Composable.Finance - Democracy

Substrate Pallet Security Audit

Prepared by: **Halborn**

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Visit: **Halborn.com**

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EXECUTIVE OVERVIEW

1.1 INTRODUCTION

Composable.Finance engaged Halborn to conduct a security audit on their smart contracts beginning on September 19th, 2022 and ending on September 26th, 2022. The security assessment was scoped to the smart contracts provided to the Halborn team.

1.2 AUDIT SUMMARY

The team at Halborn was provided two weeks for the engagement and assigned a full-time security engineer to audit the security of the smart contract. The security engineer is a blockchain and smart-contract security expert with advanced penetration testing, smart-contract hacking, and deep knowledge of multiple blockchain protocols.

The purpose of this audit is to:

- Ensure that Substrate pallet’s functions operate as intended
- Identify potential security issues with the Substrate pallet

1.3 TEST APPROACH & METHODOLOGY

Halborn performed a combination of manual and automated security testing to balance efficiency, timeliness, practicality, and accuracy regarding the scope of the Composable Substrate pallets. While manual testing is recommended to uncover flaws in logic, process, and implementation; automated testing techniques help enhance coverage of the code and can quickly identify items that do not follow security best practices. The following phases and associated tools were used throughout the term of the audit:

- Research into the architecture, purpose, and use of the platform.

- Smart contract manual code review and walkthrough to identify any logic issue.
- Mapping out possible attack vectors
- Thorough assessment of safety and usage of critical Rust variables and functions in scope that could lead to arithmetic vulnerabilities.
- On chain testing of core functions(polkadot.js).
- Active Fuzz testing {cargo-fuzz, honggfuzz}
- Scanning dependencies for known vulnerabilities (cargo audit).

RISK METHODOLOGY:

Vulnerabilities or issues observed by Halborn are ranked based on the risk assessment methodology by measuring the **LIKELIHOOD** of a security incident and the **IMPACT** should an incident occur. This framework works for communicating the characteristics and impacts of technology vulnerabilities. The quantitative model ensures repeatable and accurate measurement while enabling users to see the underlying vulnerability characteristics that were used to generate the Risk scores. For every vulnerability, a risk level will be calculated on a scale of 5 to 1 with 5 being the highest likelihood or impact.

RISK SCALE - LIKELIHOOD

5 - Almost certain an incident will occur.
4 - High probability of an incident occurring.
3 - Potential of a security incident in the long term.
2 - Low probability of an incident occurring.
1 - Very unlikely issue will cause an incident.

RISK SCALE - IMPACT

5 - May cause devastating and unrecoverable impact or loss.
4 - May cause a significant level of impact or loss.
3 - May cause a partial impact or loss to many.
2 - May cause temporary impact or loss.
1 - May cause minimal or un-noticeable impact.

The risk level is then calculated using a sum of these two values, creating a value of 10 to 1 with 10 being the highest level of security risk.

