CrowdSwap Opportunities - Final Audit Report

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Overview

CrowdSwap is a DeFi ecosystem centred around price routing and aggregation for swapping tokens with cross chain mechanisms. The current audited Opportunities Smart Contracts assist in earning, investing in aspects like yield farming, liquidity mining and staking.

Scope of Audit

The scope of this audit was to analyse **CrowdSwap Opportunities Contracts** codebase for quality, security, and correctness. This included testing of smart contracts to ensure proper logic was followed, manual analysis ,checking for bugs and vulnerabilities, checks for dead code, checks for code style, security and more. The audited contracts are as follows:

Git Repo link : https://github.com/CrowdSwap/Opportunities

Git Branch: master branch

Commit Hash: e2793ca83555520b2945cfd57055d1c14bca9df0

Fixed in**:** https://github.com/CrowdSwap/Opportunities/commits/master

Git Branch: master branch

Commit Hash: 4aa9e79c362a58fb781fe5bef466201cd51fbc20

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:

- Access Management
- Arbitrary write to storage
- Centralization of control
- Ether theft
- Improper or missing events
- Logical issues and flaws
- Arithmetic Computations Correctness
- Race conditions/front running
- SWC Registry
- 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, ERC721, ERC1155 conformance, correctness or violations
- 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 delegatecall
- Upgradeable safety
- Using throw
- Using inline assembly

Techniques and Methods

Throughout the audit of **CrowSwap Opportunities Smart Contracts,** care was taken to ensure:

- The overall quality and security of code.
- Use of best practices.
- Code documentation and comments match logic and expected behaviour.
- 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.

Contracts Information

Contract	Lines	Complexity Score	Capabilities
contracts/interfaces/IBeefyVault.sol	9	7	
contracts/interfaces/IPancakeMasterChefV2.sol	12	11	
contracts/interfaces/IStakingLP.sol	10	7	
contracts/interfaces/IUniswapV2Router02.sol	48	14	payable functions
contracts/helpers/OwnableUpgradeable.sol	83	20	
contracts/libraries/UniERC20Upgradeable.sol	48	28	initiates ETH value transfer
contracts/opportunity/BeefyMimaticUsdcOpportunity.sol	154	61	
contracts/opportunity/PancakeOpportunity.sol	297	124	
contracts/opportunity/CrowdUsdtLpStakeOpportunity.sol	152	60	
contracts/opportunity/Opportunity.sol	472	246	payable functions
contracts/opportunity/StakingLP.sol	384	185	

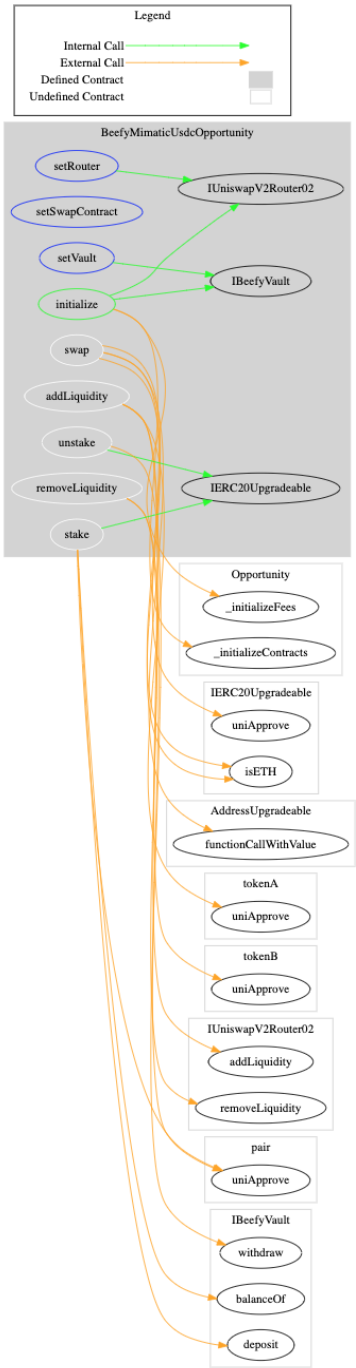
Contract	Lines	Complexity Score	Capabilities
TOTALS	**1669**	**763**	payable functions, initiates ETH value transfer

