Ocean Protocol

Smart Contract Security Audit

Prepared by: **Halborn**

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Visit: **Halborn.com**

DOCUMENT REVISION HISTORY

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EXECUTIVE OVERVIEW

1.1 INTRODUCTION

Ocean Protocol engaged Halborn to conduct a security assessment on their smart contracts v4main branch beginning on October 24th, 2021 and ending November 12th, 2021. This security assessment was scoped to the smart contracts v4main branch code in Solidity. In March 2022, Halborn reviewed the code changes that were applied since the original assessment, to ensure that the release product functioned correctly and did not present additional security concerns.

Halborn recommends that the following corrective actions are implemented to mitigate the identified security issues:

- Add checks to make sure token transfers have been successful
- Add zero address and zero amount checks where missing
- Make sure external dependencies are up-to-date
- Implement re-entrancy prevention where missing
- Lock the pragma version and be consistent across the entire set of contracts.
- Replace the use of block.timestamp with block.number or use oracles instead

1.2 AUDIT SUMMARY

The team at Halborn was provided three weeks for the engagement and assigned two full time security engineer to audit the security of the smart contract. A security engineer is a blockchain and smart-contract security expert with advanced penetration testing, smart-contract hacking, and deep knowledge of multiple blockchain protocols.

The purpose of this audit was to achieve the following:

- Ensure that all v4main Contract functions are intended
- Identify potential security issues with the assets in scope

In summary, Halborn identified some security risks that were mostly addressed by the Ocean Protocol team.

In March 2022, Halborn reviewed the final changes to the smart contracts before launch. The changes included a restructuring of access control to ensure that the contract code is simpler and more secure. In more details, changes have been applied to the ownership of FixedRateExchange and Dispenser. At the time of writing, these contracts would be owned by users with the ERC20Deployer role or the owner of the NFT #1. This prevents permission issues with transfers of NFT token #1 to a new user. Additionally, further controls were added to prevent creating pools with the same datatoken as a pair, and proper transfer of datatokens and fees prior to NFT ownership transfer.

Finally, the NFT contract code was restructured to implement EIP165 and registry interfaces to ensure that it complies with ERC721 standards.

1.3 TEST APPROACH & METHODOLOGY

Halborn performed a combination of manual and automated security testing to balance efficiency, timeliness, practicality, and accuracy in regard to the scope of this audit. While manual testing is recommended to uncover flaws in logic, process,and implementation; automated testing techniques help enhance coverage of the Ocean Protocol contract solidity code 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 review 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.
- Manual testing by custom scripts.

- Scanning of solidity files for vulnerabilities, security hotspots or bugs. (MythX)
- Static Analysis of security for scoped contract, and imported functions. (Slither)
- Testnet deployment (Remix IDE)

RISK METHODOLOGY:

Vulnerabilities or issues observed by Halborn are ranked based on the risk assessment methodology by measuring the **LIKELIHOOD** of a security incident and the **IMPACT** should an incident occur. This framework works for communicating the characteristics and impacts of technology vulnerabilities. The quantitative model ensures repeatable and accurate measurement while enabling users to see the underlying vulnerability characteristics that were used to generate the Risk scores. For every vulnerability, a risk level will be calculated on a scale of 5 to 1 with 5 being the highest likelihood or impact.

RISK SCALE - LIKELIHOOD

5 - Almost certain an incident will occur.
4 - High probability of an incident occurring.
3 - Potential of a security incident in the long term.
2 - Low probability of an incident occurring.
1 - Very unlikely issue will cause an incident.

RISK SCALE - IMPACT

5 - May cause devastating and unrecoverable impact or loss.
4 - May cause a significant level of impact or loss.
3 - May cause a partial impact or loss to many.
2 - May cause temporary impact or loss.
1 - May cause minimal or un-noticeable impact.

The risk level is then calculated using a sum of these two values, creating a value of 10 to 1 with 10 being the highest level of security risk.

10 - CRITICAL
9 - 8 - HIGH
7 - 6 - MEDIUM
5 - 4 - LOW
3 - 1 - VERY LOW AND INFORMATIONAL

1.4 SCOPE

IN-SCOPE : Ocean Protocol v4main contracts GitHub repository

POST AUDIT REPOSITORY : Ocean Protocol v4main postaudit GitHub repository

The security assessment was scoped to the following smart contracts:

```
contracts/ERC721Factory.sol
contracts/templates/ERC20Template.sol
contracts/templates/ERC20TemplateEnterprise.sol
contracts/templates/ERC721Template.sol
contracts/utils/ERC721RolesAddress.sol
contracts/utils/UtilsLib.sol
contracts/utils/Ownable.sol
contracts/utils/Deployer.sol
contracts/utils/ERC20Roles.sol
contracts/utils/ERC721/IERC721Enumerable.sol
contracts/utils/ERC721/IERC721Receiver.sol
contracts/utils/ERC721/IERC721Metadata.sol
contracts/utils/ERC721/ERC721.sol
contracts/utils/ERC721/Context.sol
contracts/utils/ERC721/IERC721.sol
contracts/utils/ERC721/Address.sol
contracts/utils/ERC721/Strings.sol
contracts/utils/ERC725/ERC725Ocean.sol
contracts/pools/ssContracts/SideStaking.sol
contracts/pools/dispenser/Dispenser.sol
contracts/pools/FactoryRouter.sol
contracts/pools/balancer/BConst.sol
contracts/pools/balancer/BFactory.sol
contracts/pools/balancer/BMath.sol
contracts/pools/balancer/BToken.sol
contracts/pools/balancer/BPool.sol
contracts/pools/balancer/BNum.sol
contracts/pools/fixedRate/FixedRateExchange.sol
contracts/interfaces/ISideStaking.sol
contracts/interfaces/IFactoryRouter.sol
contracts/interfaces/IFactory.sol
contracts/interfaces/IMetadata.sol
contracts/interfaces/IDispenser.sol
```

```
34 contracts/interfaces/IERC20Template.sol
35 contracts/interfaces/IERC721Template.sol
36 contracts/interfaces/IFixedRateExchange.sol
37 contracts/interfaces/IERC725X.sol
38 contracts/interfaces/IERC725Y.sol
39 contracts/interfaces/IERC20.sol
40 contracts/interfaces/IV3Factory.sol
41 contracts/interfaces/IERC1271.sol
42 contracts/interfaces/IV3ERC20.sol
43 contracts/interfaces/IPool.sol
44 contracts/communityFee/OPFCommunityFeeCollector.sol
```

Commit-ID : 0ecfd02598901ffa86a1aff71e7bfe92513a23a1
OUT-OF-SCOPE : External libraries and economics attacks

Halborn eventually reviewed the final version of the code to ensure that audit fixes carried over and that the new commits did not affect the security of the product. Code changes were reviewed in the v1.0.0-rc1 branch, which was eventually merged into v4main which can be found at GitHub.

2. ASSESSMENT SUMMARY & FINDINGS OVERVIEW

CRITICAL	HIGH	MEDIUM	LOW	INFORMATIONAL
0	3	2	10	7

LIKELIHOOD

IMPACT

(HAL-06)	(HAL-04) (HAL-05)		(HAL-03)	(HAL-01) (HAL-02)
(HAL-11) (HAL-12)	(HAL-08) (HAL-09) (HAL-10) (HAL-13)			
(HAL-16) (HAL-18)	(HAL-14) (HAL-15)	(HAL-07)		
(HAL-17) (HAL-19) (HAL-20) (HAL-21) (HAL-22)				

SECURITY ANALYSIS	RISK LEVEL	REMEDIATION DATE
HAL01 - MINT ATTACK AFTER NFT TRANSFER	High	SOLVED - 03/23/2022
HAL02 - MINT ATTACK WITH WORTHLESS TOKEN	High	SOLVED - 03/23/2022
HAL03 - DT TOKEN STAKING NOT CALCULATED CORRECTLY	High	SOLVED - 03/24/2022
HAL04 - UNCHECKED TRANSFER	Medium	SOLVED - 12/13/2021
HAL05 - MULTIPLE EXTERNAL CALLS WITHIN LOOP MAY LEAD TO DENIAL OF SERVICE(DOS)	Medium	PARTIALLY SOLVED - 12/13/2021
HAL06 - RE-ENTRANCY PROTECTION	Low	PARTIALLY SOLVED - 12/13/2021
HAL07 - IGNORED RETURN VALUES	Low	PARTIALLY SOLVED - 12/13/2021
HAL08 - MISSING ZERO-ADDRESS CHECK	Low	SOLVED - 12/13/2021
HAL09 - DIVIDE BEFORE MULTIPLY	Low	SOLVED - 12/13/2021
HAL10 - USE OF BLOCK-TIMESTAMP	Low	RISK ACCEPTED
HAL11 - EXPERIMENTAL FEATURES ENABLED	Low	SOLVED - 12/13/2021
HAL12 - FLOATING PRAGMA	Low	SOLVED - 12/13/2021
HAL13 - OUTDATED DEPENDENCIES	Low	SOLVED - 12/13/2021
HAL14 - PRAGMA VERSION DEPRECATED	Low	SOLVED - 12/13/2021
HAL15 - MULTIPLE PRAGMA DEFINITIONS	Low	SOLVED - 12/13/2021
HAL16 - REDUNDANT BOOLEAN COMPARISON	Informational	SOLVED - 12/13/2021
HAL17 - USE OF INLINE ASSEMBLY	Informational	ACKNOWLEDGED

HAL18 - REDUNDANT VARIABLES	Informational	SOLVED - 12/13/2021
HAL19 - POSSIBLE MISUSE OF PUBLIC FUNCTIONS	Informational	PARTIALLY SOLVED - 12/13/2021
HAL20 - POTENTIAL UNSAFE CALCULATION	Informational	SOLVED - 12/13/2021
HAL21 - GAS OPTIMIZATIONS	Informational	SOLVED - 02/23/2022

FINDINGS & TECH DETAILS

3.1 (HAL-01) MINT ATTACK AFTER NFT TRANSFER - HIGH

Description:

In the FixedRateExchange and Dispenser contracts, users can transfer the ownership of NFT #1 to another user after having created a fixed rate exchange and dispenser instance. After transferring ownership, the roles were cleaned up; however, after the new owner created another fixed-rate exchange/dispenser instance, the original contract would once again have minting rights, allowing the first user to mint new tokens and collect base tokens.

Code Location:

The issues were present in the FixedRateExchange.sol and Dispenser.sol contracts.

Risk Level:

Likelihood - 5
Impact - 4

Recommendation:

As this was due to the permissions set out in the fixed-rate exchange and dispenser contracts, the issue could be remediated by enforcing ownership of the accounts instead of the contract.

Remediation Plan:

SOLVED: The issue was fixed by the team after refactoring the permissions of the FixedRateExchanges and Dispenser contracts to accept as owners only the owner of NFT #1 and users with ERC20Deployer roles.

3.2 (HAL-02) MINT ATTACK WITH WORTHLESS TOKEN - HIGH

Description:

In the FixedRateExchange contract, users can create a new fixed-rate exchange associated with a datatoken using a worthless ERC20 token as the base token. The attacker would be able to swap their tokens for datatokens and then sell the datatokens to the first exchange.

Risk Level:

Likelihood - 5
Impact - 4

Recommendation:

Since this was because any user could create a new fixed rate exchange, the issue could be solved by restricting unauthorized users from creating a fixed rate exchange.

Remediation Plan:

SOLVED: The issue was fixed by the team after refactoring the creation of the fixed-rate exchange functionality to only allow users with the role ERC20Deployer or the owner of NFT #1.

3.3 (HAL-03) DT TOKEN STAKE NOT CALCULATED SUCCESSFULLY - HIGH

Description:

Within the BPool contract, the order of instructions resulted in wrong calculations. After the users called the joinSwapExternAmountIn function, calculations were made on the provided supply and the pool share was minted. Later, the side staking bot (ssBot) would provide their share. However, the calculations were made on the totalSupply without taking into account that this would have changed after the shares were minting. This ultimately resulted in miscalculations in the future.

Code Location:

The issue was present in the Bpool.sol contract on line 1053, 1064 and 1042.

Listing 1

```
1   function joinswapExternAmountIn(
2         uint256 tokenAmountIn,
3         uint256 minPoolAmountOut
4     ) external _lock_ returns (uint256 poolAmountOut) {
5         //tokenIn = _baseTokenAddress;
6         require(_finalized, "ERR_NOT_FINALIZED");
7         _checkBound(_baseTokenAddress);
8         require(
9             tokenAmountIn <= bmul(_records[_baseTokenAddress].
↳ balance, MAX_IN_RATIO),
10            "ERR_MAX_IN_RATIO"
11        );
12        //ask ssContract
13        Record storage inRecord = _records[_baseTokenAddress];
14
15        poolAmountOut = calcPoolOutGivenSingleIn(
16            inRecord.balance,
17            inRecord.denorm,
18            _totalSupply,
19            _totalWeight,
```

```
20              tokenAmountIn
21          );
22
23          require(poolAmountOut >= minPoolAmountOut, "ERR_LIMIT_OUT"
↳ );
24
25          inRecord.balance = badd(inRecord.balance, tokenAmountIn);
26
27          emit LOG_JOIN(msg.sender, _baseTokenAddress, tokenAmountIn
↳ , block.timestamp);
28          emit LOG_BPT(poolAmountOut);
29          _mintPoolShare(poolAmountOut);
30          _pushPoolShare(msg.sender, poolAmountOut);
31
32          _pullUnderlying(_baseTokenAddress, msg.sender,
↳ tokenAmountIn);
33
34          //ask the ssContract to stake as well
35          //calculate how much should the 1ss stake
36          Record storage ssInRecord = _records[_datatokenAddress];
37          uint256 ssAmountIn = calcSingleInGivenPoolOut(
38              ssInRecord.balance,
39              ssInRecord.denorm,
40              _totalSupply,
41              _totalWeight,
42              poolAmountOut
43          );
44          if (ssContract.canStake(_datatokenAddress, ssAmountIn)) {
45              //call 1ss to approve
46              ssContract.Stake(_datatokenAddress, ssAmountIn);
47              // follow the same path
48              ssInRecord.balance = badd(ssInRecord.balance,
↳ ssAmountIn);
49              emit LOG_JOIN(
50                  _controller,
51                  _datatokenAddress,
52                  ssAmountIn,
53                  block.timestamp
54              );
55              emit LOG_BPT_SS(poolAmountOut);
56              _mintPoolShare(poolAmountOut);
57              _pushPoolShare(_controller, poolAmountOut);
58              _pullUnderlying(_datatokenAddress, _controller,
↳ ssAmountIn);
```

```
59          }
60          return poolAmountOut;
61      }
```

Risk Level:

Likelihood - 4
Impact - 4

Recommendation:

The issue could be solved by minting shares, after the ssBot provides its part to ensure the correct totalSupply amount is considered in the calculations.

Remediation Plan:

SOLVED: Ocean protocol amended the affected lines to ensure that the totalSupply argument used in the calculations matched between the user's staking data tokens and the side staking bot - GitHub pull request fix.

3.4 (HAL-04) UNCHECKED TRANSFER - MEDIUM

Description:

In the ERC20Tempalte.sol, FactoryRouter.sol contracts, Dispenser.sol, SideStaking.sol, BPool.sol, OPFCommunityFeeCollector.sol and FixedRateExchange.sol, the return values of the external transfer calls are not checked. It should be noted that token is not reverted in case of failure and returns false. If one of these tokens is used, a deposit would not be reverted if the transfer fails, and an attacker could deposit tokens for free.

Code Location:

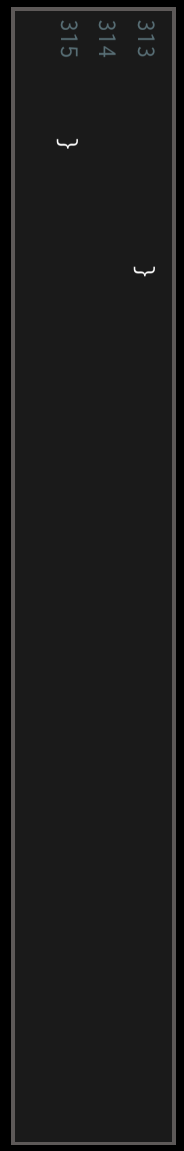
FactoryRouter

Listing 2: FactoryRouter.sol (Lines 275,299)

```
262     function buyDTBatch(
263         Operations[] calldata _operations
264         )
265         external {
266 
267             for (uint i= 0; i< _operations.length; i++) {
268 
269                 [Redacted for brevity]
270                 } else if (_operations[i].operation ==
 ↳ operationType.SwapExactOut){
271                     // calculate how much amount In we need for
 ↳ exact Out
272                     uint amountIn = IPool(_operations[i].source)
273                     .getAmountInExactOut(_operations[i].tokenIn,
 ↳ _operations[i].tokenOut,_operations[i].amountsOut);
274                     // pull amount In from user
275                     IERC20(_operations[i].tokenIn).transferFrom(
 ↳ msg.sender,address(this),amountIn);
276                     // we approve pool to pull token from router
277                     IERC20(_operations[i].tokenIn).approve(
 ↳ _operations[i].source,amountIn);
```

```
278                     // perform swap
279                     IPool(_operations[i].source)
280                     .swapExactAmountOut(_operations[i].tokenIn,
281                     _operations[i].amountsIn,
282                     _operations[i].tokenOut,
283                     _operations[i].amountsOut,
284                     _operations[i].maxPrice);
285                     // send amount out back to user
286                     require(IERC20(_operations[i].tokenOut)
287                     .transfer(msg.sender,_operations[i].amountsOut
 ↳ ),'Failed MultiSwap');
288 
289                 } else if (_operations[i].operation ==
 ↳ operationType.FixedRate) {
290                     // get datatoken address
291                     (,address datatoken,,,,,,,,,) =
292                     IFixedRateExchange(_operations[i].source).
 ↳ getExchange(_operations[i].exchangeIds);
293                     // get tokenIn amount required for dt out
294                     (uint baseTokenAmount,,,) =
295                     IFixedRateExchange(_operations[i].source).
296                     calcBaseInGivenOutDT(_operations[i].
 ↳ exchangeIds,_operations[i].amountsOut);
297 
298                     // pull tokenIn amount
299                     IERC20(_operations[i].tokenIn).transferFrom(
 ↳ msg.sender,address(this),baseTokenAmount);
300                      // we approve pool to pull token from router
301                     IERC20(_operations[i].tokenIn).approve(
 ↳ _operations[i].source,baseTokenAmount);
302                     // perform swap
303                     IFixedRateExchange(_operations[i].source)
304                     .buyDT(_operations[i].exchangeIds,_operations[
 ↳ i].amountsOut,_operations[i].amountsIn);
305                     // send dt out to user
306                     IERC20(datatoken).transfer(msg.sender,
 ↳ _operations[i].amountsOut);
307 
308                 } else {
309                     IDispenser(_operations[i].source)
310                     .dispense(_operations[i].tokenOut,_operations[
 ↳ i].amountsOut,msg.sender);
311 
312                 }
```

FINDINGS & TECH DETAILS



Dispenser

Listing 3: Dispenser.sol (Line 248)

```
236     function ownerWithdraw(address datatoken) external{
237         require(
238             datatoken != address(0),
239             'Invalid token contract address'
240         );
241         require(
242             datatokens[datatoken].owner == msg.sender,
243             'Invalid owner'
244         );
245         IERC20Template tokenInstance = IERC20Template(datatoken);
246         uint256 ourBalance = tokenInstance.balanceOf(address(this)
 ↳ );
247         if(ourBalance>0){
248             tokenInstance.transfer(msg.sender,ourBalance);
249             emit OwnerWithdrawed(datatoken, msg.sender, ourBalance
 ↳ );
250         }
251     }
```

Dispenser

Listing 4: Dispenser.sol (Line 227)

```
187     function dispense(address datatoken, uint256 amount, address
 ↳ destination) external payable{
188         require(
189             datatoken != address(0),
190             'Invalid token contract address'
191         );
192         require(
193             datatokens[datatoken].active == true,
194             'Dispenser not active'
195         );
196         require(
197             amount > 0,
198             'Invalid zero amount'
199         );
200         require(
201             datatokens[datatoken].maxTokens >= amount,
202             'Amount too high'
```

```
203         );
204         if(datatokens[datatoken].allowedSwapper != address(0)){
205             require(
206                 datatokens[datatoken].allowedSwapper == msg.sender
 ↳ ,
207                 "This address is not allowed to request DT"
208             );
209         }
210 
211         IERC20Template tokenInstance = IERC20Template(datatoken);
212         uint256 callerBalance = tokenInstance.balanceOf(
 ↳ destination);
213         require(
214             callerBalance<datatokens[datatoken].maxBalance,
215             'Caller balance too high'
216         );
217         uint256 ourBalance = tokenInstance.balanceOf(address(this)
 ↳ );
218         if(ourBalance<amount && tokenInstance.isMinter(address(
 ↳ this))){
219             //we need to mint the difference if we can
220             tokenInstance.mint(address(this),amount - ourBalance);
221             ourBalance = tokenInstance.balanceOf(address(this));
222         }
223         require(
224             ourBalance>=amount,
225             'Not enough reserves'
226         );
227         tokenInstance.transfer(destination,amount);
228         emit TokensDispensed(datatoken, destination, amount);
229     }
```

FixedRateExchange

Listing 5: FixedRateExchange.sol (Lines 397,398,399,400)

```
394         } else {
395             exchanges[exchangeId].dtBalance = (exchanges[
 ↳ exchangeId].dtBalance)
396                 .sub(dataTokenAmount);
397             IERC20Template(exchanges[exchangeId].dataToken).
 ↳ transfer(
398                 msg.sender,
```

```
399                 dataTokenAmount
400             );
401         }
```

