BASE PROTOCOL

Smart Contract Security Audit

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1.1 INTRODUCTION

Base Protocol engaged Halborn to conduct a security assessment on their all smart contracts that implement the protocol on the Ethereum blockchain. Base Protocol is a decentralized elastic supply protocol for creating indices of other tokens. It maintains a price peg by adjusting supply directly to and from wallet holders based on a data feed generated by off-chain oracles. The security assessment was scoped to the contract BaseToken, BaseTokenMonetaryPolicy, BaseTokenOrchestrator, ERC20UpgradeSafe, ERC677Token, Greeter and an audit of the security risk and implications regarding the changes introduced by the development team at Base Protocol prior to its production release shortly following the assessments deadline.

Overall, the smart contract code is extremely well documented, follows a high-quality software development standard, contains many utilities and automation scripts to support continuous deployment / testing / integration, and does NOT contain any obvious exploitation vectors that Halborn was able to leverage within the timeframe of testing allotted.

Though the outcome of this security audit is satisfactory; due to time and resource constraints, only testing and verification of essential properties were performed to achieve objectives and deliverables set in the scope. It is important to remark the use of the best practices for secure smart contract development. Halborn recommends performing further testing to validate extended safety and correctness in context to the whole set of contracts. External threats, such as economic attacks, oracle attacks, and inter-contract functions and calls should be validated for expected logic and state.

1.2 TEST APPROACH & METHODOLOGY

Halborn performed a combination of manual and automated security testing to balance efficiency, timeliness, practicality, and accuracy regarding the scope of the smart contract audit. While manual testing is recommended to uncover flaws in logic, process, and implementation; automated testing techniques help enhance coverage of smart contracts and can quickly identify items that do not follow security best practices. The following phases and associated tools were used throughout the term of the audit:

- Research into architecture and purpose
- Smart Contract manual code read and walkthrough
- Graphing out functionality and contract logic/connectivity/functions (solgraph)
- Manual Assessment of use and safety for the critical solidity variables and functions in scope to identify any arithmetic related vulnerability classes.
- Scanning of solidity files for vulnerabilities, security hotspots, or bugs. (MythX)
- Static Analysis of security for scoped contract, and imported functions. (Slither)
- Testnet deployment (Truffle, Ganache, Infura)
- Smart Contract Fuzzing and dynamic state exploitation (Echidna) Symbolic Execution / EVM bytecode security assessment (limited time)

1.3 SCOPE

Code related to:

- BaseToken.sol
- BaseTokenMonetaryPolicy.sol
- BaseTokenOrchestrastor.sol
- ERC20UpgradeSafe.sol
- ERC677Token.sol

- Greeter.sol

Specific commit of contract: Commit ID: cbbf4d8e1970e72df80b461358552c431296c6a2

OUT-OF-SCOPE:
External contracts, External Oracles, other smart contracts in the repository or imported by BASE protocol contracts, economic attacks

2. ASSESSMENT SUMMARY & FINDINGS OVERVIEW

CRITICAL	HIGH	MEDIUM	LOW
0	0	0	3

SECURITY ANALYSIS	RISK LEVEL
USE OF TX.ORIGIN	Low
AVOID USING NOW	Low
STATE VARIABLE SHADOWING	Informational
STATIC ANALYSIS	Low
AUTOMATED SECURITY SCAN RESULTS	Informational

FINDINGS & TECH DETAILS

3.1 USE OF TX.ORIGIN - LOW

Description

BaseTokenOrchestrator.sol uses tx.origin so that rebase() function can be called by anybody. It is recommended that you use msg.sender instead of tx.origin because if a transaction is made to a malicious wallet, when you check it you will have the origin address and you will not be able to know the address of the malicious wallet. Nevertheless, the use of tx.origin is semi-legitimized for recording who calls the contract most. Furthermore, tx.origin could be used to prevent an address from interacting with your contract because the owner of the address cannot use the contract as an intermediary to circumvent your blocking. Finally, it is important to remark that the use of tx.origin will be deprecated.

