



Security Assessment Report
Monaco Protocol v0.12.1

December 26, 2023

Summary

The Sec3 team (formerly Soteria) was engaged to do a thorough security analysis of the Monaco Protocol smart contracts.

The artifact of the audit was the source code of the following programs excluding tests in the repository at <https://github.com/MonacoProtocol/protocol>.

The initial audit was done on the following versions and revealed 3 issues or questions.

program	type	commit
Monaco Protocol	Solana	7d70c2b4a9c795a6fb136f6499bda07e00cf7b72

The post-audit review was done on the following versions to check if the reported issues have been addressed.

program	type	commit
Monaco Protocol	Solana	7d70c2b4a9c795a6fb136f6499bda07e00cf7b72

This report describes the findings and resolutions in detail.

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Result Overview

Issue	Impact	Status
MONACO PROTOCOL		
[I-1] Close cancelled orders	Info	Resolved
[I-2] Only settle orders and positions in ReadyForSettlement status	Info	Resolved
[I-3] Check paid status before closing market position accounts	Info	Resolved

Findings in Detail

MONACO PROTOCOL

[I-1] Close cancelled orders

In “cancel_preplay_order_post_event_start()”, for orders that are never matched (having “Open” status or “voided_stake” equal to “stake”), their status will be set to “Cancelled”. Additionally, the market’s unsettled account counter will decrease by 1.

```
/* programs/monaco_protocol/src/instructions/order/cancel_preplay_order_post_event_start.rs */
011 | pub fn cancel_preplay_order_post_event_start(
016 | ) -> Result<u64> {
046 |     order.void_stake_unmatched(); // <-- void needs to happen before refund calculation
049 |     // if never matched
050 |     if order.stake == order.voided_stake {
051 |         // no more settlement needed
052 |         market.decrement_unsettled_accounts_count()?;
053 |     }

/* programs/monaco_protocol/src/state/order_account.rs */
064 | pub fn void_stake_unmatched(&mut self) {
065 |     self.voided_stake = self.stake_unmatched;
066 |     self.stake_unmatched = 0_u64;
067 |     if self.order_status == OrderStatus::Open {
068 |         self.order_status = OrderStatus::Cancelled;
069 |     }
070 | }
```

The market can then transition to either “ReadyForSettlement” or “ReadyToVoid”. The “settle_order” function will not process such cancelled orders, and they will eventually be closed by “close_order”. A similar process occurs for “void_order”, except the order status will be set to “Voided”.

```
/* programs/monaco_protocol/src/instructions/order/cancel_order.rs */
009 | pub fn cancel_order(ctx: Context<CancelOrder>) -> Result<()> {
033 |     ctx.accounts.order.void_stake_unmatched();
045 |     // if never matched close
046 |     if order.stake == order.voided_stake {
047 |         ctx.accounts.market.decrement_account_counts()?;
048 |         ctx.accounts
049 |             .order
050 |             .close(ctx.accounts.purchaser.to_account_info()?);
051 |     }
```

This indicates that these cancelled orders can be closed. In fact, orders cancelled by “cancel_order”

will be directly closed.

However, it is also safe to leave them open, given the cancelled order can only be settled or voided once.

Resolution

The team explained that this is a retail feature, meaning it allows users on a product or website to see that their orders have been cancelled, instead of the orders simply disappearing from existence. This issue is resolved.

MONACO PROTOCOL

[I-2] Only settle orders and positions in ReadyForSettlement status

Markets with "ReadyForSettlement" or "Settled" status and some markets with "ReadyToClose" status (those not transited from the "Voided" status) all satisfy the condition at L14 and L24.

```
/* programs/monaco_protocol/src/instructions/order/settle_order.rs */
009 | pub fn settle_order(ctx: Context<SettleOrder>) -> Result<()> {
010 |     let market_account = &mut ctx.accounts.market;
012 |     // validate the market is settled
013 |     require!(
014 |         market_account.market_winning_outcome_index.is_some(),
015 |         CoreError::SettlementMarketNotSettled
016 |     );

/* programs/monaco_protocol/src/instructions/market_position/settle_market_position.rs */
014 | pub fn settle_market_position(ctx: Context<SettleMarketPosition>) -> Result<()> {
021 |     let market_account = &mut ctx.accounts.market;
022 |     // validate the market is settled
023 |     require!(
024 |         market_account.market_winning_outcome_index.is_some(),
025 |         CoreError::SettlementMarketNotSettled
026 |     );
```

However, the order and position settlement instructions should only be allowed when the market is in the "ReadyForSettlement" status:

- The "complete_settlement" instruction, which transits the market from "ReadyForSettlement" to "Settled", requires the "unsettled_accounts_count" is 0. So, all orders and positions should be settled in "ReadyForSettlement" status.
- The "transfer_market_escrow_surplus" instruction is supposed to be invoked after all positions are settled and it's only allowed when the market is in the "Settled" state in the settlement path.

Resolution

The team acknowledged this issue and has resolved it in v0.13.0.

MONACO PROTOCOL

[I-3] Check paid status before closing market position accounts

In "create_market_position", the "paid" flag is set to "false". In "settle_market_position" and "void_market_position", it is set to "true" such that the position cannot be settled or voided again.

```
/* programs/monaco_protocol/src/instructions/market_position/create_market_position.rs */
006 | pub fn create_market_position(
010 | ) -> Result<()> {
022 |     market_position.paid = false;

/* programs/monaco_protocol/src/instructions/market_position/void_market_position.rs */
009 | pub fn void_market_position(ctx: Context<VoidMarketPosition>) -> Result<()> {
025 |     market_position.paid = true;

/* programs/monaco_protocol/src/instructions/market_position/settle_market_position.rs */
014 | pub fn settle_market_position(ctx: Context<SettleMarketPosition>) -> Result<()> {
068 |     market_position.paid = true;
```

When closing the position accounts, "close_market_position" requires the "ReadyToClose" market status, which implies "market.unsettled_accounts_count" is 0 when the market transits from "ReadyForSettlement" to "Settled".

```
/* programs/monaco_protocol/src/lib.rs */
573 | pub fn close_market_position(ctx: Context<CloseMarketPosition>) -> Result<()> {
574 |     instructions::close::close_market_child_account(&mut ctx.accounts.market)
575 | }

/* programs/monaco_protocol/src/instructions/close.rs */
008 | pub fn close_market_child_account(market: &mut Market) -> Result<()> {
009 |     require!(
010 |         ReadyToClose.eq(&market.market_status),
011 |         CoreError::MarketNotReadyToClose
012 |     );
013 |     market.decrement_unclosed_accounts_count()
014 | }
```

However, the market status check doesn't guarantee the position to be closed has been settled (when the unsettled account counter incorrectly reaches 0). Consider checking the "paid" status of the position before closing.

Resolution

The team acknowledged this issue and has resolved it in v0.13.0.

Appendix: Methodology and Scope of Work

The Sec3 (formerly Soteria) audit team, which consists of Computer Science professors and industrial researchers with extensive experience in smart contract security, program analysis, testing and formal verification, performed a comprehensive manual code review, software static analysis and penetration testing.

Assisted by the Sec3 Scanner developed in-house, the audit team particularly focused on the following work items:

- Check common security issues.
- Check program logic implementation against available design specifications.
- Check poor coding practices and unsafe behavior.
- The soundness of the economics design and algorithm is out of scope of this work

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ABOUT

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At Sec3, we identify and eliminate security vulnerabilities through the most rigorous process and aided by the most advanced analysis tools.

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