FixedRateExchange

Listing 6: FixedRateExchange.sol (Lines 477,478,479,480)

```
474         } else {
475             exchanges[exchangeId].btBalance = (exchanges[
 ↳ exchangeId].btBalance)
476                 .sub(baseTokenAmountBeforeFee);
477             IERC20Template(exchanges[exchangeId].baseToken).
 ↳ transfer(
478                 msg.sender,
479                 baseTokenAmount
480             );
481         }
```

FixedRateExchange

Listing 7: FixedRateExchange.sol (Lines 500,501,502,503)

```
496         onlyExchangeOwner(exchangeId)
497     {
498         uint256 amount = exchanges[exchangeId].btBalance;
499         exchanges[exchangeId].btBalance = 0;
500         IERC20Template(exchanges[exchangeId].baseToken).transfer(
501             exchanges[exchangeId].exchangeOwner,
502             amount
503         );
504
```

FixedRateExchange

Listing 8: FixedRateExchange.sol (Lines 519,520,521,522)

```
515         onlyExchangeOwner(exchangeId)
516     {
517         uint256 amount = exchanges[exchangeId].dtBalance;
518         exchanges[exchangeId].dtBalance = 0;
```

```
519         IERC20Template(exchanges[exchangeId].dataToken).transfer(
520             exchanges[exchangeId].exchangeOwner,
521             amount
522         );
523
```

FixedRateExchange

Listing 9: FixedRateExchange.sol (Lines 536,537,538,539)

```
532     function collectMarketFee(bytes32 exchangeId) external {
533         // anyone call call this function, because funds are sent
 ↳ to the correct address
534         uint256 amount = exchanges[exchangeId].marketFeeAvailable;
535         exchanges[exchangeId].marketFeeAvailable = 0;
536         IERC20Template(exchanges[exchangeId].baseToken).transfer(
537             exchanges[exchangeId].marketFeeCollector,
538             amount
539         );
540         emit MarketFeeCollected(
```

FixedRateExchange

Listing 10: FixedRateExchange.sol (Lines 551,552,553,554)

```
548         // anyone call call this function, because funds are sent
 ↳ to the correct address
549         uint256 amount = exchanges[exchangeId].oceanFeeAvailable;
550         exchanges[exchangeId].oceanFeeAvailable = 0;
551         IERC20Template(exchanges[exchangeId].baseToken).transfer(
552             opfCollector,
553             amount
554         );
555         emit OceanFeeCollected(
```

SideStaking

Listing 11: SideStaking.sol (Lines 350,351,352,353)

```
345         IERC20Template lPTokens = IERC20Template(
346             _datatokens[datatokenAddress].poolAddress
```

```
347         );
348         uint256 lpBalance = lPTokens.balanceOf(address(this));
349       //  uint256 balanceToTransfer = lpBalance.div(2);
350         lPTokens.transfer(
351             _datatokens[datatokenAddress].publisherAddress,
352             lpBalance.div(2)
353         );
354     }
```

SideStaking

Listing 12: SideStaking.sol (Line 390)

```
385             amount > 0 &&
386             _datatokens[datatokenAddress].datatokenBalance >=
 ↳ amount
387         ) {
388             IERC20Template dt = IERC20Template(datatokenAddress);
389             _datatokens[datatokenAddress].vestingLastBlock = block
 ↳ .number;
390             dt.transfer(_datatokens[datatokenAddress].
 ↳ publisherAddress, amount);
391             _datatokens[datatokenAddress].datatokenBalance -=
 ↳ amount;
392             _datatokens[datatokenAddress].vestingAmountSoFar +=
 ↳ amount;
393         }
394     }
```

BPool

Listing 13: BPool.sol (Line 257)

```
252     function collectOPF() external {
253         address[] memory tokens = getFinalTokens();
254         for (uint256 i = 0; i < tokens.length; i++) {
255             uint256 amount = communityFees[tokens[i]];
256             communityFees[tokens[i]] = 0;
257             IERC20(tokens[i]).transfer(_opfCollector, amount);
258         }
259     }
```

BPool

Listing 14: BPool.sol (Line 268)

```
261     function collectMarketFee(address to) external {
262         require(_marketCollector == msg.sender, "ONLY MARKET
 ↳ COLLECTOR");
263 
264         address[] memory tokens = getFinalTokens();
265         for (uint256 i = 0; i < tokens.length; i++) {
266             uint256 amount = marketFees[tokens[i]];
267             marketFees[tokens[i]] = 0;
268             IERC20(tokens[i]).transfer(to, amount);
269         }
270     }
```

Risk Level:

Likelihood - 2
Impact - 4

Recommendation:

It is recommended to use SafeERC20, or to ensure that the transfer return value is checked.

Remediation Plan:

SOLVED: The Ocean Protocol team amended the smart contracts to use the safeTransfer functions instead.

3.5 (HAL-05) MULTIPLE EXTERNAL CALLS WITHIN LOOP MAY LEAD TO DENIAL OF SERVICE(DOS) - MEDIUM

Description:

External calls within a loop increase Gas usage or can lead to a denial-of-service attack. In some discovered functions, there is a for loop where multiple external calls are executed. If the integer index variable within the loop evaluates at large numbers, a denial of service could occur.

Code Location:

ERC721Factory

Listing 15: ERC721Factory.sol (Lines 473,474,479,480,481,482,483,484,489,490,491,492,493,494,497,498,499,500,501,503,504,505,506,507,508,509,510)

```
466     function startMultipleTokenOrder(
467         tokenOrder[] memory orders
468     ) external {
469         uint256 ids = orders.length;
470         // TO DO.  We can do better here , by groupping
 ↳ publishMarketFeeTokens and consumeFeeTokens and have a single
471         // transfer for each one, instead of doing it per dt..
472         for (uint256 i = 0; i < ids; i++) {
473             (address publishMarketFeeAddress, address
 ↳ publishMarketFeeToken, uint256 publishMarketFeeAmount)
474                 = IERC20Template(orders[i].tokenAddress).
 ↳ getPublishingMarketFee();
475
476             // check if we have publishFees, if so transfer them
 ↳ to us and approve dttemplate to take them
477             if (publishMarketFeeAmount > 0 &&
 ↳ publishMarketFeeToken!=address(0)
478             && publishMarketFeeAddress!=address(0)) {
```

```
479                 require(IERC20Template(publishMarketFeeToken).
 ↳ transferFrom(
480                     msg.sender,
481                     address(this),
482                     publishMarketFeeAmount
483                 ),'Failed to transfer publishFee');
484                 IERC20Template(publishMarketFeeToken).approve(
 ↳ orders[i].tokenAddress, publishMarketFeeAmount);
485             }
486             // check if we have consumeFees, if so transfer them
 ↳ to us and approve dttemplate to take them
487             if (orders[i].consumeFeeAmount > 0 && orders[i].
 ↳ consumeFeeToken!=address(0)
488             && orders[i].consumeFeeAddress!=address(0)) {
489                 require(IERC20Template(orders[i].consumeFeeToken).
 ↳ transferFrom(
490                     msg.sender,
491                     address(this),
492                     orders[i].consumeFeeAmount
493                 ),'Failed to transfer consumeFee');
494                 IERC20Template(orders[i].consumeFeeToken).approve(
 ↳ orders[i].tokenAddress, orders[i].consumeFeeAmount);
495             }
496             // transfer erc20 datatoken from consumer to us
497             require(IERC20Template(orders[i].tokenAddress).
 ↳ transferFrom(
498                 msg.sender,
499                 address(this),
500                 orders[i].amount
501             ),'Failed to transfer datatoken');
502 
503             IERC20Template(orders[i].tokenAddress).startOrder(
504                 orders[i].consumer,
505                 orders[i].amount,
506                 orders[i].serviceId,
507                 orders[i].consumeFeeAddress,
508                 orders[i].consumeFeeToken,
509                 orders[i].consumeFeeAmount
510             );
511         }
512     }
```

FactoryRouter

Listing 16: FactoryRouter.sol (Lines 271,273,275,276,277,278,279,280,281,284,287,288,290,292,294,295,296,297,298,299,301,302,306,307,309,310,311,314,316,318,319,321,324,325)

```
262     function buyDTBatch(
263         Operations[] calldata _operations
264         )
265         external {
266 
267             for (uint i= 0; i< _operations.length; i++) {
268 
269                 if(_operations[i].operation == operationType.
 ↳ SwapExactIn) {
270                     // Get amountIn from user to router
271                     IERC20(_operations[i].tokenIn).transferFrom(
 ↳ msg.sender,address(this),_operations[i].amountsIn);
272                     // we approve pool to pull token from router
273                     IERC20(_operations[i].tokenIn).approve(
 ↳ _operations[i].source,_operations[i].amountsIn);
274                     // Perform swap
275                     (uint amountReceived,) =
276                     IPool(_operations[i].source)
277                     .swapExactAmountIn(_operations[i].tokenIn,
278                     _operations[i].amountsIn,
279                     _operations[i].tokenOut,
280                     _operations[i].amountsOut,
281                     _operations[i].maxPrice);
282                     // transfer token swapped to user
283 
284                     require(IERC20(_operations[i].tokenOut).
 ↳ transfer(msg.sender,amountReceived),'Failed MultiSwap');
285                 } else if (_operations[i].operation ==
 ↳ operationType.SwapExactOut){
286                     // calculate how much amount In we need for
 ↳ exact Out
287                     uint amountIn = IPool(_operations[i].source)
288                     .getAmountInExactOut(_operations[i].tokenIn,
 ↳ _operations[i].tokenOut,_operations[i].amountsOut);
289                     // pull amount In from user
290                     IERC20(_operations[i].tokenIn).transferFrom(
 ↳ msg.sender,address(this),amountIn);
291                     // we approve pool to pull token from router
292                     IERC20(_operations[i].tokenIn).approve(
 ↳ _operations[i].source,amountIn);
```

```
293                     // perform swap
294                     IPool(_operations[i].source)
295                     .swapExactAmountOut(_operations[i].tokenIn,
296                     _operations[i].amountsIn,
297                     _operations[i].tokenOut,
298                     _operations[i].amountsOut,
299                     _operations[i].maxPrice);
300                     // send amount out back to user
301                     require(IERC20(_operations[i].tokenOut)
302                     .transfer(msg.sender,_operations[i].amountsOut
 ↳ ),'Failed MultiSwap');
303
304                 } else if (_operations[i].operation ==
 ↳ operationType.FixedRate) {
305                     // get datatoken address
306                     (,address datatoken,,,,,,,,,) =
307                     IFixedRateExchange(_operations[i].source).
 ↳ getExchange(_operations[i].exchangeIds);
308                     // get tokenIn amount required for dt out
309                     (uint baseTokenAmount,,,) =
310                     IFixedRateExchange(_operations[i].source).
311                     calcBaseInGivenOutDT(_operations[i].
 ↳ exchangeIds,_operations[i].amountsOut);
312
313                     // pull tokenIn amount
314                     IERC20(_operations[i].tokenIn).transferFrom(
 ↳ msg.sender,address(this),baseTokenAmount);
315                      // we approve pool to pull token from router
316                     IERC20(_operations[i].tokenIn).approve(
 ↳ _operations[i].source,baseTokenAmount);
317                     // perform swap
318                     IFixedRateExchange(_operations[i].source)
319                     .buyDT(_operations[i].exchangeIds,_operations[
 ↳ i].amountsOut,_operations[i].amountsIn);
320                     // send dt out to user
321                     IERC20(datatoken).transfer(msg.sender,
 ↳ _operations[i].amountsOut);
322
323                 } else {
324                     IDispenser(_operations[i].source)
325                     .dispense(_operations[i].tokenOut,_operations[
 ↳ i].amountsOut,msg.sender);
326
327                 }
```

```
328             }
329
330     }
```

ERC721Template

Listing 17: ERC721Template.sol (Line 450)

```
448     function _cleanERC20Permissions(uint256 length) internal {
449         for (uint256 i = 0; i < length; i++) {
450             IERC20Template(deployedERC20List[i]).cleanFrom721();
451         }
452     }
```

BPool

Listing 18: BPool.sol (Line 257)

```
252     function collectOPF() external {
253         address[] memory tokens = getFinalTokens();
254         for (uint256 i = 0; i < tokens.length; i++) {
255             uint256 amount = communityFees[tokens[i]];
256             communityFees[tokens[i]] = 0;
257             IERC20(tokens[i]).transfer(_opfCollector, amount);
258         }
259     }
```

Listing 19: BPool.sol (Line 268)

```
261     function collectMarketFee(address to) external {
262         require(_marketCollector == msg.sender, "ONLY MARKET
 ↳ COLLECTOR");
263
264         address[] memory tokens = getFinalTokens();
265         for (uint256 i = 0; i < tokens.length; i++) {
266             uint256 amount = marketFees[tokens[i]];
267             marketFees[tokens[i]] = 0;
268             IERC20(tokens[i]).transfer(to, amount);
269         }
270     }
```

Risk Level:

Likelihood - 2
Impact - 4

Recommendation:

If possible, use pull over push strategy for external calls. Please refer to the reference section for more details.

Reference:

External Calls Recommendation

Remediation Plan:

PARTIALLY SOLVED: The Ocean Protocol team amended loops to include a maximum amount of iterations for certain functions that can be called externally. The following functions were not modified:

- CollectMarketFee and CollectOPF in the BPool contract.
- CleanERC20Permissions in the ERC721Template contract.

3.6 (HAL-06) MISSING RE-ENTRANCY PROTECTION - LOW

Description:

Testing revealed that within some in-scope contracts, the non-reentrancy guard was missing for functions that handled token transfers. The following list presents the contracts and functions where the guard was missing.

- BPool.sol:
  - exitswapExternAmountOut, exitswapPoolAmountIn, joinswapExternAmountIn, joinswapPoolAmountOut, setup
- Dispenser.sol:
  - dispense, ownerWithdraw
- ERC20Template.sol:
  - deployPool
- ERC721Factory.sol:
  - createNftErcWithDispenser, createNftErcWithFixedRate, createNftErcWithPool, createNftWithErc, deployERC721Contract
- ERC721Template.sol:
  - createERC20
- FixedRateExchange.sol:
  - buyDT, collectBT, collectDT, collectMarketFee, collectOceanFee, sellDT
- SideStaking.sol:
  - getVesting, newDataTokenCreated, notifyFinalize, and Stake

Furthermore, in these function, persistent state reading and writing followed external calls, as well as emitting events after the call, making it vulnerable to a Reentrancy attack.

Code Location:

Listing 20: FixedRateExchange.sol (Lines 364,365,366,367,368,369,370 ,371,373,374,375,395,396)

```
333     function buyDT(bytes32 exchangeId, uint256 dataTokenAmount,
 ↳ uint256 maxBaseTokenAmount)
334         external
335         onlyActiveExchange(exchangeId)
336     {
337         require(
338             dataTokenAmount != 0,
339             "FixedRateExchange: zero data token amount"
340         );
341         if(exchanges[exchangeId].allowedSwapper != address(0)){
342             require(
343                 exchanges[exchangeId].allowedSwapper == msg.sender
 ↳ ,
344                 "FixedRateExchange: This address is not allowed to
 ↳  swap"
345             );
346         }
347         (
348             uint256 baseTokenAmount,
349             uint256 baseTokenAmountBeforeFee,
350             uint256 oceanFeeAmount,
351             uint256 marketFeeAmount
352         ) = calcBaseInGivenOutDT(exchangeId, dataTokenAmount);
353         require(
354             baseTokenAmount <= maxBaseTokenAmount,
355             "FixedRateExchange: Too many base tokens"
356         );
357         // we account fees , fees are always collected in
 ↳ basetoken
358         exchanges[exchangeId].oceanFeeAvailable = exchanges[
 ↳ exchangeId]
359             .oceanFeeAvailable
360             .add(oceanFeeAmount);
361         exchanges[exchangeId].marketFeeAvailable = exchanges[
 ↳ exchangeId]
362             .marketFeeAvailable
363             .add(marketFeeAmount);
364         require(
365             IERC20Template(exchanges[exchangeId].baseToken).
```

```
↳ transferFrom(
366                 msg.sender,
367                 address(this), // we send basetoken to this
↳ address, then exchange owner can withdraw
368                 baseTokenAmount
369             ),
370             "FixedRateExchange: transferFrom failed in the
↳ baseToken contract"
371         );
372 
373         exchanges[exchangeId].btBalance = (exchanges[exchangeId].
↳ btBalance).add(
374             baseTokenAmountBeforeFee
375         );
376 
377         if (dataTokenAmount > exchanges[exchangeId].dtBalance) {
378             //first, let's try to mint
379             if(exchanges[exchangeId].withMint
380             && IERC20Template(exchanges[exchangeId].dataToken).
↳ isMinter(address(this)))
381             {
382                 IERC20Template(exchanges[exchangeId].dataToken).
↳ mint(msg.sender,dataTokenAmount);
383             }
384             else{
385                 require(
386                     IERC20Template(exchanges[exchangeId].dataToken
↳ ).transferFrom(
387                         exchanges[exchangeId].exchangeOwner,
388                         msg.sender,
389                         dataTokenAmount
390                     ),
391                     "FixedRateExchange: transferFrom failed in the
↳  dataToken contract"
392                 );
393             }
394         } else {
395             exchanges[exchangeId].dtBalance = (exchanges[
↳ exchangeId].dtBalance)
396                 .sub(dataTokenAmount);
397             IERC20Template(exchanges[exchangeId].dataToken).
↳ transfer(
398                 msg.sender,
399                 dataTokenAmount
```

```
400             );
401         }
402 
403         emit Swapped(
404             exchangeId,
405             msg.sender,
406             baseTokenAmount,
407             dataTokenAmount,
408             exchanges[exchangeId].dataToken,
409             marketFeeAmount,
410             oceanFeeAmount
411         );
412     }
```

Listing 21: FixedRateExchange.sol (Lines 452,453,454,455,456,457,458,459,461,462,463,475,476)

```
421     function sellDT(bytes32 exchangeId, uint256 dataTokenAmount,
 ↳ uint256 minBaseTokenAmount)
422         external
423         onlyActiveExchange(exchangeId)
424     {
425         require(
426             dataTokenAmount != 0,
427             "FixedRateExchange: zero data token amount"
428         );
429         if(exchanges[exchangeId].allowedSwapper != address(0)){
430             require(
431                 exchanges[exchangeId].allowedSwapper == msg.sender
 ↳ ,
432                 "FixedRateExchange: This address is not allowed to
 ↳  swap"
433             );
434         }
435         (
436             uint256 baseTokenAmount,
437             uint256 baseTokenAmountBeforeFee,
438             uint256 oceanFeeAmount,
439             uint256 marketFeeAmount
440         ) = calcBaseOutGivenInDT(exchangeId, dataTokenAmount);
441         require(
442             baseTokenAmount >= minBaseTokenAmount,
443             "FixedRateExchange: Too few base tokens"
```

```
444         );
445         // we account fees , fees are always collected in
 ↳ basetoken
446         exchanges[exchangeId].oceanFeeAvailable = exchanges[
 ↳ exchangeId]
447             .oceanFeeAvailable
448             .add(oceanFeeAmount);
449         exchanges[exchangeId].marketFeeAvailable = exchanges[
 ↳ exchangeId]
450             .marketFeeAvailable
451             .add(marketFeeAmount);
452         require(
453             IERC20Template(exchanges[exchangeId].dataToken).
 ↳ transferFrom(
454                 msg.sender,
455                 address(this),
456                 dataTokenAmount
457             ),
458             "FixedRateExchange: transferFrom failed in the
 ↳ dataToken contract"
459         );
460
461         exchanges[exchangeId].dtBalance = (exchanges[exchangeId].
 ↳ dtBalance).add(
462             dataTokenAmount
463         );
464
465         if (baseTokenAmount > exchanges[exchangeId].btBalance) {
466             require(
467                 IERC20Template(exchanges[exchangeId].baseToken).
 ↳ transferFrom(
468                     exchanges[exchangeId].exchangeOwner,
469                     msg.sender,
470                     baseTokenAmount
471                 ),
472                 "FixedRateExchange: transferFrom failed in the
 ↳ baseToken contract"
473             );
474         } else {
475             exchanges[exchangeId].btBalance = (exchanges[
 ↳ exchangeId].btBalance)
476                 .sub(baseTokenAmountBeforeFee);
477             IERC20Template(exchanges[exchangeId].baseToken).
 ↳ transfer(
```

```
478                 msg.sender,
479                 baseTokenAmount
480             );
481         }
482 
483         emit Swapped(
484             exchangeId,
485             msg.sender,
486             baseTokenAmount,
487             dataTokenAmount,
488             exchanges[exchangeId].baseToken,
489             marketFeeAmount,
490             oceanFeeAmount
491         );
492     }
```

Listing 22: SideStaking.sol (Lines 258,259)

```
245     function Stake(
246         address datatokenAddress,
247         address stakeToken,
248         uint256 amount
249     ) public {
250         if (_datatokens[datatokenAddress].bound != true) return;
251         require(
252             msg.sender == _datatokens[datatokenAddress].
 ↳ poolAddress,
253             "ERR: Only pool can call this"
254         );
255         bool ok = canStake(datatokenAddress, stakeToken, amount);
256         if (ok != true) return;
257         IERC20Template dt = IERC20Template(datatokenAddress);
258         dt.approve(_datatokens[datatokenAddress].poolAddress,
 ↳ amount);
259         _datatokens[datatokenAddress].datatokenBalance -= amount;
260     }
```

