

Metamask Delegator Framework

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Minor

Acknowledged

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Minor

✓ Fixed

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Date	October 2024
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1 Executive Summary

This report presents the results of our engagement with **MetaMask** to review **MetaMask delegator framework**.

The review was conducted over two weeks, from **October 21, 2024** to **October 25, 2024**, by **Rai Yang** and **Sergii Kravchenko**. A total of 5 person-days were spent.

The review is performed on the changes in the codebase that were made since the previous [audit](#). The main changes are:

- Adding four new enforcer contracts.
- Switching the cryptography lib from Fresh Crypto Lib (FCL) to SmoothCryptoLib (SCL).
- Adding `beforeAllHook` / `afterAllHook` functions to `ICaveatEnforcer` .
- Changing order of `afterHook` executions.
- Using `EIP712` standard in the `DeleGatorCore` .

2 Scope

Our review focused on the commit hash `ec0c0d64a4fc1ccca24d5e910d5712e62d84c4b7`. The list of files in scope can be found in the [Appendix](#).

2.1 Objectives

Together with the **MetaMask** team, we identified the following priorities for our review:

- Correctness of the implementation, consistent with the intended functionality and without unintended edge cases.
- Identify known vulnerabilities particular to smart contract systems, as outlined in our [Smart Contract Best Practices](#), and the [Smart Contract Weakness Classification Registry](#).

3 Findings

Each issue has an assigned severity:

- Minor

 issues are subjective in nature. They are typically suggestions around best practices or readability. Code maintainers should use their own judgment as to whether to address such issues.
- Medium

 issues are objective in nature but are not security vulnerabilities. These should be addressed unless there is a clear reason not to.
- Major

 issues are security vulnerabilities that may not be directly exploitable or may require certain conditions in order to be exploited. All major issues should be addressed.
- Critical

 issues are directly exploitable security vulnerabilities that need to be fixed.

3.1 Potential Misuse of `ERC1155BalanceGteEnforcer` and `ERC721BalanceGteEnforcer` .

Acknowledged

Description

Two similar enforcers, `ERC1155BalanceGteEnforcer` and `ERC721BalanceGteEnforcer` , are designed to ensure that the balance increases after the transaction for no less than a specific amount.

src/enforcers/ERC721BalanceGteEnforcer.sol:L64-L71

```
{
    (address token_, address recipient_) = getTermsInfo(_terms);
    bytes32 hashKey_ = _getHashKey(msg.sender, token_, recipient_, _delegationHash);
    require(!isLocked[hashKey_], "ERC721BalanceGteEnforcer:enforcer-is-locked");
    isLocked[hashKey_] = true;
    uint256 balance_ = IERC721(token_).balanceOf(recipient_);
    balanceCache[hashKey_] = balance_;
}
```

This pattern of checking the balance before and after the transaction can be dangerous if there is any re-entrancy possible in between. Usually, re-entrancy can trigger a separate execution flow before the previous one is finished. This separate call can also change the token balance of the target address but in an unexpected way. It can be a problem here as a generic call to another contract is happening, and there can be more executions involving the target address, potentially changing its balance. Since this is a general-purpose system, infinite scenarios can be played here, and users should be extra cautious when relying only on the balance change.

3.2 Improper Calldata Length Check in `ERC721TransferEnforcer` and `OwnershipTransferEnforcer` Contracts

Minor

✓ Fixed

Resolution
Fixed.

Description

In both the `beforeHook` function of the `ERC721TransferEnforcer` contract and the `_validateAndEnforce` function of the `OwnershipTransferEnforcer` contract, the length of the `calldata` is improperly validated. The length check is performed after an operation is executed on the `calldata`, which poses a security risk. In the `beforeHook` function of the `ERC721TransferEnforcer` contract, the following line extracts the first 4 bytes of the `calldata` to determine the function selector:

```
bytes4 selector_ = bytes4(callData_[0:4]);
```

However, this operation is performed before validating that the `calldata` is at least 4 bytes long. If the `calldata` is less than 4 bytes, the contract will attempt to access out-of-bounds data, causing the transaction to revert unexpectedly. A similar issue exists in the `_validateAndEnforce` function of the `OwnershipTransferEnforcer` contract. In both cases, the `calldata` length should be checked before any operations are performed on the `calldata` to avoid unexpected reverts and ensure proper handling of `calldata` input.

Examples

src/enforcers/ERC721TransferEnforcer.sol:L36-L42

```
bytes4 selector_ = bytes4(callData_[0:4]);

// Decode the remaining callData into NFT transfer parameters
// The calldata should be at least 100 bytes (4 bytes for the selector + 96 bytes for the parameters)
if (callData_.length < 100) {
    revert("ERC721TransferEnforcer:invalid-calldata-length");
}
```

src/enforcers/OwnershipTransferEnforcer.sol:L75-L78

```
bytes4 selector = bytes4(callData_[0:4]);
require(selector == IERC173.transferOwnership.selector, "OwnershipTransferEnforcer:invalid-method");

require(callData_.length == 36, "OwnershipTransferEnforcer:invalid-execution-length");
```

Recommendation

Move the length check of `calldata` to the beginning of the function to ensure the `calldata` has sufficient length before any slicing or access operations are performed.

Appendix 1 - Files in Scope

This audit covered the following files:

File	SHA-1 hash
src/DeleGatorCore.sol	5310e3469b74493a391cedbaec6d4f86d84c25b5
src/DelegationManager.sol	13c4ab79238da9107eb2f68c4bad89393f28abf8
src/HybridDeleGator.sol	1b34393e16b3b895ad3206511755c5a0dcbf2a34
src/MultiSigDeleGator.sol	aaa79cc10c8baa1820c6da7cf93f780d239c7663
src/enforcers/CaveatEnforcer.sol	22875c3279162b563d5767e1d2b3933f1e5bbe93
src/enforcers/ERC1155BalanceGteEnforcer.sol	b5c26a8dd6f53b28d07d7909d953da05529dfd3f
src/enforcers/ERC721BalanceGteEnforcer.sol	9e85500e3c3cf487505847c7cfbbc0c6c6b14463
src/enforcers/ERC721TransferEnforcer.sol	58d3e810196287094ad626067c483cb2196ae709
src/enforcers/OwnershipTransferEnforcer.sol	636a4066dc39f105e0626b6ccb8a0856ba046861
src/interfaces/ICaveatEnforcer.sol	83fbc7bfc9b2990e6f7a58f140e2b6ad40affeba
src/interfaces/IDelegationManager.sol	cf9b9e2c8cbac2714e37751ebe6abb10cb1ceb0b
src/libraries/P256SCLVerifierLib.sol	8293c94ff45c0f1b2920fcd7d2f6757e3793dda4
src/libraries/P256VerifierLib.sol	6366362d9224f0667305d26998221c3aa4f7b8f1
src/libraries/WebAuthn.sol	b10fb0bedf6ad431a17112c50debc4f687bea98e

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A.2.3 Timeliness of Content

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