VRust

Security Assessment

O2Lab VRust Team

11/04/2022 19:36:45

Contents

Summary

This report has been prepared for O2Lab VRust Team to discover issues and vulnerabilities in the source code of the O2Lab VRust Team project 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 auditing process pays special attention to the following considerations:

- Testing the 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 by industry experts.

The security assessment resulted in findings that ranged from critical to informational. We recommend addressing these findings to ensure a high level of security standards and industry practices. We suggest recommendations that could better serve the project from the security perspective:

- Enhance general coding practices for better structures of source codes;
- Add enough unit tests to cover the possible use cases;
- Provide more comments per each function for readability, especially contracts that are verified in public;
- Provide more transparency on privileged activities once the protocol is live.

Overview

Project Summary

Project Name	O2Lab VRust Team
Platform	Ethereum
Language	Solana
Crate	mpl_token_metadata
GitHub Location	https://github.com/parasol-aser/vrust
sha256	Unknown

Audit Summary

Delivery Date	11/04/2022
Audit Methodology	Static Analysis
Key Components	

Vulnerability Summary

Vulnerability Level	Total
Critical	12
Major	0
Medium	0
Minor	0
Informational	0
Discussion	0

Findings

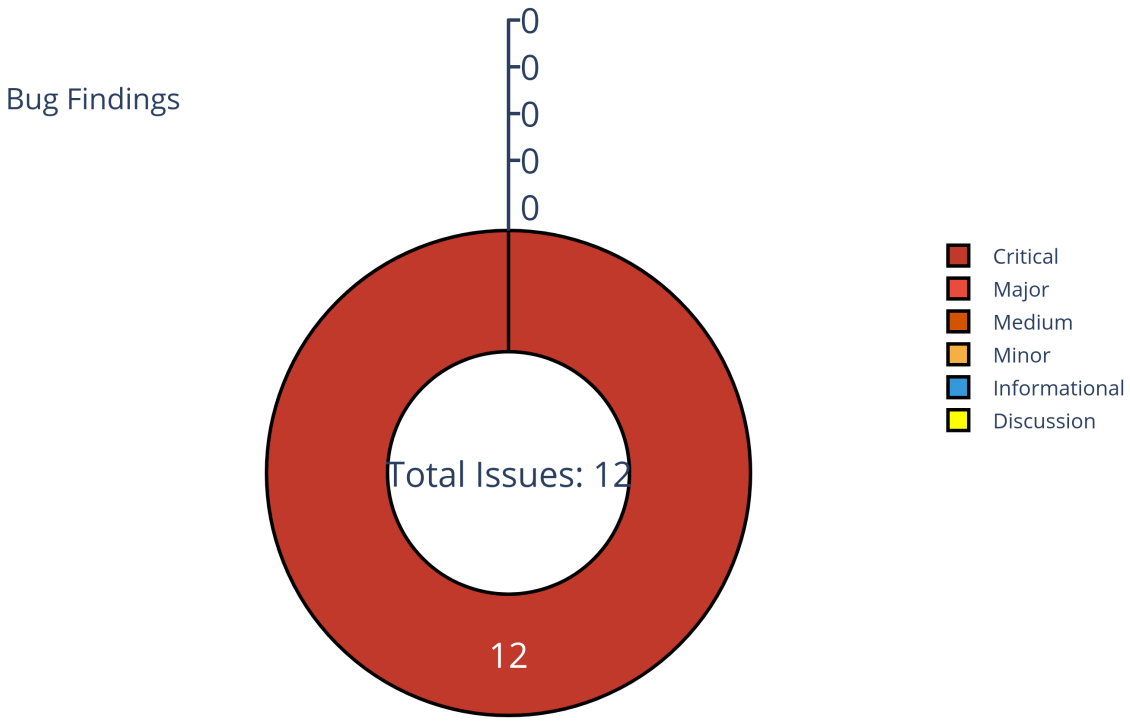

Figure 1: Findings

Finding Statistic

Category	Count
IntegerFlow	1
MissingKeyCheck	6
TypeConfusion	5

ID	Category	Severity	Status
0	IntegerFlow	Critical	UnResolved
1	MissingKeyCheck	Critical	UnResolved
2	MissingKeyCheck	Critical	UnResolved
3	MissingKeyCheck	Critical	UnResolved
4	MissingKeyCheck	Critical	UnResolved
5	MissingKeyCheck	Critical	UnResolved
6	MissingKeyCheck	Critical	UnResolved
7	TypeConfusion	Critical	GitHub Link to be added.
8	TypeConfusion	Critical	GitHub Link to be added.
9	TypeConfusion	Critical	GitHub Link to be added.
10	TypeConfusion	Critical	GitHub Link to be added.
11	TypeConfusion	Critical	GitHub Link to be added.

