QuillAudits

Audit Report
August, 2021

For

StackOS

Contents

Overview

StackOS

StackOS is an open protocol that allows individuals to collectively offer a decentralized cloud where a user can deploy any full-stack application, decentralized app, blockchain privatenets, and mainnet nodes.

Scope of the Audit

The scope of this audit was to analyse StackOS smart contract's codebase for quality, security, and correctness.

StackOS Contracts
Commit: 670ce91740088de4dfa3472a97dcc368d0fee3c4
Fixed In: 1356c1847a5f30dba14e6c4602f43ffd6ca7e87a

Escrow • BaseEscrow.sol • EscrowStorage.sol • IEscrow.sol • StackEscrow.sol	The main payment contract in the system. Individual users i.e. application deployers use this contract while deploying applications to make payments, recharge their account / renew their plan, and withdraw completely. Structurally, escrow contracts have three parts: BaseEscrow: Contains internal functions for creating a deposit, recharging accounts, and withdrawing funds and public functions for settling accounts StackEscrow: Public functions for users and clusterOwners which call internal functions of BaseEscrow EscrowStorage: Contains Storage Variables and Mappings Users can either recharge the account / upgrade the account or withdraw the deposit. For every action, first previous balance and calculations are settled, and then new changes are applied. It calculates how many funds are utilised so far using totalDripRate for the deposit. Then subtracts this utilised amount from totalDeposit. Utilised funds are transferred to the cluster Owner.

uniswap	Uniswap Interfaces for Factory, Router and Pair
Cluster-metadata • DnsClusterMetadataStore.sol • IDnsClusterMetadataStore.sol	This contract stores all the metadata of a cluster like owner, IP Address, upvotes, downvotes, isActive, qualityFactor, etc. A new cluster entry can be created only by the staking contract. Each cluster has functions to upvote and downvote the cluster. A cluster can also be marked defaulter by the owner.
Resource-feed • ResourceFeed.sol • IResourceFeed.sol	It keeps track of all the resources of a cluster. Resources can be added, removed and updated by the cluster owners. Each resource has a drip rate and a voting weight associated with it, which can be updated by the cluster owner.
Oracle • Oracle.sol • IPriceOracle.sol	Oracle's role is to recompute the average price for the entire period once every period for a longer time for token conversion via Uniswap
Staking • Staking.sol	Staking role is to set staking amount to the depositor, stake token to the cluster, withdrawal of staker amount along with calculation of staked share percentage of the invoker.

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

Mythril, Slither, SmartCheck, Surya, Solhint.

Issue Categories

Every issue in this report has been assigned with 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 to 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 four issues which 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	3	15
Closed	6	4	1	4

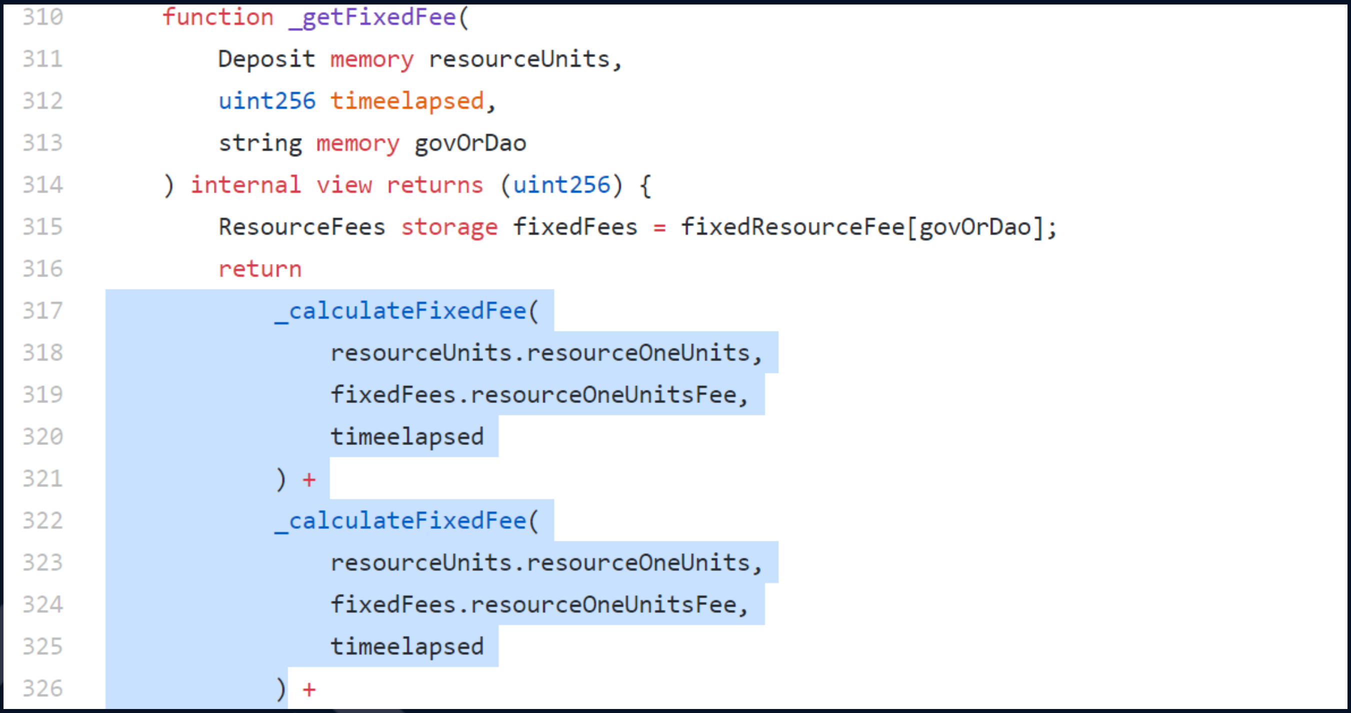
Issues Found

High severity issues

BaseEscrow & StackEscrow

- **Calculating FixedFee for Same Resource Twice**

  [#L310-362] _getFixedFee function calculates fixedFees for resourceOneUnits twice, as a result a user will be paying more fees than intended.



```
310     function _getFixedFee(
311         Deposit memory resourceUnits,
312         uint256 timeelapsed,
313         string memory govOrDao
314     ) internal view returns (uint256) {
315         ResourceFees storage fixedFees = fixedResourceFee[govOrDao];
316         return
317             _calculateFixedFee(
318                 resourceUnits.resourceOneUnits,
319                 fixedFees.resourceOneUnitsFee,
320                 timeelapsed
321             ) +
322             _calculateFixedFee(
323                 resourceUnits.resourceOneUnits,
324                 fixedFees.resourceOneUnitsFee,
325                 timeelapsed
326             ) +
```

Recommendation

Remove the duplicate statements and Fix the fees Calculation

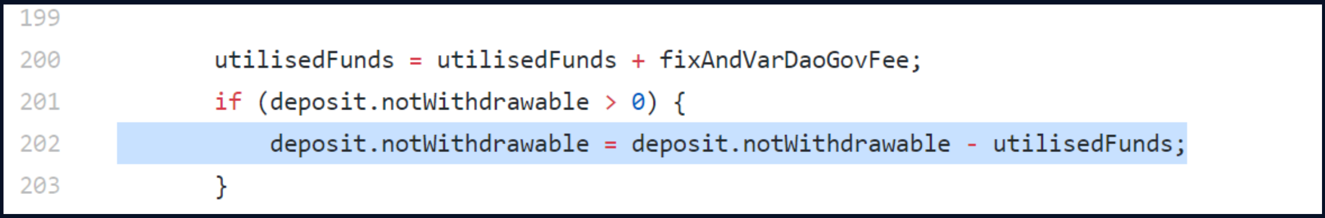
Status: Fixed

The fixed fees have been removed entirely.