Listing 23: SideStaking.sol (Lines 390,391,392)

```
357     function getVesting(address datatokenAddress) public {
358         require(
359             _datatokens[datatokenAddress].bound == true,
360             "ERR:Invalid datatoken"
```

```
361         );
362         // is this needed?
363         // require(msg.sender == _datatokens[datatokenAddress].
 ↳ publisherAddress,'ERR: Only publisher can call this');
364
365         //calculate how many tokens we need to vest to publisher<<
366         uint256 blocksPassed;
367
368         if (_datatokens[datatokenAddress].vestingEndBlock < block.
 ↳ number) {
369             blocksPassed =
370                 _datatokens[datatokenAddress].vestingEndBlock -
371                 _datatokens[datatokenAddress].vestingLastBlock;
372         } else {
373             blocksPassed =
374                 block.number -
375                 _datatokens[datatokenAddress].vestingLastBlock;
376         }
377
378         uint256 vestPerBlock = _datatokens[datatokenAddress].
 ↳ vestingAmount.div(
379             _datatokens[datatokenAddress].vestingEndBlock -
380                 _datatokens[datatokenAddress].blockDeployed
381         );
382         if (vestPerBlock == 0) return;
383         uint256 amount = blocksPassed.mul(vestPerBlock);
384         if (
385             amount > 0 &&
386             _datatokens[datatokenAddress].datatokenBalance >=
 ↳ amount
387         ) {
388             IERC20Template dt = IERC20Template(datatokenAddress);
389             _datatokens[datatokenAddress].vestingLastBlock = block
 ↳ .number;
390             dt.transfer(_datatokens[datatokenAddress].
 ↳ publisherAddress, amount);
391             _datatokens[datatokenAddress].datatokenBalance -=
 ↳ amount;
392             _datatokens[datatokenAddress].vestingAmountSoFar +=
 ↳ amount;
393         }
394     }
```

Listing 24: SideStaking.sol (Lines 322,326,327,328,329,333,334,335,336,337,338,339,340,342,343)

```
302     function notifyFinalize(address datatokenAddress, uint256
 ↳ decimals)
303         internal
304     {
305         if (_datatokens[datatokenAddress].bound != true) return;
306         if (_datatokens[datatokenAddress].poolFinalized == true)
 ↳ return;
307         _datatokens[datatokenAddress].poolFinalized = true;
308         uint256 baseTokenWeight = 5 * BASE; //pool weight: 50-50
309         uint256 dataTokenWeight = 5 * BASE; //pool weight: 50-50
310         uint256 baseTokenAmount = _datatokens[datatokenAddress]
311             .basetokenBalance;
312         //given the price, compute dataTokenAmount
313
314         uint256 dataTokenAmount = ((_datatokens[datatokenAddress].
 ↳ rate *
315             baseTokenAmount *
316             dataTokenWeight) /
317             baseTokenWeight /
318             BASE) * (10**(18 - decimals));
319
320         //approve the tokens and amounts
321         IERC20Template dt = IERC20Template(datatokenAddress);
322         dt.approve(_datatokens[datatokenAddress].poolAddress,
 ↳ dataTokenAmount);
323         IERC20Template dtBase = IERC20Template(
324             _datatokens[datatokenAddress].basetokenAddress
325         );
326         dtBase.approve(
327             _datatokens[datatokenAddress].poolAddress,
328             baseTokenAmount
329         );
330
331         // call the pool, bind the tokens, set the price, finalize
 ↳  pool
332         IPool pool = IPool(_datatokens[datatokenAddress].
 ↳ poolAddress);
333         pool.setup(
334             datatokenAddress,
335             dataTokenAmount,
336             dataTokenWeight,
337             _datatokens[datatokenAddress].basetokenAddress,
```

```
338             baseTokenAmount,
339             baseTokenWeight
340         );
341         //substract
342         _datatokens[datatokenAddress].basetokenBalance -=
 ↳ baseTokenAmount;
343         _datatokens[datatokenAddress].datatokenBalance -=
 ↳ dataTokenAmount;
344         // send 50% of the pool shares back to the publisher
345         IERC20Template lPTokens = IERC20Template(
346             _datatokens[datatokenAddress].poolAddress
347         );
348         uint256 lpBalance = lPTokens.balanceOf(address(this));
349       //  uint256 balanceToTransfer = lpBalance.div(2);
350         lPTokens.transfer(
351             _datatokens[datatokenAddress].publisherAddress,
352             lpBalance.div(2)
353         );
354     }
```

Listing 25: Dispenser.sol (Lines 220,227,228)

```
187     function dispense(address datatoken, uint256 amount, address
 ↳ destination) external payable{
188         require(
189             datatoken != address(0),
190             'Invalid token contract address'
191         );
192         require(
193             datatokens[datatoken].active == true,
194             'Dispenser not active'
195         );
196         require(
197             amount > 0,
198             'Invalid zero amount'
199         );
200         require(
201             datatokens[datatoken].maxTokens >= amount,
202             'Amount too high'
203         );
204         if(datatokens[datatoken].allowedSwapper != address(0)){
205             require(
206                 datatokens[datatoken].allowedSwapper == msg.sender
 ↳ ,
```

```
207                 "This address is not allowed to request DT"
208             );
209         }
210 
211         IERC20Template tokenInstance = IERC20Template(datatoken);
212         uint256 callerBalance = tokenInstance.balanceOf(
 ↳ destination);
213         require(
214             callerBalance<datatokens[datatoken].maxBalance,
215             'Caller balance too high'
216         );
217         uint256 ourBalance = tokenInstance.balanceOf(address(this)
 ↳ );
218         if(ourBalance<amount && tokenInstance.isMinter(address(
 ↳ this))){
219             //we need to mint the difference if we can
220             tokenInstance.mint(address(this),amount - ourBalance);
221             ourBalance = tokenInstance.balanceOf(address(this));
222         }
223         require(
224             ourBalance>=amount,
225             'Not enough reserves'
226         );
227         tokenInstance.transfer(destination,amount);
228         emit TokensDispensed(datatoken, destination, amount);
229     }
```

Listing 26: Dispenser.sol (Lines 248,249)

```
236     function ownerWithdraw(address datatoken) external{
237         require(
238             datatoken != address(0),
239             'Invalid token contract address'
240         );
241         require(
242             datatokens[datatoken].owner == msg.sender,
243             'Invalid owner'
244         );
245         IERC20Template tokenInstance = IERC20Template(datatoken);
246         uint256 ourBalance = tokenInstance.balanceOf(address(this)
 ↳ );
247         if(ourBalance>0){
248             tokenInstance.transfer(msg.sender,ourBalance);
249             emit OwnerWithdrawed(datatoken, msg.sender, ourBalance
```

```
 ↳ );
250         }
251     }
```

Listing 27: FixedRateExchange.sol (Lines 364,365,366,367,368,369,370,371,382,385,386,387,388,389,390,391,392,397,398,399,400,403,404,405,406,407,408,409,410,411)

```
333     function buyDT(bytes32 exchangeId, uint256 dataTokenAmount,
 ↳ uint256 maxBaseTokenAmount)
334         external
335         onlyActiveExchange(exchangeId)
336     {
337         require(
338             dataTokenAmount != 0,
339             "FixedRateExchange: zero data token amount"
340         );
341         if(exchanges[exchangeId].allowedSwapper != address(0)){
342             require(
343                 exchanges[exchangeId].allowedSwapper == msg.sender
 ↳ ,
344                 "FixedRateExchange: This address is not allowed to
 ↳  swap"
345             );
346         }
347         (
348             uint256 baseTokenAmount,
349             uint256 baseTokenAmountBeforeFee,
350             uint256 oceanFeeAmount,
351             uint256 marketFeeAmount
352         ) = calcBaseInGivenOutDT(exchangeId, dataTokenAmount);
353         require(
354             baseTokenAmount <= maxBaseTokenAmount,
355             "FixedRateExchange: Too many base tokens"
356         );
357         // we account fees , fees are always collected in
 ↳ basetoken
358         exchanges[exchangeId].oceanFeeAvailable = exchanges[
 ↳ exchangeId]
359             .oceanFeeAvailable
360             .add(oceanFeeAmount);
361         exchanges[exchangeId].marketFeeAvailable = exchanges[
 ↳ exchangeId]
```

```
362             .marketFeeAvailable
363             .add(marketFeeAmount);
364         require(
365             IERC20Template(exchanges[exchangeId].baseToken).
 ↳ transferFrom(
366                 msg.sender,
367                 address(this), // we send basetoken to this
 ↳ address, then exchange owner can withdraw
368                 baseTokenAmount
369             ),
370             "FixedRateExchange: transferFrom failed in the
 ↳ baseToken contract"
371         );
372 
373         exchanges[exchangeId].btBalance = (exchanges[exchangeId].
 ↳ btBalance).add(
374             baseTokenAmountBeforeFee
375         );
376 
377         if (dataTokenAmount > exchanges[exchangeId].dtBalance) {
378             //first, let's try to mint
379             if(exchanges[exchangeId].withMint
380             && IERC20Template(exchanges[exchangeId].dataToken).
 ↳ isMinter(address(this)))
381             {
382                 IERC20Template(exchanges[exchangeId].dataToken).
 ↳ mint(msg.sender,dataTokenAmount);
383             }
384             else{
385                 require(
386                     IERC20Template(exchanges[exchangeId].dataToken
 ↳ ).transferFrom(
387                         exchanges[exchangeId].exchangeOwner,
388                         msg.sender,
389                         dataTokenAmount
390                     ),
391                     "FixedRateExchange: transferFrom failed in the
 ↳  dataToken contract"
392                 );
393             }
394         } else {
395             exchanges[exchangeId].dtBalance = (exchanges[
 ↳ exchangeId].dtBalance)
396                 .sub(dataTokenAmount);
```

```
397             IERC20Template(exchanges[exchangeId].dataToken).
 ↳ transfer(
398                 msg.sender,
399                 dataTokenAmount
400             );
401         }
402 
403         emit Swapped(
404             exchangeId,
405             msg.sender,
406             baseTokenAmount,
407             dataTokenAmount,
408             exchanges[exchangeId].dataToken,
409             marketFeeAmount,
410             oceanFeeAmount
411         );
412     }
```

Listing 28: FixedRateExchange.sol (Lines 500,501,502,503,505,506,507 ,508,509,510)

```
494     function collectBT(bytes32 exchangeId)
495         external
496         onlyExchangeOwner(exchangeId)
497     {
498         uint256 amount = exchanges[exchangeId].btBalance;
499         exchanges[exchangeId].btBalance = 0;
500         IERC20Template(exchanges[exchangeId].baseToken).transfer(
501             exchanges[exchangeId].exchangeOwner,
502             amount
503         );
504 
505         emit TokenCollected(
506             exchangeId,
507             exchanges[exchangeId].exchangeOwner,
508             exchanges[exchangeId].baseToken,
509             amount
510         );
511     }
```

Listing 29: FixedRateExchange.sol (Lines 519,520,521,522,524,525,526,527,528,529)

```
513     function collectDT(bytes32 exchangeId)
514         external
515         onlyExchangeOwner(exchangeId)
516     {
517         uint256 amount = exchanges[exchangeId].dtBalance;
518         exchanges[exchangeId].dtBalance = 0;
519         IERC20Template(exchanges[exchangeId].dataToken).transfer(
520             exchanges[exchangeId].exchangeOwner,
521             amount
522         );
523 
524         emit TokenCollected(
525             exchangeId,
526             exchanges[exchangeId].exchangeOwner,
527             exchanges[exchangeId].dataToken,
528             amount
529         );
530     }
```

Listing 30: FixedRateExchange.sol (Lines 536,537,538,539,540,541,542,543,544)

```
532     function collectMarketFee(bytes32 exchangeId) external {
533         // anyone call call this function, because funds are sent
 ↳ to the correct address
534         uint256 amount = exchanges[exchangeId].marketFeeAvailable;
535         exchanges[exchangeId].marketFeeAvailable = 0;
536         IERC20Template(exchanges[exchangeId].baseToken).transfer(
537             exchanges[exchangeId].marketFeeCollector,
538             amount
539         );
540         emit MarketFeeCollected(
541             exchangeId,
542             exchanges[exchangeId].baseToken,
543             amount
544         );
545     }
```

Listing 31: FixedRateExchange.sol (Lines 551,552,553,554,555,556,557,558,559)

```
547     function collectOceanFee(bytes32 exchangeId) external {
548         // anyone call call this function, because funds are sent
 ↳ to the correct address
549         uint256 amount = exchanges[exchangeId].oceanFeeAvailable;
550         exchanges[exchangeId].oceanFeeAvailable = 0;
551         IERC20Template(exchanges[exchangeId].baseToken).transfer(
552             opfCollector,
553             amount
554         );
555         emit OceanFeeCollected(
556             exchangeId,
557             exchanges[exchangeId].baseToken,
558             amount
559         );
560     }
```

Listing 32: FixedRateExchange.sol (Lines 452,453,454,455,456,457,458,459,466,467,468,469,470,471,472,473,477,478,479,480,483,484,485,486,487,488,489,490,491)

```
421     function sellDT(bytes32 exchangeId, uint256 dataTokenAmount,
 ↳ uint256 minBaseTokenAmount)
422         external
423         onlyActiveExchange(exchangeId)
424     {
425         require(
426             dataTokenAmount != 0,
427             "FixedRateExchange: zero data token amount"
428         );
429         if(exchanges[exchangeId].allowedSwapper != address(0)){
430             require(
431                 exchanges[exchangeId].allowedSwapper == msg.sender
 ↳ ,
432                 "FixedRateExchange: This address is not allowed to
 ↳  swap"
433             );
434         }
435         (
436             uint256 baseTokenAmount,
437             uint256 baseTokenAmountBeforeFee,
```

```
438             uint256 oceanFeeAmount,
439             uint256 marketFeeAmount
440         ) = calcBaseOutGivenInDT(exchangeId, dataTokenAmount);
441         require(
442             baseTokenAmount >= minBaseTokenAmount,
443             "FixedRateExchange: Too few base tokens"
444         );
445         // we account fees , fees are always collected in
 ↳ basetoken
446         exchanges[exchangeId].oceanFeeAvailable = exchanges[
 ↳ exchangeId]
447             .oceanFeeAvailable
448             .add(oceanFeeAmount);
449         exchanges[exchangeId].marketFeeAvailable = exchanges[
 ↳ exchangeId]
450             .marketFeeAvailable
451             .add(marketFeeAmount);
452         require(
453             IERC20Template(exchanges[exchangeId].dataToken).
 ↳ transferFrom(
454                 msg.sender,
455                 address(this),
456                 dataTokenAmount
457             ),
458             "FixedRateExchange: transferFrom failed in the
 ↳ dataToken contract"
459         );
460
461         exchanges[exchangeId].dtBalance = (exchanges[exchangeId].
 ↳ dtBalance).add(
462             dataTokenAmount
463         );
464
465         if (baseTokenAmount > exchanges[exchangeId].btBalance) {
466             require(
467                 IERC20Template(exchanges[exchangeId].baseToken).
 ↳ transferFrom(
468                     exchanges[exchangeId].exchangeOwner,
469                     msg.sender,
470                     baseTokenAmount
471                 ),
472                 "FixedRateExchange: transferFrom failed in the
 ↳ baseToken contract"
473             );
```

```
474         } else {
475             exchanges[exchangeId].btBalance = (exchanges[
 ↳ exchangeId].btBalance)
476                 .sub(baseTokenAmountBeforeFee);
477             IERC20Template(exchanges[exchangeId].baseToken).
 ↳ transfer(
478                 msg.sender,
479                 baseTokenAmount
480             );
481         }
482 
483         emit Swapped(
484             exchangeId,
485             msg.sender,
486             baseTokenAmount,
487             dataTokenAmount,
488             exchanges[exchangeId].baseToken,
489             marketFeeAmount,
490             oceanFeeAmount
491         );
492     }
```

Listing 33: SideStaking.sol (Lines 104,109,110,111,112,113,114,115,116,117,118,119,120,121,122,123,124,125)

```
74     function newDataTokenCreated(
75         address datatokenAddress,
76         address basetokenAddress,
77         address poolAddress,
78         address publisherAddress,
79         uint256[] memory ssParams
80     ) external onlyRouter returns (bool) {
81         //check if we are the controller of the pool
82         require(poolAddress != address(0), "Invalid poolAddress");
83         IPool bpool = IPool(poolAddress);
84         require(
85             bpool.getController() == address(this),
86             "We are not the pool controller"
87         );
88         //check if the tokens are bound
89         require(
90             bpool.getDataTokenAddress() == datatokenAddress,
91             "DataToken address missmatch"
```

```
92          );
93          require(
94              bpool.getBaseTokenAddress() == basetokenAddress,
95              "BaseToken address missmatch"
96          );
97          // check if we are the minter of DT
98          IERC20Template dt = IERC20Template(datatokenAddress);
99          require(
100             (dt.permissions(address(this))).minter == true,
101             "BaseToken address mismatch"
102         );
103         // get cap and mint it..
104         dt.mint(address(this), dt.cap());
105
106         require(dt.balanceOf(address(this)) == dt.totalSupply(), "
 ↳ Mint failed");
107         require(dt.totalSupply().div(10) >= ssParams[2], "Max
 ↳ vesting 10%");
108         //we are rich :)let's setup the records and we are good to
 ↳  go
109         _datatokens[datatokenAddress] = Record({
110             bound: true,
111             basetokenAddress: basetokenAddress,
112             poolAddress: poolAddress,
113             poolFinalized: false,
114             datatokenBalance: dt.totalSupply() - ssParams[2], //
 ↳ We need to remove the vesting amount from that
115             datatokenCap: dt.cap(),
116             basetokenBalance: ssParams[4],
117             lastPrice: 0,
118             rate: ssParams[0],
119             publisherAddress: publisherAddress,
120             blockDeployed: block.number,
121             vestingEndBlock: block.number + ssParams[3],
122             vestingAmount: ssParams[2],
123             vestingLastBlock: block.number,
124             vestingAmountSoFar: 0
125         });
126
127         notifyFinalize(datatokenAddress, ssParams[1]);
128
129         return (true);
130     }
```

Risk Level:

Likelihood - 1
Impact - 4

Recommendation:

To protect against cross-functional reentrancy attacks, it may be necessary to use a mutex. By using this lock, an attacker can no longer exploit the function with a recursive call. OpenZeppelin has its own mutex implementation called ReentrancyGuard which provides a modifier to any function called nonReentrant that guards the function with a mutex against the Reentrancy attacks.

Ocean Protocol should consider refactoring the code to follow the checks-effects-interactions pattern and use the nonReentrant modifier. See the references' section for more information.

References:

Checks-Effect-Interactions pattern

Remediation Plan:

PARTIALLY SOLVED: The Ocean Protocol team added the reentrancy protection guard on all external functions that any user could call. It was decided not to implement protection on internal functions and functions that can be called by a privileged user. An additional function where guard was not implemented was deployErc721Contract within the ERC721Factory contract.

3.7 (HAL-07) IGNORED RETURN VALUES - LOW

Description:

In the ERC721Factory.sol, SideStaking.sol, BFactory.sol and FactoryRouter.sol contract, there are instances where external methods are called, and the return values are not stored in a local or state variable.

Code Location:

ERC721Factory

Listing 34: ERC721Factory.sol (Line 484)

```
479                 require(IERC20Template(publishMarketFeeToken).
 ↳ transferFrom(
480                     msg.sender,
481                     address(this),
482                     publishMarketFeeAmount
483                 ),'Failed to transfer publishFee');
484                 IERC20Template(publishMarketFeeToken).approve(
 ↳ orders[i].tokenAddress, publishMarketFeeAmount);
485             }
```

ERC721Factory

Listing 35: ERC721Factory.sol (Line 494)

```
489                 require(IERC20Template(orders[i].consumeFeeToken).
 ↳ transferFrom(
490                     msg.sender,
491                     address(this),
492                     orders[i].consumeFeeAmount
493                 ),'Failed to transfer consumeFee');
494                 IERC20Template(orders[i].consumeFeeToken).approve(
 ↳ orders[i].tokenAddress, orders[i].consumeFeeAmount);
495             }
```

ERC721Factory

Listing 36: ERC721Factory.sol (Line 598)

```
597         // allow router to take the liquidity
598         IERC20Template(_PoolData.addresses[1]).approve(router,
 ↳ _PoolData.ssParams[4]);
599
600         poolAddress = IERC20Template(erc20Address).deployPool(
601             _PoolData.ssParams,
602             _PoolData.swapFees,
603            _PoolData.addresses
604         );
```

FactoryRouter

Listing 37: FactoryRouter.sol (Lines 273,292,294,295,296,297,298,299 ,316,321)

```
262     function buyDTBatch(
263         Operations[] calldata _operations
264         )
265         external {
266
267             for (uint i= 0; i< _operations.length; i++) {
268
269                 if(_operations[i].operation == operationType.
 ↳ SwapExactIn) {
270                     // Get amountIn from user to router
271                     IERC20(_operations[i].tokenIn).transferFrom(
 ↳ msg.sender,address(this),_operations[i].amountsIn);
272                     // we approve pool to pull token from router
273                     IERC20(_operations[i].tokenIn).approve(
 ↳ _operations[i].source,_operations[i].amountsIn);
274                     // Perform swap
275                     (uint amountReceived,) =
276                     IPool(_operations[i].source)
277                     .swapExactAmountIn(_operations[i].tokenIn,
278                     _operations[i].amountsIn,
279                     _operations[i].tokenOut,
280                     _operations[i].amountsOut,
281                     _operations[i].maxPrice);
282                     // transfer token swapped to user
```

```
283
284                     require(IERC20(_operations[i].tokenOut).
 ↳ transfer(msg.sender,amountReceived),'Failed MultiSwap');
285                 } else if (_operations[i].operation ==
 ↳ operationType.SwapExactOut){
286                     // calculate how much amount In we need for
 ↳ exact Out
287                     uint amountIn = IPool(_operations[i].source)
288                     .getAmountInExactOut(_operations[i].tokenIn,
 ↳ _operations[i].tokenOut,_operations[i].amountsOut);
289                     // pull amount In from user
290                     IERC20(_operations[i].tokenIn).transferFrom(
 ↳ msg.sender,address(this),amountIn);
291                     // we approve pool to pull token from router
292                     IERC20(_operations[i].tokenIn).approve(
 ↳ _operations[i].source,amountIn);
293                     // perform swap
294                     IPool(_operations[i].source)
295                     .swapExactAmountOut(_operations[i].tokenIn,
296                     _operations[i].amountsIn,
297                     _operations[i].tokenOut,
298                     _operations[i].amountsOut,
299                     _operations[i].maxPrice);
300                     // send amount out back to user
301                     require(IERC20(_operations[i].tokenOut)
302                     .transfer(msg.sender,_operations[i].amountsOut
 ↳ ),'Failed MultiSwap');
303
304                 } else if (_operations[i].operation ==
 ↳ operationType.FixedRate) {
305                     // get datatoken address
306                     (,address datatoken,,,,,,,,,) =
307                     IFixedRateExchange(_operations[i].source).
 ↳ getExchange(_operations[i].exchangeIds);
308                     // get tokenIn amount required for dt out
309                     (uint baseTokenAmount,,,) =
310                     IFixedRateExchange(_operations[i].source).
311                     calcBaseInGivenOutDT(_operations[i].
 ↳ exchangeIds,_operations[i].amountsOut);
312
313                     // pull tokenIn amount
314                     IERC20(_operations[i].tokenIn).transferFrom(
 ↳ msg.sender,address(this),baseTokenAmount);
315                      // we approve pool to pull token from router
```

```
316                     IERC20(_operations[i].tokenIn).approve(
 ↳ _operations[i].source,baseTokenAmount);
317                     // perform swap
318                     IFixedRateExchange(_operations[i].source)
319                     .buyDT(_operations[i].exchangeIds,_operations[
 ↳ i].amountsOut,_operations[i].amountsIn);
320                     // send dt out to user
321                     IERC20(datatoken).transfer(msg.sender,
 ↳ _operations[i].amountsOut);
322 
323                 } else {
324                     IDispenser(_operations[i].source)
325                     .dispense(_operations[i].tokenOut,_operations[
 ↳ i].amountsOut,msg.sender);
326 
327                 }
328             }
329 
330     }
```