Reference:

https://consensys.net/blog/blockchain-development/solidity-best-practices-for-smart-contract-security/

Code Location

BaseTokenOrchestrator.sol Line #46

```
45      {
46          require(msg.sender == tx.origin);
47
48          policy.rebase();
```

Recommendation:

It is recommended not to use tx.origin because a malicious wallet could receive funds and cannot be tracked. However, its use is semi-legitimate in some cases with caution.

3.2. AVOID USING NOW - LOW

Description:

The use of “now” can be influenced by miners to some degree. Miners can manipulate “now” to exploit the contract. Here in BaseTokenMonetaryPolicy.sol contract, “now” is being used in inRebaseWindow() and rebase() methods.

Code Location:

BaseTokenMonetaryPolicy.sol Lines #100-103

```
100         require(lastRebaseTimestampSec.add(minRebaseTimeIntervalSec) < now, "cannot rebase yet");
101
102         // Snap the rebase time to the start of this window.
103         lastRebaseTimestampSec = now.sub(now.mod(minRebaseTimeIntervalSec)).add(rebaseWindowOffsetSec);
```

BaseTokenMonetaryPolicy.sol Line #134

```
132         uint256 supplyAfterRebase = BASE.rebase(epoch, supplyDelta);
133         assert(supplyAfterRebase <= MAX_SUPPLY);
134         emit LogRebase(epoch, tokenPrice, mcap, supplyDelta, now);
135     }
```

BaseTokenMonetaryPolicy.sol Lines #257-258

```
255     function inRebaseWindow() public view returns (bool) {
256         return (
257             now.mod(minRebaseTimeIntervalSec) >= rebaseWindowOffsetSec &&
258             now.mod(minRebaseTimeIntervalSec) < (rebaseWindowOffsetSec.add(rebaseWindowLengthSec))
259         );
260     }
```

Recommendation:

Avoid getting relied on use of “now” in require methods because it could be manipulated by miners.

3.3 STATE VARIABLE SHADOWING - INFORMATIONAL

Description:

There are few state variables are getting shadowed by the child contract BaseToken.sol (_totalSupply variable) and ERC20UpgradeSafe.sol (__gap variable).

Code Location:

BaseToken.sol Line #144

```
144         _totalSupply = INITIAL_SHARES_SUPPLY;
145         _shareBalances[owner()] = TOTAL_SHARES;
146         _sharesPerBASE = TOTAL_SHARES.div(_totalSupply);
```

ERC20UpgradeSafe.sol Line #41

```
41      uint256 private _totalSupply;
42
43      string private _name;
44      string private _symbol;
45      uint8 private _decimals;
```

ERC20UpgradeSafe.sol Line #317

```
317     uint256[44] private __gap;
318 }
319
```

Recommendation:

It is recommended to carefully review the variable storage design in the contracts to avoid possible ambiguities.

