent the number to be zero in the setNftExitBlockNumbers function:

```
if (number > block.number || number == 0) revert InvalidBlockHeight();
```

Alleviation Fixed

The development team resolved this issue in the commit https://github.com/NodeDAO/NodeDAO-Protocol/commit/a0f7d8786c80dcc848b44aca6ac5c0c1bd8187e8

Medium risk (0)

No Medium risk vulnerabilities found here

Low risk (1)

1. Missing emit event

Low risk Security Analyzer

In the `_slash` function, an `OperatorArrearsIncrease` event needs to be emitted once the `operatorSlashAmountOwed` increases. However, in the final else branch, there is no OperatorArrearsIncrease event to be emitted.

File(s) Affected

src/registries/NodeOperatorRegistry.sol #641-646

```
        } else {
            operatorSlashAmountOwed[_operatorId] += _amount - pledgeAmounts;
            operatorPledgeVaultBalances[_operatorId] = 0;
            emit Slashed(_operatorId, pledgeAmounts);
            return pledgeAmounts;
        }
```

Recommendation

Recommend emitting the `OperatorArrearsIncrease` event in the else branch in the `_slash` function.

Alleviation Fixed

The development team resolved this issue in the commit https://github.com/NodeDAO/NodeDAO-Protocol/commit/8295963ffa703ce89ea0c9bb34f6ee187c77c93a

Informational (2)

1. Typo

Informational Security Analyzer

Per the meaning of the state variable `userActiceNftCounts` and its function `getUserActiveNftCountsOfOperator`, the name of the state variable `userActiceNftCounts` should be `userActiveNftCounts`.

File(s) Affected

src/tokens/VNFT.sol #531-533

```
    function getUserActiveNftCountsOfOperator(uint256 _operatorId) external view returns (uint256) {
        return userActiceNftCounts[_operatorId];
    }
```

Recommendation

Recommend fixing the typo.

Alleviation Fixed

The development team resolved this issue in the commit https://github.com/NodeDAO/NodeDAO-Protocol/commit/a725d04618274e04649067d18e8aed07182e60fd

2. Gas Optimization

Informational Security Analyzer

To avoid re-assigning **`isSettle`** to true, the **`isSettle`** variable could be checked in the **`if`** branch.

File(s) Affected

src/vault/VaultManager.sol #180-198

```
    function _elSettle(uint256[] memory _operatorIds) internal returns (uint256[] memory, bool) {
        uint256[] memory reinvestAmounts = new uint256[] (_operatorIds.length);
        uint256[] memory operatorElComissionRate;
        operatorElComissionRate = nodeOperatorRegistryContract.getOperatorComissionRate(_operatorIds);

        bool isSettle = false;
        for (uint256 i = 0; i < _operatorIds.length; ++i) {
            uint256 operatorId = _operatorIds[i];
            address vaultContractAddress = nodeOperatorRegistryContract.getNodeOperatorVaultContract(op

            uint256 _reinvest = _settle(operatorId, vaultContractAddress, operatorElComissionRate[i]);
            if (_reinvest > 0) {
                isSettle = true;
            }
            reinvestAmounts[i] = _reinvest;
        }

        return (reinvestAmounts, isSettle);
    }
```

Recommendation

Recommend checking the isSettle before assigning value to it.

```
            if (!isSettle && _reinvest > 0) {
                isSettle = true;
            }
```

Alleviation Fixed

The development team acknowledged this issue.

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