Issue: 0: IntegerFlow

Category	Severity	Status
IntegerFlow	Critical	UnResolved

- Location

program/src/state.rs:712:12: 714:66

```
712 7 - offset_from_start
713             .checked_rem(8)
714             .ok_or(MetadataError::NumericalOverflowError)? as u32
715
```

- Code Context

– Function Definition:

```
707 fn get_offset_from_right(offset_from_start: usize) -> Result<u32,
    ↪  ProgramError>
708
```

Vulnerability at Line: 712

```
707 fn get_offset_from_right(offset_from_start: usize) -> Result<u32,
    ↪  ProgramError> {
708         // We're saying the left hand side of a u8 is the 0th index so to
            ↪  get a 1 in that 0th index
709         // you need to shift a 1 over 8 spots from the right hand side. To
            ↪  do that you actually
710         // need not 00000001 but 10000000 which you can get by simply
            ↪  multiplying 1 by 2^7, 128 and then ORing
711         // it with the current value.
712         Ok(7 - offset_from_start
713             .checked_rem(8)
714             .ok_or(MetadataError::NumericalOverflowError)? as u32)
715     }
716
```

- Call Stack

```
fn entrypoint::process_instruction(){// program/src/entrypoint.rs:12:1: 23:2 }
    fn processor::process_instruction(){// program/src/processor.rs:53:1: 207:2 }
        fn proces-
        ↪ sor::process_mint_new_edition_from_master_edition_via_vault_proxy(){//
        ↪ program/src/processor.rs:557:1: 670:2 }
            fn
            ↪ utils::process_mint_new_edition_from_master_edition_via_token_logic(){//
            ↪ program/src/utils.rs:995:1: 1113:2 }
                fn state::EditionMarker::edition_taken(){//
                ↪ program/src/state.rs:734:5: 742:6 }
                    fn state::EditionMarker::get_index_and_mask(){//
                    ↪ program/src/state.rs:717:5: 732:6 }
                        fn
                        ↪ state::EditionMarker::get_offset_from_right(){//
                        ↪ program/src/state.rs:707:5: 715:6 }

```

- description:
- link:
- alleviation:

Issue: 1: MissingKeyCheck

Category	Severity	Status
MissingKeyCheck	Critical	UnResolved

- Location

program/src/utils.rs:139:43: 139:69

```
account_info.data.borrow()

```

- Code Context

Vulnerability at Line: 139

```
pub fn assert_initialized<T: Pack + IsInitialized>(
    account_info: &AccountInfo,
) -> Result<T, ProgramError> {
    let account: T = T::unpack_unchecked(&account_info.data.borrow())?;
    if !account.is_initialized() {
        Err(MetadataError::Uninitialized.into())
    } else {
        Ok(account)

```

- Call Stack

```
fn entrypoint::process_instruction(){// program/src/entrypoint.rs:12:1:
↪  23:2 }
    fn processor::process_instruction(){// program/src/processor.rs:53:1:
    ↪  207:2 }
        fn processor::process_thaw_delegated_account(){//
        ↪  program/src/processor.rs:1294:1: 1351:2 }
            fn utils::assert_initialized(){// program/src/utils.rs:136:1:
            ↪  145:2 }

```

- description:

- link:
- alleviation:

Issue: 2: MissingKeyCheck

Category	Severity	Status
MissingKeyCheck	Critical	UnResolved

- Location

/home/yifei/.cargo/registry/src/github.com-1ecc6299db9ec823/solana-program-1.9.5/src/account_info.rs:102:9: 103:26

```
102 self.data
103             .try_borrow()
104
```

- Code Context

Vulnerability at Line: 102

```
101 pub fn try_borrow_data(&self) -> Result<Ref<&mut [u8]>, ProgramError> {
102         self.data
103             .try_borrow()
104             .map_err(|_| ProgramError::AccountBorrowFailed)
105     }
106
```