- Dependencies

Dependency / Import Path	Count
@openzeppelin/contracts-upgradeable/proxy/utils/Initializable.sol	3
@openzeppelin/contracts-upgradeable/proxy/utils/UUPSUpgradeable.sol	2
@openzeppelin/contracts-upgradeable/security/PausableUpgradeable.sol	2
@openzeppelin/contracts-upgradeable/security/ReentrancyGuardUpgradeable.sol	2
@openzeppelin/contracts-upgradeable/token/ERC20/IERC20Upgradeable.sol	5
@openzeppelin/contracts-upgradeable/token/ERC20/utils/SafeERC20Upgradeable.sol	4
@openzeppelin/contracts-upgradeable/utils/AddressUpgradeable.sol	3

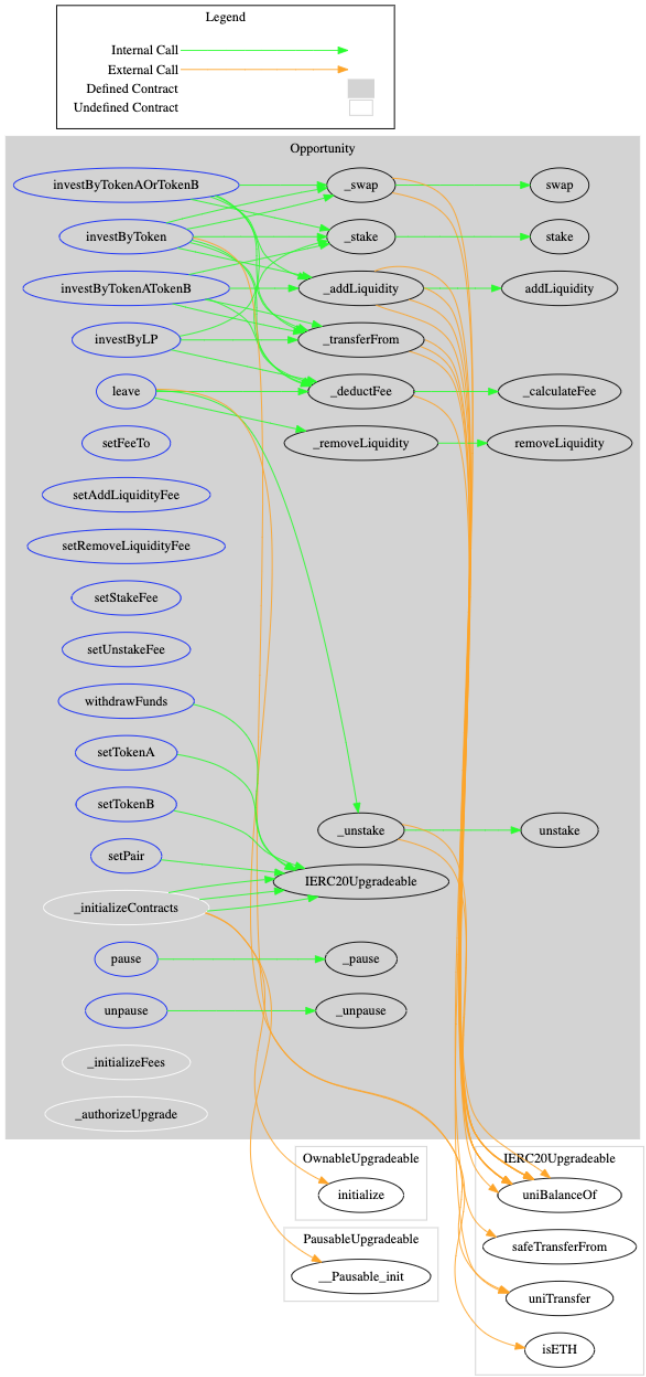
Call Graphs

- contracts/opportunity/BeefyMimaticUsdcOpportunity.sol

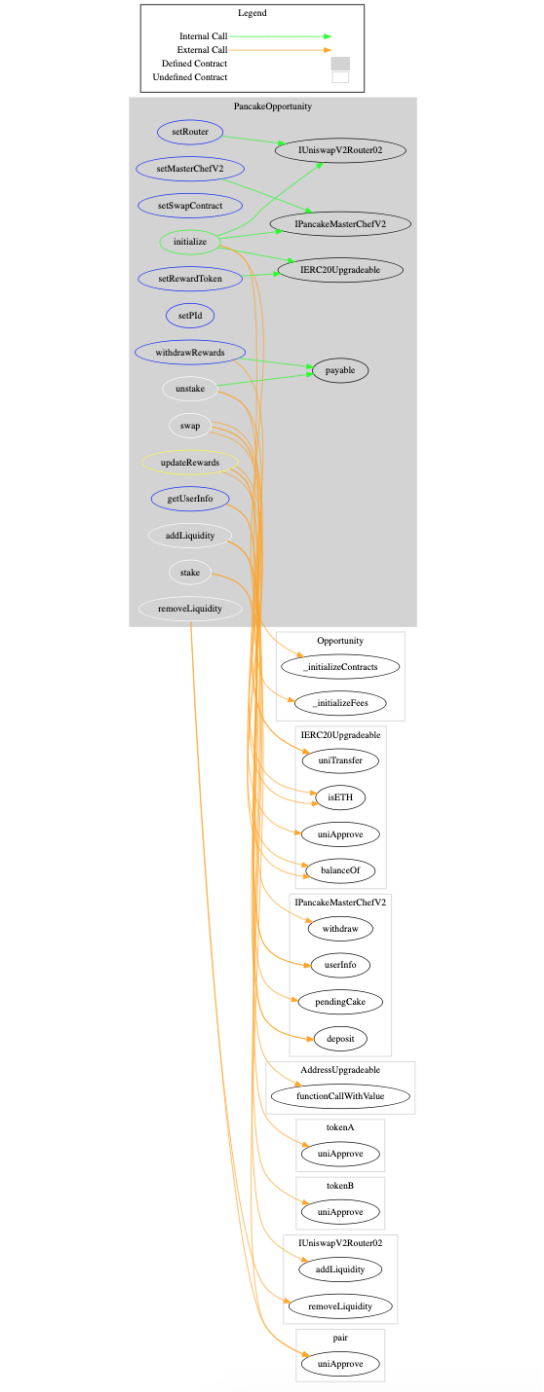


- contracts/opportunity/CrowdUsdtLpStakeOpportunity.sol

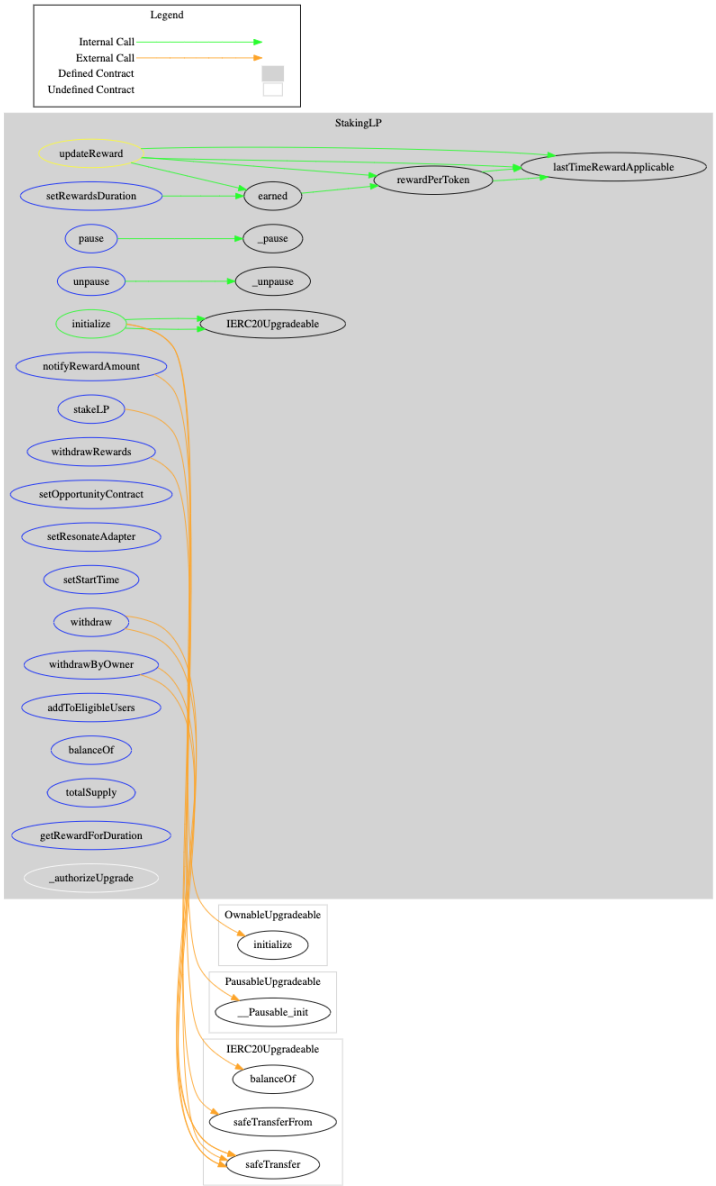
- contracts/opportunity/Opportunity.sol



- contracts/opportunity/PancakeOpportunity.sol


Legend
Internal Call
External Call
Defined Contract
Undefined Contract
PancakeOpportunity
setRouter
IUniswapV2Router02
setMasterChefV2
setSwapContract
IPancakeMasterChefV2
initialize
IERC20Upgradeable
setRewardToken
setPId
withdrawRewards