SideStaking

Listing 38: SideStaking.sol (Line 258)

```
245     function Stake(
246         address datatokenAddress,
247         address stakeToken,
248         uint256 amount
249     ) public {
250         if (_datatokens[datatokenAddress].bound != true) return;
251         require(
252             msg.sender == _datatokens[datatokenAddress].
 ↳ poolAddress,
253             "ERR: Only pool can call this"
254         );
255         bool ok = canStake(datatokenAddress, stakeToken, amount);
256         if (ok != true) return;
257         IERC20Template dt = IERC20Template(datatokenAddress);
258         dt.approve(_datatokens[datatokenAddress].poolAddress,
 ↳ amount);
259         _datatokens[datatokenAddress].datatokenBalance -= amount;
260     }
```

SideStaking

Listing 39: SideStaking.sol (Lines 322,326,327,328,329)

```
320         //approve the tokens and amounts
321         IERC20Template dt = IERC20Template(datatokenAddress);
322         dt.approve(_datatokens[datatokenAddress].poolAddress,
 ↳ dataTokenAmount);
323         IERC20Template dtBase = IERC20Template(
324             _datatokens[datatokenAddress].basetokenAddress
325         );
326         dtBase.approve(
327             _datatokens[datatokenAddress].poolAddress,
328             baseTokenAmount
329         );
```

BFactory

Listing 40: BFactory.sol (Lines 117,118,119,120,121,122)

```
116         // requires approval first from basetokenSender
117         ISideStaking(addresses[0]).newDataTokenCreated(
118         tokens[0],
119         tokens[1],
120         bpool,
121         addresses[3],//publisherAddress
122         ssParams);
123 
124         return bpool;
```

Risk Level:

Likelihood - 3
Impact - 2

Recommendation:

It is recommended to add return values check to avoid unexpected contract crashes. This can be implemented with a `require` statement and will help handle exceptions more comprehensively.

Remediation Plan:

PARTIALLY SOLVED: The Ocean Protocol team amended certain functionalities to include return value checking; however, the following functions were called without checking the return value:

- newDataTokenCreated: BFactory contract
- swapExactAmountOut function called within the buyDTBatch function : FactoryRouter contract

3.8 (HAL-08) MISSING ZERO-ADDRESS CHECK - LOW

Description:

There are several instances where address validation is missing. For instance, zero address validation failure has been found when assigning user-supplied address values to state variables directly.

The following list shows all the instances where zero address check failure was identified:

- ERC721Factory.sol: variable _router
- FactoryRouter.sol: variables _routerOwner, _opfCollector within the constructor, and variable _factory within function addFactory
- ERC20Template.sol, variables _publishMarketFeeAddress and _publishMarketFeeToken within function setPublishingMarketFee; variable _newFeeCollector within function setFeeCollector
- SideStaking.sol, variable _router within the constructor
- BPool.sol variable _newCollector within updateMarketFeeCollector

Code Location:

ERC721Factory

Listing 41: ERC721Factory.sol (Lines 83,93)

```
79     constructor(
80         address _template721,
81         address _template,
82         address _collector,
83         address _router
84     ) {
85         require(
86             _template != address(0) &&
87                 _collector != address(0) &&
88                 _template721 != address(0),
```

```
89              "ERC721DTFactory: Invalid template token/community fee
↳  collector address"
90          );
91          add721TokenTemplate(_template721);
92          addTokenTemplate(_template);
93          router = _router;
94          communityFeeCollector = _collector;
95      }
```

FactoryRouter

Listing 42: FactoryRouter.sol (Lines 41,42)

```
34      constructor(
35          address _routerOwner,
36          address _oceanToken,
37          address _bpoolTemplate,
38          address _opfCollector,
39          address[] memory _preCreatedPools
40      ) public BFactory(_bpoolTemplate, _opfCollector,
↳ _preCreatedPools) {
41          routerOwner = _routerOwner;
42          opfCollector = _opfCollector;
43          oceanTokens[_oceanToken] = true;
44      }
```

FactoryRouter

Listing 43: FactoryRouter.sol (Line 68)

```
66      function addFactory(address _factory) external onlyRouterOwner
↳  {
67          require(factory == address(0), "FACTORY ALREADY SET");
68          factory = _factory;
69      }
```

ERC20Template.sol

Listing 44: ERC20Template.sol (Lines 555,556,558,559)

```
554     function setPublishingMarketFee(
555         address _publishMarketFeeAddress,
556         address _publishMarketFeeToken,
557         uint256 _publishMarketFeeAmount) external
 ↳ onlyPublishingMarketFeeAddress {
558         publishMarketFeeAddress = _publishMarketFeeAddress;
559         publishMarketFeeToken =  _publishMarketFeeToken;
560         publishMarketFeeAmount = _publishMarketFeeAmount;
561     }
```

ERC20Template.sol

Listing 45: ERC20Template.sol (Lines 527,532)

```
527     function setFeeCollector(address _newFeeCollector) external {
528         require(
529             permissions[msg.sender].feeManager == true,
530             "ERC20Template: NOT FEE MANAGER"
531         );
532         feeCollector = _newFeeCollector;
533     }
```

SideStaking.sol

Listing 46: SideStaking.sol (Line 61)

```
60     constructor(address _router) public {
61         router = _router;
62     }
```

Listing 47: BPool.sol (Line 274)

```
272     function updateMarketFeeCollector(address _newCollector)
 ↳ external {
273         require(_marketCollector == msg.sender, "ONLY MARKET
 ↳ COLLECTOR");
274         _marketCollector = _newCollector;
275     }
```

Risk Level:

Likelihood - 2
Impact - 3

Recommendation:

Although administrative restrictions are imposed on this function due to the role-based access controls (RBAC) it is recommended to add proper address validation when assigning user supplied input to a variable. This could be as simple as using the following statement:

Listing 48

```
1 require(address_input != 0, "Address is zero")
```

Remediation Plan:

SOLVED: The Ocean Protocol team implemented the recommended fix to ensure addresses are not equal to zero.

3.9 (HAL-09) DIVIDE BEFORE MULTIPLY - LOW

Description:

Solidity's integer division could be truncated. As a result, loss of precision can sometimes be avoided by multiplying before dividing, although the manual implementation of the precision/decimal calculation is taken care of by the developer. In the smart contracts set, there are multiple instances where division is performed before multiplication.

Code Location:

FixedRateExchange

Listing 49: FixedRateExchange.sol (Lines 259,260,261,262,263,268,269,270,273,274,275)

```
248     function calcBaseInGivenOutDT(bytes32 exchangeId, uint256
 ↳ dataTokenAmount)
249         public
250         view
251         onlyActiveExchange(exchangeId)
252         returns (
253             uint256 baseTokenAmount,
254             uint256 baseTokenAmountBeforeFee,
255             uint256 oceanFeeAmount,
256             uint256 marketFeeAmount
257         )
258     {
259         baseTokenAmountBeforeFee = dataTokenAmount
260             .mul(exchanges[exchangeId].fixedRate)
261             .div(BASE)
262             .mul(10**exchanges[exchangeId].btDecimals)
263             .div(10**exchanges[exchangeId].dtDecimals);
264
265
266         oceanFeeAmount;
267         if (getOPFFee(exchanges[exchangeId].baseToken) != 0) {
268             oceanFeeAmount = baseTokenAmountBeforeFee
```

```
269                 .mul(getOPFFee(exchanges[exchangeId].baseToken))
270                 .div(BASE);
271         }
272
273         marketFeeAmount = baseTokenAmountBeforeFee
274             .mul(exchanges[exchangeId].marketFee)
275             .div(BASE);
276
277
278         baseTokenAmount = baseTokenAmountBeforeFee.add(
 ↳ marketFeeAmount).add(
279             oceanFeeAmount
280         );
281
282     }
```

FixedRateExchange

Listing 50: FixedRateExchange.sol (Lines 301,302,303,304,305,310,311 ,312,315,316,317)

```
290     function calcBaseOutGivenInDT(bytes32 exchangeId, uint256
 ↳ dataTokenAmount)
291         public
292         view
293         onlyActiveExchange(exchangeId)
294         returns (
295             uint256 baseTokenAmount,
296             uint256 baseTokenAmountBeforeFee,
297             uint256 oceanFeeAmount,
298             uint256 marketFeeAmount
299         )
300     {
301         baseTokenAmountBeforeFee = dataTokenAmount
302             .mul(exchanges[exchangeId].fixedRate)
303             .div(BASE)
304             .mul(10**exchanges[exchangeId].btDecimals)
305             .div(10**exchanges[exchangeId].dtDecimals);
306
307
308         oceanFeeAmount;
309         if (getOPFFee(exchanges[exchangeId].baseToken) != 0) {
310             oceanFeeAmount = baseTokenAmountBeforeFee
```

```
311                 .mul(getOPFFee(exchanges[exchangeId].baseToken))
312                 .div(BASE);
313         }
314
315         marketFeeAmount = baseTokenAmountBeforeFee
316             .mul(exchanges[exchangeId].marketFee)
317             .div(BASE);
318
319
320         baseTokenAmount = baseTokenAmountBeforeFee.sub(
 ↳ marketFeeAmount).sub(
321             oceanFeeAmount
322         );
323
324     }
```

SideStaking

Listing 51: SideStaking.sol (Lines 314,315,316,317,318)

```
310         uint256 baseTokenAmount = _datatokens[datatokenAddress]
311             .basetokenBalance;
312         //given the price, compute dataTokenAmount
313
314         uint256 dataTokenAmount = ((_datatokens[datatokenAddress].
 ↳ rate *
315             baseTokenAmount *
316             dataTokenWeight) /
317             baseTokenWeight /
318             BASE) * (10**(18 - decimals));
319
```

SideStaking

Listing 52: SideStaking.sol (Lines 378,379,380,381,383)

```
375                 _datatokens[datatokenAddress].vestingLastBlock;
376         }
377
378         uint256 vestPerBlock = _datatokens[datatokenAddress].
 ↳ vestingAmount.div(
379             _datatokens[datatokenAddress].vestingEndBlock -
```

```
380                 _datatokens[datatokenAddress].blockDeployed
381         );
382         if (vestPerBlock == 0) return;
383         uint256 amount = blocksPassed.mul(vestPerBlock);
384         if (
385             amount > 0 &&
```

Risk Level:

Likelihood - 2
Impact - 3

Recommendation:

Consider performing multiplications before divisions to ensure precision in results when using non-floating-point data types.

Remediation Plan:

SOLVED: The Ocean Protocol team amended smart contracts to perform multiplication operations before division.

3.10 (HAL-10) USE OF BLOCK-TIMESTAMP - LOW

Description:

During a manual review, the use of block.timestamp in the ERC20Template.sol contract was observed. Contract developers should note that block.timestamp does not mean the current time. Miners can influence the value of block.timestamp to a certain degree, so developers should be warned that this may be at some risk if miners collude in time manipulation to influence oracle pricing. Miners can influence the timestamp with a tolerance of 15 seconds.

Code Location:

Listing 53: ERC20Template.sol (Line 638)

```
629     function permit(
630         address owner,
631         address spender,
632         uint256 value,
633         uint256 deadline,
634         uint8 v,
635         bytes32 r,
636         bytes32 s
637     ) external {
638         require(deadline >= block.timestamp, "ERC20DT: EXPIRED");
639         bytes32 digest = keccak256(
640             abi.encodePacked(
641                 "\x19\x01",
642                 DOMAIN_SEPARATOR,
643                 keccak256(
644                     abi.encode(
645                         PERMIT_TYPEHASH,
```

Risk Level:

Likelihood - 2
Impact - 3

Recommendation:

Use block.number instead of block.timestamp or now to reduce the risk of MEV attacks. Check if the project timescale occurs across years, days, and months rather than seconds. If possible, it is recommended to use Oracles.

Remediation Plan:

ACKNOWLEDGED: The Ocean Protocol team decided not to modify the highlighted occurrence of block.timestamp.

3.11 (HAL-11) EXPERIMENTAL FEATURES ENABLED - LOW

Description:

The use of experimental features could be dangerous on live deployments. The experimental ABI encoder does not handle non-integer values shorter than 32 bytes properly. This applies to bytesNN types, bool, enum and other types when they are part of an array or a struct and encoded directly from storage. This means these storage references have to be used directly inside abi.encode(. . .) as arguments in external function calls or in event data without prior assignment to a local variable. Using return does not trigger the bug. The types bytesNN and bool will result in corrupted data while enum might lead to an invalid revert.

Furthermore, arrays with elements shorter than 32 bytes may not be handled correctly, even if the base type is an integer type. Encoding such arrays in the way described above can lead to other data in the encoding being overwritten if the number of elements encoded is not a multiple of the number of elements that fit a single slot. If nothing follows the array in the encoding (note that dynamically-sized arrays are always encoded after statically-sized arrays with statically-sized content), or if only a single array is encoded, no other data is overwritten. There are known bugs that are publicly released while using this feature. However, the bug only manifests itself when all the following conditions are met:

1. Storage data involving arrays or structs is sent directly to an external function call, to abi.encode or to event data without prior assignment to a local (memory) variable.
2. There is an array that contains elements with size less than 32 bytes or a struct that has elements that share a storage slot or members of type bytesNN shorter than 32 bytes.

In addition to that, in the following situations, your code is NOT affected:

1. If all the structs or arrays only use uint256 or int256 types.
2. If only integer types (that may be shorter) are used and only encode at most one array at a time.
3. If only such data is returned and is not used in abi.encode, external calls or event data.

ABIEncoderV2 is enabled to be able to pass a struct type into a function, both web3 and in another contract. Naturally, any bug can have wildly varying consequences depending on the program control flow, but it is expected that this is more likely to lead to malfunction than exploitability. The bug, when triggered, will under certain circumstances send corrupt parameters on method invocations to other contracts.

Reference:

Solidity Optimizer and ABIEncoderV2 Bug

Code Location:

Listing 54

```
1 ERC721Factory.sol:2:pragma experimental ABIEncoderV2;
2 FactoryRouter.sol:5:pragma experimental ABIEncoderV2;
3 IFactory.sol:2:pragma experimental ABIEncoderV2;
4 IERC20Template.sol:2:pragma experimental ABIEncoderV2;
```

Risk Level:

Likelihood - 1
Impact - 3

Recommendation:

When possible, do not use experimental features in the final live deployment. Validate and check that all the above conditions are true for integers and arrays (i.e., all using uint256).

Remediation Plan:

SOLVED: Experimental features have been removed from the smart contracts set.

3.12 (HAL-12) FLOATING PRAGMA - LOW

Description:

Some OceanProtocol v4main contracts use the floating pragma ^0.8.0. Contracts should be deployed with the same compiler version and flags with which they were thoroughly tested. Locking the pragma ensures that contracts are not accidentally get deployed using an outdated compiler version. New pragmas could introduce bugs that negatively affect the contract system or a pragma version too new and has not been extensively tested.

Code Location:

Listing 55: v4main-contract

```
(contracts/utils/Ownable.sol:3) pragma solidity ^0.8.0;
(contracts/utils/ERC721/IERC721Enumerable.sol:1) pragma solidity
↳ ^0.8.0;
(contracts/utils/ERC721/IERC721Receiver.sol:1) pragma solidity
↳ ^0.8.0;
(contracts/utils/ERC721/IERC721Metadata.sol:1) pragma solidity
↳ ^0.8.0;
(contracts/utils/ERC721/ERC721.sol:1) pragma solidity ^0.8.0;
(contracts/utils/ERC721/Context.sol:2) pragma solidity ^0.8.0;
(contracts/utils/ERC721/IERC721.sol:5) pragma solidity ^0.8.0;
(contracts/utils/ERC721/Address.sol:2) pragma solidity ^0.8.0;
(contracts/utils/ERC721/Strings.sol:3) pragma solidity ^0.8.0;
(contracts/utils/ERC725/ERC725Ocean.sol:2) pragma solidity ^0.8.0;
(contracts/interfaces/IV3ERC20.sol:1) pragma solidity ^0.8.0;
```

Risk Level:

Likelihood - 1
Impact - 3

Recommendation:

Consider locking the pragma version into a secure and stable compiler version. When possible, do not use floating pragma in the final live deployment. Specifying a fixed version of the compiler ensures that the bytecode produced does not vary between builds. This is especially important if the solution relies on code verification at the bytecode level.

Remediation Plan:

SOLVED: Floating pragma were removed from the smart contracts set.

3.13 (HAL-13) OUTDATED DEPENDENCIES - LOW

Description:

The 4.2.0 version of openzepplin-contracts is used in the v4main smart contracts. The latest version is 4.3.2 where a vulnerability in UUPSUpgradeable is fixed. Although this is not used in v4main contracts, it is a good security practice to keep all libraries up-to-date.

Code Location:

Listing 56: v4main/package.json (Line 29)

```
27   "dependencies": {
28     "@balancer-labs/v2-pool-utils": "^1.0.0",
29     "@openzeppelin/contracts": "^4.2.0",
30     "@openzeppelin/test-helpers": "^0.5.10",
31     "dotenv": "^10.0.0",
32     "eth-permit": "^0.1.10",
33     "ethereumjs-util": "^7.0.10",
34     "hardhat-contract-sizer": "^2.0.3",
35     "solidity-bytes-utils": "^0.8.0"
36   }
```

Risk Level:

Likelihood - 2
Impact - 3

Recommendation:

Although UUPSUpgradeable is not used directly within v4main contracts, it is always important to keep all libraries up-to-date. See references' section for a more detailed description of OpenZeppelin contract issues.

References:

Open Zeppelin Advisory
UUPS Implementation Workaround

Remediation Plan:

SOLVED: The Ocean Protocol team updated the external dependency version to v4.3.3.

3.14 (HAL-14) PRAGMA VERSION DEPRECATED - LOW

Description:

In some in-scope contracts, the current pragma versions in use are pragma >=0.5.0, >=0.5.7, >=0.6.0 etc. While these versions are still functional, and some security issues are mitigated by implementing contracts such as SafeMath.sol, it increases the risk to long-term sustainability and Solidity code integrity.

Code Location:

Listing 57: v4main-contract

```
(contracts/ERC721Factory.sol:1) pragma solidity >=0.6.0;
(contracts/templates/ERC20Template.sol:1) pragma solidity >=0.6.0;
(contracts/templates/ERC20TemplateEnterprise.sol:1) pragma
↳ solidity >=0.6.0;
(contracts/templates/ERC721Template.sol:1) pragma solidity
↳ >=0.6.0;
(contracts/utils/ERC721RolesAddress.sol:1) pragma solidity
↳ >=0.6.0;
(contracts/utils/UtilsLib.sol:9) pragma solidity >=0.5.0 <0.9.0;
(contracts/utils/Deployer.sol:1) pragma solidity >=0.5.7;
(contracts/utils/ERC20Roles.sol:1) pragma solidity >=0.6.0;
(contracts/pools/sscontracts/SideStaking.sol:1) pragma solidity
↳ >=0.6.0;
(contracts/pools/dispenser/Dispenser.sol:1) pragma solidity
↳ >=0.5.7;
(contracts/pools/FactoryRouter.sol:4) pragma solidity >=0.5.7;
(contracts/pools/balancer/BConst.sol:14) pragma solidity >=0.5.7;
(contracts/pools/balancer/BFactory.sol:1) pragma solidity >=0.5.7;
(contracts/pools/balancer/BMath.sol:14) pragma solidity >=0.5.7;
(contracts/pools/balancer/BToken.sol:14) pragma solidity >=0.5.7;
(contracts/pools/balancer/BPool.sol:1://pragma solidity 0.5.7;
(contracts/pools/balancer/BPool.sol:2) pragma solidity >=0.6.0;
(contracts/pools/balancer/BNum.sol:14) pragma solidity >=0.5.7;
(contracts/pools/fixedRate/FixedRateExchange.sol:1) pragma
↳ solidity >=0.5.7;
```

```
20 (contracts/interfaces/ISideStaking.sol:9) pragma solidity >=0.5.7;
21 (contracts/interfaces/IFactoryRouter.sol:1) pragma solidity
↳ >=0.5.7;
22 (contracts/interfaces/IFactory.sol:1) pragma solidity >=0.5.7;
23 (contracts/interfaces/IMetadata.sol:3) pragma solidity >=0.6.2
↳ <0.9.0;
24 (contracts/interfaces/IDispenser.sol:1) pragma solidity >=0.5.7;
25 (contracts/interfaces/IERC20Template.sol:1) pragma solidity
↳ >=0.5.0;
26 (contracts/interfaces/IERC721Template.sol:3) pragma solidity
↳ >=0.6.2 <0.9.0;
27 (contracts/interfaces/IFixedRateExchange.sol:1) pragma solidity
↳ >=0.5.7;
28 (contracts/interfaces/IERC725X.sol:2) pragma solidity >=0.5.0
↳ <0.9.0;
29 (contracts/interfaces/IERC725Y.sol:2) pragma solidity >=0.5.0
↳ <0.9.0;
30 (contracts/interfaces/IERC20.sol:3) pragma solidity >=0.5.7;
31 (contracts/interfaces/IV3Factory.sol:1) pragma solidity >=0.6.0;
32 (contracts/interfaces/IERC1271.sol:2) pragma solidity >=0.5.0
↳ <0.79.0;
33 (contracts/interfaces/IPool.sol:10) pragma solidity >=0.5.7;
34 (contracts/communityFee/OPFCommunityFeeCollector.sol:1) pragma
↳ solidity >=0.6.0;
```

Risk Level:

Likelihood - 2
Impact - 2

Recommendation:

At the time of this audit, the current solidity version is already at 0.8.X. When possible, it is recommended to use an updated pragma version to take advantage of new features, for example, after Solidity version 0.8.0, arithmetic operations revert to underflow and overflow by default. Using this version, utility contracts like SafeMath.sol will not be needed.