- Call Stack

```
1 fn entrypoint::process_instruction(){// program/src/entrypoint.rs:12:1:
  ↪  23:2 }
2     fn processor::process_instruction(){// program/src/processor.rs:53:1:
      ↪  207:2 }
3         fn processor::set_and_verify_collection(){//
          ↪  program/src/processor.rs:1177:1: 1231:2 }
4             fn assertions::collection::assert_has_collection_authority(){//
              ↪  program/src/assertions/collection.rs:32:1: 59:2 }
5                 fn
                  ↪  solana_program::account_info::AccountInfo::<'a>::try_borrow_data
                  ↪  /home/yifei/.cargo/registry/src/github.com-
                  ↪  1ecc6299db9ec823/solana-program-
                  ↪  1.9.5/src/account_info.rs:101:5: 105:6
                  ↪  }
```

6

- description:
- link:
- alleviation:

Issue: 3: MissingKeyCheck

Category	Severity	Status
MissingKeyCheck	Critical	UnResolved

- Location

/home/yifei/.cargo/registry/src/github.com-1ecc6299db9ec823/solana-program-1.9.5/src/account_info.rs:66:11: 66:33

```
66 self.lamports.borrow()
67
```

- Code Context

Vulnerability at Line: 66

```
65 pub fn lamports(&self) -> u64 {
66         **self.lamports.borrow()
67     }
68
```

- Call Stack

```
1 fn entrypoint::process_instruction(){// program/src/entrypoint.rs:12:1:
  ↪  23:2 }
2     fn processor::process_instruction(){// program/src/processor.rs:53:1:
      ↪  207:2 }
3         fn processor::process_revoke_collection_authority(){//
          ↪  program/src/processor.rs:1136:1: 1175:2 }
4             fn
              ↪  solana_program::account_info::AccountInfo::<'a>::lamports(){//
              ↪  /home/yifei/.cargo/registry/src/github.com-
              ↪  1ecc6299db9ec823/solana-program-
              ↪  1.9.5/src/account_info.rs:65:5: 67:6
              ↪  }
5
```

- description:

- link:
- alleviation:

Issue: 4: MissingKeyCheck

Category	Severity	Status
MissingKeyCheck	Critical	UnResolved

- Location

/home/yifei/.cargo/registry/src/github.com-1ecc6299db9ec823/solana-program-1.9.5/src/account_info.rs:96:9: 97:30

```
96 self.lamports
97             .try_borrow_mut()
98
```

- Code Context

Vulnerability at Line: 96

```
95 pub fn try_borrow_mut_lamports(&self) -> Result<RefMut<&'a mut u64>,
   ↪  ProgramError> {
96         self.lamports
97             .try_borrow_mut()
98             .map_err(|_| ProgramError::AccountBorrowFailed)
99     }
100
```

- Call Stack

```
1 fn entrypoint::process_instruction(){// program/src/entrypoint.rs:12:1:
  ↪  23:2 }
2     fn processor::process_instruction(){// program/src/processor.rs:53:1:
      ↪  207:2 }
3         fn processor::process_revoke_collection_authority(){//
          ↪  program/src/processor.rs:1136:1: 1175:2 }
4             fn
              ↪  solana_program::account_info::AccountInfo::<'a>::try_borrow_mut_lamports
              ↪  /home/yifei/.cargo/registry/src/github.com-
              ↪  1ecc6299db9ec823/solana-program-
              ↪  1.9.5/src/account_info.rs:95:5: 99:6
              ↪  }
5
```

- description:
- link:
- alleviation:

Issue: 5: MissingKeyCheck

Category	Severity	Status
MissingKeyCheck	Critical	UnResolved

- Location

program/src/processor.rs:588:22: 588:46

```
588 vault_info.data.borrow()
589
```

- Code Context

Vulnerability at Line: 588

```
583     // not sure how they would get away with it - they'd need to actually
        ↪  own that account! - J.
584     let token_vault_program_info = next_account_info(account_info_iter)?;
585     let system_account_info = next_account_info(account_info_iter)?;
586     let rent_info = next_account_info(account_info_iter)?;
587
588     let vault_data = vault_info.data.borrow();
589     let safety_deposit_data = safety_deposit_info.data.borrow();
590
591     // Since we're crunching out borsh for CPU units, do type checks this
        ↪  way
592     if vault_data[0] != mpl_token_vault::state::Key::VaultV1 as u8 {
593
```