CRITICAL	HIGH	MEDIUM	LOW	INFORMATIONAL

10 - CRITICAL
9 - 8 - HIGH
7 - 6 - MEDIUM
5 - 4 - LOW
3 - 1 - VERY LOW AND INFORMATIONAL

1.4 SCOPE

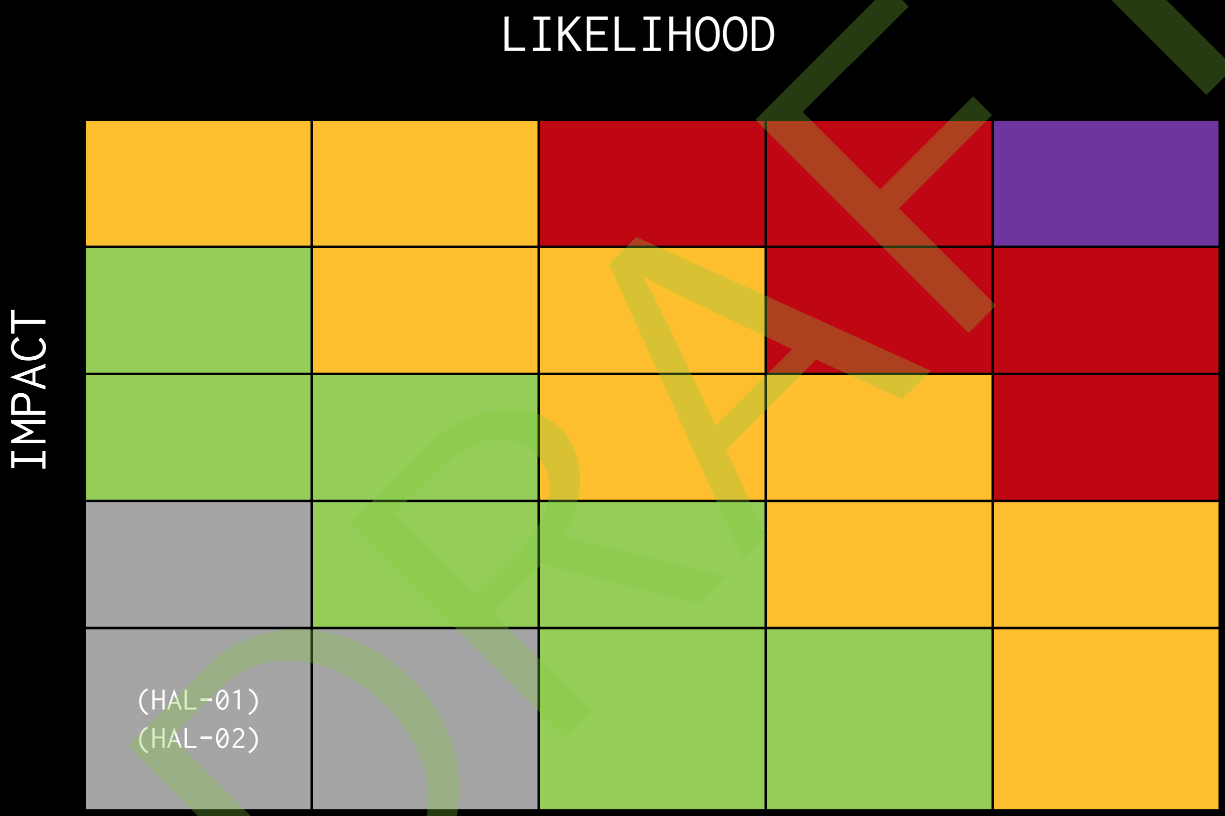
The review was scoped to the democracy pallet in frame directory in the ComposableFi/substrate repository.

Commit IDs used for the engagement:

- 76e3033cd1ebe9487757381fd2f34f3fb54caa93

2. ASSESSMENT SUMMARY & FINDINGS OVERVIEW

CRITICAL	HIGH	MEDIUM	LOW	INFORMATIONAL
0	0	0	0	2



SECURITY ANALYSIS	RISK LEVEL	REMEDIATION DATE
POTENTIAL UNEXPECTED BEHAVIOUR CAUSED BY BIG PREIMAGE	Informational	-
USAGE OF ROOT ORIGIN	Informational	-

FINDINGS & TECH DETAILS

3.1 (HAL-01) POTENTIAL UNEXPECTED BEHAVIOUR CAUSED BY BIG PREIMAGE - INFORMATIONAL

Description:

The democracy pallet requires a preimage to be submitted prior to submitting a proposal. The preimage itself is constructed by hashing the encoded proposal and matching it with its corresponding asset ID. User can submit anything as an encoded proposal, not necessarily a valid one. The user submitting the preimage via note_preimage function needs to transfer some balance, which depends on the size of the encoded_proposal. The encoded proposal is represented as a Vector of bytes in the code. When the number of tokens owed for this proposal is calculated, the length of the encoded_proposal is casted to u32 type. This will work as expected for proposals of size not exceeding 4 GB; however, it will break if the user manages to send bigger proposals.