3.4 STATIC ANALYSIS - LOW

Halborn used automated testing techniques to enhance coverage of certain areas of the scoped contract. Among the tools used was Slither, a Solidity static analysis framework. After Halborn verified all the contracts in the repository and was able to compile them correctly into their abi and binary formats, Slither was run on all contracts (BaseToken.sol, BaseTokenMonetaryPolicy.sol, BaseTokenOrchestrator.sol, ERC20UpgradeSafe.sol, ERC677Token.sol and Greeter.sol).

```
INFO:Detectors:
OwnableUpgradeSafe.__gap (FlattenBaseTokenOrchestrator.sol#185) shadows:
        - ContextUpgradeSafe.__gap (FlattenBaseTokenOrchestrator.sol#104)
ERC20UpgradeSafe.__gap (FlattenBaseTokenOrchestrator.sol#2470) shadows:
        - ContextUpgradeSafe.__gap (FlattenBaseTokenOrchestrator.sol#104)
BaseToken._totalSupply (FlattenBaseTokenOrchestrator.sol#2608) shadows:
        - ERC20UpgradeSafe._totalSupply (FlattenBaseTokenOrchestrator.sol#2194)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#state-variable-shadowing
INFO:Detectors:
BaseTokenOrchestrator.addTransaction(address,bytes) (FlattenBaseTokenOrchestrator.sol#3215-3222) uses a Boolean constant improperly:
        -transactionEnabled.push(true) (FlattenBaseTokenOrchestrator.sol#3219)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#misuse-of-a-boolean-constant
INFO:Detectors:
ERC20UpgradeSafe.__ERC20_init(string,string).name (FlattenBaseTokenOrchestrator.sol#2210) shadows:
        - ERC20UpgradeSafe.name() (FlattenBaseTokenOrchestrator.sol#2228-2230) (function)
ERC20UpgradeSafe.__ERC20_init(string,string).symbol (FlattenBaseTokenOrchestrator.sol#2210) shadows:
        - ERC20UpgradeSafe.symbol() (FlattenBaseTokenOrchestrator.sol#2236-2238) (function)
ERC20UpgradeSafe.__ERC20_init_unchained(string,string).name (FlattenBaseTokenOrchestrator.sol#2215) shadows:
        - ERC20UpgradeSafe.name() (FlattenBaseTokenOrchestrator.sol#2228-2230) (function)
ERC20UpgradeSafe.__ERC20_init_unchained(string,string).symbol (FlattenBaseTokenOrchestrator.sol#2215) shadows:
        - ERC20UpgradeSafe.symbol() (FlattenBaseTokenOrchestrator.sol#2236-2238) (function)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#local-variable-shadowing
INFO:Detectors:
Reentrancy in BaseTokenMonetaryPolicy.rebase() (FlattenBaseTokenOrchestrator.sol#2944-2984):
        External calls:
        - (mcap,mcapValid) = mcapOracle.getData() (FlattenBaseTokenOrchestrator.sol#2958)
        - (tokenPrice,tokenPriceValid) = tokenPriceOracle.getData() (FlattenBaseTokenOrchestrator.sol#2965)
        - supplyAfterRebase = BASE.rebase(epoch,supplyDelta) (FlattenBaseTokenOrchestrator.sol#2981)
        Event emitted after the call(s):
        - LogRebase(epoch,tokenPrice,mcap,supplyDelta,now) (FlattenBaseTokenOrchestrator.sol#2983)
Reentrancy in BaseTokenOrchestrator.rebase() (FlattenBaseTokenOrchestrator.sol#3191-3208):
        External calls:
        - policy.rebase() (FlattenBaseTokenOrchestrator.sol#3196)
        Event emitted after the call(s):
        - TransactionFailed(transactionDestination[i],i,transactionData[i]) (FlattenBaseTokenOrchestrator.sol#3203)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#reentrancy-vulnerabilities-3
```