- Call Stack

```
1 fn entrypoint::process_instruction(){// program/src/entrypoint.rs:12:1:
  ↪  23:2 }
2     fn processor::process_instruction(){// program/src/processor.rs:53:1:
      ↪  207:2 }
3         fn proces-
          ↪  sor::process_mint_new_edition_from_master_edition_via_vault_proxy(){//
          ↪  program/src/processor.rs:557:1: 670:2 }
4
```

- description:
- link:
- alleviation:

Issue: 6: MissingKeyCheck

Category	Severity	Status
MissingKeyCheck	Critical	UnResolved

- Location

program/src/state.rs:430:19: 430:40

```
430 account.data.borrow()
431
```

- Code Context

Vulnerability at Line: 430

```
427 pub fn get_reservation_list(
428     account: &AccountInfo,
429 ) -> Result<Box<dyn ReservationList>, ProgramError> {
430     let version = account.data.borrow()[0];
431
432     // For some reason when converting Key to u8 here, it becomes
        ↪ unreachable. Use direct constant instead.
433     match version {
434         3 => return
            ↪ Ok(Box::new(ReservationListV1::from_account_info(account)?)),
435
```

- Call Stack

```
1 fn entrypoint::process_instruction(){// program/src/entrypoint.rs:12:1:
  ↪ 23:2 }
2     fn processor::process_instruction(){// program/src/processor.rs:53:1:
      ↪ 207:2 }
3         fn proces-
          ↪ sor::process_mint_new_edition_from_master_edition_via_vault_proxy(){//
          ↪ program/src/processor.rs:557:1: 670:2 }
4             fn
              ↪ utils::process_mint_new_edition_from_master_edition_via_token_logic(){//
              ↪ program/src/utils.rs:995:1: 1113:2 }
```

```
                    fn utils::mint_limited_edition(){//
                    ↪  program/src/utils.rs:531:1: 666:2 }
                        fn utils::calculate_edition_number(){//
                        ↪  program/src/utils.rs:446:1: 468:2 }
                            fn
                            ↪  utils::extract_edition_number_from_deprecated_reservatio
                            ↪  program/src/utils.rs:391:1: 444:2 }
    fn state::get_reservation_list(){// program/src/state.rs:427:1:
    ↪  438:2 }

```

- description:
- link:
- alleviation:

Issue: 7: TypeConfusion

Category	Severity	Status
TypeConfusion	Critical	GitHub Link to be added.

- Location

program/src/deprecated_instruction.rs:14:1: 16:2

```
14 pub struct MintPrintingTokensViaTokenArgs {
15     pub supply: u64,
16 }
17 program/src/instruction.rs:60:1: 62:2
18     pub struct MintNewEditionFromMasterEditionViaTokenArgs {
19     pub edition: u64,
20 }
21 program/src/instruction.rs:66:1: 68:2
22     pub struct ApproveUseAuthorityArgs {
23     pub number_of_uses: u64,
24 }
25 program/src/instruction.rs:72:1: 74:2
26     pub struct UtilizeArgs {
27     pub number_of_uses: u64,
28 }
29 program/src/utils.rs:808:1: 816:2
30     pub struct CreateMetadataAccountsLogicArgs<'a> {
31     pub metadata_account_info: &'a AccountInfo<'a>,
32     pub mint_info: &'a AccountInfo<'a>,
33     pub mint_authority_info: &'a AccountInfo<'a>,
34     pub payer_account_info: &'a AccountInfo<'a>,
35     pub update_authority_info: &'a AccountInfo<'a>,
36     pub system_account_info: &'a AccountInfo<'a>,
37     pub rent_info: &'a AccountInfo<'a>,
38 }
39 program/src/utils.rs:978:1: 993:2
40     pub struct MintNewEditionFromMasterEditionViaTokenLogicArgs<'a> {
41     pub new_metadata_account_info: &'a AccountInfo<'a>,
42     pub new_edition_account_info: &'a AccountInfo<'a>,
43     pub master_edition_account_info: &'a AccountInfo<'a>,
44     pub mint_info: &'a AccountInfo<'a>,
```

```
    pub edition_marker_info: &'a AccountInfo<'a>,
    pub mint_authority_info: &'a AccountInfo<'a>,
    pub payer_account_info: &'a AccountInfo<'a>,
    pub owner_account_info: &'a AccountInfo<'a>,
    pub token_account_info: &'a AccountInfo<'a>,
    pub update_authority_info: &'a AccountInfo<'a>,
    pub master_metadata_account_info: &'a AccountInfo<'a>,
    pub token_program_account_info: &'a AccountInfo<'a>,
    pub system_account_info: &'a AccountInfo<'a>,
    pub rent_info: &'a AccountInfo<'a>,
}

```

- Call Stack

```
UnResolved
```

- description:
- link:
- alleviation:

Issue: 8: TypeConfusion

Category	Severity	Status
TypeConfusion	Critical	GitHub Link to be added.