Remediation Plan:

SOLVED: All smart contracts have been upgraded to use the compiler version `0.8.10`.

3.15 (HAL-15) MULTIPLE PRAGMA DEFINITIONS - LOW

Description:

OceanProtocol v4main contract uses a complex pragma version (such as >=0.5.0 <0.9.0, >=0.5.7, >=0.6.0, >=0.6.2 <0.9.0). Contracts should be deployed with the same compiler version and flags with which they were thoroughly tested. Locking the pragma helps to ensure that contracts are not accidentally get deployed using another pragma, for example, either an outdated pragma version that could introduce bugs that negatively affect the contract system or a recently released pragma version that has not been extensively tested. The latest pragma version (0.8.9) was released in September 2021. Many pragma versions have been lately released, going from version 0.7.x to the recently released version 0.8.x. in just 8 months.

Reference: https://github.com/ethereum/solidity/releases

In the Solitidy Github repository, there is a json file where are all the bugs found in the different compiler versions. It should be noted that pragma 0.6.12 and 0.7.6 are widely used by Solidity developers and have been extensively tested in many security audits.

Reference: https://github.com/ethereum/solidity/blob/develop/docs/bugs_by_version.json

Code Location:

Listing 58: v4main-contract

```
1 (contracts/ERC721Factory.sol:1) pragma solidity >=0.6.0;
2 (contracts/templates/ERC20Template.sol:1) pragma solidity >=0.6.0;
3 (contracts/templates/ERC20TemplateEnterprise.sol:1) pragma
↳ solidity >=0.6.0;
4 (contracts/templates/ERC721Template.sol:1) pragma solidity
↳ >=0.6.0;
```

```
5 (contracts/utils/ERC721RolesAddress.sol:1) pragma solidity
↳ >=0.6.0;
6 (contracts/utils/UtilsLib.sol:9) pragma solidity >=0.5.0 <0.9.0;
7 (contracts/utils/Ownable.sol:3) pragma solidity ^0.8.0;
8 (contracts/utils/Deployer.sol:1) pragma solidity >=0.5.7;
9 (contracts/utils/ERC20Roles.sol:1) pragma solidity >=0.6.0;
10 (contracts/utils/ERC721/IERC721Enumerable.sol:1) pragma solidity
↳ ^0.8.0;
11 (contracts/utils/ERC721/IERC721Receiver.sol:1) pragma solidity
↳ ^0.8.0;
12 (contracts/utils/ERC721/IERC721Metadata.sol:1) pragma solidity
↳ ^0.8.0;
13 (contracts/utils/ERC721/ERC721.sol:1) pragma solidity ^0.8.0;
14 (contracts/utils/ERC721/Context.sol:2) pragma solidity ^0.8.0;
15 (contracts/utils/ERC721/IERC721.sol:5) pragma solidity ^0.8.0;
16 (contracts/utils/ERC721/Address.sol:2) pragma solidity ^0.8.0;
17 (contracts/utils/ERC721/Strings.sol:3) pragma solidity ^0.8.0;
18 (contracts/utils/ERC725/ERC725Ocean.sol:2) pragma solidity ^0.8.0;
19 (contracts/pools/sscontracts/SideStaking.sol:1) pragma solidity
↳ >=0.6.0;
20 (contracts/pools/dispenser/Dispenser.sol:1) pragma solidity
↳ >=0.5.7;
21 (contracts/pools/FactoryRouter.sol:4) pragma solidity >=0.5.7;
22 (contracts/pools/balancer/BConst.sol:14) pragma solidity >=0.5.7;
23 (contracts/pools/balancer/BFactory.sol:1) pragma solidity >=0.5.7;
24 (contracts/pools/balancer/BMath.sol:14) pragma solidity >=0.5.7;
25 (contracts/pools/balancer/BToken.sol:14) pragma solidity >=0.5.7;
26 (contracts/pools/balancer/BPool.sol:1://pragma solidity 0.5.7;
27 (contracts/pools/balancer/BPool.sol:2) pragma solidity >=0.6.0;
28 (contracts/pools/balancer/BNum.sol:14) pragma solidity >=0.5.7;
29 (contracts/pools/fixedRate/FixedRateExchange.sol:1) pragma
↳ solidity >=0.5.7;
30 (contracts/interfaces/ISideStaking.sol:9) pragma solidity >=0.5.7;
31 (contracts/interfaces/IFactoryRouter.sol:1) pragma solidity
↳ >=0.5.7;
32 (contracts/interfaces/IFactory.sol:1) pragma solidity >=0.5.7;
33 (contracts/interfaces/IMetadata.sol:3) pragma solidity >=0.6.2
↳ <0.9.0;
34 (contracts/interfaces/IDispenser.sol:1) pragma solidity >=0.5.7;
35 (contracts/interfaces/IERC20Template.sol:1) pragma solidity
↳ >=0.5.0;
36 (contracts/interfaces/IERC721Template.sol:3) pragma solidity
↳ >=0.6.2 <0.9.0;
37 (contracts/interfaces/IFixedRateExchange.sol:1) pragma solidity
```

```
↳ >=0.5.7;
38 (contracts/interfaces/IERC725X.sol:2) pragma solidity >=0.5.0
↳ <0.9.0;
39 (contracts/interfaces/IERC725Y.sol:2) pragma solidity >=0.5.0
↳ <0.9.0;
40 (contracts/interfaces/IERC20.sol:3) pragma solidity >=0.5.7;
41 (contracts/interfaces/IV3Factory.sol:1) pragma solidity >=0.6.0;
42 (contracts/interfaces/IERC1271.sol:2) pragma solidity >=0.5.0
↳ <0.79.0;
43 (contracts/interfaces/IV3ERC20.sol:1) pragma solidity ^0.8.0;
44 (contracts/interfaces/IPool.sol:10) pragma solidity >=0.5.7;
45 (contracts/communityFee/OPFCommunityFeeCollector.sol:1) pragma
↳ solidity >=0.6.0;
```

Risk Level:

Likelihood - 2
Impact - 2

Recommendation:

Consider locking and using a single pragma version with no known bugs for the compiler version. If possible, consider using the latest stable version of pragma that has been thoroughly tested for potential undiscovered vulnerabilities, such as a pragma between 0.6.12 - 0.7.6, or the latest pragma. For example, after the Solidity v 0.8.0, arithmetic operations revert to underflow and overflow by default. Using this version, utility contracts like SafeMath.sol will not be needed.

Remediation Plan:

SOLVED: All smart contracts have been upgraded to use compiler version 0.8.10.

3.16 (HAL-16) MISSING EVENTS EMISSION - INFORMATIONAL

Description:

It has been observed that important functionality is not to emit events. This was observed in the FactoryRouter.sol, BPool.sol, and ERC20Template.sol contracts. Events are a method of informing the transaction initiator about the actions performed by the called function. Event logs emit parameters in a specific log history, which can be accessed outside the contracts using some filter parameters.

Code Location:

Factory Router

Listing 59: FactoryRouter.sol (Line 51)

```
46     function changeRouterOwner(address _routerOwner) public
↳ onlyRouterOwner {
47         require(
48             _routerOwner != address(0),
49             'Invalid new router owner'
50         );
51         routerOwner = _routerOwner;
52     }
```

Factory Router

Listing 60: FactoryRouter.sol (Line 86)

```
84     function updateOPFFee(uint256 _newSwapOceanFee) external
↳ onlyRouterOwner {
85         // TODO: add a maximum? how much? add event?
86         swapOceanFee = _newSwapOceanFee;
87     }
```

ERC20Template.sol

Listing 61: ERC20Template.sol (Lines 558,560)

```
554     function setPublishingMarketFee(
555         address _publishMarketFeeAddress,
556         address _publishMarketFeeToken,
557         uint256 _publishMarketFeeAmount) external
 ↳ onlyPublishingMarketFeeAddress {
558         publishMarketFeeAddress = _publishMarketFeeAddress;
559         publishMarketFeeToken =  _publishMarketFeeToken;
560         publishMarketFeeAmount = _publishMarketFeeAmount;
561     }
```

BPool.sol

Listing 62: BPool.sol (Line 339)

```
334     function setSwapFee(uint256 swapFee) public {
335         require(!_finalized, "ERR_IS_FINALIZED");
336         require(msg.sender == _controller, "ERR_NOT_CONTROLLER");
337         require(swapFee >= MIN_FEE, "ERR_MIN_FEE");
338         require(swapFee <= MAX_FEE, "ERR_MAX_FEE");
339         _swapFee = swapFee;
340     }
```

Risk Level:

Likelihood - 1
Impact - 2

Recommendation:

For best security practices consider, as much as possible, to declare events at the end of a function. Events can be used to detect the end of an operation.

Remediation Plan:

SOLVED: The Ocean Protocol team added events for critical functionality within the highlighted functions.

3.17 (HAL-17) REDUNDANT BOOLEAN COMPARISON - INFORMATIONAL

Description:

In the solidity language, Boolean constants can be used directly and do not need to be compared to true or false. In the ERC721Factory.sol, ERC20Template.sol, ERC721Template.sol, FixedRateExchange.sol, Dispenser.sol, BFactory.sol, BPool.sol and FactoryRouter.sol contracts, boolean constants are compared to true or false.

Code Location:

ERC721Factory.sol

Listing 63: ERC721Factory.sol (Line 121)

```
120         require(
121             tokenTemplate.isActive == true,
122             "ERC721DTFactory: ERC721Token Template disabled"
123         );
```

ERC721Factory.sol

Listing 64: ERC721Factory.sol (Line 317)

```
316         require(
317             tokenTemplate.isActive == true,
318             "ERC20Factory: ERC721Token Template disabled"
319         );
```

FactoryRouter.sol

Listing 65: FactoryRouter.sol (Line 79)

```
78     function getOPFFee(address baseToken) public view returns (
↳ uint256) {
79         if (oceanTokens[baseToken] == true) {
```

```
80              return 0;
81          } else return swapOceanFee;
82      }
```

FactoryRouter.sol

Listing 66: FactoryRouter.sol (Lines 127,131,138)

```
126         require(
127             IFactory(factory).erc20List(msg.sender) == true,
128             "FACTORY ROUTER: NOT ORIGINAL ERC20 TEMPLATE"
129         );
130         require(
131             ssContracts[addresses[0]] == true,
132             "FACTORY ROUTER: invalid ssContract"
133         );
134         require(ssParams[1] > 0, "Wrong decimals");
135
136         // TODO: do we need this? used only for the event?
137         bool flag;
138         if (oceanTokens[tokens[1]] == true) {
139             flag = true;
140         }
```

FactoryRouter.sol

Listing 67: FactoryRouter.sol (Lines 183,188)

```
176     function deployFixedRate(
177         address fixedPriceAddress,
178         address[] calldata addresses,
179         uint[] calldata uints
180
181     ) external returns (bytes32 exchangeId) {
182         require(
183             IFactory(factory).erc20List(msg.sender) == true,
184             "FACTORY ROUTER: NOT ORIGINAL ERC20 TEMPLATE"
185         );
186
187         require(
188             fixedPrice[fixedPriceAddress] == true,
189             "FACTORY ROUTER: Invalid FixedPriceContract"
```

```
190         );
```

FactoryRouter.sol

Listing 68: FactoryRouter.sol (Lines 221,226)

```
212     function deployDispenser(
213         address _dispenser,
214         address datatoken,
215         uint256 maxTokens,
216         uint256 maxBalance,
217         address owner,
218         address allowedSwapper
219     ) external {
220         require(
221             IFactory(factory).erc20List(msg.sender) == true,
222             "FACTORY ROUTER: NOT ORIGINAL ERC20 TEMPLATE"
223         );
224 
225         require(
226             dispenser[_dispenser]  == true,
227             "FACTORY ROUTER: Invalid DispenserContract"
228         );
```

Dispenser.sol

Listing 69: Dispenser.sol (Lines 192,193,194,195)

```
190             'Invalid token contract address'
191         );
192         require(
193             datatokens[datatoken].active == true,
194             'Dispenser not active'
195         );
196         require(
```

FixedRateExchange.sol

Listing 70: FixedRateExchange.sol (Lines 51,52,53,54,55)

```
50      modifier onlyActiveExchange(bytes32 exchangeId) {
51          require(
52              //exchanges[exchangeId].fixedRate != 0 &&
53                  exchanges[exchangeId].active == true,
54              "FixedRateExchange: Exchange does not exist!"
55          );
56          _;
57      }
```

FixedRateExchange.sol

Listing 71: FixedRateExchange.sol (Lines 675,676,677)

```
673         returns (uint256 supply)
674     {
675         if (exchanges[exchangeId].active == false) supply = 0;
676         else if (exchanges[exchangeId].withMint == true
677         && IERC20Template(exchanges[exchangeId].dataToken).
 ↳ isMinter(address(this))){
678             supply = IERC20Template(exchanges[exchangeId].
 ↳ dataToken).cap()
679             - IERC20Template(exchanges[exchangeId].dataToken).
 ↳ totalSupply();
```

FixedRateExchange.sol

Listing 72: FixedRateExchange.sol (Line 704)

```
700         public
701         view
702         returns (uint256 supply)
703     {
704         if (exchanges[exchangeId].active == false) supply = 0;
705         else {
706             uint256 balance = IERC20Template(exchanges[exchangeId
 ↳ ].baseToken)
```

ERC721Template.sol

Listing 73: ERC721Template.sol (Lines 159,160,161,162,166)

```
156     function setMetaData(uint8 _metaDataState, string calldata
 ↳ _metaDataDecryptorUrl
157         , string calldata _metaDataDecryptorAddress, bytes
 ↳ calldata flags,
158         bytes calldata data,bytes calldata _metaDataHash) external
 ↳  {
159         require(
160             permissions[msg.sender].updateMetadata == true,
161             "ERC721Template: NOT METADATA_ROLE"
162         );
163         metaDataState = _metaDataState;
164         metaDataDecryptorUrl = _metaDataDecryptorUrl;
165         metaDataDecryptorAddress = _metaDataDecryptorAddress;
166         if(hasMetaData == false){
167             emit MetadataCreated(msg.sender, _metaDataState,
 ↳ _metaDataDecryptorUrl,
168             flags, data, _metaDataHash,
169             /* solium-disable-next-line */
170             block.timestamp,
171             block.number);
172             hasMetaData = true;
173         }
174         else
175             emit MetadataUpdated(msg.sender, metaDataState,
 ↳ _metaDataDecryptorUrl,
176             flags, data, _metaDataHash,
177             /* solium-disable-next-line */
178             block.timestamp,
179             block.number);
180     }
```

ERC721Template.sol

Listing 74: ERC721Template.sol (Lines 222,223,224,225)

```
220         bytes[] calldata bytess
221     ) external returns (address ) {
222         require(
223             permissions[msg.sender].deployERC20 == true,
224             "ERC721Template: NOT ERC20DEPLOYER_ROLE"
225         );
226
```

ERC721Template.sol

Listing 75: ERC721Template.sol (Lines 336,337,338,339)

```
334
335     function setNewData(bytes32 _key, bytes calldata _value)
 ↳ external {
336         require(
337             permissions[msg.sender].store == true,
338             "ERC721Template: NOT STORE UPDATER"
339         );
340         setData(_key, _value);
```

ERC721Template.sol

Listing 76: ERC721Template.sol (Lines 353,354,355,356)

```
352     function setDataERC20(bytes32 _key, bytes calldata _value)
 ↳ public {
353         require(
354             deployedERC20[msg.sender] == true,
355             "ERC721Template: NOT ERC20 Contract"
356         );
357         setData(_key, _value);
358     }
```

ERC20Template.sol

Listing 77: ERC20Template.sol (Line 313)

```
310         IFactoryRouter(router).deployDispenser(
311             _dispenser, address(this), maxTokens, maxBalance, msg.
 ↳ sender, allowedSwapper );
312         // add FixedPriced contract as minter if withMint == true
313         if (withMint == true)
314             _addMinter(_dispenser);
315
316     }
```

ERC20Template.sol

Listing 78: ERC20Template.sol (Lines 326,327,328,329)

```
325     function mint(address account, uint256 value) external {
326         require(
327             permissions[msg.sender].minter == true,
328             "ERC20Template: NOT MINTER"
329         );
330         require(
331             totalSupply().add(value) <= _cap,
332             "DataTokenTemplate: cap exceeded"
333         );
334         _mint(account, value);
335     }
```

ERC20Template.sol

Listing 79: ERC20Template.sol (Lines 102,103,104,105,106,107)

```
101     modifier onlyERC20Deployer() {
102         require(
103             IERC721Template(_erc721Address)
104                 .getPermissions(msg.sender)
105                 .deployERC20 == true,
106             "ERC20Template: NOT DEPLOYER ROLE"
107         );
108         _;
109     }
```

ERC20Template.sol

Listing 80: ERC20Template.sol (Lines 528,529,530,531)

```
527     function setFeeCollector(address _newFeeCollector) external {
528         require(
529             permissions[msg.sender].feeManager == true,
530             "ERC20Template: NOT FEE MANAGER"
531         );
532         feeCollector = _newFeeCollector;
533     }
```

SideStaking.sol

Listing 81: SideStaking.sol (Lines 99,100,101,102)

```
97          // check if we are the minter of DT
98          IERC20Template dt = IERC20Template(datatokenAddress);
99          require(
100             (dt.permissions(address(this))).minter == true,
101             "BaseToken address mismatch"
102         );
103         // get cap and mint it..
104         dt.mint(address(this), dt.cap());
105
```