FINDINGS & TECH DETAILS

```
INFO:Detectors:
BaseTokenMonetaryPolicy.rebase() (FlattenBaseTokenOrchestrator.sol#2944-2984) uses timestamp for comparisons
        Dangerous comparisons:
        - require(bool,string)(lastRebaseTimestampSec.add(minRebaseTimeIntervalSec) < now,cannot rebase yet) (FlattenBaseTokenOrchestrator.sol#2949)
BaseTokenMonetaryPolicy.inRebaseWindow() (FlattenBaseTokenOrchestrator.sol#3104-3109) uses timestamp for comparisons
        Dangerous comparisons:
        - (now.mod(minRebaseTimeIntervalSec) >= rebaseWindowOffsetSec && now.mod(minRebaseTimeIntervalSec) < (rebaseWindowOffsetSec.add(rebaseWindowLengthSec))) (FlattenB
aseTokenOrchestrator.sol#3105-3108)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#block-timestamp
INFO:Detectors:
Initializable.isConstructor() (FlattenBaseTokenOrchestrator.sol#50-60) uses assembly
        - INLINE ASM (FlattenBaseTokenOrchestrator.sol#58)
console._sendLogPayload(bytes) (FlattenBaseTokenOrchestrator.sol#330-337) uses assembly
        - INLINE ASM (FlattenBaseTokenOrchestrator.sol#333-336)
Address.isContract(address) (FlattenBaseTokenOrchestrator.sol#2117-2126) uses assembly
        - INLINE ASM (FlattenBaseTokenOrchestrator.sol#2124)
ERC677Token.isContract(address) (FlattenBaseTokenOrchestrator.sol#2528-2537) uses assembly
        - INLINE ASM (FlattenBaseTokenOrchestrator.sol#2535)
BaseTokenOrchestrator.externalCall(address,bytes) (FlattenBaseTokenOrchestrator.sol#3274-3304) uses assembly
        - INLINE ASM (FlattenBaseTokenOrchestrator.sol#3279-3302)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#assembly-usage
INFO:Detectors:
BaseToken.transfer(address,uint256) (FlattenBaseTokenOrchestrator.sol#2736-2749) compares to a boolean constant:
        -require(bool,string)(bannedUsers[msg.sender] == false,you are banned) (FlattenBaseTokenOrchestrator.sol#2742)
BaseToken.transferFrom(address,address,uint256) (FlattenBaseTokenOrchestrator.sol#2772-2788) compares to a boolean constant:
        -require(bool,string)(bannedUsers[msg.sender] == false,you are banned) (FlattenBaseTokenOrchestrator.sol#2778)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#boolean-equality
```

```
INFO:Detectors:
Different versions of Solidity is used in :
        - Version used: ['0.6.12', '>=0.4.22<0.8.0', '>=0.4.24<0.7.0', '^0.6.0', '^0.6.2']
        - >=0.4.24<0.7.0 (FlattenBaseTokenOrchestrator.sol#3)
        - ^0.6.0 (FlattenBaseTokenOrchestrator.sol#68)
        - ^0.6.0 (FlattenBaseTokenOrchestrator.sol#109)
        - 0.6.12 (FlattenBaseTokenOrchestrator.sol#216)
        - 0.6.12 (FlattenBaseTokenOrchestrator.sol#299)
        - >=0.4.22<0.8.0 (FlattenBaseTokenOrchestrator.sol#325)
        - ^0.6.0 (FlattenBaseTokenOrchestrator.sol#1863)
        - ^0.6.0 (FlattenBaseTokenOrchestrator.sol#1941)
        - ^0.6.2 (FlattenBaseTokenOrchestrator.sol#2094)
        - 0.6.12 (FlattenBaseTokenOrchestrator.sol#2155)
        - 0.6.12 (FlattenBaseTokenOrchestrator.sol#2475)
        - 0.6.12 (FlattenBaseTokenOrchestrator.sol#2487)
        - 0.6.12 (FlattenBaseTokenOrchestrator.sol#2496)
        - 0.6.12 (FlattenBaseTokenOrchestrator.sol#2542)
        - 0.6.12 (FlattenBaseTokenOrchestrator.sol#2852)
        - 0.6.12 (FlattenBaseTokenOrchestrator.sol#3151)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#different-pragma-directives-are-used
INFO:Detectors:
Pragma version>=0.4.24<0.7.0 (FlattenBaseTokenOrchestrator.sol#3) allows old versions
Pragma version^0.6.0 (FlattenBaseTokenOrchestrator.sol#68) allows old versions
Pragma version^0.6.0 (FlattenBaseTokenOrchestrator.sol#109) allows old versions
Pragma version0.6.12 (FlattenBaseTokenOrchestrator.sol#216) necessitates a version too recent to be trusted. Consider deploying with 0.6.11
Pragma version0.6.12 (FlattenBaseTokenOrchestrator.sol#299) necessitates a version too recent to be trusted. Consider deploying with 0.6.11
Pragma version>=0.4.22<0.8.0 (FlattenBaseTokenOrchestrator.sol#325) is too complex
Pragma version^0.6.0 (FlattenBaseTokenOrchestrator.sol#1863) allows old versions
Pragma version^0.6.0 (FlattenBaseTokenOrchestrator.sol#1941) allows old versions
Pragma version^0.6.2 (FlattenBaseTokenOrchestrator.sol#2094) allows old versions
Pragma version0.6.12 (FlattenBaseTokenOrchestrator.sol#2155) necessitates a version too recent to be trusted. Consider deploying with 0.6.11