- Location

program/src/instruction.rs:60:1: 62:2

```
pub struct MintNewEditionFromMasterEditionViaTokenArgs {
    pub edition: u64,
}
program/src/instruction.rs:66:1: 68:2
    pub struct ApproveUseAuthorityArgs {
    pub number_of_uses: u64,
}
program/src/instruction.rs:72:1: 74:2
    pub struct UtilizeArgs {
    pub number_of_uses: u64,
}
program/src/utils.rs:808:1: 816:2
    pub struct CreateMetadataAccountsLogicArgs<'a> {
    pub metadata_account_info: &'a AccountInfo<'a>,
    pub mint_info: &'a AccountInfo<'a>,
    pub mint_authority_info: &'a AccountInfo<'a>,
    pub payer_account_info: &'a AccountInfo<'a>,
    pub update_authority_info: &'a AccountInfo<'a>,
    pub system_account_info: &'a AccountInfo<'a>,
    pub rent_info: &'a AccountInfo<'a>,
}
program/src/utils.rs:978:1: 993:2
    pub struct MintNewEditionFromMasterEditionViaTokenLogicArgs<'a> {
    pub new_metadata_account_info: &'a AccountInfo<'a>,
    pub new_edition_account_info: &'a AccountInfo<'a>,
    pub master_edition_account_info: &'a AccountInfo<'a>,
    pub mint_info: &'a AccountInfo<'a>,
    pub edition_marker_info: &'a AccountInfo<'a>,
    pub mint_authority_info: &'a AccountInfo<'a>,
    pub payer_account_info: &'a AccountInfo<'a>,
    pub owner_account_info: &'a AccountInfo<'a>,
```

```
91      pub token_account_info: &'a AccountInfo<'a>,
92      pub update_authority_info: &'a AccountInfo<'a>,
93      pub master_metadata_account_info: &'a AccountInfo<'a>,
94      pub token_program_account_info: &'a AccountInfo<'a>,
95      pub system_account_info: &'a AccountInfo<'a>,
96      pub rent_info: &'a AccountInfo<'a>,
97  }
98
```

- Call Stack

```
1  UnResolved
```

- description:
- link:
- alleviation:

Issue: 9: TypeConfusion

Category	Severity	Status
TypeConfusion	Critical	GitHub Link to be added.

- Location

program/src/instruction.rs:66:1: 68:2

```
pub struct ApproveUseAuthorityArgs {
    pub number_of_uses: u64,
}
program/src/instruction.rs:72:1: 74:2
    pub struct UtilizeArgs {
    pub number_of_uses: u64,
}
program/src/utils.rs:808:1: 816:2
    pub struct CreateMetadataAccountsLogicArgs<'a> {
    pub metadata_account_info: &'a AccountInfo<'a>,
    pub mint_info: &'a AccountInfo<'a>,
    pub mint_authority_info: &'a AccountInfo<'a>,
    pub payer_account_info: &'a AccountInfo<'a>,
    pub update_authority_info: &'a AccountInfo<'a>,
    pub system_account_info: &'a AccountInfo<'a>,
    pub rent_info: &'a AccountInfo<'a>,
}
program/src/utils.rs:978:1: 993:2
    pub struct MintNewEditionFromMasterEditionViaTokenLogicArgs<'a> {
    pub new_metadata_account_info: &'a AccountInfo<'a>,
    pub new_edition_account_info: &'a AccountInfo<'a>,
    pub master_edition_account_info: &'a AccountInfo<'a>,
    pub mint_info: &'a AccountInfo<'a>,
    pub edition_marker_info: &'a AccountInfo<'a>,
    pub mint_authority_info: &'a AccountInfo<'a>,
    pub payer_account_info: &'a AccountInfo<'a>,
    pub owner_account_info: &'a AccountInfo<'a>,
    pub token_account_info: &'a AccountInfo<'a>,
    pub update_authority_info: &'a AccountInfo<'a>,
    pub master_metadata_account_info: &'a AccountInfo<'a>,
    pub token_program_account_info: &'a AccountInfo<'a>,
```

```
97      pub system_account_info: &'a AccountInfo<'a>,
98      pub rent_info: &'a AccountInfo<'a>,
99  }
100
```

- Call Stack

```
1  UnResolved
```

- description:
- link:
- alleviation:

Issue: 10: TypeConfusion

Category	Severity	Status
TypeConfusion	Critical	GitHub Link to be added.