SideStaking.sol

Listing 82: SideStaking.sol (Lines 138,148,157,166,175,184,193,202,211,220,234,250,256,269,291,297,305,306)

```
137     {
138         if (_datatokens[datatokenAddress].bound != true) return
 ↳ (0);
139         return (_datatokens[datatokenAddress].datatokenCap -
140             _datatokens[datatokenAddress].datatokenBalance);
141     }
142
143     function getPublisherAddress(address datatokenAddress)
144         public
145         view
146         returns (address)
147     {
148         if (_datatokens[datatokenAddress].bound != true) return (
 ↳ address(0));
149         return (_datatokens[datatokenAddress].publisherAddress);
150     }
151
152     function getBaseTokenAddress(address datatokenAddress)
153         public
154         view
155         returns (address)
156     {
157         if (_datatokens[datatokenAddress].bound != true) return (
 ↳ address(0));
```

```
158         return (_datatokens[datatokenAddress].basetokenAddress);
159     }
160
161     function getPoolAddress(address datatokenAddress)
162         public
163         view
164         returns (address)
165     {
166         if (_datatokens[datatokenAddress].bound != true) return (
    ↳ address(0));
167         return (_datatokens[datatokenAddress].poolAddress);
168     }
169
170     function getBaseTokenBalance(address datatokenAddress)
171         public
172         view
173         returns (uint256)
174     {
175         if (_datatokens[datatokenAddress].bound != true) return
    ↳ (0);
176         return (_datatokens[datatokenAddress].basetokenBalance);
177     }
178
179     function getDataTokenBalance(address datatokenAddress)
180         public
181         view
182         returns (uint256)
183     {
184         if (_datatokens[datatokenAddress].bound != true) return
    ↳ (0);
185         return (_datatokens[datatokenAddress].datatokenBalance);
186     }
187
188     function getvestingEndBlock(address datatokenAddress)
189         public
190         view
191         returns (uint256)
192     {
193         if (_datatokens[datatokenAddress].bound != true) return
    ↳ (0);
194         return (_datatokens[datatokenAddress].vestingEndBlock);
195     }
196
197     function getvestingAmount(address datatokenAddress)
```

```
198         public
199         view
200         returns (uint256)
201     {
202         if (_datatokens[datatokenAddress].bound != true) return
 ↳ (0);
203         return (_datatokens[datatokenAddress].vestingAmount);
204     }
205
206     function getvestingLastBlock(address datatokenAddress)
207         public
208         view
209         returns (uint256)
210     {
211         if (_datatokens[datatokenAddress].bound != true) return
 ↳ (0);
212         return (_datatokens[datatokenAddress].vestingLastBlock);
213     }
214
215     function getvestingAmountSoFar(address datatokenAddress)
216         public
217         view
218         returns (uint256)
219     {
220         if (_datatokens[datatokenAddress].bound != true) return
 ↳ (0);
221         return (_datatokens[datatokenAddress].vestingAmountSoFar);
222     }
223
224     //called by pool to confirm that we can stake a token (add
 ↳ pool liquidty). If true, pool will call Stake function
225     function canStake(
226         address datatokenAddress,
227         address stakeToken,
228         uint256 amount
229     ) public view returns (bool) {
230         require(
231             msg.sender == _datatokens[datatokenAddress].
 ↳ poolAddress,
232             "ERR: Only pool can call this"
233         );
234         if (_datatokens[datatokenAddress].bound != true) return (
 ↳ false);
235         if (_datatokens[datatokenAddress].basetokenAddress ==
```

```
 ↳ stakeToken)
236             return (false);
237
238         //check balances
239         if (_datatokens[datatokenAddress].datatokenBalance >=
 ↳ amount)
240             return (true);
241         return (false);
242     }
243
244     //called by pool so 1ss will stake a token (add pool liquidty)
 ↳ . Function only needs to approve the amount to be spent by the
 ↳ pool, pool will do the rest
245     function Stake(
246         address datatokenAddress,
247         address stakeToken,
248         uint256 amount
249     ) public {
250         if (_datatokens[datatokenAddress].bound != true) return;
251         require(
252             msg.sender == _datatokens[datatokenAddress].
 ↳ poolAddress,
253             "ERR: Only pool can call this"
254         );
255         bool ok = canStake(datatokenAddress, stakeToken, amount);
256         if (ok != true) return;
257         IERC20Template dt = IERC20Template(datatokenAddress);
258         dt.approve(_datatokens[datatokenAddress].poolAddress,
 ↳ amount);
259         _datatokens[datatokenAddress].datatokenBalance -= amount;
260     }
261
262     //called by pool to confirm that we can stake a token (add
 ↳ pool liquidty). If true, pool will call Unstake function
263     function canUnStake(
264         address datatokenAddress,
265         address stakeToken,
266         uint256 lptIn
267     ) public view returns (bool) {
268         //TO DO
269         if (_datatokens[datatokenAddress].bound != true) return (
 ↳ false);
270         require(
271             msg.sender == _datatokens[datatokenAddress].
```

```
 ↳ poolAddress,
272             "ERR: Only pool can call this"
273         );
274         //check balances, etc and issue true or false
275         if (_datatokens[datatokenAddress].basetokenAddress ==
 ↳ stakeToken)
276             return (false);
277 
278         // we check LPT balance TODO: review this part
279         if (IERC20Template(msg.sender).balanceOf(address(this)) >=
 ↳  lptIn) {
280             return true;
281         }
282         return false;
283     }
284 
285     //called by pool so 1ss will unstake a token (remove pool
 ↳ liquidty). In our case the balancer pool will handle all, this is
 ↳ just a notifier so 1ss can handle internal kitchen
286     function UnStake(
287         address datatokenAddress,
288         address stakeToken,
289         uint256 amount
290     ) public {
291         if (_datatokens[datatokenAddress].bound != true) return;
292         require(
293             msg.sender == _datatokens[datatokenAddress].
 ↳ poolAddress,
294             "ERR: Only pool can call this"
295         );
296         bool ok = canUnStake(datatokenAddress, stakeToken, amount)
 ↳ ;
297         if (ok != true) return;
298         _datatokens[datatokenAddress].datatokenBalance += amount;
299     }
300 
301     //called by the pool (or by us) when we should finalize the
 ↳ pool
302     function notifyFinalize(address datatokenAddress, uint256
 ↳ decimals)
303         internal
304     {
305         if (_datatokens[datatokenAddress].bound != true) return;
306         if (_datatokens[datatokenAddress].poolFinalized == true)
```

```
 ↳ return;
307         _datatokens[datatokenAddress].poolFinalized = true;
```

SideStaking.sol

Listing 83: SideStaking.sol (Lines 358,359,360,361)

```
357     function getVesting(address datatokenAddress) public {
358         require(
359             _datatokens[datatokenAddress].bound == true,
360             "ERR:Invalid datatoken"
361         );
362         // is this needed?
```

BPool.sol

Listing 84: BPool.sol (Lines 735,736)

```
734         if (
735             ssContract.canStake(_datatokenAddress, ssStakeToken,
 ↳ ssAmountIn) ==
736             true
737         ) {
```

BPool.sol

Listing 85: BPool.sol (Lines 816,817)

```
815         if (
816             ssContract.canStake(_datatokenAddress, ssStakeToken,
 ↳ ssAmountIn) ==
817             true
818         ) {
```

BPool.sol

Listing 86: BPool.sol (Lines 899,900,901,902,903)

```
897
898         if (
```

```
899             ssContract.canUnStake(
900                 _datatokenAddress,
901                 ssStakeToken,
902                 poolAmountIn
903             ) == true
904         ) {
```

BPool.sol

Listing 87: BPool.sol (Lines 980,981,982,983,984)

```
978         );
979         if (
980             ssContract.canUnStake(
981                 _datatokenAddress,
982                 ssStakeToken,
983                 ssAmountOut
984             ) == true
985         ) {
```

BPool.sol

Listing 88: BFactory.sol (Line 88)

```
79     function newBPool(
80         address[2] memory tokens,
81         uint256[] memory ssParams,
82         uint256[] memory swapFees,
83         address[] memory addresses
84         )
85         internal
86         returns (address bpool)
87     {
88         require(poolTemplates[addresses[5]] == true, 'BFactory:
↳ Wrong Pool Template');
89         address[2] memory feeCollectors = [addresses[4],
↳ opfCollector];
90
```

Risk Level:

Likelihood - 1
Impact - 1

Recommendation:

It is recommended to remove the redundant boolean comparison within `if` and `require` statements.

Remediation Plan:

SOLVED: The Ocean Protocol team removed the redundant boolean comparisons with commit id `c428e0cff8356778f9643954b86a31e511fd6e06`.

3.18 (HAL-18) USE OF INLINE ASSEMBLY - INFORMATIONAL

Description:

Inline assembly is a way to access the Ethereum Virtual Machine at a low level. This discards several important safety features in Solidity and could incur in some risks should they used incorrectly.

Code Location:

ERC721Factory.sol

Listing 89: ERC721Factory.sol (Line 254)

```
254 assembly {
255     size := extcodesize(account)
256     }
```

ERC20Factory.sol

Listing 90: ERC20Template.sol (Line 207)

```
207 assembly {
208     chainId := chainid()
209     }
```

ERC20TemplateEnterprise.sol

Listing 91: ERC20TemplateEnterprise.sol (Line 213)

```
213 assembly {
214     chainId := chainid()
215     }
```

UtilsLib.sol

Listing 92: UtilsLib.sol (Line 22)

```
22 assembly {
23         result := gt(extcodesize(_target), 0)
24     }
25
```

Deployer.sol

Listing 93: Deployer.sol (Line 39)

```
39 assembly {
40     let clone := mload(0x40)
41     mstore(clone, 0
↳ x3d602d80600a3d3981f3363d3d373d3d3d363d730000000000000000000000000)
42     mstore(add(clone, 0x14), targetBytes)
43     mstore(add(clone, 0x28), 0
↳ x5af43d82803e903d91602b57fd5bf3000000000000000000000000000000000)
44     instance := create(0, clone, 0x37)
45     }
```

ERC725Ocean.sol

Listing 94: ERC725Ocean.sol (Line 104)

```
104 assembly {
105     success := call(txGas, to, value, add(data, 0x20), mload(data)
↳ , 0, 0)
106     }
```

ERC725Ocean.sol

Listing 95: ERC725Ocean.sol (Line 116)

```
116 assembly {
117     success := delegatecall(txGas, to, add(data, 0x20), mload(data
↳ ), 0, 0)
118     }
```

ERC725Ocean.sol

Listing 96: ERC725Ocean.sol (Line 128)

```
128 assembly {
129     newContract := create(value, add(deploymentData, 0x20), mload(
 ↳ deploymentData))
130     }
```

Risk Level:

Likelihood - 1
Impact - 2

Recommendation:

When possible, it is not recommended to use inline assembly because it allows access to the Ethereum Virtual Machine (EVM) at a low level. An attacker could bypass many important safety features of Solidity.

Remediation Plan:

ACKNOWLEDGED: The Ocean Protocol team has not removed inline assembly statements, as they are required for the functioning of the contracts.

3.19 (HAL-19) REDUNDANT VARIABLES - INFORMATIONAL

Description:

During the manual code review, it has been observed that **oceanFeeAmount** variable is unnecessarily declared in the contract. By deleting this variable, it is possible to optimize the use of gas.

Code Location:

FixedRateExchange

Listing 97: FixedRateExchange.sol (Line 266)

```
266         oceanFeeAmount;
267         if (getOPFFee(exchanges[exchangeId].baseToken) != 0) {
```

FixedRateExchange

Listing 98: FixedRateExchange.sol (Line 308)

```
308         oceanFeeAmount;
309         if (getOPFFee(exchanges[exchangeId].baseToken) != 0) {
```

Risk Level:

Likelihood - 1
Impact - 1

Recommendation:

It is recommended to remove unused state variables within the code base.

Remediation Plan:

SOLVED: The Ocean Protocol team implemented the suggested fix and removed the redundant variable declaration.

3.20 (HAL-20) POSSIBLE MISUSE OF PUBLIC FUNCTIONS - INFORMATIONAL

Description:

In public functions, the array arguments are immediately copied into memory, while external functions can read directly from calldata which is cheaper in terms of gas. Public functions need to write the arguments to memory because public functions can be called internally using pointers to memory locations. Therefore, the function expects its arguments being located in memory when the compiler generates the code for an internal function.

Additionally, methods do not necessarily have to be public if they are only called within the contract, in which case they should be marked internal.

Code Location:

Below are smart contracts and their corresponding functions affected:

ERC721Factory:
createToken(uint256,string[],address[],uint256[],bytes[])

FactoryRouter:
changeRouterOwner(address) changeRouterOwner(address) addOceanToken(address) removeOceanToken(address) getOPFFee(address)

FixedRateExchange.sol:
createWithDecimals(address,address[],uint256[])

SideStaking.sol:
getDataTokenCirculatingSupply(address) getPublisherAddress(address) getBaseTokenAddress(address) getPoolAddress(address) getBaseTokenBalance(address) getDataTokenBalance(address) getvestingEndBlock(address) getvestingAmount(address) getvestingLastBlock(address) getvestingAmountSoFar(address) Stake(address,address,uint256) Un-

Stake(address,address,uint256) getVesting(address)

ERC721Template.sol:
isERC20Deployer(address) isInitialized() setDataERC20(bytes32,bytes)

ERC20Template.sol:
isMinter(address)

BToken.sol:
name() symbol() decimals() totalSupply()

BPool.sol:
setSwapFee(uint256)

Risk Level:

Likelihood - 1
Impact - 1

Recommendation:

It is recommended to declare external variables instead of public functions and variables as often as possible. As for best practice, use external if the function is expected to be called only externally, and use public if the function needs to be called internally. To sum up, public functions can be accessed by everyone, external functions can only be accessed externally, and internal functions can only be called within the contract itself.

Remediation Plan:

PARTIALLY SOLVED: The Ocean Protocol team modified the function visibility to be external instead of public for all the above mentioned functions apart from the following:

- getVestingAmountSoFar: (SideStaking contract)
- canStake: (SideStaking contract)

- `canUnstake`: (`SideStaking` contract)
- `isERC20Deployer`: (`ERC20Template` contract)
- `totalSupply`: (`BToken` contract)
- `setSwapFee`: (`BPool` contract)

3.21 (HAL-21) POTENTIAL UNSAFE CALCULATION - INFORMATIONAL

Description:

Within the SideStaking contract, calculations were performed without the use of a secure library such as SafeMath. While operations with Solidity 0.8.0 are safe, the current pragma might be set to a lower one. It should be noted that when using Solidity 0.8.0, the unchecked statement can be used to remove arithmetic safety checks in the event that an overflow/underflow does not occur. This would help save gas.

Code Location:

SideStaking Lines# 314-318

Listing 99

```
        uint256 dataTokenAmount = ((_datatokens[datatokenAddress].
↳ rate *
            baseTokenAmount *
            dataTokenWeight) /
            baseTokenWeight /
            BASE) * (10**(18 - decimals));
```

Recommendation:

It is recommended to lock the pragma to version 0.8.0 where the calculations are performed safely or directly use a library like SafeMath.

Remediation Plan:

SOLVED: The compiler version was updated to version 0.8.10.

3.22 (HAL-22) GAS OPTIMIZATIONS - INFORMATIONAL

Description:

Within the code, the most expensive variable computation usage was identified. While this does not pose any security risks to smart contracts, it does increase deployment costs.

Code Locations:

ERC20Template Line 46

Listing 100

```
1 uint256 public constant BASE = 1e18;
```

Recommendation:

It is recommended to change the expression to `uint256 public constant BASE = 1e18`.

Remediation Plan:

SOLVED: The Ocean Protocol team amended the code to perform a more optimized computation.

AUTOMATED TESTING

4.1 STATIC ANALYSIS REPORT

Description:

Halborn used automated testing techniques to enhance coverage of certain areas of the in-scope contracts. After Halborn verified all the contracts in the repository and was able to compile them correctly into their application binary interface (ABI) and binary formats, the tool Slither was used. Slither is a Solidity static analysis framework. This tool can statically verify mathematical relationships between Solidity variables to detect invalid or inconsistent usage of the contracts' application programming interfaces (APIs) across the entire code-base.

Results:

```
ERC721Factory._createToken(uint256,string[],address[],uint256[],bytes[],address).tokenData (contracts/ERC721Factory.sol#329) is a local variable never initialized
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#uninitialized-local-variables

ERC721Factory.startMultipleTokenOrder(ERC721Factory.tokenOrder[]) (contracts/ERC721Factory.sol#466-512) ignores return value by IERC20Template(publishMarketFeeToken).approve(orders[i].tokenAddress,publishMarketFeeAmount) (contracts/ERC721Factory.sol#484)
ERC721Factory.startMultipleTokenOrder(ERC721Factory.tokenOrder[]) (contracts/ERC721Factory.sol#466-512) ignores return value by IERC20Template(orders[i].consumeFeeToken).approve(orders[i].tokenAddress,orders[i].consumeFeeAmount) (contracts/ERC721Factory.sol#494)
ERC721Factory.createNftErcWithPool(ERC721Factory.NftCreateData,ERC721Factory.ErcCreateData,ERC721Factory.PoolData) (contracts/ERC721Factory.sol#573-606) ignores return value by IERC20Template(_PoolData.addresses[1]).approve(router,_PoolData.ssParams[4]) (contracts/ERC721Factory.sol#598)

ERC721Factory.constructor(address,address,address,address)._router (contracts/ERC721Factory.sol#83) lacks a zero-check on :
        - router = _router (contracts/ERC721Factory.sol#93)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#missing-zero-address-validation

ERC721Factory.startMultipleTokenOrder(ERC721Factory.tokenOrder[]) (contracts/ERC721Factory.sol#466-512) has external calls inside a loop: (publishMarketFeeAddress,publishMarketFeeToken,publishMarketFeeAmount) = IERC20Template(orders[i].tokenAddress).getPublishingMarketFee() (contracts/ERC721Factory.sol#473-474)
ERC721Factory.startMultipleTokenOrder(ERC721Factory.tokenOrder[]) (contracts/ERC721Factory.sol#466-512) has external calls inside a loop: require(bool,string)(IERC20Template(publishMarketFeeToken).transferFrom(msg.sender,address(this),publishMarketFeeAmount),Failed to transfer publishFee) (contracts/ERC721Factory.sol#479-483)
ERC721Factory.startMultipleTokenOrder(ERC721Factory.tokenOrder[]) (contracts/ERC721Factory.sol#466-512) has external calls inside a loop: IERC20Template(publishMarketFeeToken).approve(orders[i].tokenAddress,publishMarketFeeAmount) (contracts/ERC721Factory.sol#484)
ERC721Factory.startMultipleTokenOrder(ERC721Factory.tokenOrder[]) (contracts/ERC721Factory.sol#466-512) has external calls inside a loop: require(bool,string)(IERC20Template(orders[i].consumeFeeToken).transferFrom(msg.sender,address(this),orders[i].consumeFeeAmount),Failed to transfer consumeFee) (contracts/ERC721Factory.sol#489-493)
ERC721Factory.startMultipleTokenOrder(ERC721Factory.tokenOrder[]) (contracts/ERC721Factory.sol#466-512) has external calls inside a loop: IERC20Template(orders[i].consumeFeeToken).approve(orders[i].tokenAddress,orders[i].consumeFeeAmount) (contracts/ERC721Factory.sol#494)
ERC721Factory.startMultipleTokenOrder(ERC721Factory.tokenOrder[]) (contracts/ERC721Factory.sol#466-512) has external calls inside a loop: require(bool,string)(IERC20Template(orders[i].tokenAddress).transferFrom(msg.sender,address(this),orders[i].amount),Failed to transfer datatoken) (contracts/ERC721Factory.sol#497-501)
ERC721Factory.startMultipleTokenOrder(ERC721Factory.tokenOrder[]) (contracts/ERC721Factory.sol#466-512) has external calls inside a loop: IERC20Template(orders[i].tokenAddress).startOrder(orders[i].consumer,orders[i].amount,orders[i].serviceId,orders[i].consumeFeeAddress,orders[i].consumeFeeToken,orders[i].consumeFeeAmount) (contracts/ERC721Factory.sol#503-510)

Reentrancy in ERC721Factory.createNftWithErc(ERC721Factory.NftCreateData,ERC721Factory.ErcCreateData) (contracts/ERC721Factory.sol#540-557):
        External calls:
        - erc721Address = deployERC721Contract(_NftCreateData.name,_NftCreateData.symbol,_NftCreateData.templateIndex,address(0),_NftCreateData.baseURI) (contracts/ERC721Factory.sol#544-549)
                - require(bool,string)(tokenInstance.initialize(msg.sender,name,symbol,address(this),additionalERC20Deployer,baseURI),ERC721DTFactory: Unable to initialize token instance) (contracts/ERC721Factory.sol#135-145)
        - erc20Address = _createToken(_ErcCreateData.templateIndex,_ErcCreateData.strings,_ErcCreateData.addresses,_ErcCreateData.uints,_ErcCreateData.bytess,erc721Address) (contracts/ERC721Factory.sol#550-556)
                - require(bool,string)(tokenInstance.initialize(tokenData.strings,tokenData.addresses,factoryAddresses,tokenData.uints,tokenData.bytess),ERC20Factory: Unable to initialize token instance) (contracts/ERC721Factory.sol#348-357)
        State variables written after the call(s):
        - erc20Address = _createToken(_ErcCreateData.templateIndex,_ErcCreateData.strings,_ErcCreateData.addresses,_ErcCreateData.uints,_ErcCreateData.bytess,erc721Address) (contracts/ERC721Factory.sol#550-556)
                - erc20List[token] = true (contracts/ERC721Factory.sol#321)
Reentrancy in ERC721Factory.deployERC721Contract(string,string,uint256,address,string) (contracts/ERC721Factory.sol#107-149):
        External calls:
        - require(bool,string)(tokenInstance.initialize(msg.sender,name,symbol,address(this),additionalERC20Deployer,baseURI),ERC721DTFactory: Unable to initialize token instance) (contracts/ERC721Factory.sol#135-145)
        State variables written after the call(s):
        - currentNFTCount += 1 (contracts/ERC721Factory.sol#148)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#reentrancy-vulnerabilities-2

Reentrancy in ERC721Factory.deployERC721Contract(string,string,uint256,address,string) (contracts/ERC721Factory.sol#107-149):
        External calls:
        - require(bool,string)(tokenInstance.initialize(msg.sender,name,symbol,address(this),additionalERC20Deployer,baseURI),ERC721DTFactory: Unable to initialize token instance) (contracts/ERC721Factory.sol#135-145)
        Event emitted after the call(s):
        - NFTCreated(token,tokenTemplate.templateAddress,name,msg.sender) (contracts/ERC721Factory.sol#147)
```

