Overview

This report has been prepared for cLabs in review of Optics-core smart contracts to identify issues and vulnerabilities in the source code as well as any contract dependencies that were not part of an officially recognized library. A comprehensive examination has been performed, utilizing Static Analysis and Manual Review techniques.

The assessment process pays particular attention to the following considerations:

- Testing smart contracts against both common and uncommon attack vectors.
- Assessing the codebase to ensure compliance with current best practices and industry standards. Ensuring contract logic meets the specifications and intentions of the client.
- Cross referencing contract structure and implementation against similar smart contracts produced by industry leaders.
- Thorough line-by-line manual review of the entire codebase.

The security assessment did not result in findings that were critical, only medium, and low. FTI recommends addressing these findings to ensure security standards as well as enhancing general coding practices for better structure of source code as described in Detailed Findings.

Project Summary

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Optics-Core Smart Contracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>The assessment is comprised of code review of all smart contracts within the Optics-core repository</td>
</tr>
</tbody>
</table>
### Assessment Summary

<table>
<thead>
<tr>
<th>Delivery Date</th>
<th>Oct 8, 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Methodology</td>
<td>Static Analysis, Manual Review</td>
</tr>
</tbody>
</table>

### Vulnerability Summary

<table>
<thead>
<tr>
<th>Total Issues</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>2</td>
</tr>
<tr>
<td>Low</td>
<td>8</td>
</tr>
</tbody>
</table>
## Overview of All Contracts Assessed

<table>
<thead>
<tr>
<th>Number</th>
<th>Contract</th>
<th>Name</th>
<th>General Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CMN-01</td>
<td>Common.sol</td>
<td>No changes required</td>
</tr>
<tr>
<td>2</td>
<td>HM-01</td>
<td>Home.sol</td>
<td>Gas Optimization</td>
</tr>
<tr>
<td>3</td>
<td>MRK-01</td>
<td>Merkle.sol</td>
<td>No changes required</td>
</tr>
<tr>
<td>4</td>
<td>QUE-01</td>
<td>Queue.sol</td>
<td>No changes required</td>
</tr>
<tr>
<td>5</td>
<td>RPLA-01</td>
<td>Replica.sol</td>
<td>Gas Optimization and Logical Issue</td>
</tr>
<tr>
<td>6</td>
<td>UM-01</td>
<td>UpdateManager.sol</td>
<td>Gas Optimization and Logical Issue</td>
</tr>
<tr>
<td>7</td>
<td>V0-01</td>
<td>Version0.sol</td>
<td>No changes required</td>
</tr>
<tr>
<td>8</td>
<td>XACM-01</td>
<td>XAppConnectionManager.sol</td>
<td>No changes required</td>
</tr>
<tr>
<td>9</td>
<td>GM-01</td>
<td>GovernanceMessage.sol</td>
<td>Gas Optimization</td>
</tr>
<tr>
<td>10</td>
<td>GR-01</td>
<td>GovernanceRouter.sol</td>
<td>Coding Style, Volatile Code, Gas Optimization</td>
</tr>
<tr>
<td>11</td>
<td>UB-01</td>
<td>UpgradeBeacon.sol</td>
<td>Logical Issue and Gas Optimization</td>
</tr>
<tr>
<td>12</td>
<td>UBC-01</td>
<td>UpgradeBeaconController.sol</td>
<td>Volatile Code</td>
</tr>
<tr>
<td>13</td>
<td>UBP-01</td>
<td>UpgradeBeaconProxy.sol</td>
<td>Volatile Code</td>
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## Findings – Vulnerability Summary

<table>
<thead>
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<th>ID</th>
<th>Title</th>
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<tbody>
<tr>
<td>UM-01</td>
<td>contracts/UpdaterManager.sol</td>
<td>Logical Issue</td>
<td>Medium</td>
<td>Requires Attention</td>
</tr>
<tr>
<td>UB-01</td>
<td>contracts/upgrade/UpgradeBeacon.sol</td>
<td>Logical Issue</td>
<td>Medium</td>
<td>Requires Attention</td>
</tr>
<tr>
<td>GR-01</td>
<td>contracts/governance/GovernanceRouter.sol</td>
<td>Coding Style; Volatile Code; Gas Optimization</td>
<td>Low</td>
<td>Requires Attention</td>
</tr>
<tr>
<td>GM-01</td>
<td>contracts/governance/GovernanceMessage.sol</td>
<td>Gas Optimization</td>
<td>Low</td>
<td>Requires Attention</td>
</tr>
<tr>
<td>UB-02</td>
<td>contracts/upgrade/UpgradeBeacon.sol</td>
<td>Volatile Code</td>
<td>Low</td>
<td>Requires Attention</td>
</tr>
<tr>
<td>UBC-01</td>
<td>contracts/upgrade/UpgradeBeaconController.sol</td>
<td>Volatile Code</td>
<td>Low</td>
<td>Requires Attention</td>
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<td>contracts/upgrade/UpgradeBeaconProxy.sol</td>
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Detailed Findings

