METATRUST

Draft
Security Assessment for

52-LogicBug-Vader2 (StaticFail) (3OK-SP)

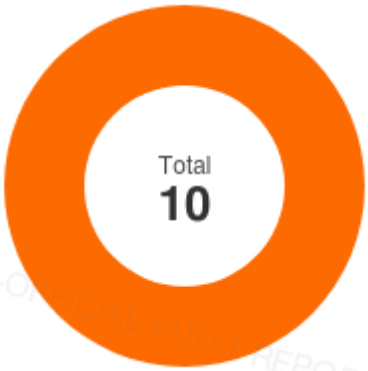
July 23, 2023

Executive Summary

Overview	
Project Name	52-LogicBug-Vader2 (StaticFail) (3OK-SP)
Codebase URL	https://github.com/metatrust-demo/LogicBug-Vader2
Scan Engine	AI Analyzer
Scan Time	2023/07/23 22:33:36
Commit Id	9913cbf

Total	
Critical Issues	0
High risk Issues	10
Medium risk Issues	0
Low risk Issues	0
Informational Issues	0

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



Critical Issues	0%	0
High risk Issues	100%	10
Medium risk Issues	0%	0
Low risk Issues	0%	0
Informational Issues	0%	0

Summary of Findings

MetaScan security assessment was performed on **July 23, 2023 22:33:36** on project **52-LogicBug-Vader2 (StaticFail) (3OK-SP)** with the repository **https://github.com/metatrust-demo/LogicBug-Vader2** on branch **default branch**. The assessment was carried out by scanning the project's codebase using the scan engine **AI Analyzer**. There are in total **10** vulnerabilities / security risks discovered during the scanning session, among which **0** critical vulnerabilities, **10** high risk vulnerabilities, **0** medium risk vulnerabilities, **0** low risk vulnerabilities, **0** informational issues.

ID	Description	Severity
MSA-001	MWE-206: No Slippage Limit Check	High risk
MSA-002	MWE-206: No Slippage Limit Check	High risk
MSA-003	MWE-206: No Slippage Limit Check	High risk
MSA-004	MWE-200: Insecure LP Token Value Calculation	High risk
MSA-005	MWE-206: No Slippage Limit Check	High risk
MSA-006	MWE-200: Insecure LP Token Value Calculation	High risk
MSA-007	MWE-206: No Slippage Limit Check	High risk
MSA-008	MWE-206: No Slippage Limit Check	High risk
MSA-009	MWE-206: No Slippage Limit Check	High risk
MSA-010	MWE-206: No Slippage Limit Check	High risk

Findings

Critical (0)

No Critical vulnerabilities found here

High risk (10)

1. MWE-206: No Slippage Limit Check

High risk Security Analyzer

No slippage limit check was performed to prevent sandwich attacks.

File(s) Affected

contracts/dex-v2/pool/VaderPoolV2.sol #126-167

```
126     function mintSynth(
127         IERC20 foreignAsset,
128         uint256 nativeDeposit,
129         address from,
130         address to
131     )
132         external
133         override
134         nonReentrant
135         supportedToken(foreignAsset)
136         returns (uint256 amountSynth)
137     {
138         nativeAsset.safeTransferFrom(from, address(this), nativeDeposit);
139
140         ISynth synth = synthFactory.synths(foreignAsset);
141
142         if (synth == ISynth(_ZERO_ADDRESS))
143             synth = synthFactory.createSynth(
144                 IERC20Extended(address(foreignAsset))
145             );
146
147         (uint112 reserveNative, uint112 reserveForeign, ) = getReserves(
148             foreignAsset
149         ); // gas savings
150
151         amountSynth = VaderMath.calculateSwap(
152             nativeDeposit,
153             reserveNative,
154             reserveForeign
155         );
156
157         // TODO: Clarify
158         _update(
159             foreignAsset,
160             reserveNative + nativeDeposit,
161             reserveForeign,
162             reserveNative,
163             reserveForeign
164         );
165
166         synth.mint(to, amountSynth);
167     }
```

Recommendation

Add slippage limit check when do liquidity-related operations.