Pragma version0.6.12 (FlattenBaseTokenOrchestrator.sol#2475) necessitates a version too recent to be trusted. Consider deploying with 0.6.11
Pragma version0.6.12 (FlattenBaseTokenOrchestrator.sol#2487) necessitates a version too recent to be trusted. Consider deploying with 0.6.11
Pragma version0.6.12 (FlattenBaseTokenOrchestrator.sol#2496) necessitates a version too recent to be trusted. Consider deploying with 0.6.11
Pragma version0.6.12 (FlattenBaseTokenOrchestrator.sol#2542) necessitates a version too recent to be trusted. Consider deploying with 0.6.11
Pragma version0.6.12 (FlattenBaseTokenOrchestrator.sol#2852) necessitates a version too recent to be trusted. Consider deploying with 0.6.11
Pragma version0.6.12 (FlattenBaseTokenOrchestrator.sol#3151) necessitates a version too recent to be trusted. Consider deploying with 0.6.11
solc-0.6.12 is not recommended for deployment
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#incorrect-versions-of-solidity
INFO:Detectors:
Low level call in Address.sendValue(address,uint256) (FlattenBaseTokenOrchestrator.sol#2144-2150):
        - (success) = recipient.call{value: amount}() (FlattenBaseTokenOrchestrator.sol#2148)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#low-level-calls
```

```
INFO:Detectors:
Variable Initializable._____gap (FlattenBaseTokenOrchestrator.sol#63) is not in mixedCase
Function ContextUpgradeSafe.__Context_init() (FlattenBaseTokenOrchestrator.sol#85-87) is not in mixedCase
Function ContextUpgradeSafe.__Context_init_unchained() (FlattenBaseTokenOrchestrator.sol#89-92) is not in mixedCase
Variable ContextUpgradeSafe.__gap (FlattenBaseTokenOrchestrator.sol#104) is not in mixedCase
Function OwnableUpgradeSafe.__Ownable_init() (FlattenBaseTokenOrchestrator.sol#133-136) is not in mixedCase
Function OwnableUpgradeSafe.__Ownable_init_unchained() (FlattenBaseTokenOrchestrator.sol#138-145) is not in mixedCase
Variable OwnableUpgradeSafe.__gap (FlattenBaseTokenOrchestrator.sol#185) is not in mixedCase
Contract console (FlattenBaseTokenOrchestrator.sol#327-1859) is not in CapWords
Function ERC20UpgradeSafe.__ERC20_init(string,string) (FlattenBaseTokenOrchestrator.sol#2210-2213) is not in mixedCase
Function ERC20UpgradeSafe.__ERC20_init_unchained(string,string) (FlattenBaseTokenOrchestrator.sol#2215-2222) is not in mixedCase
Variable ERC20UpgradeSafe.__gap (FlattenBaseTokenOrchestrator.sol#2470) is not in mixedCase
Parameter ERC677Token.transferAndCall(address,uint256,bytes)._to (FlattenBaseTokenOrchestrator.sol#2508) is not in mixedCase
Parameter ERC677Token.transferAndCall(address,uint256,bytes)._value (FlattenBaseTokenOrchestrator.sol#2508) is not in mixedCase
Parameter ERC677Token.transferAndCall(address,uint256,bytes)._data (FlattenBaseTokenOrchestrator.sol#2508) is not in mixedCase
Parameter ERC677Token.contractFallback(address,uint256,bytes)._to (FlattenBaseTokenOrchestrator.sol#2521) is not in mixedCase
Parameter ERC677Token.contractFallback(address,uint256,bytes)._value (FlattenBaseTokenOrchestrator.sol#2521) is not in mixedCase
Parameter ERC677Token.contractFallback(address,uint256,bytes)._data (FlattenBaseTokenOrchestrator.sol#2521) is not in mixedCase
Parameter ERC677Token.isContract(address)._addr (FlattenBaseTokenOrchestrator.sol#2528) is not in mixedCase
Parameter BaseTokenMonetaryPolicy.initialize(BaseToken,uint256).BASE_ (FlattenBaseTokenOrchestrator.sol#3080) is not in mixedCase
Variable BaseTokenMonetaryPolicy.BASE (FlattenBaseTokenOrchestrator.sol#2887) is not in mixedCase
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#conformity-to-solidity-naming-conventions
INFO:Detectors:
console.slitherConstructorConstantVariables() (FlattenBaseTokenOrchestrator.sol#327-1859) uses literals with too many digits:
        - CONSOLE_ADDRESS = address(0x000000000000000000636F6e736F6c652e6c6f67) (FlattenBaseTokenOrchestrator.sol#328)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#too-many-digits
```

```
INFO:Detectors:
SafeMathInt.MAX_INT256 (FlattenBaseTokenOrchestrator.sol#225) is never used in SafeMathInt (FlattenBaseTokenOrchestrator.sol#223-295)
Initializable._____gap (FlattenBaseTokenOrchestrator.sol#63) is never used in BaseToken (FlattenBaseTokenOrchestrator.sol#2560-2848)
