



# VRust

## **Security Assessment**

O2Lab VRust Team

11/02/2022 21:05:31

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## 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	bridge
GitHub Location	<a href="https://github.com/parasol-aser/vrust">https://github.com/parasol-aser/vrust</a>
sha256	Unknown

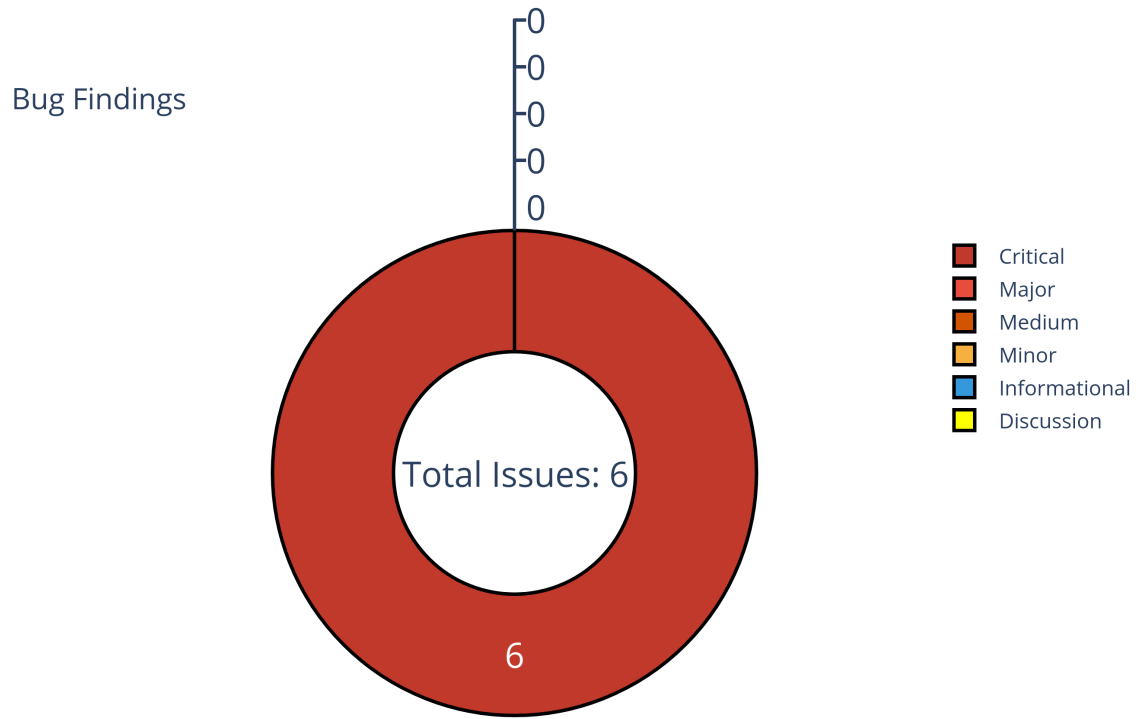
### Audit Summary

Delivery Date	11/02/2022
Audit Methodology	Static Analysis
Key Components	

### Vulnerability Summary

Vulnerability Level	Total
Critical	6
Major	0
Medium	0
Minor	0
Informational	0
Discussion	0

## Findings



**Figure 1:** Findings

## Finding Statistic

Category	Count
IntegerFlow	3
MissingKeyCheck	3

ID	Category	Severity	Status
0	IntegerFlow	Critical	UnResolved
1	IntegerFlow	Critical	UnResolved
2	IntegerFlow	Critical	UnResolved
3	MissingKeyCheck	Critical	UnResolved
4	MissingKeyCheck	Critical	UnResolved
5	MissingKeyCheck	Critical	UnResolved

**Issue: 0: IntegerFlow**

Category	Severity	Status
IntegerFlow	Critical	UnResolved

- Location

/home/yifei/.cargo/registry/src/github.com-1ecc6299db9ec823/solana-program-1.7.0/src/serialize\_utils.rs:26:21: 26:33

```
26 *current + 1
27
```