2. MWE-206: No Slippage Limit Check

High risk Security Analyzer

No slippage limit check was performed to prevent sandwich attacks.

File(s) Affected

contracts/dex-v2/pool/VaderPoolV2.sol #179-219

```
179     function burnSynth(
180         IERC20 foreignAsset,
181         uint256 synthAmount,
182         address to
183     ) external override nonReentrant returns (uint256 amountNative) {
184         ISynth synth = synthFactory.synths(foreignAsset);
185
186         require(
187             synth != ISynth(_ZERO_ADDRESS),
188             "VaderPoolV2::burnSynth: Inexistent Synth"
189         );
190
191         require(
192             synthAmount > 0,
193             "VaderPoolV2::burnSynth: Insufficient Synth Amount"
194         );
195
196         IERC20(synth).safeTransferFrom(msg.sender, address(this), synthAmount);
197         synth.burn(synthAmount);
198
199         (uint112 reserveNative, uint112 reserveForeign, ) = getReserves(
200             foreignAsset
201         ); // gas savings
202
203         amountNative = VaderMath.calculateSwap(
204             synthAmount,
205             reserveForeign,
206             reserveNative
207         );
208
209         // TODO: Clarify
210         _update(
211             foreignAsset,
212             reserveNative - amountNative,
213             reserveForeign,
214             reserveNative,
215             reserveForeign
216         );
217
218         nativeAsset.safeTransfer(to, amountNative);
219     }
```

Recommendation

Add slippage limit check when do liquidity-related operations.

3. MWE-206: No Slippage Limit Check

High risk Security Analyzer

No slippage limit check was performed to prevent sandwich attacks.

File(s) Affected

contracts/dex-v2/pool/VaderPoolV2.sol #284-335

```
    function mintFungible(
        IERC20 foreignAsset,
        uint256 nativeDeposit,
        uint256 foreignDeposit,
        address from,
        address to
    ) external override nonReentrant returns (uint256 liquidity) {
        IERC20Extended lp = wrapper.tokens(foreignAsset);

        require(
            lp != IERC20Extended(_ZERO_ADDRESS),
            "VaderPoolV2::mintFungible: Unsupported Token"
        );

        (uint112 reserveNative, uint112 reserveForeign, ) = getReserves(
            foreignAsset
        ); // gas savings

        nativeAsset.safeTransferFrom(from, address(this), nativeDeposit);
        foreignAsset.safeTransferFrom(from, address(this), foreignDeposit);

        PairInfo storage pair = pairInfo[foreignAsset];
        uint256 totalLiquidityUnits = pair.totalSupply;
        if (totalLiquidityUnits == 0) liquidity = nativeDeposit;
        else
            liquidity = VaderMath.calculateLiquidityUnits(
                nativeDeposit,
                reserveNative,
                foreignDeposit,
                reserveForeign,
                totalLiquidityUnits
            );

        require(
            liquidity > 0,
            "VaderPoolV2::mintFungible: Insufficient Liquidity Provided"
        );

        pair.totalSupply = totalLiquidityUnits + liquidity;

        _update(
            foreignAsset,
            reserveNative + nativeDeposit,
            reserveForeign + foreignDeposit,
            reserveNative,
            reserveForeign
        );

        lp.mint(to, liquidity);

        emit Mint(from, to, nativeDeposit, foreignDeposit);
    }
```

Recommendation

Add slippage limit check when do liquidity-related operations.

4. MWE-200: Insecure LP Token Value Calculation

High risk Security Analyzer

Liquidity token value/price can be manipulated to cause flashloan attacks.