OwnableUpgradeSafe.__gap (FlattenBaseTokenOrchestrator.sol#185) is never used in BaseToken (FlattenBaseTokenOrchestrator.sol#2560-2848)
Initializable._____gap (FlattenBaseTokenOrchestrator.sol#63) is never used in BaseTokenMonetaryPolicy (FlattenBaseTokenOrchestrator.sol#2874-3147)
OwnableUpgradeSafe.__gap (FlattenBaseTokenOrchestrator.sol#185) is never used in BaseTokenMonetaryPolicy (FlattenBaseTokenOrchestrator.sol#2874-3147)
Initializable._____gap (FlattenBaseTokenOrchestrator.sol#63) is never used in BaseTokenOrchestrator (FlattenBaseTokenOrchestrator.sol#3161-3305)
OwnableUpgradeSafe.__gap (FlattenBaseTokenOrchestrator.sol#185) is never used in BaseTokenOrchestrator (FlattenBaseTokenOrchestrator.sol#3161-3305)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#unused-state-variables
INFO:Detectors:
renounceOwnership() should be declared external:
        - OwnableUpgradeSafe.renounceOwnership() (FlattenBaseTokenOrchestrator.sol#170-173)
transferOwnership(address) should be declared external:
        - OwnableUpgradeSafe.transferOwnership(address) (FlattenBaseTokenOrchestrator.sol#179-183)
name() should be declared external:
        - ERC20UpgradeSafe.name() (FlattenBaseTokenOrchestrator.sol#2228-2230)
symbol() should be declared external:
        - ERC20UpgradeSafe.symbol() (FlattenBaseTokenOrchestrator.sol#2236-2238)
decimals() should be declared external:
        - ERC20UpgradeSafe.decimals() (FlattenBaseTokenOrchestrator.sol#2253-2255)
totalSupply() should be declared external:
        - BaseToken.totalSupply() (FlattenBaseTokenOrchestrator.sol#2708-2715)
        - ERC20UpgradeSafe.totalSupply() (FlattenBaseTokenOrchestrator.sol#2260-2262)
balanceOf(address) should be declared external:
        - BaseToken.balanceOf(address) (FlattenBaseTokenOrchestrator.sol#2721-2728)
        - ERC20UpgradeSafe.balanceOf(address) (FlattenBaseTokenOrchestrator.sol#2267-2269)
allowance(address,address) should be declared external:
        - BaseToken.allowance(address,address) (FlattenBaseTokenOrchestrator.sol#2757-2764)
        - ERC20UpgradeSafe.allowance(address,address) (FlattenBaseTokenOrchestrator.sol#2287-2289)
approve(address,uint256) should be declared external:
        - BaseToken.approve(address,uint256) (FlattenBaseTokenOrchestrator.sol#2801-2809)
        - ERC20UpgradeSafe.approve(address,uint256) (FlattenBaseTokenOrchestrator.sol#2298-2301)
transferFrom(address,address,uint256) should be declared external:
        - ERC20UpgradeSafe.transferFrom(address,address,uint256) (FlattenBaseTokenOrchestrator.sol#2315-2319)
        - BaseToken.transferFrom(address,address,uint256) (FlattenBaseTokenOrchestrator.sol#2772-2788)
increaseAllowance(address,uint256) should be declared external:
        - BaseToken.increaseAllowance(address,uint256) (FlattenBaseTokenOrchestrator.sol#2818-2826)
        - ERC20UpgradeSafe.increaseAllowance(address,uint256) (FlattenBaseTokenOrchestrator.sol#2333-2336)
decreaseAllowance(address,uint256) should be declared external:
        - BaseToken.decreaseAllowance(address,uint256) (FlattenBaseTokenOrchestrator.sol#2834-2847)
        - ERC20UpgradeSafe.decreaseAllowance(address,uint256) (FlattenBaseTokenOrchestrator.sol#2352-2355)
transferAndCall(address,uint256,bytes) should be declared external:
        - ERC677Token.transferAndCall(address,uint256,bytes) (FlattenBaseTokenOrchestrator.sol#2508-2519)
        - ERC677.transferAndCall(address,uint256,bytes) (FlattenBaseTokenOrchestrator.sol#2480)
onTokenTransfer(address,uint256,bytes) should be declared external:
        - ERC677Receiver.onTokenTransfer(address,uint256,bytes) (FlattenBaseTokenOrchestrator.sol#2491)
initialize() should be declared external:
        - BaseToken.initialize() (FlattenBaseTokenOrchestrator.sol#2672-2691)
setUserBanStatus(address,bool) should be declared external:
        - BaseToken.setUserBanStatus(address,bool) (FlattenBaseTokenOrchestrator.sol#2693-2703)
initialize(BaseToken,uint256) should be declared external:
        - BaseTokenMonetaryPolicy.initialize(BaseToken,uint256) (FlattenBaseTokenOrchestrator.sol#3080-3098)
initialize(address) should be declared external:
        - BaseTokenOrchestrator.initialize(address) (FlattenBaseTokenOrchestrator.sol#3175-3181)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#public-function-that-could-be-declared-external
```