- Location

program/src/instruction.rs:72:1: 74:2

```
72 pub struct UtilizeArgs {
73     pub number_of_uses: u64,
74 }
75 program/src/utils.rs:808:1: 816:2
76     pub struct CreateMetadataAccountsLogicArgs<'a> {
77     pub metadata_account_info: &'a AccountInfo<'a>,
78     pub mint_info: &'a AccountInfo<'a>,
79     pub mint_authority_info: &'a AccountInfo<'a>,
80     pub payer_account_info: &'a AccountInfo<'a>,
81     pub update_authority_info: &'a AccountInfo<'a>,
82     pub system_account_info: &'a AccountInfo<'a>,
83     pub rent_info: &'a AccountInfo<'a>,
84 }
85 program/src/utils.rs:978:1: 993:2
86     pub struct MintNewEditionFromMasterEditionViaTokenLogicArgs<'a> {
87     pub new_metadata_account_info: &'a AccountInfo<'a>,
88     pub new_edition_account_info: &'a AccountInfo<'a>,
89     pub master_edition_account_info: &'a AccountInfo<'a>,
90     pub mint_info: &'a AccountInfo<'a>,
91     pub edition_marker_info: &'a AccountInfo<'a>,
92     pub mint_authority_info: &'a AccountInfo<'a>,
93     pub payer_account_info: &'a AccountInfo<'a>,
94     pub owner_account_info: &'a AccountInfo<'a>,
95     pub token_account_info: &'a AccountInfo<'a>,
96     pub update_authority_info: &'a AccountInfo<'a>,
97     pub master_metadata_account_info: &'a AccountInfo<'a>,
98     pub token_program_account_info: &'a AccountInfo<'a>,
99     pub system_account_info: &'a AccountInfo<'a>,
100    pub rent_info: &'a AccountInfo<'a>,
101 }
102
```

- Call Stack

```
UnResolved
```

- description:
- link:
- alleviation:

Issue: 11: TypeConfusion

Category	Severity	Status
TypeConfusion	Critical	GitHub Link to be added.

- Location

program/src/state.rs:95:1: 106:2

```
95  pub struct Data {
96      /// The name of the asset
97      pub name: String,
98      /// The symbol for the asset
99      pub symbol: String,
100     /// URI pointing to JSON representing the asset
101     pub uri: String,
102     /// Royalty basis points that goes to creators in secondary sales
        ↪ (0-10000)
103     pub seller_fee_basis_points: u16,
104     /// Array of creators, optional
105     pub creators: Option<Vec<Creator>>,
106 }
107 program/src/state.rs:110:1: 125:2
108     pub struct DataV2 {
109     /// The name of the asset
110     pub name: String,
111     /// The symbol for the asset
112     pub symbol: String,
113     /// URI pointing to JSON representing the asset
114     pub uri: String,
115     /// Royalty basis points that goes to creators in secondary sales
        ↪ (0-10000)
116     pub seller_fee_basis_points: u16,
117     /// Array of creators, optional
118     pub creators: Option<Vec<Creator>>,
119     /// Collection
120     pub collection: Option<Collection>,
121     /// Uses
122     pub uses: Option<Uses>,
123 }
```

```
124
```

- Call Stack

```
1 UnResolved
```

- description:
- link:
- alleviation:

Appendix

Copied from https://leaderboard.certik.io/projects/aave

Finding Categories

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.

Mathematical Operations

Mathematical Operation findings relate to mishandling of math formulas, such as overflows, incorrect operations etc.

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.

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 more legible and, as a result, easily maintainable.

Checksum Calculation Method

The “Checksum” field in the “Audit Scope” section is calculated as the SHA-256 (Secure Hash Algorithm 2 with digest size of 256 bits) digest of the content of each file hosted in the listed source repository under the specified commit.

The result is hexadecimal encoded and is the same as the output of the Linux “sha256sum” command against the target file.

Disclaimer

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