- **Underflow leading to Unoperational Withdrawal for Depositor**

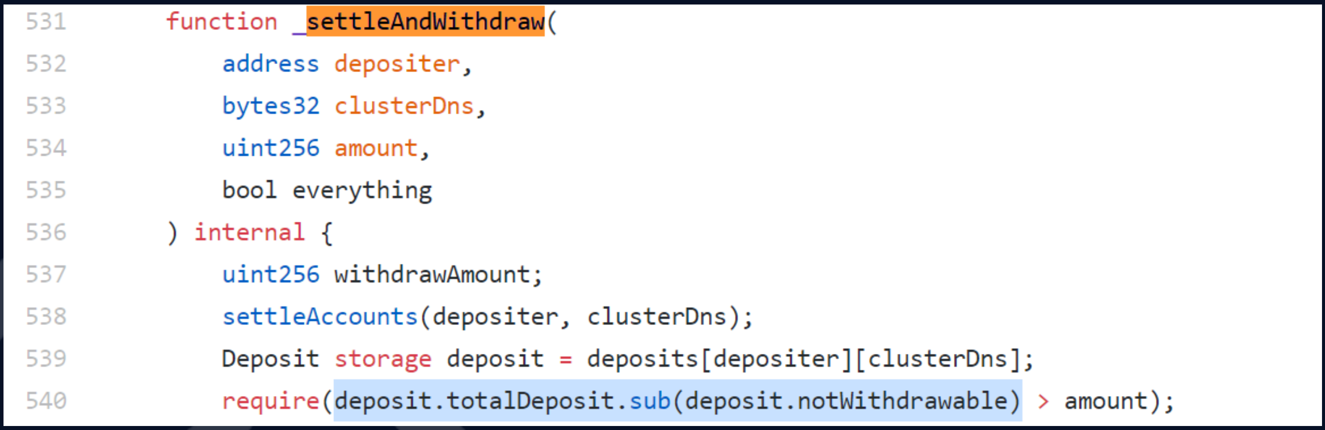
[#L159-218] settleAccounts function: The function checks, if there is any notWithdrawable balance in the depositor's account, and subtracts utilisedFunds from it.

As **utilisedFunds** can be more than **notWithdrawable**, it can lead to integer underflow, which will make **deposit.notWithdrawable** in the range of 2256.



```
199
200         utilisedFunds = utilisedFunds + fixAndVarDaoGovFee;
201         if (deposit.notWithdrawable > 0) {
202             deposit.notWithdrawable = deposit.notWithdrawable - utilisedFunds;
203         }
```

So, if a user tries to withdraw its withdrawable balance with [#L531-572] _settleAndWithdraw function, the SafeMath subtraction of notWithdrawable balance from totalDeposit will fail, resulting in failure of withdrawal of withdrawable balance.



```
531     function _settleAndWithdraw(
532         address depositer,
533         bytes32 clusterDns,
534         uint256 amount,
535         bool everything
536     ) internal {
537         uint256 withdrawAmount;
538         settleAccounts(depositer, clusterDns);
539         Deposit storage deposit = deposits[depositer][clusterDns];
540         require(deposit.totalDeposit.sub(deposit.notWithdrawable) > amount);
```

Possible Exploit Scenarios

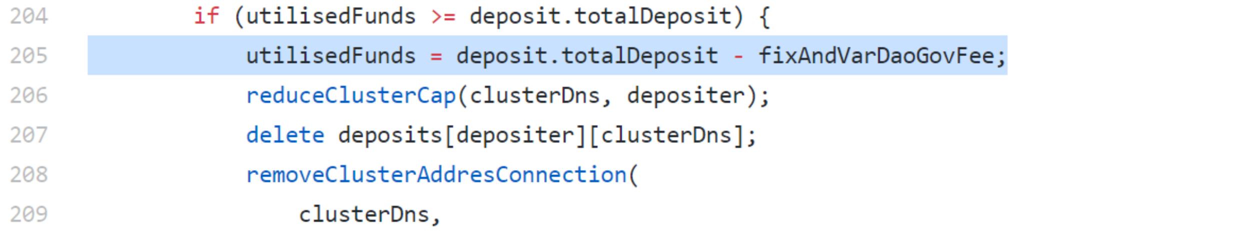
1. Owner issues a grant to an account, thereby increasing the notWithdrawable balance for that account, and if the depositor has funds or later decides to recharge its account. With this the user can utilize more funds than notWithdrawable balance, thus leading to underflow

2. ClusterOwner can rebate an account by sending some notWithdrawable balance, to an account. This can be intentional as well, taking advantage of underflow

Status: **Fixed**
The code has been updated with the logic to deduct utlisedFunds from notWithdrawable balance, only if the notWithdrawable balance is more than the utlisedFunds, and if it is less than utlisedFunds, then it means the notWithdrawable has been completely utilized and hence updated to 0.

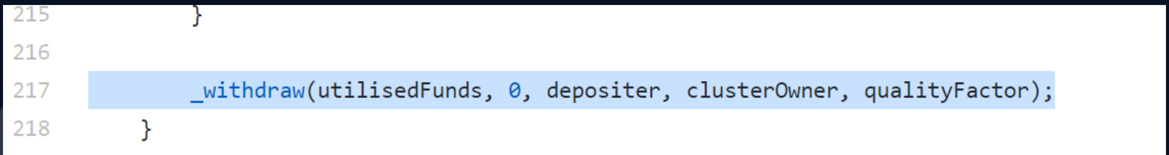
- **Incorrect Fees Collection can lead to Underflow, leading to Unoperational Withdrawal for ClusterOwner, Unoperational Settling of Account or possible drain of all available contract balance.**

[#L159-218] settleAccounts function: As function deducts fixed and variable fees for dao and gov addresses. Incorrect fixed and variable fees settings may become more than the utilisedFunds itself, thereby subtraction of fixAndVarDaoGovFee from totalDeposit will cause an underflow.



```
        if (utilisedFunds >= deposit.totalDeposit) {
            utilisedFunds = deposit.totalDeposit - fixAndVarDaoGovFee;
            reduceClusterCap(clusterDns, depositer);
            delete deposits[depositer][clusterDns];
            removeClusterAddresConnection(
                clusterDns,
```

And as the function sends the utilisedFunds to ClusterOwner



```
        }

        _withdraw(utilisedFunds, 0, depositer, clusterOwner, qualityFactor);
    }
```

Theoretically, it may drain out/ transfer all the contract's balance to ClusterOwner, or logically, the operation will fail as the contract will never be having this much balance, as a result settleAccount will fail.

Possible Exploit Scenarios
1. The first scenario has already been described above.

2. [In Theory] An attacker can set up a cluster from staking contract, deposit some funds as a user, and can call settleAccount in order to drain the contract balance.

Status: **Fixed**
The fixed fees have been removed entirely

DnsClusterMetadataStore

- **No deposits() function in Escrow contracts**

<table>
<tr><th>Line</th><th>Code</th></tr>
<tr><td>117-128</td><td><pre>
function upvoteCluster(bytes32 _dns) public {
    // check here if _dns = deposit.clusterDns
    (
        bytes32 clusterDns,
        uint256 cpuCoresUnits,
        uint256 diskSpaceUnits,
        uint256 bandwithUnits,
        uint256 memoryUnits,
        ,
        ,
        ,

) = escrow.deposits(msg.sender);
</pre></td></tr>
</table>

Description

There is no function with the name ‘deposits’ in the contract files related to Escrow. This function is also defined in the IEscrow interface. The upvoteCluster() function will always revert because there is no ‘deposits’ function to be called.

Recommendation

Add the missing function in the Escrow contract and update it accordingly in the interface.

Status: Fixed

A function getDeposits() was added in the Escrow contracts.

- **DNS Cluster entry can be replaced by any user**

<table>
<tr><th>Line</th><th>Code</th></tr>
<tr><td>74-96</td><td>

```
function addDnsToClusterEntry(
        bytes32 _dns,
        address _clusterOwner,
        string memory _ipAddress,
        string memory _whitelistedIps,
        string memory _clusterType,
        bool _isPrivate
    ) public onlyStakingContract {
        ClusterMetadata memory metadata = ClusterMetadata(
            _clusterOwner,
            _ipAddress,
            _whitelistedIps,
            0,
            0,
            false,
            100,
            true,
            _clusterType,
            _isPrivate
        );

        dnsToClusterMetadata[_dns] = metadata;
    }
```

</td></tr>
</table>

Description

The addDnsToClusterEntry() function can only be called by the staking contract. In the staking contract, any user can stake some STACK tokens and create a new DNS entry in the cluster metadata contract, by calling the deposit() function. There is no check if the 'dns' entry is already in the cluster metadata. It will always overwrite the previous entries. This can be used by any malicious user to gain the cluster ownership and manipulate resource values according to their benefit.