- Code Context

Vulnerability at Line: 26

```
25 pub fn read_u8(current: &mut usize, data: &[u8]) -> Result<u8,
    ↳ SanitizeError> {
26     if data.len() < *current + 1 {
27         return Err(SanitizeError::IndexOutOfBounds);
28     }
29     let e = data[*current];
30     *current += 1;
31
```

- Call Stack

```
1 fn entrypoint() { // /home/yifei/.cargo/registry/src/github.com-
    ↳ 1ecc6299db9ec823/solana-program-1.7.0/src/entrypoint.rs:46:9: 53:10
    ↳ }
2 fn instruction::solitaire() { //
    ↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
    ↳ 108:14 }
3 fn instruction::dispatch() { //
    ↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
    ↳ 99:14 }
4 fn instruction::VerifySignatures::execute() { //
    ↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
    ↳ 74:22 }
```

5  
6  
7  
8  
9

```
fn api::verify_signature::verify_signatures(){//  
    ↪ program/src/api/verify_signature.rs:68:1: 223:2 }  
fn  
    ↪ solana_program::sysvar::instructions::load_instruction_at()  
    ↪ /home/yifei/.cargo/registry/src/github.com-  
    ↪ 1ecc6299db9ec823/solana-program-  
    ↪ 1.7.0/src/sysvar/instructions.rs:26:1: 28:2  
    ↪ }  
fn  
    ↪ solana_program::message::Message::deserialize_instruction()  
    ↪ /home/yifei/.cargo/registry/src/github.com-  
    ↪ 1ecc6299db9ec823/solana-program-  
    ↪ 1.7.0/src/message.rs:480:5: 522:6  
    ↪ }  
fn solana_program::serialize_utils::read_u8(){//  
    ↪ /home/yifei/.cargo/registry/src/github.com-  
    ↪ 1ecc6299db9ec823/solana-program-  
    ↪ 1.7.0/src/serialize_utils.rs:25:1: 32:2  
    ↪ }
```

- description:
- link:
- alleviation:



## Issue: 1: IntegerFlow

Category	Severity	Status
IntegerFlow	Critical	UnResolved

- Location

/home/yifei/.cargo/registry/src/github.com-1ecc6299db9ec823/solana-program-1.7.0/src/serialize\_utils.rs:36:21: 36:35

```
36 *current + len
37
```

- Code Context

Vulnerability at Line: 36

```
34 pub fn read_pubkey(current: &mut usize, data: &[u8]) -> Result<Pubkey,
    ↳ SanitizeError> {
35     let len = std::mem::size_of::<Pubkey>();
36     if data.len() < *current + len {
37         return Err(SanitizeError::IndexOutOfBounds);
38     }
39     let e = Pubkey::new(&data[*current..*current + len]);
40     *current += len;
41
```

Other Use Case for Variable: \*current + len

```
39     let e = Pubkey::new(&data[*current..*current + len]);
```

- Call Stack

```
1 fn entrypoint() { // /home/yifei/.cargo/registry/src/github.com-
    ↳ 1ecc6299db9ec823/solana-program-1.7.0/src/entrypoint.rs:46:9: 53:10
    ↳ }
2 fn instruction::solitaire() { //
    ↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
    ↳ 108:14 }
```

3  
4  
5  
6  
7  
8  
9

```

fn instruction::dispatch() {
    ↪ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macro
    ↪ 99:14 }

fn instruction::VerifySignatures::execute() {
    ↪ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/m
    ↪ 74:22 }

fn api::verify_signature::verify_signatures() {
    ↪ program/src/api/verify_signature.rs:68:1: 223:2 }

fn
    ↪ solana_program::sysvar::instructions::load_instruction_at() {
    ↪ /home/yifei/.cargo/registry/src/github.com-
    ↪ 1ecc6299db9ec823/solana-program-
    ↪ 1.7.0/src/sysvar/instructions.rs:26:1: 28:2
    ↪ }

fn
    ↪ solana_program::message::Message::deserialize_instructio
    ↪ /home/yifei/.cargo/registry/src/github.com-
    ↪ 1ecc6299db9ec823/solana-program-
    ↪ 1.7.0/src/message.rs:480:5: 522:6
    ↪ }

fn solana_program::serialize_utils::read_pubkey() {
    ↪ /home/yifei/.cargo/registry/src/github.com-
    ↪ 1ecc6299db9ec823/solana-program-
    ↪ 1.7.0/src/serialize_utils.rs:34:1: 42:2
    ↪ }