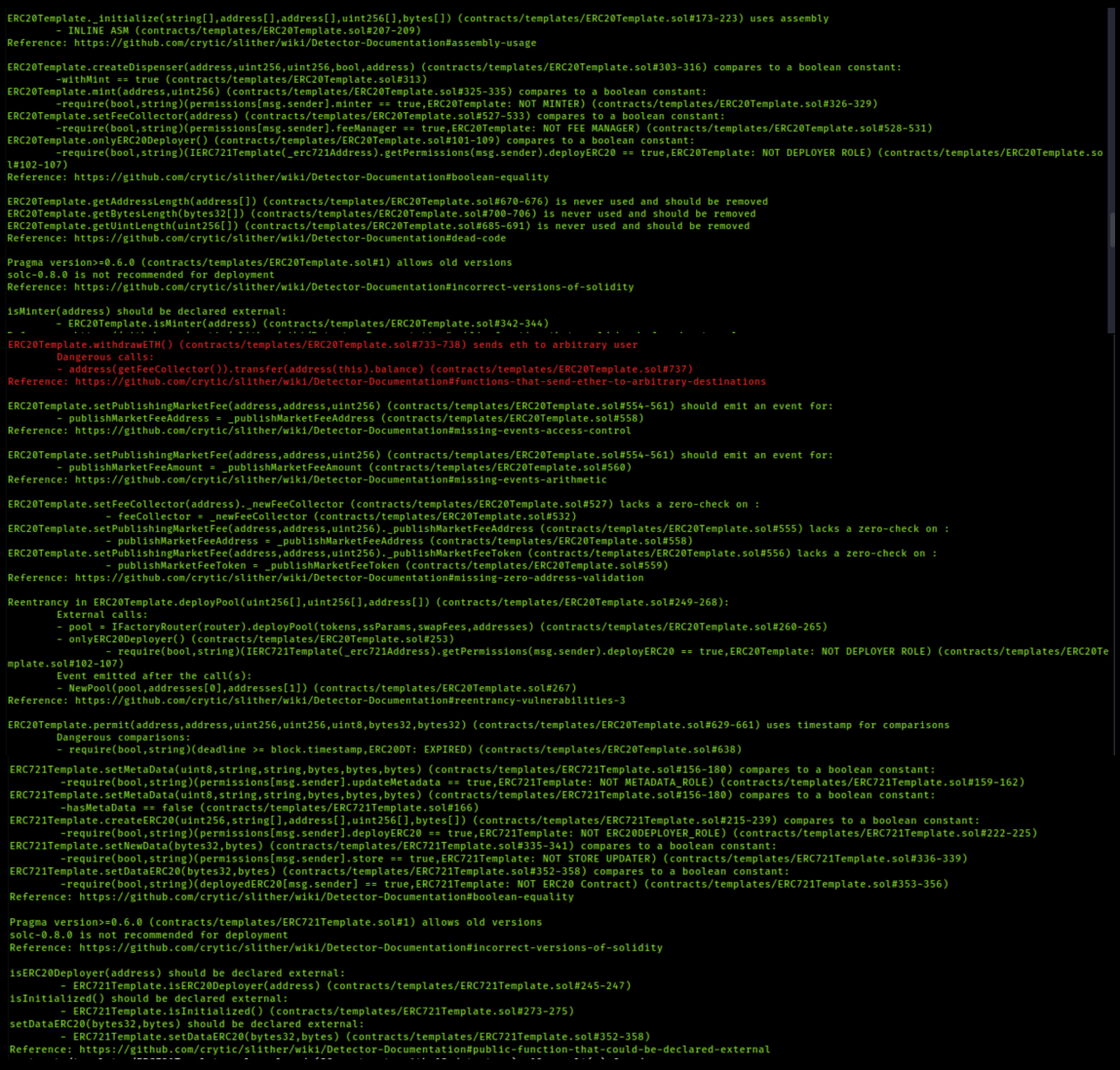
```
ERC721Factory.isContract(address) (contracts/ERC721Factory.sol#247-258) uses assembly
        - INLINE ASM (contracts/ERC721Factory.sol#254-256)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#assembly-usage

ERC721Factory.deployERC721Contract(string,string,uint256,address,string) (contracts/ERC721Factory.sol#107-149) compares to a boolean constant:
        -require(bool,string)(tokenTemplate.isActive == true,ERC721DTFactory: ERC721Token Template disabled) (contracts/ERC721Factory.sol#120-123)
ERC721Factory._createToken(uint256,string[],address[],uint256[],bytes[],address) (contracts/ERC721Factory.sol#301-336) compares to a boolean constant:
        -require(bool,string)(tokenTemplate.isActive == true,ERC20Factory: ERC721Token Template disabled) (contracts/ERC721Factory.sol#316-319)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#boolean-equality

Pragma version>=0.6.0 (contracts/ERC721Factory.sol#1) allows old versions
solc-0.8.0 is not recommended for deployment
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#incorrect-versions-of-solidity

ERC721Factory.erc20Factory (contracts/ERC721Factory.sol#25) is never used in ERC721Factory (contracts/ERC721Factory.sol#22-689)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#unused-state-variable

createToken(uint256,string[],address[],uint256[],bytes[]) should be declared external:
        - ERC721Factory.createToken(uint256,string[],address[],uint256[],bytes[]) (contracts/ERC721Factory.sol#287-300)
```

```
OPFCommunityFeeCollector.withdrawETH() (contracts/communityFee/OPFCommunityFeeCollector.sol#51-56) sends eth to arbitrary user
        Dangerous calls:
        - collector.transfer(address(this).balance) (contracts/communityFee/OPFCommunityFeeCollector.sol#55)

FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) ignores return value by IERC20(_operations[i].tokenIn).transferFrom(msg.sender,addr
ess(this),_operations[i].amountsIn) (contracts/pools/FactoryRouter.sol#271)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) ignores return value by IERC20(_operations[i].tokenIn).transferFrom(msg.sender,addr
ess(this),amountIn) (contracts/pools/FactoryRouter.sol#290)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) ignores return value by IERC20(_operations[i].tokenIn).transferFrom(msg.sender,addr
ess(this),baseTokenAmount) (contracts/pools/FactoryRouter.sol#314)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) ignores return value by IERC20(datatoken).transfer(msg.sender,_operations[i].amount
sOut) (contracts/pools/FactoryRouter.sol#321)
BPool.collectOPF() (contracts/pools/balancer/BPool.sol#253-260) ignores return value by IERC20(tokens[i]).transfer(_opfCollector,amount) (contracts/pools/balancer/BPool.sol#258)
BPool.collectMarketFee(address) (contracts/pools/balancer/BPool.sol#262-271) ignores return value by IERC20(tokens[i]).transfer(to,amount) (contracts/pools/balancer/BPool.sol#269)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#unchecked-transfer

Reentrancy in BPool.exitswapExternAmountOut(address,uint256,uint256) (contracts/pools/balancer/BPool.sol#925-1004):
        External calls:
        - _pushUnderlying(tokenOut,msg.sender,tokenAmountOut) (contracts/pools/balancer/BPool.sol#970)
                - xfer = IERC20(erc20).transfer(to,amount) (contracts/pools/balancer/BPool.sol#1027)
        State variables written after the call(s):
        - _pullPoolShare(_controller,poolAmountIn) (contracts/pools/balancer/BPool.sol#996)
                - _balance[src] = bsub(_balance[src],amt) (contracts/pools/balancer/BToken.sol#63)
                - _balance[dst] = badd(_balance[dst],amt) (contracts/pools/balancer/BToken.sol#64)
        - _burnPoolShare(bsub(poolAmountIn,exitFee)) (contracts/pools/balancer/BPool.sol#997)
                - _balance[address(this)] = bsub(_balance[address(this)],amt) (contracts/pools/balancer/BToken.sol#56)
        - _pushPoolShare(_factory,exitFee) (contracts/pools/balancer/BPool.sol#998)
                - _balance[src] = bsub(_balance[src],amt) (contracts/pools/balancer/BToken.sol#63)
                - _balance[dst] = badd(_balance[dst],amt) (contracts/pools/balancer/BToken.sol#64)
        - ssOutRecord.balance = bsub(ssOutRecord.balance,ssAmountOut) (contracts/pools/balancer/BPool.sol#988)
        - _burnPoolShare(bsub(poolAmountIn,exitFee)) (contracts/pools/balancer/BPool.sol#997)
                - _totalSupply = bsub(_totalSupply,amt) (contracts/pools/balancer/BToken.sol#57)
Reentrancy in BPool.exitswapPoolAmountIn(address,uint256,uint256) (contracts/pools/balancer/BPool.sol#838-923):
        External calls:
        - _pushUnderlying(tokenOut,msg.sender,tokenAmountOut) (contracts/pools/balancer/BPool.sol#887)
                - xfer = IERC20(erc20).transfer(to,amount) (contracts/pools/balancer/BPool.sol#1027)
        State variables written after the call(s):
        - _pullPoolShare(_controller,poolAmountIn) (contracts/pools/balancer/BPool.sol#915)
                - _balance[src] = bsub(_balance[src],amt) (contracts/pools/balancer/BToken.sol#63)
                - _balance[dst] = badd(_balance[dst],amt) (contracts/pools/balancer/BToken.sol#64)
        - _burnPoolShare(bsub(poolAmountIn,exitFee)) (contracts/pools/balancer/BPool.sol#916)
                - _balance[address(this)] = bsub(_balance[address(this)],amt) (contracts/pools/balancer/BToken.sol#56)
        - _pushPoolShare(_factory,exitFee) (contracts/pools/balancer/BPool.sol#917)
                - _balance[src] = bsub(_balance[src],amt) (contracts/pools/balancer/BToken.sol#63)
                - _balance[dst] = badd(_balance[dst],amt) (contracts/pools/balancer/BToken.sol#64)
```

```
Reentrancy in BPool.setup(address,uint256,uint256,address,uint256,uint256) (contracts/pools/balancer/BPool.sol#175-213):
        External calls:
        - bind(dataTokenAddress,dataTokenAmount,dataTokenWeight) (contracts/pools/balancer/BPool.sol#195)
                - xfer = IERC20(erc20).transferFrom(from,address(this),amount) (contracts/pools/balancer/BPool.sol#1016)
                - xfer = IERC20(erc20).transfer(to,amount) (contracts/pools/balancer/BPool.sol#1027)
        - bind(baseTokenAddress,baseTokenAmount,baseTokenWeight) (contracts/pools/balancer/BPool.sol#204)
                - xfer = IERC20(erc20).transferFrom(from,address(this),amount) (contracts/pools/balancer/BPool.sol#1016)
                - xfer = IERC20(erc20).transfer(to,amount) (contracts/pools/balancer/BPool.sol#1027)
        State variables written after the call(s):
        - finalize() (contracts/pools/balancer/BPool.sol#212)
                - _finalized = true (contracts/pools/balancer/BPool.sol#346)
        - bind(baseTokenAddress,baseTokenAmount,baseTokenWeight) (contracts/pools/balancer/BPool.sol#204)
                - _records[token] = Record(true,_tokens.length,0,0) (contracts/pools/balancer/BPool.sol#364-369)
                - _records[token].denorm = denorm (contracts/pools/balancer/BPool.sol#391)
                - _records[token].balance = balance (contracts/pools/balancer/BPool.sol#395)
        - bind(baseTokenAddress,baseTokenAmount,baseTokenWeight) (contracts/pools/balancer/BPool.sol#204)
                - _tokens.push(token) (contracts/pools/balancer/BPool.sol#370)
        - bind(baseTokenAddress,baseTokenAmount,baseTokenWeight) (contracts/pools/balancer/BPool.sol#204)
                - _totalWeight = badd(_totalWeight,bsub(denorm,oldWeight)) (contracts/pools/balancer/BPool.sol#386)
                - _totalWeight = bsub(_totalWeight,bsub(oldWeight,denorm)) (contracts/pools/balancer/BPool.sol#389)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#reentrancy-vulnerabilities-1

FactoryRouter.deployPool(address[2],uint256[],uint256[],address[]).flag (contracts/pools/FactoryRouter.sol#137) is a local variable never initialized
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#uninitialized-local-variables

FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) ignores return value by IERC20(_operations[i].tokenIn).approve(_operations[i].sourc
e,_operations[i].amountsIn) (contracts/pools/FactoryRouter.sol#273)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) ignores return value by IERC20(_operations[i].tokenIn).approve(_operations[i].sourc
e,amountIn) (contracts/pools/FactoryRouter.sol#292)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) ignores return value by IPool(_operations[i].source).swapExactAmountOut(_operations
[i].tokenIn,_operations[i].amountsIn,_operations[i].tokenOut,_operations[i].amountsOut,_operations[i].maxPrice) (contracts/pools/FactoryRouter.sol#294-299)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) ignores return value by IERC20(_operations[i].tokenIn).approve(_operations[i].sourc
e,baseTokenAmount) (contracts/pools/FactoryRouter.sol#316)
BFactory.newBPool(address[2],uint256[],uint256[],address[]) (contracts/pools/balancer/BFactory.sol#79-127) ignores return value by ISideStaking(addresses[0]).newDataTokenCreated(to
kens[0],tokens[1],bpool,addresses[3],ssParams) (contracts/pools/balancer/BFactory.sol#117-122)
```

```
FactoryRouter.changeRouterOwner(address) (contracts/pools/FactoryRouter.sol#46-52) should emit an event for:
        - routerOwner = _routerOwner (contracts/pools/FactoryRouter.sol#51)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#missing-events-access-control

FactoryRouter.updateOPFFee(uint256) (contracts/pools/FactoryRouter.sol#84-87) should emit an event for:
        - swapOceanFee = _newSwapOceanFee (contracts/pools/FactoryRouter.sol#86)
BPool.setSwapFee(uint256) (contracts/pools/balancer/BPool.sol#335-341) should emit an event for:
        - _swapFee = swapFee (contracts/pools/balancer/BPool.sol#340)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#missing-events-arithmetic

FactoryRouter.constructor(address,address,address,address,address[])._routerOwner (contracts/pools/FactoryRouter.sol#35) lacks a zero-check on :
                - routerOwner = _routerOwner (contracts/pools/FactoryRouter.sol#41)
FactoryRouter.constructor(address,address,address,address,address[])._opfCollector (contracts/pools/FactoryRouter.sol#38) lacks a zero-check on :
                - opfCollector = _opfCollector (contracts/pools/FactoryRouter.sol#42)
FactoryRouter.addFactory(address)._factory (contracts/pools/FactoryRouter.sol#66) lacks a zero-check on :
                - factory = _factory (contracts/pools/FactoryRouter.sol#68)
BPool.updateMarketFeeCollector(address)._newCollector (contracts/pools/balancer/BPool.sol#273) lacks a zero-check on :
                - _marketCollector = _newCollector (contracts/pools/balancer/BPool.sol#275)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#missing-zero-address-validation

FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) has external calls inside a loop: IERC20(_operations[i].tokenIn).transferFrom(msg.s
ender,address(this),_operations[i].amountsIn) (contracts/pools/FactoryRouter.sol#271)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) has external calls inside a loop: IERC20(_operations[i].tokenIn).approve(_operation
s[i].source,_operations[i].amountsIn) (contracts/pools/FactoryRouter.sol#273)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) has external calls inside a loop: (amountReceived) = IPool(_operations[i].source).s
wapExactAmountIn(_operations[i].tokenIn,_operations[i].amountsIn,_operations[i].tokenOut,_operations[i].amountsOut,_operations[i].maxPrice) (contracts/pools/FactoryRouter.sol#275-2
81)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) has external calls inside a loop: require(bool,string)(IERC20(_operations[i].tokenO
ut).transfer(msg.sender,amountReceived),Failed MultiSwap) (contracts/pools/FactoryRouter.sol#284)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) has external calls inside a loop: amountIn = IPool(_operations[i].source).getAmount
InExactOut(_operations[i].tokenIn,_operations[i].tokenOut,_operations[i].amountsOut) (contracts/pools/FactoryRouter.sol#287-288)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) has external calls inside a loop: IERC20(_operations[i].tokenIn).transferFrom(msg.s
ender,address(this),amountIn) (contracts/pools/FactoryRouter.sol#290)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) has external calls inside a loop: IERC20(_operations[i].tokenIn).approve(_operation
s[i].source,amountIn) (contracts/pools/FactoryRouter.sol#292)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) has external calls inside a loop: IPool(_operations[i].source).swapExactAmountOut(_
operations[i].tokenIn,_operations[i].amountsIn,_operations[i].tokenOut,_operations[i].amountsOut,_operations[i].maxPrice) (contracts/pools/FactoryRouter.sol#294-299)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) has external calls inside a loop: require(bool,string)(IERC20(_operations[i].tokenO
ut).transfer(msg.sender,_operations[i].amountsOut),Failed MultiSwap) (contracts/pools/FactoryRouter.sol#301-302)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) has external calls inside a loop: (datatoken) = IFixedRateExchange(_operations[i].s
ource).getExchange(_operations[i].exchangeIds) (contracts/pools/FactoryRouter.sol#306-307)
FactoryRouter.buyDTBatch(FactoryRouter.Operations[]) (contracts/pools/FactoryRouter.sol#262-330) has external calls inside a loop: (baseTokenAmount) = IFixedRateExchange(_operation
s[i].source).calcBaseInGivenOutDT(_operations[i].exchangeIds,_operations[i].amountsOut) (contracts/pools/FactoryRouter.sol#309-311)

BPool.collectMarketFee(address) (contracts/pools/balancer/BPool.sol#262-271) has external calls inside a loop: IERC20(tokens[i]).transfer(to,amount) (contracts/pools/balancer/BPool
.sol#269)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation/#calls-inside-a-loop

Reentrancy in BPool.setup(address,uint256,uint256,address,uint256,uint256) (contracts/pools/balancer/BPool.sol#175-213):
        External calls:
        - bind(dataTokenAddress,dataTokenAmount,dataTokenWeight) (contracts/pools/balancer/BPool.sol#195)
                - xfer = IERC20(erc20).transferFrom(from,address(this),amount) (contracts/pools/balancer/BPool.sol#1016)
                - xfer = IERC20(erc20).transfer(to,amount) (contracts/pools/balancer/BPool.sol#1027)
        - bind(baseTokenAddress,baseTokenAmount,baseTokenWeight) (contracts/pools/balancer/BPool.sol#204)
                - xfer = IERC20(erc20).transferFrom(from,address(this),amount) (contracts/pools/balancer/BPool.sol#1016)
                - xfer = IERC20(erc20).transfer(to,amount) (contracts/pools/balancer/BPool.sol#1027)
        State variables written after the call(s):
        - finalize() (contracts/pools/balancer/BPool.sol#212)
                - _balance[address(this)] = badd(_balance[address(this)],amt) (contracts/pools/balancer/BToken.sol#46)
                - _balance[src] = bsub(_balance[src],amt) (contracts/pools/balancer/BToken.sol#63)
                - _balance[dst] = badd(_balance[dst],amt) (contracts/pools/balancer/BToken.sol#64)
        - finalize() (contracts/pools/balancer/BPool.sol#212)
                - _publicSwap = true (contracts/pools/balancer/BPool.sol#347)
        - finalize() (contracts/pools/balancer/BPool.sol#212)
                - _totalSupply = badd(_totalSupply,amt) (contracts/pools/balancer/BToken.sol#47)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#reentrancy-vulnerabilities-2

Reentrancy in BPool.exitswapExternAmountOut(address,uint256,uint256) (contracts/pools/balancer/BPool.sol#925-1004):
        External calls:
        - _pushUnderlying(tokenOut,msg.sender,tokenAmountOut) (contracts/pools/balancer/BPool.sol#970)
                - xfer = IERC20(erc20).transfer(to,amount) (contracts/pools/balancer/BPool.sol#1027)
        Event emitted after the call(s):
        - LOG_EXIT(_controller,ssStakeToken,ssAmountOut,block.timestamp) (contracts/pools/balancer/BPool.sol#990-995)
        - Transfer(address(this),address(0),amt) (contracts/pools/balancer/BToken.sol#58)
                - _burnPoolShare(bsub(poolAmountIn,exitFee)) (contracts/pools/balancer/BPool.sol#997)
        - Transfer(src,dst,amt) (contracts/pools/balancer/BToken.sol#65)
                - _pullPoolShare(_controller,poolAmountIn) (contracts/pools/balancer/BPool.sol#996)
        - Transfer(src,dst,amt) (contracts/pools/balancer/BToken.sol#65)
                - _pushPoolShare(_factory,exitFee) (contracts/pools/balancer/BPool.sol#998)
Reentrancy in BPool.exitswapPoolAmountIn(address,uint256,uint256) (contracts/pools/balancer/BPool.sol#838-923):
        External calls:
        - _pushUnderlying(tokenOut,msg.sender,tokenAmountOut) (contracts/pools/balancer/BPool.sol#887)
                - xfer = IERC20(erc20).transfer(to,amount) (contracts/pools/balancer/BPool.sol#1027)
        Event emitted after the call(s):
        - LOG_EXIT(_controller,ssStakeToken,ssAmountOut,block.timestamp) (contracts/pools/balancer/BPool.sol#909-914)
        - Transfer(address(this),address(0),amt) (contracts/pools/balancer/BToken.sol#58)
                - _burnPoolShare(bsub(poolAmountIn,exitFee)) (contracts/pools/balancer/BPool.sol#916)

FactoryRouter.getOPFFee(address) (contracts/pools/FactoryRouter.sol#78-82) compares to a boolean constant:
        -oceanTokens[baseToken] == true (contracts/pools/FactoryRouter.sol#79)
FactoryRouter.deployPool(address[2],uint256[],uint256[],address[]) (contracts/pools/FactoryRouter.sol#117-159) compares to a boolean constant:
        -require(bool,string)(IFactory(factory).erc20List(msg.sender) == true,FACTORY ROUTER: NOT ORIGINAL ERC20 TEMPLATE) (contracts/pools/FactoryRouter.sol#126-129)
FactoryRouter.deployPool(address[2],uint256[],uint256[],address[]) (contracts/pools/FactoryRouter.sol#117-159) compares to a boolean constant:
        -require(bool,string)(ssContracts[addresses[0]] == true,FACTORY ROUTER: invalid ssContract) (contracts/pools/FactoryRouter.sol#130-133)
FactoryRouter.deployPool(address[2],uint256[],uint256[],address[]) (contracts/pools/FactoryRouter.sol#117-159) compares to a boolean constant:
        -oceanTokens[tokens[1]] == true (contracts/pools/FactoryRouter.sol#138)
FactoryRouter.deployFixedRate(address,address[],uint256[]) (contracts/pools/FactoryRouter.sol#176-197) compares to a boolean constant:
        -require(bool,string)(IFactory(factory).erc20List(msg.sender) == true,FACTORY ROUTER: NOT ORIGINAL ERC20 TEMPLATE) (contracts/pools/FactoryRouter.sol#182-185)
FactoryRouter.deployFixedRate(address,address[],uint256[]) (contracts/pools/FactoryRouter.sol#176-197) compares to a boolean constant:
        -require(bool,string)(fixedPrice[fixedPriceAddress] == true,FACTORY ROUTER: Invalid FixedPriceContract) (contracts/pools/FactoryRouter.sol#187-190)
FactoryRouter.deployDispenser(address,address,uint256,uint256,address,address) (contracts/pools/FactoryRouter.sol#212-230) compares to a boolean constant:
        -require(bool,string)(dispenser[_dispenser] == true,FACTORY ROUTER: Invalid DispenserContract) (contracts/pools/FactoryRouter.sol#225-228)
FactoryRouter.deployDispenser(address,address,uint256,uint256,address,address) (contracts/pools/FactoryRouter.sol#212-230) compares to a boolean constant:
        -require(bool,string)(IFactory(factory).erc20List(msg.sender) == true,FACTORY ROUTER: NOT ORIGINAL ERC20 TEMPLATE) (contracts/pools/FactoryRouter.sol#220-223)
BFactory.newBPool(address[2],uint256[],uint256[],address[]) (contracts/pools/balancer/BFactory.sol#79-127) compares to a boolean constant:
        -require(bool,string)(poolTemplates[addresses[5]] == true,BFactory: Wrong Pool Template) (contracts/pools/balancer/BFactory.sol#88)
BPool.joinswapExternAmountIn(address,uint256,uint256) (contracts/pools/balancer/BPool.sol#678-758) compares to a boolean constant:
        -ssContract.canStake(_datatokenAddress,ssStakeToken,ssAmountIn) == true (contracts/pools/balancer/BPool.sol#737-738)
BPool.joinswapPoolAmountOut(address,uint256,uint256) (contracts/pools/balancer/BPool.sol#760-836) compares to a boolean constant:
        -ssContract.canStake(_datatokenAddress,ssStakeToken,ssAmountIn) == true (contracts/pools/balancer/BPool.sol#818-819)
BPool.exitswapPoolAmountIn(address,uint256,uint256) (contracts/pools/balancer/BPool.sol#838-923) compares to a boolean constant:
        -ssContract.canUnStake(_datatokenAddress,ssStakeToken,poolAmountIn) == true (contracts/pools/balancer/BPool.sol#901-905)
BPool.exitswapExternAmountOut(address,uint256,uint256) (contracts/pools/balancer/BPool.sol#925-1004) compares to a boolean constant:
        -ssContract.canUnStake(_datatokenAddress,ssStakeToken,ssAmountOut) == true (contracts/pools/balancer/BPool.sol#982-986)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#boolean-equality

FactoryRouter.getLength(IERC20[]) (contracts/pools/FactoryRouter.sol#161-163) is never used and should be removed
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#dead-code

Pragma version>=0.5.7 (contracts/pools/FactoryRouter.sol#4) allows old versions
Pragma version>=0.5.7 (contracts/pools/balancer/BConst.sol#14) allows old versions
Pragma version>=0.5.7 (contracts/pools/balancer/BFactory.sol#1) allows old versions
Pragma version>=0.5.7 (contracts/pools/balancer/BMath.sol#14) allows old versions
Pragma version>=0.5.7 (contracts/pools/balancer/BNum.sol#14) allows old versions
Pragma version>=0.6.0 (contracts/pools/balancer/BPool.sol#2) allows old versions
Pragma version>=0.5.7 (contracts/pools/balancer/BToken.sol#14) allows old versions
solc-0.6.0 is not recommended for deployment
```

```
Dispenser.dispense(address,uint256,address) (contracts/pools/dispenser/Dispenser.sol#187-229) ignores return value by tokenInstance.transfer(destination,amount) (contracts/pools/dispenser/Dispenser.sol#227)
Dispenser.ownerWithdraw(address) (contracts/pools/dispenser/Dispenser.sol#236-251) ignores return value by tokenInstance.transfer(msg.sender,ourBalance) (contracts/pools/dispenser/Dispenser.sol#248)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#unchecked-transfer

Contract locking ether found:
        Contract Dispenser (contracts/pools/dispenser/Dispenser.sol#10-252) has payable functions:
         - Dispenser.dispense(address,uint256,address) (contracts/pools/dispenser/Dispenser.sol#187-229)
        But does not have a function to withdraw the ether

FixedRateExchange.buyDT(bytes32,uint256,uint256) (contracts/pools/fixedRate/FixedRateExchange.sol#333-412) ignores return value by IERC20Template(exchanges[exchangeId].dataToken).transfer(msg.sender,dataTokenAmount) (contracts/pools/fixedRate/FixedRateExchange.sol#397-400)
FixedRateExchange.sellDT(bytes32,uint256,uint256) (contracts/pools/fixedRate/FixedRateExchange.sol#421-492) ignores return value by IERC20Template(exchanges[exchangeId].baseToken).transfer(msg.sender,baseTokenAmount) (contracts/pools/fixedRate/FixedRateExchange.sol#477-480)
FixedRateExchange.collectBT(bytes32) (contracts/pools/fixedRate/FixedRateExchange.sol#494-511) ignores return value by IERC20Template(exchanges[exchangeId].baseToken).transfer(exchanges[exchangeId].exchangeOwner,amount) (contracts/pools/fixedRate/FixedRateExchange.sol#500-503)
FixedRateExchange.collectDT(bytes32) (contracts/pools/fixedRate/FixedRateExchange.sol#513-530) ignores return value by IERC20Template(exchanges[exchangeId].dataToken).transfer(exchanges[exchangeId].exchangeOwner,amount) (contracts/pools/fixedRate/FixedRateExchange.sol#519-522)
FixedRateExchange.collectMarketFee(bytes32) (contracts/pools/fixedRate/FixedRateExchange.sol#532-545) ignores return value by IERC20Template(exchanges[exchangeId].baseToken).transfer(exchanges[exchangeId].marketFeeCollector,amount) (contracts/pools/fixedRate/FixedRateExchange.sol#536-539)
FixedRateExchange.collectOceanFee(bytes32) (contracts/pools/fixedRate/FixedRateExchange.sol#547-560) ignores return value by IERC20Template(exchanges[exchangeId].baseToken).transfer(opfCollector,amount) (contracts/pools/fixedRate/FixedRateExchange.sol#551-554)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#unchecked-transfer

FixedRateExchange.calcBaseInGivenOutDT(bytes32,uint256) (contracts/pools/fixedRate/FixedRateExchange.sol#248-282) performs a multiplication on the result of a division:
        -baseTokenAmountBeforeFee = dataTokenAmount.mul(exchanges[exchangeId].fixedRate).div(BASE).mul(10 ** exchanges[exchangeId].btDecimals).div(10 ** exchanges[exchangeId].dtDecimals) (contracts/pools/fixedRate/FixedRateExchange.sol#259-263)
FixedRateExchange.calcBaseInGivenOutDT(bytes32,uint256) (contracts/pools/fixedRate/FixedRateExchange.sol#248-282) performs a multiplication on the result of a division:
        -baseTokenAmountBeforeFee = dataTokenAmount.mul(exchanges[exchangeId].fixedRate).div(BASE).mul(10 ** exchanges[exchangeId].btDecimals).div(10 ** exchanges[exchangeId].dtDecimals) (contracts/pools/fixedRate/FixedRateExchange.sol#259-263)
        -oceanFeeAmount = baseTokenAmountBeforeFee.mul(getOPFFee(exchanges[exchangeId].baseToken)).div(BASE) (contracts/pools/fixedRate/FixedRateExchange.sol#268-270)
FixedRateExchange.calcBaseInGivenOutDT(bytes32,uint256) (contracts/pools/fixedRate/FixedRateExchange.sol#248-282) performs a multiplication on the result of a division:
        -baseTokenAmountBeforeFee = dataTokenAmount.mul(exchanges[exchangeId].fixedRate).div(BASE).mul(10 ** exchanges[exchangeId].btDecimals).div(10 ** exchanges[exchangeId].dtDecimals) (contracts/pools/fixedRate/FixedRateExchange.sol#259-263)
        -marketFeeAmount = baseTokenAmountBeforeFee.mul(exchanges[exchangeId].marketFee).div(BASE) (contracts/pools/fixedRate/FixedRateExchange.sol#273-275)
FixedRateExchange.calcBaseOutGivenInDT(bytes32,uint256) (contracts/pools/fixedRate/FixedRateExchange.sol#290-324) performs a multiplication on the result of a division:
        -baseTokenAmountBeforeFee = dataTokenAmount.mul(exchanges[exchangeId].fixedRate).div(BASE).mul(10 ** exchanges[exchangeId].btDecimals).div(10 ** exchanges[exchangeId].dtDecimals) (contracts/pools/fixedRate/FixedRateExchange.sol#301-305)
FixedRateExchange.calcBaseOutGivenInDT(bytes32,uint256) (contracts/pools/fixedRate/FixedRateExchange.sol#290-324) performs a multiplication on the result of a division:
        -baseTokenAmountBeforeFee = dataTokenAmount.mul(exchanges[exchangeId].fixedRate).div(BASE).mul(10 ** exchanges[exchangeId].btDecimals).div(10 ** exchanges[exchangeId].dtDecimals) (contracts/pools/fixedRate/FixedRateExchange.sol#301-305)
        -oceanFeeAmount = baseTokenAmountBeforeFee.mul(getOPFFee(exchanges[exchangeId].baseToken)).div(BASE) (contracts/pools/fixedRate/FixedRateExchange.sol#310-312)
FixedRateExchange.calcBaseOutGivenInDT(bytes32,uint256) (contracts/pools/fixedRate/FixedRateExchange.sol#290-324) performs a multiplication on the result of a division:
        -baseTokenAmountBeforeFee = dataTokenAmount.mul(exchanges[exchangeId].fixedRate).div(BASE).mul(10 ** exchanges[exchangeId].btDecimals).div(10 ** exchanges[exchangeId].dtDecimals) (contracts/pools/fixedRate/FixedRateExchange.sol#301-305)
        -marketFeeAmount = baseTokenAmountBeforeFee.mul(exchanges[exchangeId].marketFee).div(BASE) (contracts/pools/fixedRate/FixedRateExchange.sol#315-317)

Reentrancy in Dispenser.dispense(address,uint256,address) (contracts/pools/dispenser/Dispenser.sol#187-229):
        External calls:
        - tokenInstance.mint(address(this),amount - ourBalance) (contracts/pools/dispenser/Dispenser.sol#220)
        - tokenInstance.transfer(destination,amount) (contracts/pools/dispenser/Dispenser.sol#227)
        Event emitted after the call(s):
        - TokensDispensed(datatoken,destination,amount) (contracts/pools/dispenser/Dispenser.sol#228)
Reentrancy in Dispenser.ownerWithdraw(address) (contracts/pools/dispenser/Dispenser.sol#236-251):
        External calls:
        - tokenInstance.transfer(msg.sender,ourBalance) (contracts/pools/dispenser/Dispenser.sol#248)
        Event emitted after the call(s):
        - OwnerWithdrawed(datatoken,msg.sender,ourBalance) (contracts/pools/dispenser/Dispenser.sol#249)
Reentrancy in FixedRateExchange.buyDT(bytes32,uint256,uint256) (contracts/pools/fixedRate/FixedRateExchange.sol#333-412):
        External calls:
        - require(bool,string)(IERC20Template(exchanges[exchangeId].baseToken).transferFrom(msg.sender,address(this),baseTokenAmount),FixedRateExchange: transferFrom failed in the baseToken contract) (contracts/pools/fixedRate/FixedRateExchange.sol#364-371)
        - IERC20Template(exchanges[exchangeId].dataToken).mint(msg.sender,dataTokenAmount) (contracts/pools/fixedRate/FixedRateExchange.sol#382)
        - require(bool,string)(IERC20Template(exchanges[exchangeId].dataToken).transferFrom(exchanges[exchangeId].exchangeOwner,msg.sender,dataTokenAmount),FixedRateExchange: transferFrom failed in the dataToken contract) (contracts/pools/fixedRate/FixedRateExchange.sol#385-392)
        - IERC20Template(exchanges[exchangeId].dataToken).transfer(msg.sender,dataTokenAmount) (contracts/pools/fixedRate/FixedRateExchange.sol#397-400)
        Event emitted after the call(s):
        - Swapped(exchangeId,msg.sender,baseTokenAmount,dataTokenAmount,exchanges[exchangeId].dataToken,marketFeeAmount,oceanFeeAmount) (contracts/pools/fixedRate/FixedRateExchange.sol#403-411)
Reentrancy in FixedRateExchange.collectBT(bytes32) (contracts/pools/fixedRate/FixedRateExchange.sol#494-511):
        External calls:
        - IERC20Template(exchanges[exchangeId].baseToken).transfer(exchanges[exchangeId].exchangeOwner,amount) (contracts/pools/fixedRate/FixedRateExchange.sol#500-503)
        Event emitted after the call(s):
        - TokenCollected(exchangeId,exchanges[exchangeId].exchangeOwner,exchanges[exchangeId].baseToken,amount) (contracts/pools/fixedRate/FixedRateExchange.sol#505-510)
Reentrancy in FixedRateExchange.collectDT(bytes32) (contracts/pools/fixedRate/FixedRateExchange.sol#513-530):
        External calls:
        - IERC20Template(exchanges[exchangeId].dataToken).transfer(exchanges[exchangeId].exchangeOwner,amount) (contracts/pools/fixedRate/FixedRateExchange.sol#519-522)
        Event emitted after the call(s):
        - TokenCollected(exchangeId,exchanges[exchangeId].exchangeOwner,exchanges[exchangeId].dataToken,amount) (contracts/pools/fixedRate/FixedRateExchange.sol#524-529)
Reentrancy in FixedRateExchange.collectMarketFee(bytes32) (contracts/pools/fixedRate/FixedRateExchange.sol#532-545):
        External calls:
        - IERC20Template(exchanges[exchangeId].baseToken).transfer(exchanges[exchangeId].marketFeeCollector,amount) (contracts/pools/fixedRate/FixedRateExchange.sol#536-539)
        Event emitted after the call(s):
        - MarketFeeCollected(exchangeId,exchanges[exchangeId].baseToken,amount) (contracts/pools/fixedRate/FixedRateExchange.sol#540-544)
Reentrancy in FixedRateExchange.collectOceanFee(bytes32) (contracts/pools/fixedRate/FixedRateExchange.sol#547-560):
        External calls:
        - IERC20Template(exchanges[exchangeId].baseToken).transfer(opfCollector,amount) (contracts/pools/fixedRate/FixedRateExchange.sol#551-554)
        Event emitted after the call(s):
        - OceanFeeCollected(exchangeId,exchanges[exchangeId].baseToken,amount) (contracts/pools/fixedRate/FixedRateExchange.sol#555-559)
Reentrancy in FixedRateExchange.sellDT(bytes32,uint256,uint256) (contracts/pools/fixedRate/FixedRateExchange.sol#421-492):
        External calls:
        - require(bool,string)(IERC20Template(exchanges[exchangeId].dataToken).transferFrom(msg.sender,address(this),dataTokenAmount),FixedRateExchange: transferFrom failed in the dataToken contract) (contracts/pools/fixedRate/FixedRateExchange.sol#452-459)
        - require(bool,string)(IERC20Template(exchanges[exchangeId].baseToken).transferFrom(exchanges[exchangeId].exchangeOwner,msg.sender,baseTokenAmount),FixedRateExchange: transferFrom failed in the baseToken contract) (contracts/pools/fixedRate/FixedRateExchange.sol#466-473)
        - IERC20Template(exchanges[exchangeId].baseToken).transfer(msg.sender,baseTokenAmount) (contracts/pools/fixedRate/FixedRateExchange.sol#477-480)

Dispenser.dispense(address,uint256,address) (contracts/pools/dispenser/Dispenser.sol#187-229) compares to a boolean constant:
        -require(bool,string)(datatokens[datatoken].active == true,Dispenser not active) (contracts/pools/dispenser/Dispenser.sol#192-195)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#boolean-equality

Pragma version>=0.5.7 (contracts/pools/dispenser/Dispenser.sol#1) allows old versions
solc-0.8.0 is not recommended for deployment
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#incorrect-versions-of-solidity
FixedRateExchange.getDTSupply(bytes32) (contracts/pools/fixedRate/FixedRateExchange.sol#670-690) compares to a boolean constant:
        -exchanges[exchangeId].active == false (contracts/pools/fixedRate/FixedRateExchange.sol#675)
FixedRateExchange.getDTSupply(bytes32) (contracts/pools/fixedRate/FixedRateExchange.sol#670-690) compares to a boolean constant:
        -exchanges[exchangeId].withMint == true && IERC20Template(exchanges[exchangeId].dataToken).isMinter(address(this)) (contracts/pools/fixedRate/FixedRateExchange.sol#676-677)
FixedRateExchange.getBTSupply(bytes32) (contracts/pools/fixedRate/FixedRateExchange.sol#699-714) compares to a boolean constant:
        -exchanges[exchangeId].active == false (contracts/pools/fixedRate/FixedRateExchange.sol#704)
FixedRateExchange.onlyActiveExchange(bytes32) (contracts/pools/fixedRate/FixedRateExchange.sol#50-57) compares to a boolean constant:
        -require(bool,string)(exchanges[exchangeId].active == true,FixedRateExchange: Exchange does not exist!) (contracts/pools/fixedRate/FixedRateExchange.sol#51-55)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#boolean-equality

Pragma version>=0.5.7 (contracts/pools/fixedRate/FixedRateExchange.sol#1) allows old versions
solc-0.8.0 is not recommended for deployment
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#incorrect-versions-of-solidity

Redundant expression "oceanFeeAmount (contracts/pools/fixedRate/FixedRateExchange.sol#266)" inFixedRateExchange (contracts/pools/fixedRate/FixedRateExchange.sol#21-814)
Redundant expression "oceanFeeAmount (contracts/pools/fixedRate/FixedRateExchange.sol#308)" inFixedRateExchange (contracts/pools/fixedRate/FixedRateExchange.sol#21-814)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#redundant-statements

createWithDecimals(address,address[],uint256[]) should be declared external:
        - FixedRateExchange.createWithDecimals(address,address[],uint256[]) (contracts/pools/fixedRate/FixedRateExchange.sol#166-225)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#public-function-that-could-be-declared-external
```