File(s) Affected

contracts/dex-v2/pool/BasePoolV2.sol #250-293

```
250     function _burn(uint256 id, address to)
251         internal
252         nonReentrant
253         returns (uint256 amountNative, uint256 amountForeign)
254     {
255         require(
256             ownerOf(id) == address(this),
257             "BasePoolV2::burn: Incorrect Ownership"
258         );
259
260         IERC20 foreignAsset = positions[id].foreignAsset;
261
262         (uint112 reserveNative, uint112 reserveForeign, ) = getReserves(
263             foreignAsset
264         ); // gas savings
265
266         uint256 liquidity = positions[id].liquidity;
267
268         PairInfo storage pair = pairInfo[foreignAsset];
269         uint256 _totalSupply = pair.totalSupply;
270         amountNative = (liquidity * reserveNative) / _totalSupply;
271         amountForeign = (liquidity * reserveForeign) / _totalSupply;
272
273         require(
274             amountNative > 0 && amountForeign > 0,
275             "BasePoolV2::burn: Insufficient Liquidity Burned"
276         );
277
278         pair.totalSupply = _totalSupply - liquidity;
279         _burn(id);
280
281         nativeAsset.safeTransfer(to, amountNative);
282         foreignAsset.safeTransfer(to, amountForeign);
283
284         _update(
285             foreignAsset,
286             reserveNative - amountNative,
287             reserveForeign - amountForeign,
288             reserveNative,
289             reserveForeign
290         );
291
292         emit Burn(msg.sender, amountNative, amountForeign, to);
293     }
```

Recommendation

Do not use AMM pool or custom liquidity calculation to caculate LP token value/price.

5. MWE-206: No Slippage Limit Check

High risk Security Analyzer

No slippage limit check was performed to prevent sandwich attacks.

File(s) Affected

contracts/dex-v2/router/VaderRouterV2.sol #114-151

```
114     function addLiquidity(
115         IERC20 tokenA,
116         IERC20 tokenB,
117         uint256 amountADesired,
118         uint256 amountBDesired,
119         address to,
120         uint256 deadline
121     ) public override ensure(deadline) returns (uint256 liquidity) {
122         IERC20 foreignAsset;
123         uint256 nativeDeposit;
124         uint256 foreignDeposit;
125 
126         if (tokenA == nativeAsset) {
127             require(
128                 pool.supported(tokenB),
129                 "VaderRouterV2::addLiquidity: Unsupported Assets Specified"
130             );
131             foreignAsset = tokenB;
132             foreignDeposit = amountBDesired;
133             nativeDeposit = amountADesired;
134         } else {
135             require(
136                 tokenB == nativeAsset && pool.supported(tokenA),
137                 "VaderRouterV2::addLiquidity: Unsupported Assets Specified"
138             );
139             foreignAsset = tokenA;
140             foreignDeposit = amountADesired;
141             nativeDeposit = amountBDesired;
142         }
143 
144         liquidity = pool.mint(
145             foreignAsset,
146             nativeDeposit,
147             foreignDeposit,
148             msg.sender,
149             to
150         );
151     }
```

Recommendation

Add slippage limit check when do liquidity-related operations.

6. MWE-200: Insecure LP Token Value Calculation

High risk Security Analyzer

Liquidity token value/price can be manipulated to cause flashloan attacks.

File(s) Affected

contracts/dex/pool/BasePool.sol #214-253

```
214     function _burn(uint256 id, address to)
215         internal
216         nonReentrant
217         returns (uint256 amountNative, uint256 amountForeign)
218     {
219         require(
220             ownerOf(id) == address(this),
221             "BasePool::burn: Incorrect Ownership"
222         );
223
224         (uint112 reserveNative, uint112 reserveForeign, ) = getReserves(); // gas savings
225         IERC20 _nativeAsset = nativeAsset; // gas savings
226         IERC20 _foreignAsset = foreignAsset; // gas savings
227         uint256 nativeBalance = IERC20(_nativeAsset).balanceOf(address(this));
228         uint256 foreignBalance = IERC20(_foreignAsset).balanceOf(address(this));
229
230         uint256 liquidity = positions[id].liquidity;
231
232         uint256 _totalSupply = totalSupply; // gas savings, must be defined here since totalSupply can
233         amountNative = (liquidity * nativeBalance) / _totalSupply; // using balances ensures pro-rata
234         amountForeign = (liquidity * foreignBalance) / _totalSupply; // using balances ensures pro-rata
235
236         require(
237             amountNative > 0 && amountForeign > 0,
238             "BasePool::burn: Insufficient Liquidity Burned"
239         );
240
241         totalSupply -= liquidity;
242         _burn(id);
243
244         _nativeAsset.safeTransfer(to, amountNative);
245         _foreignAsset.safeTransfer(to, amountForeign);
246
247         nativeBalance = _nativeAsset.balanceOf(address(this));
248         foreignBalance = _foreignAsset.balanceOf(address(this));
249
250         _update(nativeBalance, foreignBalance, reserveNative, reserveForeign);
251
252         emit Burn(msg.sender, amountNative, amountForeign, to);
253     }
```