Recommendation

Check for previous entries of the 'dns' before adding a new one.

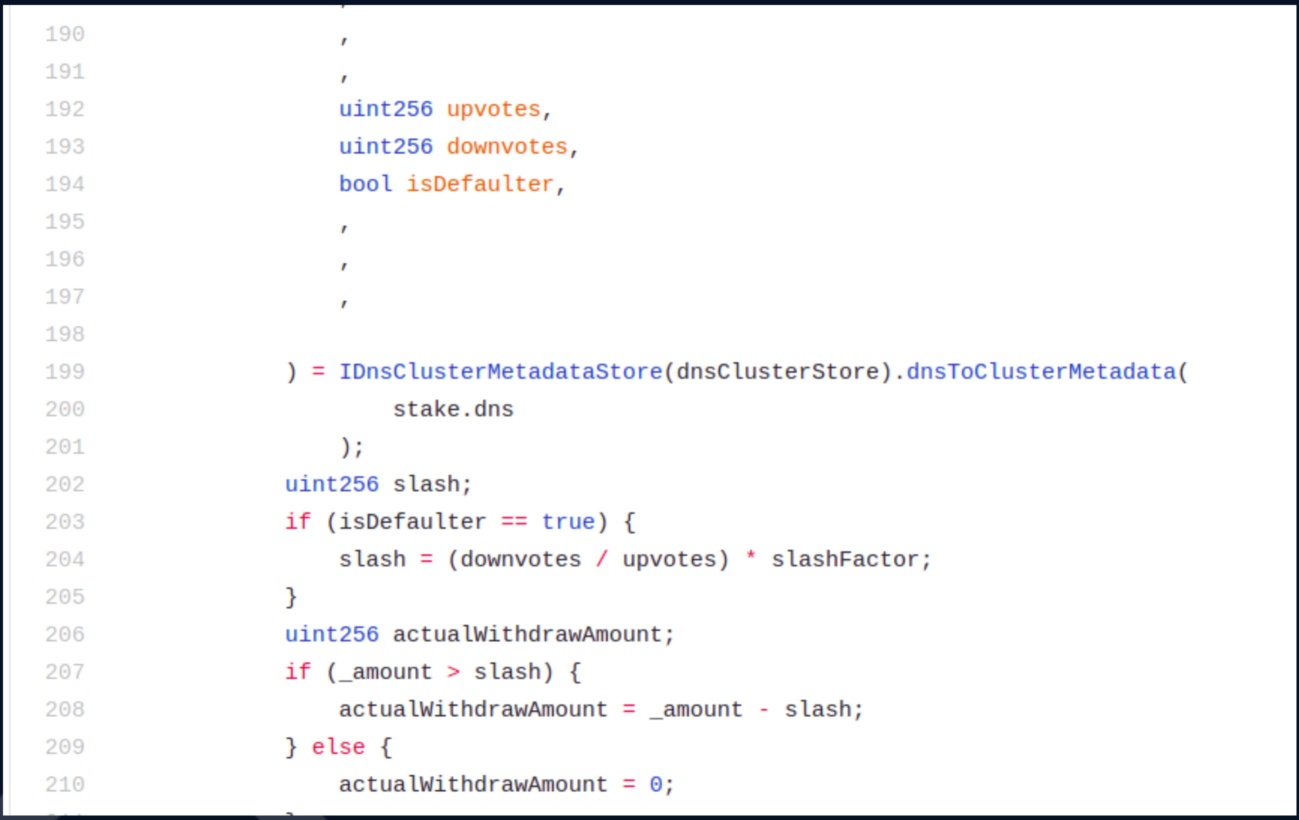
Status: Fixed

A function getDeposits() was added in the Escrow contracts.

Oracle (Oracle.sol, IPriceOracle.sol, Staking.sol)

- **Edge case for the divide isn't handled properly for the withdraw function.**

  While calculating the slash value, there is a chance that upvotes for the cluster is 0 and dividing downvotes with 0 will result in an error.



```
            ,
            ,
            uint256 upvotes,
            uint256 downvotes,
            bool isDefaulter,
            ,
            ,
            ,

        ) = IDnsClusterMetadataStore(dnsClusterStore).dnsToClusterMetadata(
                stake.dns
            );
        uint256 slash;
        if (isDefaulter == true) {
            slash = (downvotes / upvotes) * slashFactor;
        }
        uint256 actualWithdrawAmount;
        if (_amount > slash) {
            actualWithdrawAmount = _amount - slash;
        } else {
            actualWithdrawAmount = 0;
```

Which means if isDefaulter == true and upvotes == 0 then the staker can never withdraw.

Recommendation

We need to define the scenario for this edge case.

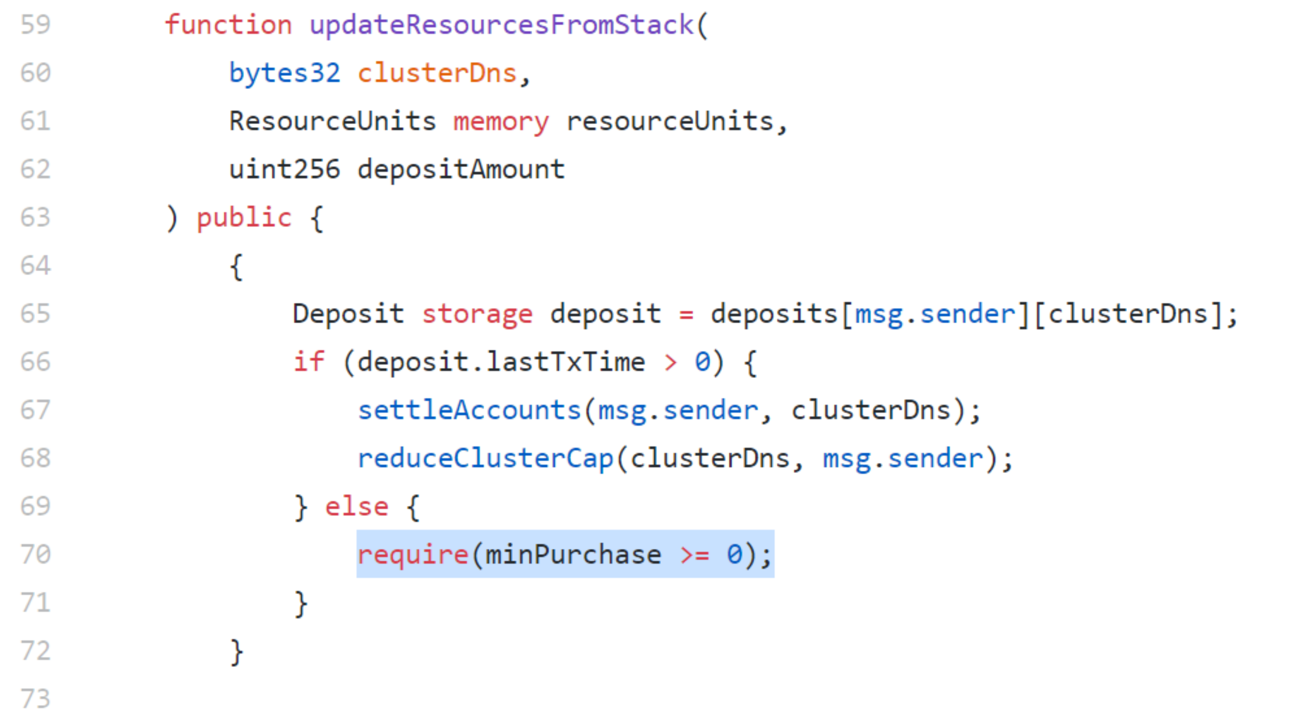
Status: Fixed

Medium severity issues

BaseEscrow & StackEscrow

- **Code with no Logic**

[#L59-82] updateResourcesFromStack function: It checks for an existing deposit entry by checking the lastTxTime, and if there is no entry, the else condition checks for minPurchase >= 0 which will be true all the time, and thus have no logic.



```
59        function updateResourcesFromStack(
60            bytes32 clusterDns,
61            ResourceUnits memory resourceUnits,
62            uint256 depositAmount
63        ) public {
64            {
65                Deposit storage deposit = deposits[msg.sender][clusterDns];
66                if (deposit.lastTxTime > 0) {
67                    settleAccounts(msg.sender, clusterDns);
68                    reduceClusterCap(clusterDns, msg.sender);
69                } else {
70                    require(minPurchase >= 0);
71                }
72            }
73
```

Recommendation

A possible implementation can be, to check depositAmount should be greater than or equal to minPurchase.