According to the test results, some findings found by these tools were considered false positives, while some of these findings were real security concerns. All relevant findings were reviewed by the auditors and addressed in the report as security concerns.

4.2 AUTOMATED SECURITY SCAN

Description:

Halborn used automated security scanners to assist with detection of well-known security issues, and to identify low-hanging fruits on the target contracts. 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. Only security-related findings are shown below.

Results:

ERC20Template.sol

Report for contracts/templates/ERC20Template.sol
https://dashboard.mythx.io/#/console/analyses/a137c08a-4243-41de-81d3-9175b197b61e

Line	SWC Title	Severity	Short Description
1	(SWC-103) Floating Pragma	Low	A floating pragma is set.
428	(SWC-120) Weak Sources of Randomness from Chain Attributes	Low	Potential use of "block.number" as source of randonmness.

ERC721Template.sol

Report for contracts/templates/ERC721Template.sol
https://dashboard.mythx.io/#/console/analyses/91f9850a-64be-47a2-be0b-1f153a68a094

Line	SWC Title	Severity	Short Description
1	(SWC-103) Floating Pragma	Low	A floating pragma is set.
171	(SWC-120) Weak Sources of Randomness from Chain Attributes	Low	Potential use of "block.number" as source of randonmness.
179	(SWC-120) Weak Sources of Randomness from Chain Attributes	Low	Potential use of "block.number" as source of randonmness.

ERC721Factory.sol

Report for contracts/ERC721Factory.sol
https://dashboard.mythx.io/#/console/analyses/b6d7a374-548e-4344-9087-7f0bb49d0aeb

Line	SWC Title	Severity	Short Description
1	(SWC-103) Floating Pragma	Low	A floating pragma is set.
148	(SWC-101) Integer Overflow and Underflow	Unknown	Arithmetic operation "+=" discovered
190	(SWC-101) Integer Overflow and Underflow	Unknown	Arithmetic operation "+=" discovered
309	(SWC-110) Assert Violation	Unknown	Out of bounds array access
327	(SWC-110) Assert Violation	Unknown	Out of bounds array access
328	(SWC-101) Integer Overflow and Underflow	Unknown	Arithmetic operation "+=" discovered
342	(SWC-110) Assert Violation	Unknown	Out of bounds array access

OPFCommunityFeeCollector.sol

Report for contracts/communityFee/OPFCommunityFeeCollector.sol
https://dashboard.mythx.io/#/console/analyses/f5f9d124-7e28-4694-97a3-4932797508c4

Line	SWC Title	Severity	Short Description
1	(SWC-103) Floating Pragma	Low	A floating pragma is set.

FactoryRouter.sol

Report for pools/FactoryRouter.sol
https://dashboard.mythx.io/#/console/analyses/15a467b1-ea97-4d7b-bb1c-66cbb06d7de2

Line	SWC Title	Severity	Short Description
4	(SWC-103) Floating Pragma	Low	A floating pragma is set.

Dispenser.sol

Report for contracts/pools/dispenser/Dispenser.sol
https://dashboard.mythx.io/#/console/analyses/54cd37b6-83e4-44d9-9869-370a1141c5fa

Line	SWC Title	Severity	Short Description
1	(SWC-103) Floating Pragma	Low	A floating pragma is set.
22	(SWC-108) State Variable Default Visibility	Low	State variable visibility is not set.
23	(SWC-110) Assert Violation	Unknown	Public state variable with array type causing reacheable exception by default.
220	(SWC-101) Integer Overflow and Underflow	Unknown	Arithmetic operation "-" discovered

FixedRateExchange.sol

Report for contracts/pools/fixedRate/FixedRateExchange.sol
https://dashboard.mythx.io/#/console/analyses/76e10cdb-4312-49a2-b1c1-c9fde30b4a25

Line	SWC Title	Severity	Short Description
1	(SWC-103) Floating Pragma	Low	A floating pragma is set.
23	(SWC-101) Integer Overflow and Underflow	Unknown	Arithmetic operation "**" discovered
173	(SWC-110) Assert Violation	Unknown	Out of bounds array access

BFactory.sol

Report for pools/balancer/BFactory.sol
https://dashboard.mythx.io/#/console/analyses/a5fc8e43-6536-461a-be68-9e52a91151f0

Line	SWC Title	Severity	Short Description
1	(SWC-103) Floating Pragma	Low	A floating pragma is set.

BPool.sol

Report for pools/balancer/BPool.sol
https://dashboard.mythx.io/#/console/analyses/31a96126-7a8e-45c3-96ef-a978b4af6a42

Line	SWC Title	Severity	Short Description
2	(SWC-103) Floating Pragma	Low	A floating pragma is set.
94	(SWC-108) State Variable Default Visibility	Low	State variable visibility is not set.

All relevant valid findings were identified in the manual code review.

THANK YOU FOR CHOOSING

// HALBORN