contracts/dex-v2/pool/BasePoolV2.sol #250-293

```
    function _burn(uint256 id, address to)
        internal
        nonReentrant
        returns (uint256 amountNative, uint256 amountForeign)
    {
        require(
            ownerOf(id) == address(this),
            "BasePoolV2::burn: Incorrect Ownership"
        );

        IERC20 foreignAsset = positions[id].foreignAsset;

        (uint112 reserveNative, uint112 reserveForeign, ) = getReserves(
            foreignAsset
        ); // gas savings

        uint256 liquidity = positions[id].liquidity;

        PairInfo storage pair = pairInfo[foreignAsset];
        uint256 _totalSupply = pair.totalSupply;
        amountNative = (liquidity * reserveNative) / _totalSupply;
        amountForeign = (liquidity * reserveForeign) / _totalSupply;

        require(
            amountNative > 0 && amountForeign > 0,
            "BasePoolV2::burn: Insufficient Liquidity Burned"
        );

        pair.totalSupply = _totalSupply - liquidity;
        _burn(id);

        nativeAsset.safeTransfer(to, amountNative);
        foreignAsset.safeTransfer(to, amountForeign);

        _update(
            foreignAsset,
            reserveNative - amountNative,
            reserveForeign - amountForeign,
            reserveNative,
            reserveForeign
        );

        emit Burn(msg.sender, amountNative, amountForeign, to);
    }
```

Recommendation

Do not use AMM pool or custom liquidity calculation to caculate LP token value/price.

7. MWE-206: No Slippage Limit Check

High risk Security Analyzer

No slippage limit check was performed to prevent sandwich attacks.

File(s) Affected

contracts/dex/math/VaderMath.sol #117-150

```
117     function calculateSwapReverse(
118         uint256 amountOut,
119         uint256 reserveIn,
120         uint256 reserveOut
121     ) public pure returns (uint256 amountIn) {
122         // X * Y
123         uint256 XY = reserveIn * reserveOut;
124
125         // 2y
126         uint256 y2 = amountOut * 2;
127
128         // 4y
129         uint256 y4 = y2 * 2;
130
131         require(
132             y4 < reserveOut,
133             "VaderMath::calculateSwapReverse: Desired Output Exceeds Maximum Output Possible (1/4 of L
134         );
135
136         // root(-X^2 * Y * (4y - Y))     =>     root(X^2 * Y * (Y - 4y)) as Y - 4y >= 0     =>     Y >= 4y
137         uint256 numeratorA = root(XY) * root(reserveIn * (reserveOut - y4));
138
139         // X * (2y - Y)     =>     2yX - XY
140         uint256 numeratorB = y2 * reserveIn;
141         uint256 numeratorC = XY;
142
143         // -1 * (root(-X^2 * Y * (4y - Y)) + (X * (2y - Y)))     =>     -1 * (root(X^2 * Y * (Y - 4y)) +
144         uint256 numerator = numeratorC - numeratorA - numeratorB;
145
146         // 2y
147         uint256 denominator = y2;
148
149         amountIn = numerator / denominator;
150     }
```

Recommendation

Add slippage limit check when do liquidity-related operations.

8. MWE-206: No Slippage Limit Check

High risk Security Analyzer

No slippage limit check was performed to prevent sandwich attacks.