Status: Fixed

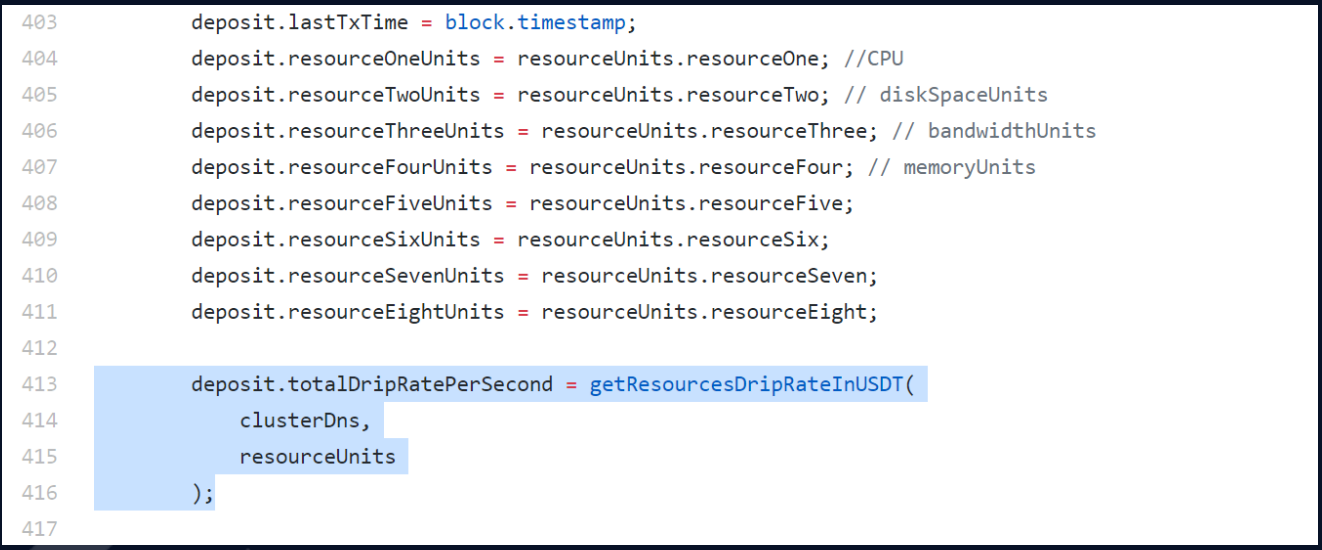
The code has now been updated with implementing the recommended logic stated above.

- **0 totalDripRatePerSecond can lead to Unoperational settleAccounts**

  [#L387-424] _createDepositInternal function: The function calculates totalDripRatePerSecond for a deposit as the accumulated drip rate for all the resources that a depositor has taken.

  Drip Rate for one resource is calculated as dripRatePerUnit * resourceUnits

  Where resourceUnits defines the number of units for a particular resource.



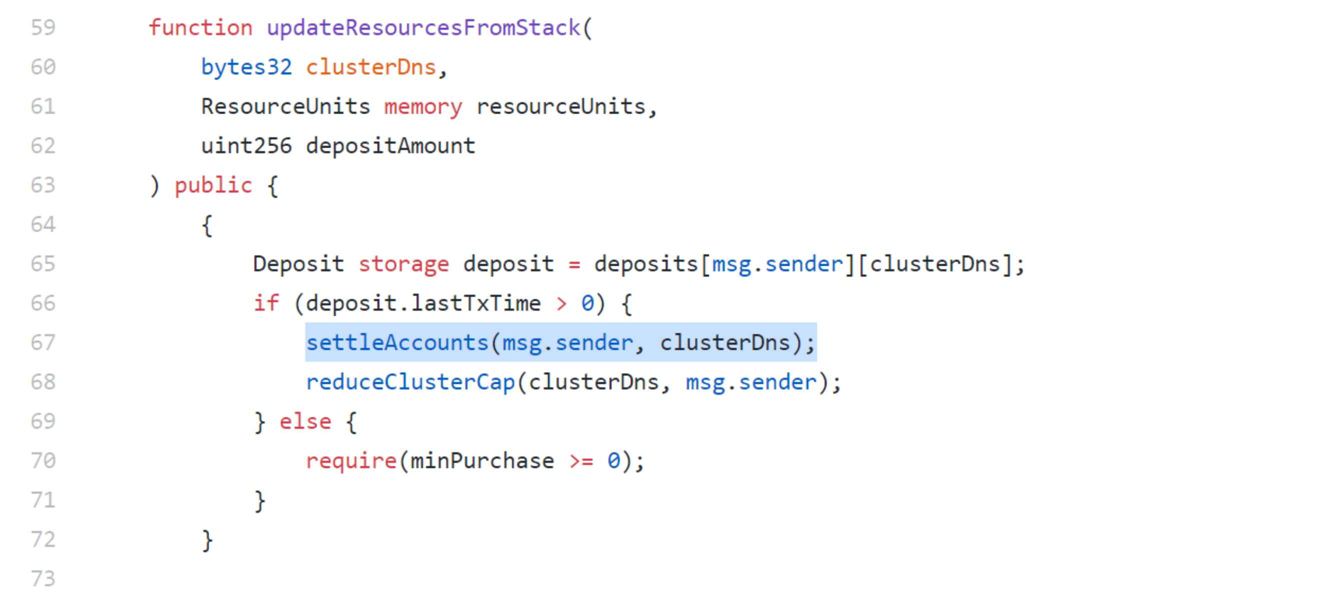
```
        deposit.lastTxTime = block.timestamp;
        deposit.resourceOneUnits = resourceUnits.resourceOne; //CPU
        deposit.resourceTwoUnits = resourceUnits.resourceTwo; // diskSpaceUnits
        deposit.resourceThreeUnits = resourceUnits.resourceThree; // bandwidthUnits
        deposit.resourceFourUnits = resourceUnits.resourceFour; // memoryUnits
        deposit.resourceFiveUnits = resourceUnits.resourceFive;
        deposit.resourceSixUnits = resourceUnits.resourceSix;
        deposit.resourceSevenUnits = resourceUnits.resourceSeven;
        deposit.resourceEightUnits = resourceUnits.resourceEight;

        deposit.totalDripRatePerSecond = getResourcesDripRateInUSDT(
            clusterDns,
            resourceUnits
        );

```

So, in cases, where drip rates for resources have not yet been set, or the user accidentally has taken 0 resourceUnits, the totalDripRatePerSecond calculated will be 0.

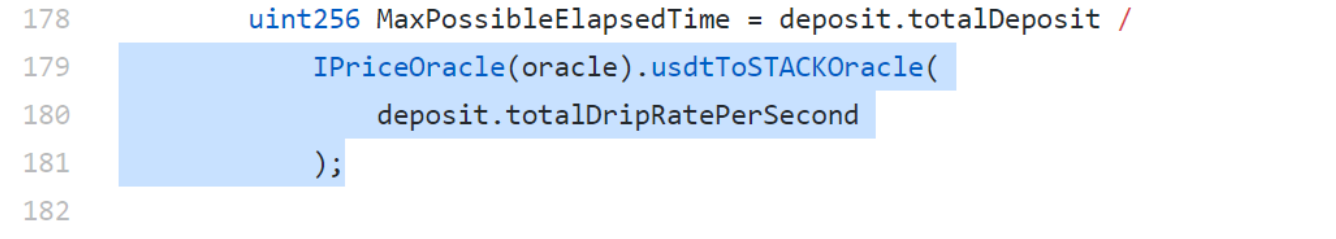
If a user tries to update the resources thereafter by calling [#L59-82] updateResourcesFromStack function in StackEscrow, it will never work for the depositor, as the function firstly tries to call settleAccounts for the depositor.



```
    function updateResourcesFromStack(
        bytes32 clusterDns,
        ResourceUnits memory resourceUnits,
        uint256 depositAmount
    ) public {
        {
            Deposit storage deposit = deposits[msg.sender][clusterDns];
            if (deposit.lastTxTime > 0) {
                settleAccounts(msg.sender, clusterDns);
                reduceClusterCap(clusterDns, msg.sender);
            } else {
                require(minPurchase >= 0);
            }
        }

```

And settleAccounts is now unoperational for the depositor due to divide by 0 issue (totalDripRatePerSecond = 0)



```
        uint256 MaxPossibleElapsedTime = deposit.totalDeposit /
            IPriceOracle(oracle).usdtToSTACKOracle(
                deposit.totalDripRatePerSecond
            );

```

Status: **Fixed**

The divide by 0 issue has now been fixed.