Medium

1. UM-01 (UpdaterManager.sol)

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<tr>
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</tbody>
</table>

Line 55-57 Function

constructor(address _updaterAddress) payable Ownable()

Issue

The constructor is payable but does not have a function to withdraw the ether which can lead to a locking of ether.

Recommendation

Confirm that the lack of withdrawal functionality is intentional. If locking of ether is a requirement then this is a non-issue.
2. UB-01 (UpgradeBeacon.sol)

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</tbody>
</table>

**Line 44-47 Function**

constructor(address _initialImplementation, address _controller) payable

**Line 58-77 Function**

fallback() external payable

**Issue**

The constructor is payable but does not have a function to withdraw the ether which can lead to a locking of ether.

**Recommendation**

Confirm that the lack of withdrawal functionality is intentional. If locking of ether is a requirement then this is a non-issue.

**Low**

1. GR-01 (GovernanceRouter.sol)

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<tr>
<td>GR-01</td>
<td>contracts/governance/GovernanceRouter.sol</td>
<td>Coding Style, Volatile Code, Gas Optimization</td>
<td>Low</td>
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</tbody>
</table>

**Line 164-180 Function**
GovernanceRouter.initialize(address,address)
recoveryManager = _recoveryManager (governance/GovernanceRouter.sol#173)

**Issue**

The code sets recoveryManager without emitting an event which is difficult to track off-chain.

**Recommendation**

Emit an event for critical parameter changes.

**Zero address validation**

**Line 164-180 Function**

GovernanceRouter.initialize(address,address)
recoveryManager = _recoveryManager (governance/GovernanceRouter.sol#173)

**Line 281-287 Function**

GovernanceRouter.transferRecoveryManager(address)._newRecoveryManager
recoveryManager = _newRecoveryManager (governance/GovernanceRouter.sol#286)

**Issue**

The function does not check for a zero-address.

**Recommendation**

Before setting the recoveryManager check for non-zero address.

**Declare external**

**Line 164-180 Function**

GovernanceRouter.initialize(address,address)
**Issue**

The function is declared with visibility mode as public instead of external. The function is never called by the contract.

**Recommendation**

For gas optimization use the external attribute for functions if they are not called from the contract but are used externally.

**2. GM-01 (GovernanceMessage.sol)**

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<td>contracts/governance/GovernanceMessage.sol</td>
<td>Gas Optimization</td>
<td>Low</td>
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</tr>
</tbody>
</table>

**Line 191-193 Function**

GovernanceMessage.isCall(bytes29)

**Line 265-267 Function**

GovernanceMessage.isSetRouter(bytes29)

**Line 225-229 Function**

GovernanceMessage.isTransferGovernor(bytes29)

**Line 134-136 Function**

GovernanceMessage.messageType(bytes29)

**Line 202-204 Function**

GovernanceMessage.mustBeCalls(bytes29)
**Issue**

The above functions are not used in the contract and are considered dead code.

**Recommendation**

Remove unused functions for better gas optimization.

3. **UB-02 (UpgradeBeacon.sol)**

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<tbody>
<tr>
<td>UB-02</td>
<td>contracts/upgrade/UpgradeBeacon.sol</td>
<td>Volatile Code</td>
<td>Low</td>
<td>Requires Attention</td>
</tr>
</tbody>
</table>

**Zero address validation**

**Line 44-47 Function**

```
constructor(address _initialImplementation, address _controller) payable
controller = _controller (upgrade/UpgradeBeacon.sol#46)
```

**Issue**

The function does not check for a zero-address.

**Recommendation**

Before using address _controller check for non-zero address.

**Inline Assembly**

**Line 58-77 Function**

**Inline assembly** (function line : 63-66)

Inline Assembly (upgrade/UpgradeBeacon.sol#63-66)
Inline assembly (function line: 71-73)
Inline Assembly (upgrade/UpgradeBeacon.sol#71-73)

Issue

The use of assembly is error-prone and uses excess gas.

Recommendation

Avoid EVM assembly and use standard solidity instead.