File(s) Affected

contracts/dex/router/VaderRouter.sol #123-150

```
123     function addLiquidity(
124         IERC20 tokenA,
125         IERC20 tokenB,
126         uint256 amountADesired,
127         uint256 amountBDesired,
128         address to,
129         uint256 deadline
130     )
131         public
132         override
133         ensure(deadline)
134         returns (
135             uint256 amountA,
136             uint256 amountB,
137             uint256 liquidity
138         )
139     {
140         IVaderPool pool;
141         (pool, amountA, amountB) = _addLiquidity(
142             address(tokenA),
143             address(tokenB),
144             amountADesired,
145             amountBDesired
146         );
147         tokenA.safeTransferFrom(msg.sender, address(pool), amountA);
148         tokenB.safeTransferFrom(msg.sender, address(pool), amountB);
149         liquidity = pool.mint(to);
150     }
```

Recommendation

Add slippage limit check when do liquidity-related operations.

9. MWE-206: No Slippage Limit Check

High risk Security Analyzer

No slippage limit check was performed to prevent sandwich attacks.

File(s) Affected

contracts/dex/router/VaderRouter.sol #394-438

```
    function calculateInGivenOut(uint256 amountOut, address[] calldata path)
        public
        view
        returns (uint256 amountIn)
    {
        if (path.length == 2) {
            address nativeAsset = factory.nativeAsset();
            IVaderPool pool = factory.getPool(path[0], path[1]);
            (uint256 nativeReserve, uint256 foreignReserve, ) = pool
                .getReserves();
            if (path[0] == nativeAsset) {
                return
                    VaderMath.calculateSwapReverse(
                        amountOut,
                        nativeReserve,
                        foreignReserve
                    );
            } else {
                return
                    VaderMath.calculateSwapReverse(
                        amountOut,
                        foreignReserve,
                        nativeReserve
                    );
            }
        } else {
            IVaderPool pool0 = factory.getPool(path[0], path[1]);
            IVaderPool pool1 = factory.getPool(path[1], path[2]);
            (uint256 nativeReserve0, uint256 foreignReserve0, ) = pool0
                .getReserves();
            (uint256 nativeReserve1, uint256 foreignReserve1, ) = pool1
                .getReserves();

            return
                VaderMath.calculateSwapReverse(
                    VaderMath.calculateSwapReverse(
                        amountOut,
                        nativeReserve1,
                        foreignReserve1
                    ),
                    foreignReserve0,
                    nativeReserve0
                );
        }
    }
```

Recommendation

Add slippage limit check when do liquidity-related operations.

10. MWE-206: No Slippage Limit Check

High risk Security Analyzer

No slippage limit check was performed to prevent sandwich attacks.

File(s) Affected

contracts/dex/router/VaderRouter.sol #453-497

```
    function calculateOutGivenIn(uint256 amountIn, address[] calldata path)
        external
        view
        returns (uint256 amountOut)
    {
        if (path.length == 2) {
            address nativeAsset = factory.nativeAsset();
            IVaderPool pool = factory.getPool(path[0], path[1]);
            (uint256 nativeReserve, uint256 foreignReserve, ) = pool
                .getReserves();
            if (path[0] == nativeAsset) {
                return
                    VaderMath.calculateSwap(
                        amountIn,
                        nativeReserve,
                        foreignReserve
                    );
            } else {
                return
                    VaderMath.calculateSwap(
                        amountIn,
                        foreignReserve,
                        nativeReserve
                    );
            }
        } else {
            IVaderPool pool0 = factory.getPool(path[0], path[1]);
            IVaderPool pool1 = factory.getPool(path[1], path[2]);
            (uint256 nativeReserve0, uint256 foreignReserve0, ) = pool0
                .getReserves();
            (uint256 nativeReserve1, uint256 foreignReserve1, ) = pool1
                .getReserves();

            return
                VaderMath.calculateSwap(
                    VaderMath.calculateSwap(
                        amountIn,
                        nativeReserve1,
                        foreignReserve1
                    ),
                    foreignReserve0,
                    nativeReserve0
                );
        }
    }
```

Recommendation

Add slippage limit check when do liquidity-related operations.

Medium risk (0)

No Medium risk vulnerabilities found here

Low risk (0)

No Low risk vulnerabilities found here

Informational (0)

No Informational vulnerabilities found here

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