DnsClusterMetadataStore

- **The vote ratio can be manipulated**

Line	Code

146-147	clusterUpvotes[_dns][msg.sender] = clusterUpvotes[_dns][msg.sender] + 1;
	dnsToClusterMetadata[_dns].upvotes += 1;

Description

The ratio of downvotes to upvotes is calculated and used in the Staking Contract as a 'slash' value, when the cluster is declared a defaulter. Now this ratio can be manipulated by any user by upvoting and then downvoting a cluster, several times.

Recommendation

Change the logic implementation for upvote and downvote of the cluster.

Status: Fixed

Voting logic was changed so that no single user can manipulate the votes.

- **getTotalVotes() reverts if voting weights are not set for the resource**

Line	Code

638	`function _calculateVotesPerResource(`
	`    bytes32 clusterDns,`
	`    string calldata name,`
	`    uint256 resourceUnits`
	`) internal view returns (uint256) {`
	`    return`
	`        (resourceUnits * 1e18) /`
	`     resourceFeed.getResourceVotingWeight(clusterDns, name);`
	`}`

Description

Resource units are divided by the voting weights of that specific resource. If the voting weights are not set for that resource then it is 0 by default,which means resourceUnits will be divided by 0. This transaction will revert. The upvoteCluster() function uses this function to calculate the votingCapacity, which will also revert.

Recommendation

Keep a require check for the case when voting weights are zero.

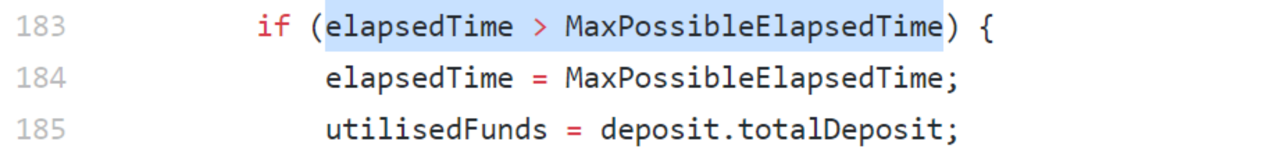
Status: Fixed

A require check for the case 'when voting weights are zero' was added.

Low level severity issues

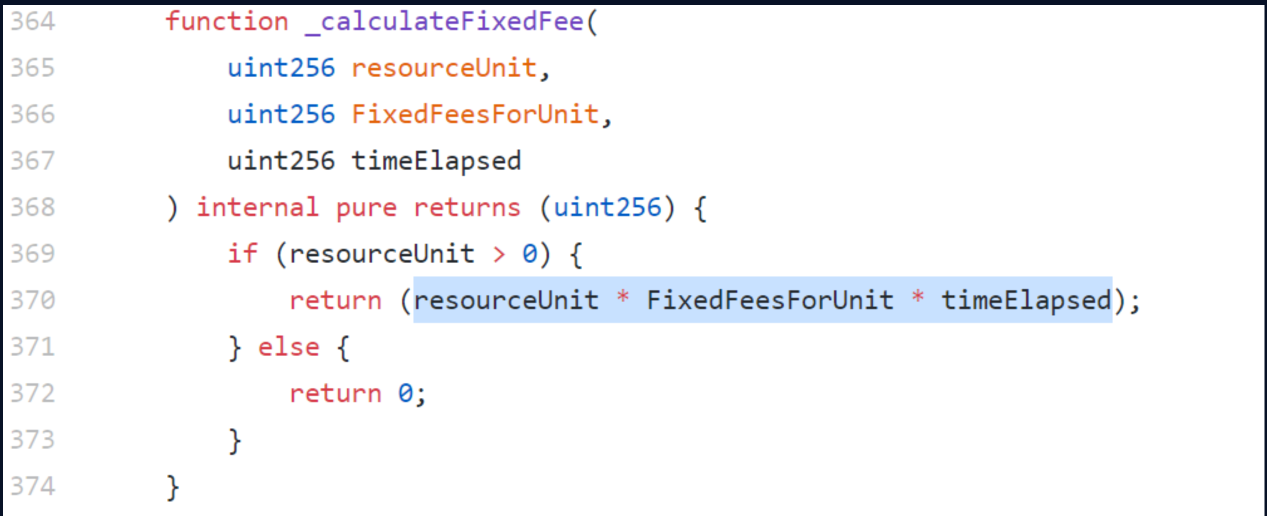
BaseEscrow & StackEscrow

- **[#L183] block.timestamp has been used for comparison**



```
183         if (elapsedTime > MaxPossibleElapsedTime) {
184             elapsedTime = MaxPossibleElapsedTime;
185             utilisedFunds = deposit.totalDeposit;
```

And for calculating FixedFees for dao and gov



```
    function _calculateFixedFee(
        uint256 resourceUnit,
        uint256 FixedFeesForUnit,
        uint256 timeElapsed
    ) internal pure returns (uint256) {
        if (resourceUnit > 0) {
            return (resourceUnit * FixedFeesForUnit * timeElapsed);
        } else {
            return 0;
        }
    }
```

Reference
Avoid using block.timestamp, as it can be manipulated by miners.

Status: Acknowledged by the Auditee

- **Missing Zero Address Validation**

[#L50-74] constructor() missing zero address checks for _stackToken, _resourceFeed, _staking, _dnsStore, _factory, _router, _dao, _gov, _weth, _usdt, _oracle addresses

[#L122-128] setFeeAddress() missing zero address checks for _daoAddress and _govAddress addresses

Status: Acknowledged by the Auditee
It will be fixed in a future release

DnsClusterMetadataStore

- **Hardcoded strings for resource names**

Line	Code

198-207	votes = _calculateVotesPerResource(clusterDns, "cpu", cpuCoresUnits);
	votes =
	votes +
	_calculateVotesPerResource(clusterDns, "memory", memoryUnits);
	votes =
	votes +
	_calculateVotesPerResource(clusterDns, "bandwidth", bandwidthUnits);
	votes =
	votes +
	_calculateVotesPerResource(clusterDns, "disk", diskSpaceUnits);

Description

Cluster owners can add resources with any name in the ResourceFeed contract. In the DnsClusterMetadataStore contract, getTotalVotes() function expects resources with some specific names to be present. If the clusterOwner never adds these resources then, upvoteCluster() will always revert.

Recommendation

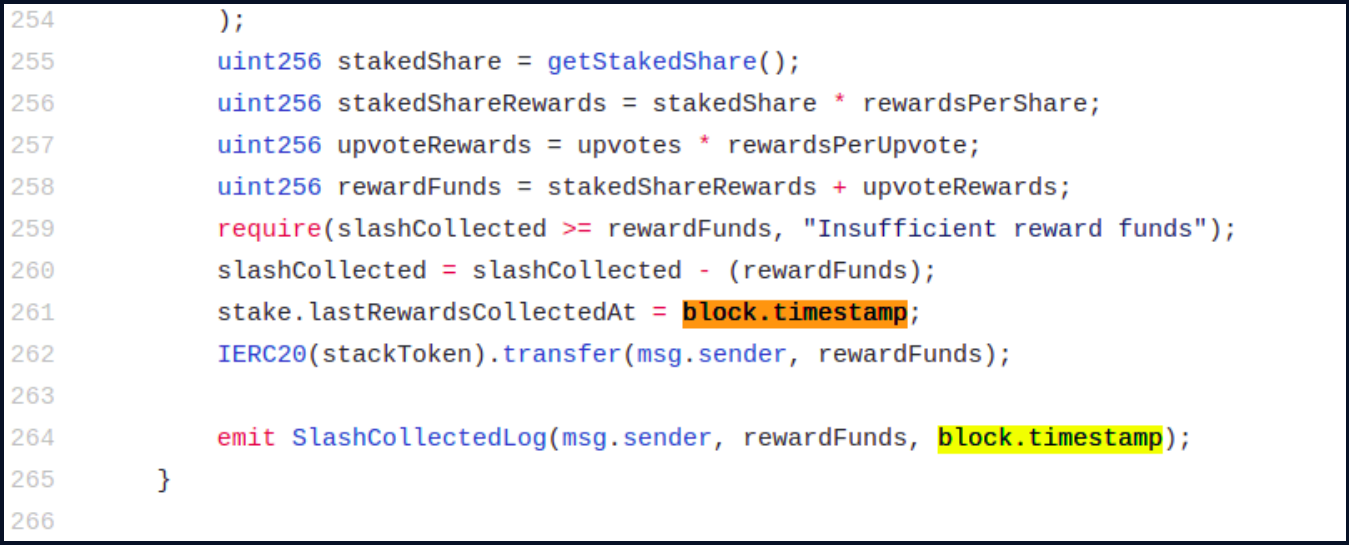
Do not use predefined names for resources, in votes calculation. Or make sure that cluster owners add resources with the same name in the ResourceFeed Contract.