payable
unstake
swap
updateRewards
getUserInfo
addLiquidity
stake
removeLiquidity
Opportunity
_initializeContracts
_initializeFees
IERC20Upgradeable
uniTransfer
isETH
uniApprove
balanceOf
IPancakeMasterChefV2
withdraw
userInfo
pendingCake
deposit
AddressUpgradeable
functionCallWithValue
tokenA
uniApprove
tokenB
uniApprove
IUniswapV2Router02
addLiquidity
removeLiquidity
pair
uniApprove

- contracts/opportunity/StakingLP.sol



Notes: Above metrics and call graphs obtained from Solidity Metrics

Tools and Platforms used for Audit

Solidity Metrics, Smartcheck, Solhint, Slither, MythX, Hardhat, Tests,Remix,

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.

High Severity Issues

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 Severity Issues

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 Severity Issues

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 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	0
Closed	0	0	0	2

Issues Found

High Severity Issues

None

Medium Severity Issues

None

Low Severity Issues

None

Informational Issues

1. **Missing events**

The missing event makes it difficult to track off-chain and impact off-chain monitoring and incident response functionality. An event should be emitted for critical operations, critical functions and significant transactions: It is especially important for admin functions and changes to emit events for transparency and monitoring so it is considered best practise to always have them logged. Consider the functions below

`BeefyMimaticUsdcOpportunity.sol functions lines 70 setSwapContract, 75 setRouter, and 80 setVault.`

`CrowdUsdtLpStakeOpportunity.sol functions lines 68 setSwapContract, 73 setRouter, and 78 setStakingLP`

`Opportunity.sol functions lines setFeeTo 241, setAddLiquidityFee 246, setRemoveLiquidityFee 251, setStakeFee 256, setUnstakeFee 261, setTokenA 266,setTokenB 271, setPair 276.`

`PancakeOpportunity.sol functions lines 109 setSwapContract, 114 setRouter, 119 setMasterChefV2, 124 setPId, 128 setRewardToken`

Remedy

Critical updates may need to emit events. We recommend emitting an event to log the update of the above functions or any other functions or operations deemed requiring event emission that may not be mentioned above.

