Uniswap v4 Universal Router Security Review

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1 About Spearbit

Spearbit is a decentralized network of expert security engineers offering reviews and other security related services to Web3 projects with the goal of creating a stronger ecosystem. Our network has experience on every part of the blockchain technology stack, including but not limited to protocol design, smart contracts and the Solidity compiler. Spearbit brings in untapped security talent by enabling expert freelance auditors seeking flexibility to work on interesting projects together.

Learn more about us at spearbit.com

2 Introduction

Uniswap is an open source decentralized exchange that facilitates automated transactions between ERC20 token tokens on various EVM-based chains through the use of liquidity pools and automatic market makers (AMM).

Disclaimer: This security review does not guarantee against a hack. It is a snapshot in time of universal-router according to the specific commit. Any modifications to the code will require a new security review.

3 Risk classification

Severity level	Impact: High	Impact: Medium	Impact: Low
Likelihood: high	Critical	High	Medium
Likelihood: medium	High	Medium	Low
Likelihood: low	Medium	Low	Low

3.1 Impact

- High - leads to a loss of a significant portion (>10%) of assets in the protocol, or significant harm to a majority of users.
- Medium - global losses <10% or losses to only a subset of users, but still unacceptable.
- Low - losses will be annoying but bearable--applies to things like griefing attacks that can be easily repaired or even gas inefficiencies.

3.2 Likelihood

- High - almost certain to happen, easy to perform, or not easy but highly incentivized
- Medium - only conditionally possible or incentivized, but still relatively likely
- Low - requires stars to align, or little-to-no incentive

3.3 Action required for severity levels

- Critical - Must fix as soon as possible (if already deployed)
- High - Must fix (before deployment if not already deployed)
- Medium - Should fix
- Low - Could fix

4 Executive Summary

Disclaimer: *The current report is a* ***draft****. Fix review is still in progress for many issues and nothing in this report should be considered finalized.*

Over the course of 30 days in total, Uniswap engaged with Spearbit to review the universal-router protocol. In this period of time a total of **6** issues were found.

Summary

Project Name	Uniswap
Repository	universal-router
Commit	4ce107...cadef4
Type of Project	DeFi, AMM
Audit Timeline	Jul 15 to Aug 26
Two week fix period	Aug 26 - Sep 10

Issues Found

Severity	Count	Fixed	Acknowledged
Critical Risk	0	0	0
High Risk	0	0	0
Medium Risk	1	1	0
Low Risk	0	0	0
Gas Optimizations	0	0	0
Informational	5	2	0
Total	**6**	**3**	**0**

5 Findings

5.1 Medium Risk

5.1.1 `UniversalRouter` doesn't support incoming native token transfers from `poolManager`

Severity: Medium Risk

Context: UniversalRouter.sol#L68-L70

Description: One notable change in UniV4 core is the built-in compatibility for native tokens. As such, the universal router should be able to accept native token transfers from the `PoolManager` singleton contract, but the `receive()` function only allow calls from the `WETH9` contract, causing this functionality to break.

Recommendation: Also allow `poolManager` to call `receive()` function.

Uniswap: Fixed in PR 376.

Spearbit: Fixed.

5.2 Informational

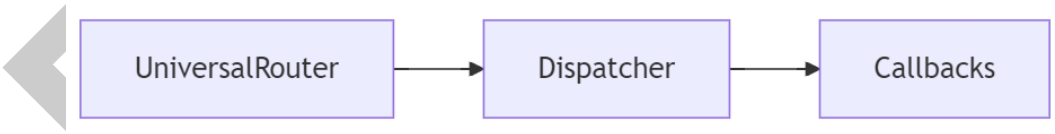
5.2.1 `Callbacks` contract can be removed

Severity: Informational

Context: Callbacks.sol#L10, Dispatcher.sol#L11, Dispatcher.sol#L21

Description: The `Callbacks` contract currently only has one end-point `supportsInterface` which only supports the `ERC165` interface and so basically it is the most minimal implementation of that interface. Previously this endpoint used to support more interfaces such as `ERC721`, ... and their corresponding callbacks were also included in this contract which were consequently got removed in PR 346.

`Callbacks` is inherited by the `Dispatcher` contract which is inherited by the `UniversalRouter`:



Recommendation: If the `Callback` contract is not going be used for things such as:

- Backward compatibility for integrators.

It should probably be removed from the codebase to keep the structure clean.

Uniswap: Fixed in PR 389.

Spearbit: Verified.

5.2.2 Comment Improvements

Severity: Informational

Context: Dispatcher.sol#L258-L259, Commands.sol#L56

Description: The following are comment clarifications for correctness, clarity and typos.

Recommendation:

```
- // should only call modifyLiquidities() to mint or increase liquidity
- // do not permit or approve this contract over a v4 position or someone could use this command to
↪  decrease/burn your position
+ // should only call modifyLiquidities() to mint
+ // do not permit or approve this contract over a v4 position or someone could use this command to
↪  decrease, burn or transfer your position

- // COMMAND_PLACEHOLDER for 0x23 to 0x3f (all unused)
+ // COMMAND_PLACEHOLDER for 0x22 to 0x3f (all unused)
```

Uniswap: Fixed in PR 392 and PR 387.

Spearbit: Verified.

5.2.3 Missing NatSpec comments affect readability

Severity: Informational

Context: Permit2Payments.sol#L64-L66

Description: Proper NatSpec documentation is crucial for code readability, maintainability, and for generating clear and comprehensive external documentation.

- `Permit2Payments.sol` is missing the `@param` description for the `owner` parameter.

Recommendation: Add the missing `@param` description for the `owner` parameter in the NatSpec comment:

```
  /// @notice Performs a batch transferFrom on Permit2
+ /// @param owner The owner of the tokens to be transferred
  /// @param batchDetails An array detailing each of the transfers that should occur
  function permit2TransferFrom(address owner, BatchTransferDetails[] calldata batchDetails) internal {
      // ... function implementation ...
  }
```

Uniswap: Fixed in PR 392.

5.2.4 Unused code should be removed

Severity: Informational

Context: Payments.sol#L14, PaymentsImmutables.sol#L19-L22

Description: Unused code should be removed, this would help decreasing cognitive load and make easier the read, additionally reducing a little the contract codesize. Some instances:

- `InvalidSpender()` is an error defined in `Payments.sol` but unused.
- `enum Spenders` is an enum defined in `PaymentsImmutables.sol` but unused.

Recommendation: Remove unused code.

Uniswap: Fixed in PR 391.

Spearbit: Verified.

5.2.5 Use `abi.encodeCall` whenever possible

Severity: Informational

Context: Dispatcher.sol#L271

Description: In this context, `encodeWithSelector` is used.

Recommendation: Use `encodeCall` to make sure that there are no typos and the also the correct types are used:

```
(address(this)).call(abi.encodeCall(Dispatcher.execute, (_commands, _inputs)));
```

Uniswap: Fixed in PR 382.

Spearbit: Verified.