Status: Fixed

Resource names are now retrieved from the Escrow contract.

Oracle (Oracle.sol, IPriceOracle.sol, Staking.sol)

- **Potential use of "block.timestamp" as a source of randomness (staking.sol)**



```
        );
        uint256 stakedShare = getStakedShare();
        uint256 stakedShareRewards = stakedShare * rewardsPerShare;
        uint256 upvoteRewards = upvotes * rewardsPerUpvote;
        uint256 rewardFunds = stakedShareRewards + upvoteRewards;
        require(slashCollected >= rewardFunds, "Insufficient reward funds");
        slashCollected = slashCollected - (rewardFunds);
        stake.lastRewardsCollectedAt = block.timestamp;
        IERC20(stackToken).transfer(msg.sender, rewardFunds);

        emit SlashCollectedLog(msg.sender, rewardFunds, block.timestamp);
    }

```

Contracts often need access to time values to perform certain types of functionality. Values such as block.timestamp, and block.number can give you a sense of the current time or a time delta, however, they are not safe to use for most purposes.
In the case of block.timestamp, developers often attempt to use it to trigger time-dependent events. As Ethereum is decentralized, nodes can synchronize time only to some degree. Moreover, malicious miners can alter the timestamp of their blocks, especially if they can gain advantages by doing so. However, miners can't set a timestamp smaller than the previous one (otherwise the block will be rejected), nor can they set the timestamp too far ahead in the future. Taking all of the above into consideration, developers can't rely on the preciseness of the provided timestamp.

Recommendation
Developers should write smart contracts with the notion that block values are not precise, and the use of them can lead to unexpected effects. Alternatively, they may make use of oracles.

Status: Acknowledged by the Auditee

Informational

- **Public functions that are never called by the contract should be declared external to save gas.**

  Status: Acknowledged by the Auditee

- **An old compiler has been used.**

  Recommendation
  Use the latest solidity compilers so as to avoid bugs introduced in older versions

  Status: Acknowledged by the Auditee

- **Multiple Pragma Directives have been used.**

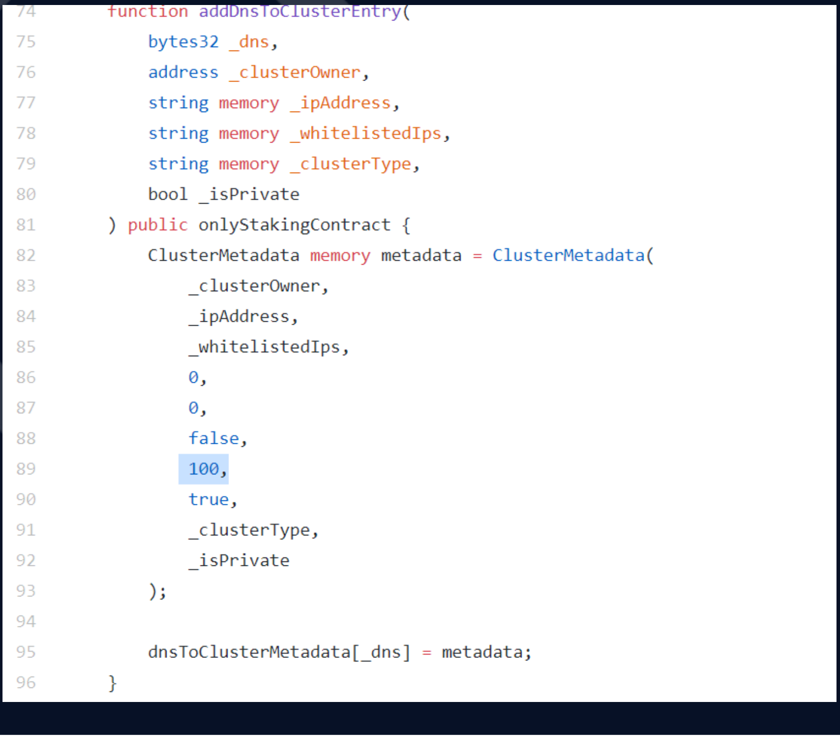
  Recommendation
  Use one solidity compiler

  Status: Acknowledged by the Auditee
  It will be fixed in a future release.

BaseEscrow & StackEscrow

- **No Penalty Deduction due to 100% quality factor**

  The clusters are always set up with qualityFactor as 100.

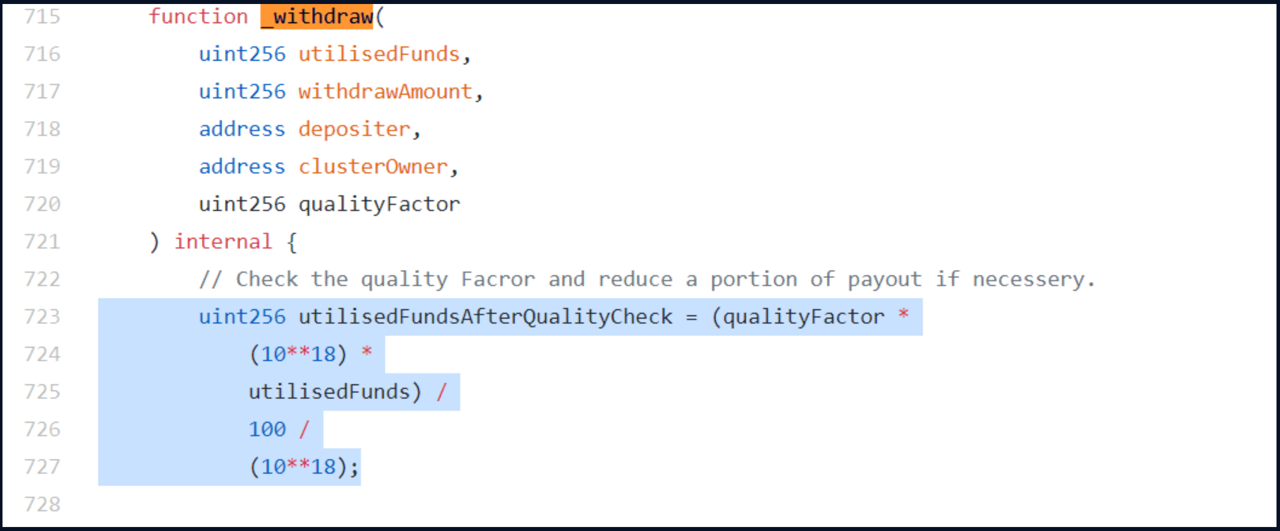


```
    function addDnsToClusterEntry(
        bytes32 _dns,
        address _clusterOwner,
        string memory _ipAddress,
        string memory _whitelistedIps,
        string memory _clusterType,
        bool _isPrivate
    ) public onlyStakingContract {
        ClusterMetadata memory metadata = ClusterMetadata(
            _clusterOwner,
            _ipAddress,
            _whitelistedIps,
            0,
            0,
            false,
            100,
            true,
            _clusterType,
            _isPrivate
        );

        dnsToClusterMetadata[_dns] = metadata;
    }
```

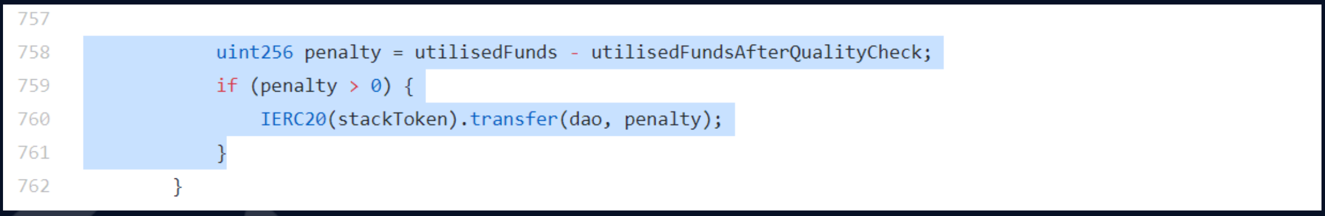
And there are no features available to modify the qualityFactor later on.