Code Location:

Listing 1: substrate/frame/democracy/src/lib.rs

```
fn note_preimage_inner(who: T::AccountId, encoded_proposal: Vec<u8
↳ >) -> DispatchResult {
    let proposal_hash = T::Hashing::hash(&encoded_proposal[..]);
    ensure!(!<Preimages<T, I>>::contains_key(&proposal_hash),
↳ Error::<T, I>::DuplicatePreimage);

    let deposit = <BalanceOf<T, I>>::from(encoded_proposal.len()
↳ as u32)
        .saturating_mul(T::PreimageByteDeposit::get());
    T::Currency::reserve(&who, deposit)?;

    let now = <frame_system::Pallet<T>>::block_number();
    let a = PreimageStatus::Available {
        data: encoded_proposal,
        provider: who.clone(),
        deposit,
            since: now,
            expiry: None,
        };
        <Preimages<T, I>>::insert(proposal_hash, a);

        Self::deposit_event(Event::<T, I>::PreimageNoted {
    ↳ proposal_hash, who, deposit });

        Ok(())
}
```

Risk Level:

Likelihood - 1
Impact - 1

Recommendation:

It is recommended to implement a verification mechanism which will first check the size of encoded_proposal and will not perform any further computation if that size exceeds a predefined limit.

3.2 (HAL-02) USAGE OF ROOT ORIGIN - INFORMATIONAL

Description:

The democracy pallet is using the root origin in multiple function. Using such origin does not align with the blockchain paradigm of decentralization.

Code Location:

An exemplary function utilizing a root origin:

Listing 2: substrate/frame/democracy/src/lib.rs (Line 956)

```rust
pub fn cancel_queued(origin: OriginFor<T>, which: ReferendumIndex)
    -> DispatchResult {
    T::EnsureRoot::ensure_origin(origin)?;
    T::Scheduler::cancel_named((T::DemocracyId::get(), which).encode())
        .map_err(|_| Error::<T, I>::ProposalMissing)?;
    Ok(())
}
```

Risk Level:

Likelihood - 1
Impact - 1

Recommendation:

It is recommended to not use a root origin and introduce an appropriate committee for handling administrative operations.

AUTOMATED TESTING

4.1 CARGO AUDIT

Description:

Halborn used automated security scanners to assist with detection of well-known security issues and vulnerabilities. Among the tools used was cargo audit, a security scanner for vulnerabilities reported to the RustSec Advisory Database. All vulnerabilities published in https://crates.io are stored in a repository named The RustSec Advisory Database. cargo audit is a human-readable version of the advisory database which performs a scanning on Cargo.lock. Security Detections are only in scope. All vulnerabilities shown here were already disclosed in the above report. However, to better assist the developers maintaining this code, the auditors are including the output with the dependencies tree, and this is included in the cargo audit output to better know the dependencies affected by unmaintained and vulnerable crates.

Results:

```
Crate: owning_ref
Version: 0.4.1
Title: Multiple soundness issues in owning_ref
Date: 2022-01-26
ID: RUSTSEC-2022-0040
URL: https://rustsec.org/advisories/RUSTSEC-2022-0040
Solution: No safe upgrade is available!

Crate: rocksdb
Version: 0.18.0
Title: Out-of-bounds read when opening multiple column families with TTL
Date: 2022-05-11
ID: RUSTSEC-2022-0046
URL: https://rustsec.org/advisories/RUSTSEC-2022-0046
Solution: Upgrade to >=0.19.0

Crate: time
Version: 0.1.44
```

```
Title: Potential segfault in the time crate
Date: 2020-11-18
ID: RUSTSEC-2020-0071
URL: https://rustsec.org/advisories/RUSTSEC-2020-0071
Solution: Upgrade to >=0.2.23

Crate: ansi_term
Version: 0.12.1
Warning: unmaintained
Title: ansi_term is Unmaintained
Date: 2021-08-18
ID: RUSTSEC-2021-0139
URL: https://rustsec.org/advisories/RUSTSEC-2021-0139

Crate: serde_cbor
Version: 0.11.2
Warning: unmaintained
Title: serde_cbor is unmaintained
Date: 2021-08-15
ID: RUSTSEC-2021-0127
URL: https://rustsec.org/advisories/RUSTSEC-2021-0127

Crate: sp-version
Version: 5.0.0
Warning: yanked
```

THANK YOU FOR CHOOSING

// HALBORN