```

- description:
- link:
- alleviation:

## Issue: 2: IntegerFlow

Category	Severity	Status
IntegerFlow	Critical	UnResolved

- Location

/home/yifei/.cargo/registry/src/github.com-1ecc6299db9ec823/solana-program-1.7.0/src/serialize\_utils.rs:60:21: 60:40

```
60 *current + data_len
61
```

- Code Context

Vulnerability at Line: 60

```
55 pub fn read_slice(
56     current: &mut usize,
57     data: &[u8],
58     data_len: usize,
59 ) -> Result<Vec<u8>, SanitizeError> {
60     if data.len() < *current + data_len {
61         return Err(SanitizeError::IndexOutOfBounds);
62     }
63     let e = data[*current..*current + data_len].to_vec();
64     *current += data_len;
65
```

Other Use Case for Variable: \*current + data\_len

```
63     let e = data[*current..*current + data_len].to_vec();
```

- Call Stack

```
1 fn entrypoint() { // /home/yifei/.cargo/registry/src/github.com-
  ↳ 1ecc6299db9ec823/solana-program-1.7.0/src/entrypoint.rs:46:9: 53:10
  ↳ }
2 fn instruction::solitaire() { //
  ↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
  ↳ 108:14 }
```

3  
4  
5  
6  
7  
8  
9

```
fn instruction::dispatch() {
    ↪ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macro
    ↪ 99:14 }

fn instruction::VerifySignatures::execute() {
    ↪ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/m
    ↪ 74:22 }

fn api::verify_signature::verify_signatures() {
    ↪ program/src/api/verify_signature.rs:68:1: 223:2 }

fn
    ↪ solana_program::sysvar::instructions::load_instruction_at() {
    ↪ /home/yifei/.cargo/registry/src/github.com-
    ↪ 1ecc6299db9ec823/solana-program-
    ↪ 1.7.0/src/sysvar/instructions.rs:26:1: 28:2
    ↪ }

fn
    ↪ solana_program::message::Message::deserialize_instruction
    ↪ /home/yifei/.cargo/registry/src/github.com-
    ↪ 1ecc6299db9ec823/solana-program-
    ↪ 1.7.0/src/message.rs:480:5: 522:6
    ↪ }

fn solana_program::serialize_utils::read_slice() {
    ↪ /home/yifei/.cargo/registry/src/github.com-
    ↪ 1ecc6299db9ec823/solana-program-
    ↪ 1.7.0/src/serialize_utils.rs:55:1: 66:2
    ↪ }
```

- description:
- link:
- alleviation:

### Issue: 3: MissingKeyCheck

Category	Severity	Status
MissingKeyCheck	Critical	UnResolved

- Location

/home/yifei/.cargo/registry/src/github.com-1ecc6299db9ec823/solana-program-1.7.0/src/account\_info.rs:70:11: 70:33

```
70 self.lamports.borrow()
71
```

- Code Context

Vulnerability at Line: 70

```
69 pub fn lamports(&self) -> u64 {
70     **self.lamports.borrow()
71 }
72
```

- Call Stack

```
1 fn entrypoint() { // /home/yifei/.cargo/registry/src/github.com-
  ↳ 1ecc6299db9ec823/solana-program-1.7.0/src/entrypoint.rs:46:9: 53:10
  ↳ }
2   fn instruction::solitaire() { //
  ↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
  ↳ 108:14 }
3   fn instruction::dispatch() { //
  ↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
  ↳ 99:14 }
4   fn instruction::Initialize::execute() { //
  ↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
  ↳ 74:22 }
5   fn api::initialize::initialize() { //
  ↳ program/src/api/initialize.rs:55:1: 98:2 }
```