Auditor's Response:

Status : Fixed

2. **Unnecessary checks**

It appears some code checks allow 0 value and yet still check if uint is greater than or equal to zero. uint256 values will always be 0 or greater.

`Opportunity.sol line 247, 252, 257, 262(_feePercentage >= 0,oe11)`

Remedy

Consider removing the above code snippets and any other that are similar to above but may not have been mentioned to save on gas costs.

Auditor's Response:

Status : Fixed

Functional Tests

Some of the tests performed are mentioned below:

helpers/OwnableUpgradeable.sol

initialize	function	PASS
onlyOwner	modifier	PASS
owner	function	PASS
pendingOwner	function	PASS
transferOwnership	function	PASS
claimOwnership	function	PASS

libraries/UniERC20Upgradeable.sol

isETH	function	PASS
uniBalanceOf	function	PASS
uniTransfer	function	PASS
uniApprove	function	PASS

opportunity/BeefyMimaticUsdcOpportunity.sol

initialize	function	PASS
setSwapContract	function	PASS
setRouter	function	PASS
setVault	function	PASS
swap	function	PASS
addLiquidity	function	PASS
removeLiquidity	function	PASS
stake	function	PASS
unstake	function	PASS

opportunity/CrowdUsdtLpOpportunity.sol

initialize	function	PASS
setSwapContract	function	PASS
setRouter	function	PASS
setStakingLp	function	PASS
swap	function	PASS
addLiquidity	function	PASS
removeLiquidity	function	PASS
stake	function	PASS
unstake	function	PASS

opportunity/Opportunity.sol

investByTokenATokenB	function	PASS
investByTokenAOrTokenB	function	PASS
investByToken	function	PASS
investByLP	function	PASS
leave	function	PASS
setFeeTo	function	PASS
setAddLiquidityFee	function	PASS
setRemoveLiquidityFee	function	PASS
setStakeFee	function	PASS
setUnstakeFee	function	PASS
setTokenA	function	PASS
setTokenB	function	PASS
setPair	function	PASS
withdrawFunds	function	PASS

pause	function	PASS
unpause	function	PASS
swap	function	PASS
addLiquidity	function	PASS
removeLiquidity	function	PASS
stake	function	PASS
unstake	function	PASS
_initializeContracts	function	PASS
_initializeFees	function	PASS
_authorizeUpgrade	function	PASS
_addLiquidity	function	PASS
_removeLiquidity	function	PASS
_stake	function	PASS
_unstake	function	PASS
_deductFee	function	PASS
_calculateFee	function	PASS
_transferFrom	function	PASS

opportunity/PancakeOpportunity.sol

initialize	function	PASS
updateRewards	modifier	PASS
setSwapContract	function	PASS
setRouter	function	PASS
setMasterChefV2	function	PASS
setPId	function	PASS
setRewardToken	function	PASS

getUserInfo	function	PASS
withdrawRewards	function	PASS
swap	function	PASS
addLiquidity	function	PASS
removeLiquidity	function	PASS
stake	function	PASS
unstake	function	PASS

opportunity/StakingLP.sol

initialize	function	PASS
updateReward	modifier	PASS
stakeLP	function	PASS
withdrawRewards	function	PASS
withdraw	function	PASS
withdrawByOwner	function	PASS
notifyRewardAmount	function	PASS
setRewardsDuration	function	PASS
setOpportunityContract	function	PASS
setResonateAdapter	function	PASS
setStartTime	function	PASS
pause	function	PASS
unpause	function	PASS
addToEligibleUsers	function	PASS
balanceOf	function	PASS
totalSupply	function	PASS
getRewardForDuration	function	PASS
lastTimeRewardApplicable	function	PASS
rewardPerToken	function	PASS

earned	function	PASS

Automated Tests

No major issues were found. Some false positive errors were reported by the tools. All the other issues have been categorised above according to their level of severity.

Closing Summary:

Some issues of Low Severity and Informational nature were found in this audit. Some suggestions and best practices are also provided in order to improve the code quality and security posture.

Disclaimer

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