3.5 AUTOMATED SECURITY SCAN - INFORMATIONAL

Halborn used automated security scanners to assist with detection of well-known security issues, and to identify low-hanging fruit on the targets for this engagement. Among the tools used was MythX, a security analysis service for Ethereum smart contracts. MythX performed a scan on the testers machine and sent the compiled results to the analyzers to locate any vulnerabilities. Security Detections are only in scope, and the analysis was pointed towards issues with BaseTokenOrchestrator.sol and ERC20UpgradeSafe.sol.

MythX detected 0 High findings, 3 Medium, and 7 Low.

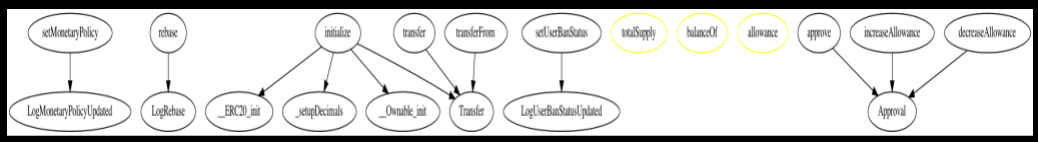
0 High | 3 Medium | 7 Low

ID	SEVERITY	NAME	FILE	LOCATION
SWC-128	Medium	Loop over unbounded data structure.	BaseTokenOrchestrator.sol	L: 50 C: 25
SWC-128	Medium	Implicit loop over unbounded data structure.	BaseTokenOrchestrator.sol	L: 53 C: 70
SWC-128	Medium	Implicit loop over unbounded data structure.	BaseTokenOrchestrator.sol	L: 89 C: 12
SWC-108	Low	State variable visibility is not set.	BaseTokenOrchestrator.sol	L: 18 C: 11
SWC-108	Low	State variable visibility is not set.	BaseTokenOrchestrator.sol	L: 19 C: 14
SWC-108	Low	State variable visibility is not set.	BaseTokenOrchestrator.sol	L: 20 C: 12
SWC-115	Low	Use of "tx.origin" as a part of authorization control.	BaseTokenOrchestrator.sol	L: 46 C: 30
SWC-131	Low	Unused function parameter "from".	ERC20UpgradeSafe.sol	L: 315 C: 34
SWC-131	Low	Unused function parameter "to".	ERC20UpgradeSafe.sol	L: 315 C: 48
SWC-131	Low	Unused function parameter "amount".	ERC20UpgradeSafe.sol	L: 315 C: 60