The utilisedFundsAfterQualityCheck will always be the same as utilisedFunds



```
715        function _withdraw(
716            uint256 utilisedFunds,
717            uint256 withdrawAmount,
718            address depositer,
719            address clusterOwner,
720            uint256 qualityFactor
721        ) internal {
722            // Check the quality Facror and reduce a portion of payout if necessery.
723            uint256 utilisedFundsAfterQualityCheck = (qualityFactor *
724                (10**18) *
725                utilisedFunds) /
726                100 /
727                (10**18);
728
```

As a result, the penalty in [#L715-767] _withdraw function will always be 0, hence will never be deducted.

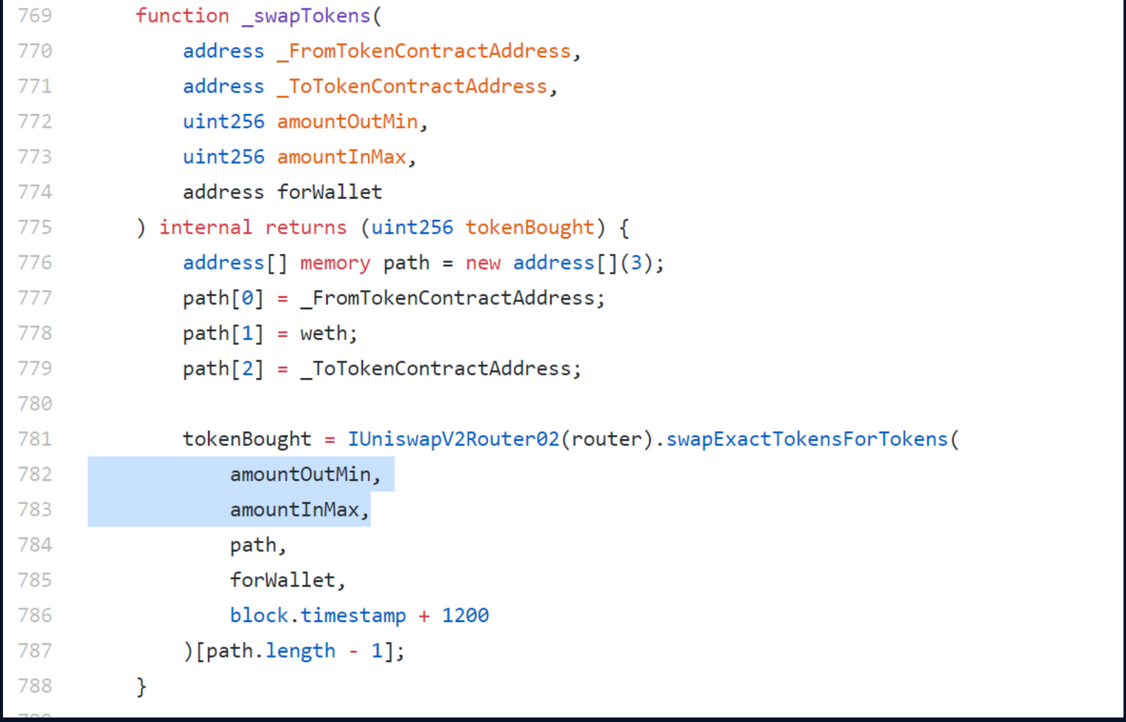


```
757
758             uint256 penalty = utilisedFunds - utilisedFundsAfterQualityCheck;
759             if (penalty > 0) {
760                 IERC20(stackToken).transfer(dao, penalty);
761             }
762         }
```

Status: Acknowledged by the Auditee
No penalty deduction will happen in the current release of the Contracts, as the clusters will all be from the StackOS itself.

- **Incorrect Parameters**

[#L769-788] _swapTokens function takes input value of the token in parameter amountOutMin and minimum output amount value in amountInMax. Although the values passed to UniswapRouter for swapping are correct, the parameter names give different meanings and create confusion in code readability.



```
    function _swapTokens(
        address _FromTokenContractAddress,
        address _ToTokenContractAddress,
        uint256 amountOutMin,
        uint256 amountInMax,
        address forWallet
    ) internal returns (uint256 tokenBought) {
        address[] memory path = new address[](3);
        path[0] = _FromTokenContractAddress;
        path[1] = weth;
        path[2] = _ToTokenContractAddress;

        tokenBought = IUniswapV2Router02(router).swapExactTokensForTokens(
            amountOutMin,
            amountInMax,
            path,
            forWallet,
            block.timestamp + 1200
        )[path.length - 1];
    }
```

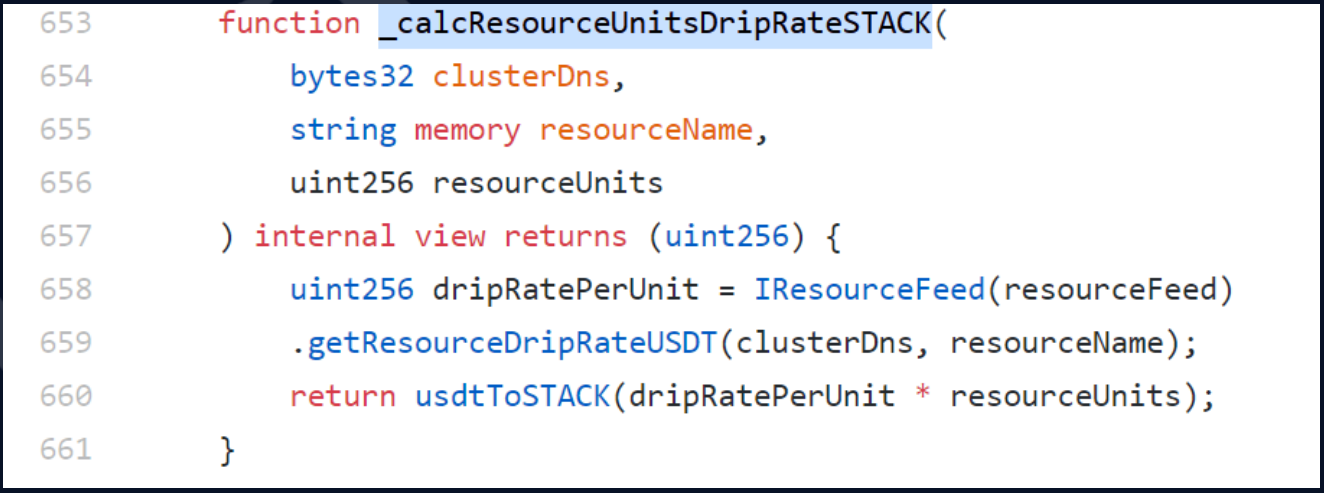
Recommendation

Rename parameters with their logical meaning.