6

**fn**

```
↳ solana_program::account_info::AccountInfo:::<'a>::lamports() {
↳ /home/yifei/.cargo/registry/src/github.com-
↳ 1ecc6299db9ec823/solana-program-
↳ 1.7.0/src/account_info.rs:69:5: 71:6
↳ }
```

7

- description:
- link:
- alleviation:

## Issue: 4: MissingKeyCheck

Category	Severity	Status
MissingKeyCheck	Critical	UnResolved

- Location

/home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/processors/peel.rs:211:22:  
211:50

```
211 ctx.info().lamports.borrow()  
212
```

- Code Context

– Function Definition:

```
192 fn peel<I>(ctx: &'c mut Context<'a, 'b, 'c, I>) -> Result<Self>  
193
```

Vulnerability at Line: 202

```
197     }  
198  
199     // If we're initializing the type, we should emit system/rent as  
200     ↳ deps.  
201     let (initialized, data): (bool, T) = match IsInitialized {  
202         AccountState::Uninitialized => {  
203             if **ctx.info().lamports.borrow() != 0 {  
204                 return  
205                 ↳ Err(SolitaireError::AlreadyInitialized(*ctx.info().key));  
206             }  
207             (false, T::default())  
208         }  
209     }
```

Other Use Case for Variable: ctx.info().lamports.borrow()

211

```
if **ctx.info().lamports.borrow() == 0 {
```

- Call Stack

1  
2  
3  
4  
5  
6  
7

```
fn entrypoint() { // /home/yifei/.cargo/registry/src/github.com-
↳ 1ecc6299db9ec823/solana-program-1.7.0/src/entrypoint.rs:46:9: 53:10
↳ }
fn instruction::solitaire() { //
↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
↳ 108:14 }
fn instruction::dispatch() { //
↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
↳ 99:14 }
fn instruction::PostVAA::execute() { //
↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
↳ 74:22 }
fn <api::post_vaa::PostVAA<'b> as
↳ solitaire::FromAccounts<'a, 'b, 'c>::from() { //
↳ program/src/api/post_vaa.rs:54:10: 54:22 }
fn <solitaire::Data<'b, T, IsInitialized> as
↳ solitaire::Peel<'a, 'b, 'c>::peel() { //
↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
↳ 236:6 }
```

- description:
- link:
- alleviation:



## Issue: 5: MissingKeyCheck

Category	Severity	Status
MissingKeyCheck	Critical	UnResolved

- Location

/home/yifei/.cargo/registry/src/github.com-1ecc6299db9ec823/solana-program-1.7.0/src/account\_info.rs:112:9:113:30

```

112 self.data
113     .try_borrow_mut()
114

```

- Code Context

Vulnerability at Line: 112

```

111 pub fn try_borrow_mut_data(&self) -> Result<RefMut<&'a mut [u8]>,
    ↳ ProgramError> {
112     self.data
113         .try_borrow_mut()
114         .map_err(|_| ProgramError::AccountBorrowFailed)
115 }
116

```

- Call Stack

```

1 fn entrypoint() { // /home/yifei/.cargo/registry/src/github.com-
    ↳ 1ecc6299db9ec823/solana-program-1.7.0/src/entrypoint.rs:46:9: 53:10
    ↳ }
2 fn instruction::solitaire() { //
    ↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
    ↳ 108:14 }
3 fn instruction::dispatch() { //
    ↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
    ↳ 99:14 }
4 fn instruction::VerifySignatures::execute() { //
    ↳ /home/yifei/open/vrust/examples2/wormhole/solana/solitaire/program/src/macros.rs
    ↳ 74:22 }

```

5

```
fn api::verify_signature::verify_signatures(){//
↳ program/src/api/verify_signature.rs:68:1: 223:2 }
```

6

```
fn
↳ solana_program::account_info::AccountInfo:::<'a>::try_borrow_
↳ /home/yifei/.cargo/registry/src/github.com-
↳ 1ecc6299db9ec823/solana-program-
↳ 1.7.0/src/account_info.rs:111:5: 115:6
↳ }
```

7

- 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

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

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