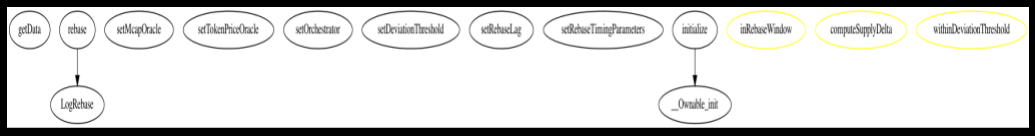
3.6 SOLGRAPH - INFORMATIONAL

Solgraph is a tool to visualize an insight into the execution flow of a smart contract. In this way, it is possible to detect potential vulnerabilities through the flow of functions within a smart contract.

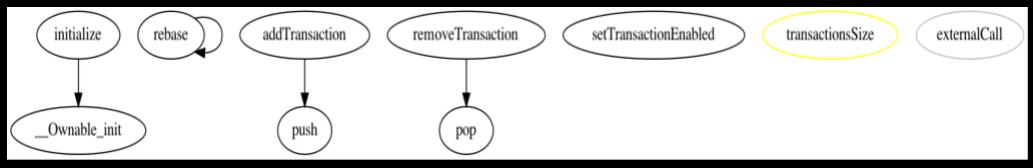
BaseToken.sol



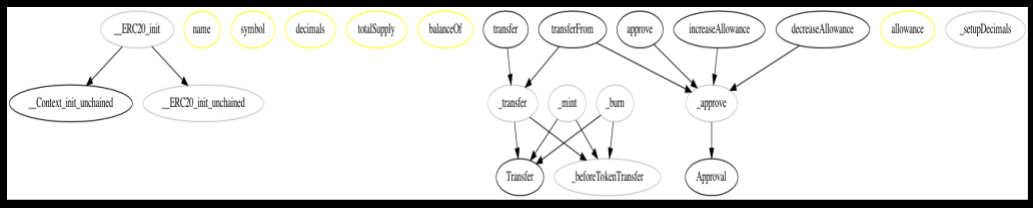
BaseTokenMonetaryPolicy.sol



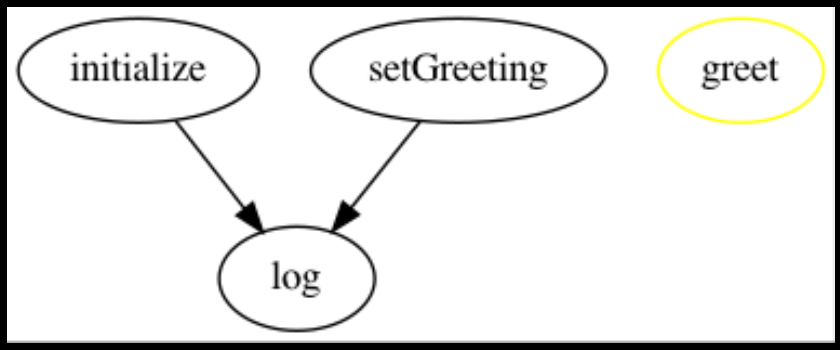
BaseTokenOrchestrastor.sol



ERC20UpgradeSafe.sol


_ERC20_init
name
symbol
decimals
totalSupply
balanceOf
transfer
transferFrom
approve
increaseAllowance
decreaseAllowance
allowance
_setupDecimals
_Context_init_unchained
_ERC20_init_unchained
_transfer
_mint
_burn
_approve
Transfer
_beforeTokenTransfer
Approval

Greeter.sol


initialize
setGreeting
greet
log

THANK YOU FOR CHOOSING

// HALBORN