Status: Fixed

- **Dead Code**

[#L653-661] _calcResourceUnitsDripRateSTACK internal function has not been used anywhere in the contract



```
653     function _calcResourceUnitsDripRateSTACK(
654         bytes32 clusterDns,
655         string memory resourceName,
656         uint256 resourceUnits
657     ) internal view returns (uint256) {
658         uint256 dripRatePerUnit = IResourceFeed(resourceFeed)
659         .getResourceDripRateUSDT(clusterDns, resourceName);
660         return usdtToSTACK(dripRatePerUnit * resourceUnits);
661     }
```

Status: Acknowledged by the Auditee

- **Comparison with a boolean constant.**

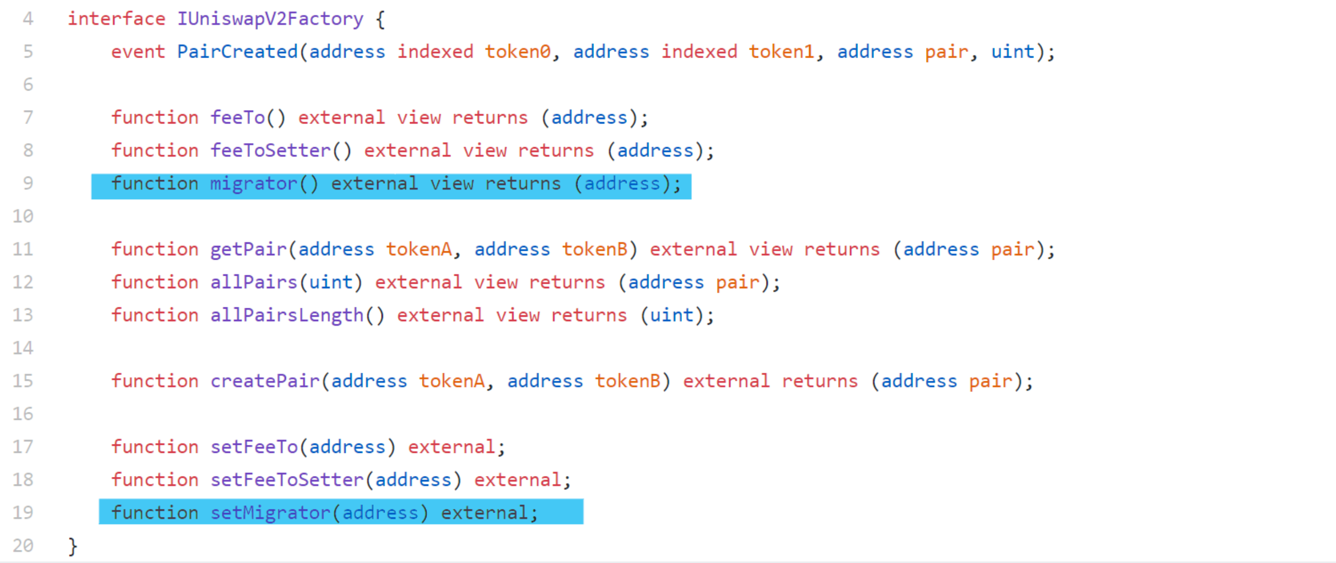
#L397	active == true
#L419	grant == false
#L420 & #L525	withdrawable == false
#L512 & #L528	OverLimit == false
#L553	everything == false

Recommendation
Boolean constants can be used directly and do not need to be compared to true or false.

Status: Acknowledged by the Auditee
The devs will stick to the existing coding style.

IUniswapV2Factory

- **The Interface has some unknown functions as compared to the official Uniswap V2 Factory interface for which the details are not provided in the contract specification document.**



```
interface IUniswapV2Factory {
    event PairCreated(address indexed token0, address indexed token1, address pair, uint);

    function feeTo() external view returns (address);
    function feeToSetter() external view returns (address);
    function migrator() external view returns (address);

    function getPair(address tokenA, address tokenB) external view returns (address pair);
    function allPairs(uint) external view returns (address pair);
    function allPairsLength() external view returns (uint);

    function createPair(address tokenA, address tokenB) external returns (address pair);

    function setFeeTo(address) external;
    function setFeeToSetter(address) external;
    function setMigrator(address) external;
}
```

Status: Fixed
The functions have been removed

DnsClusterMetadataStore

- **Use SafeMath for all arithmetic operations**

  Description
  There is no check for overflow/underflow in the contract.

  Recommendation
  Use SafeMath library by Openzeppelin for all the arithmetic operations to avoid overflow/underflow in the calculations.

  Status: Fixed

- **State variables that could be declared immutable**

  IResourceFeed public resourceFeed;

  Description
  The above constant state variables should be declared immutable to save gas.

  Recommendation
  Add the immutable attributes to state variables that never change after deployment.

  Status: Acknowledged by the Auditee

- **Code with no use**

Line	Code
25	bool isPrivate;

Description
This variable is stored in the metadata entry of every cluster. But there has been no actual use found for this variable isPrivate in any of the other contracts.

Recommendation
Remove this variable from the struct for metadata or specify a use for it.

Status: Acknowledged by the Auditee
Comments from Auditee: It will be used in later versions.

ResourceFeed

- **No function ‘getResourcePriceUSDT’ found in contract**

```
    function getResourcePriceUSDT(bytes32 clusterDns, string calldata
name)
        external
        view
        returns (uint256);
```

Description
This function was in the IResourceFeed interface, but there is no such function in the ResourceFeed contract.

Recommendation
Remove this function definition.

Status: Fixed
This function was removed from the interface.

- **Unused state variables**

address public stackToken;
address public USDToken;

Description
These state variables are never used in the contract.

Recommendation
Remove them.

Status: **Acknowledged by the Auditee**
Only the address USDToken was removed.

- **Use calldata for string parameters to save gas**

  Description
  The following functions use the memory keyword for the string parameter in functions. They can save gas if changed to calldata keyword.
  addResource()
  removeResource()
  setResourceDripRateUSDT()

  Recommendation
  Change memory to calldata.

  Status: Acknowledged by the Auditee

Oracle (Oracle.sol, IPriceOracle.sol, Staking.sol)

- **Description Safemath is missing in staking.sol**

  Description
  There is a missing check for overflow/underflow in the contract.

  Recommendation
  Use SafeMath library by Openzeppelin as the industry best standard for all the arithmetic operations to avoid overflow/underflow in the calculations.

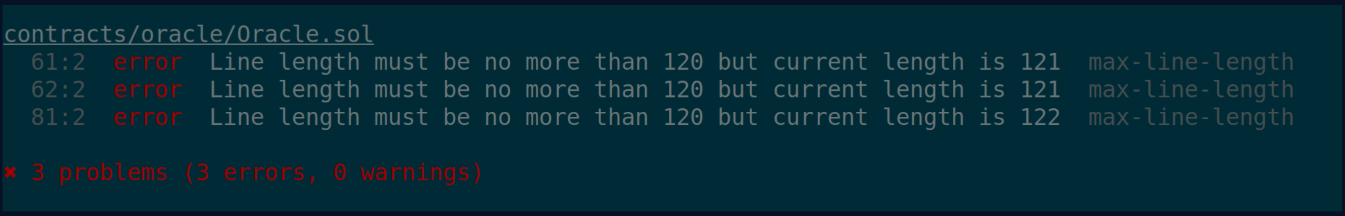
  Status: Acknowledged by the Auditee

- **License missing**

  Description
  Developers need to use a license according to your project. The suggestion to use here would be an SPDX license. You can find a list of licenses here: https://spdx.org/licenses/
  The SPDX License List is an integral part of the SPDX Specification. The SPDX License List itself is a list of commonly found licenses and exceptions used in free and open or collaborative software, data, hardware, or documentation. The SPDX License List includes a standardized short identifier, the full name, the license text, and a canonical permanent URL for each license and exception.

Status: Acknowledged by the Auditee

- **Linting issue**



```
contracts/oracle/Oracle.sol
  61:2  error  Line length must be no more than 120 but current length is 121  max-line-length
  62:2  error  Line length must be no more than 120 but current length is 121  max-line-length
  81:2  error  Line length must be no more than 120 but current length is 122  max-line-length

✖ 3 problems (3 errors, 0 warnings)
```

Status: Acknowledged by the Auditee

- **Decimal compatibility for USDT (Oracle.sol)**

As USDT has a different numbers of decimals on different chains, contracts should be selected with caution so as to get the correct rate from USDT to STACK and vice-versa.

Status: Acknowledged by the Auditee

- **Reentrancy Guard missing**

Use the reentrancy OpenZeppelin guard to avoid improper Enforcement of Behavioral Workflow. Link1, Link2

Status: Acknowledged by the Auditee

Closing Summary

Overall, smart contracts are very well written and adhere to guidelines.

Numerous issues of high, medium, and low severity were discovered during the initial audit. Most of them are now fixed and checked for correctness.

Disclaimer

Quillhash audit is not a security warranty, investment advice, or an endorsement of the StackOS platform. 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 StackOS Team put in place a bug bounty program to encourage further analysis of the smart contract by other third parties.

Audit Report
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For

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