4. UBC-01 (UpgradeBeaconController.sol)

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<td>Volatile Code</td>
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</tr>
</tbody>
</table>

Zero address validation

Line 31-47 Function

UpgradeBeaconController.upgrade( address _beacon, address _implementation) (_success) = _beacon.call(abi.encode(_implementation))
(UpgradeBeaconController.sol#38)

Issue

The function does not check for a zero-address.

Recommendation

Before using address _implementation check for non-zero address.

Inline Assembly
Line 31-47 Function

**Inline assembly** (function line : 41-44)

**Issue**

The use of assembly is error-prone and uses excess gas.

**Recommendation**

Avoid EVM assembly and use standard solidity instead.

5. UBP-01 (UpgradeBeaconProxy.sol)

<table>
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<tbody>
<tr>
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<td>contracts/upgrade/UpgradeBeaconProxy.sol</td>
<td>Volatile Code</td>
<td>Low</td>
<td>Requires Attention</td>
</tr>
</tbody>
</table>

**Inline Assembly**

Line 85-98 Function

UpgradeBeaconProxy._initialize(address,bytes)

**Inline assembly** (function line : 93-96)

```
assembly {
    returndatacopy(0, 0, returndatasize())
    revert(0, returndatasize())
}
```

Line 115-142 Function

UpgradeBeaconProxy._delegate(address)

**Inline assembly** (function line : 116-141)

**Issue**
The use of assembly is error-prone and uses excess gas.

**Recommendation**

Avoid EVM assembly and use standard solidity instead.

6. **HM-01 (Home.sol)**

<table>
<thead>
<tr>
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<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM-01</td>
<td>contracts/Home.sol</td>
<td>Gas Optimization</td>
<td>Low</td>
<td>Requires Attention</td>
</tr>
</tbody>
</table>

**Line 111-120 Function**

`initialize(IUpdaterManager _updaterManager) public initializer` (Home.sol#111-120)

**Issue**

The function is declared with visibility mode as public instead of external. The function is never called by the contract.

**Recommendation**

For gas optimization use the external attribute for functions if they are not called from the contract but are used externally.

7. **UM-02 (UpdaterManager.sol)**

<table>
<thead>
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<tbody>
<tr>
<td>UM-02</td>
<td>contracts/UpdaterManager.sol</td>
<td>Volatile Code</td>
<td>Low</td>
<td>Requires Attention</td>
</tr>
</tbody>
</table>
Zero address validation

Line 55-57 Function

UpdaterManager.constructor(address _updaterAddress )
_updater = _updaterAddress (UpdaterManager.sol#56)

Issue

The function does not check for a zero-address.

Recommendation

Before using address _updaterAddress check whether it is a non-zero address or not

8. RPLA-01 (Replica.sol)

<table>
<thead>
<tr>
<th>ID</th>
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<th>Category</th>
<th>Severity</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPLA-01</td>
<td>contracts/Replica.sol</td>
<td>Gas Optimization, Volatile Code</td>
<td>Low</td>
<td>Requires Attention</td>
</tr>
</tbody>
</table>

Line 94-106 Function

Replica.initialize(uint32,address,bytes32,uint256) (Replica.sol#94-106)

Issue

The function is declared with visibility mode as public instead of external. The function is never called by the contract.

Recommendation

For gas optimization use the external attribute for functions if they are not called from the contract but are used externally.
Inline Assembly

Line 168-230 Function

Replica.process(bytes) (Replica.sol#168-230)
Inline assembly (function line : 206-225)

Issue

The use of assembly is error-prone and uses excess gas.

Recommendation

Avoid EVM assembly and use standard solidity instead.
Appendix - Category Descriptions

Gas Optimization

Gas Optimization findings do not affect the functionality of the code but generate different, more optimal EVM opcodes resulting in a reduction on the total gas cost of a transaction.

Logical Issue

Logical Issue findings detail a fault in the logic of the linked code, such as an incorrect notion on how block.timestamp works.

Control Flow

Control Flow findings concern the access control imposed on functions, such as owner-only functions being invoke-able by anyone under certain circumstances.

Volatile Code

Volatile Code findings refer to segments of code that behave unexpectedly on certain edge cases that may result in a vulnerability.

Language Specific

Language Specific findings are issues that would only arise within Solidity, i.e., incorrect usage of private or delete.

Coding Style

Coding Style findings usually do not affect the generated byte-code but rather comment on how to make the codebase is more legible and, as a result, easily maintainable.

Mathematical Operations

Mathematical operation findings related to mishandling of math formulas, such as overflows, incorrect operations etc.
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