

**DeHacker**

Security Assessment

# TARS Protocol

June 10th, 2022



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## Summary

DeHacker's objective was to evaluate the repository for security-related issues, code quality, and adherence to specification and best practices. Possible issues we looked for included (but are not limited to):

- Transaction-ordering dependence
- Timestamp dependence
- Mishandled exceptions and call stack limits
- Unsafe external calls
- Integer overflow/underflow
- Number rounding errors
- Reentrancy and cross-function vulnerabilities
- Denial of service/logical oversights
- Access control
- Centralization of power
- Business logic contradicting the specification
- Code clones, functionality duplication
- Gas usage
- Arbitrary token minting



# Issue Categories

Every issue in this report was assigned a severity level from the following:

## Critical severity issues

A vulnerability that can disrupt the contract functioning in a number of scenarios or creates a risk that the contract may be broken.

## Major severity issues

A vulnerability that affects the desired outcome when using a contract or provides the opportunity to use a contract in an unintended way.

## Medium severity issues

A vulnerability that could affect the desired outcome of executing the contract in a specific scenario.

## Minor severity issues

A vulnerability that does not have a significant impact on possible scenarios for the use of the contract and is probably subjective.

## Informational

A vulnerability that has informational character but is not affecting any of the code.



# Overview

## Project Summary

Project Name	TARS Protocol
Platform	BSC
website	<a href="https://tars.pro/">https://tars.pro/</a>
Type	DeFi Infrastructure
Language	Solidity

## Vulnerability Summary

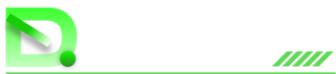
Vulnerability Level	Total	Pending	Declined	Acknowledged	Partially Resolved	Resolved
Critical	0	0	0	0	0	0
Major	4	0	0	1	0	3
Medium	4	0	0	1	0	3
Minor	5	0	0	3	1	1
Informational	4	0	0	3	0	1
Discussion	0	0	0	0	0	0



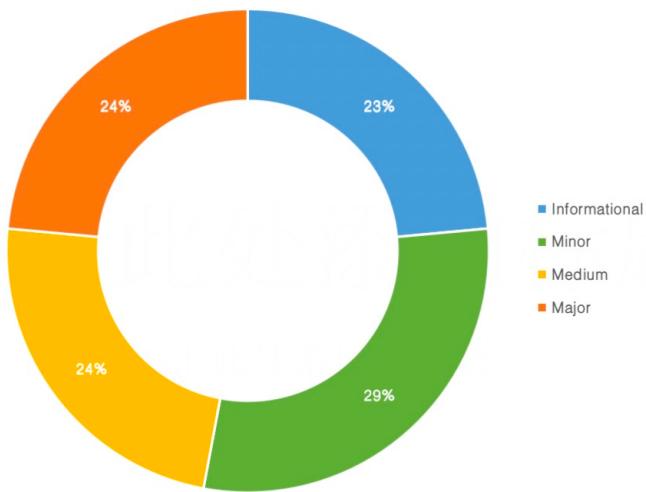
## Audit scope

---

ID	File	SHA256 Checksum
CSI	CoinSalesIDO.sol	cd8d2415a75364d4473c7774403ee697cf6b575094861dc53ebc5d64bb772eee
ALT	AssemblyLine.sol	52b0b2ab0e134dad04dfab7834b827f340fc8b03b9c5e4b5bf3b0ff06f81168e
VNT	token/VoucherNft.sol	d6f6f43ab261c2986193396dc988353001280a002b730f67998ccca341470247
FID	FactoryIDO.sol	7a5dec9eae43ca4dcf43de9ac53397e9f6ad143847507a228b9be08ba5475556
ITP	Insurance.sol	75c2b0a6ff5cd277083e605249fc4973dcb18c8da4961edfa05cb53a1c796cc0



# Findings



ID	Title	Category	Severity	Status
GLOBAL-01	Centralization Related Risks	Centralization / Privilege	major	Acknowledged
CSI-01	Missing Validation	Logical Issue	Major	Resolved
CSI-02	Missing Input Validation	Volatile Code	Minor	Resolved
CSI-03	Lack Of Reasonable Boundary	Volatile Code	Minor	Partially Resolved
CSI-04	Missing Input Validation	Volatile Code	Minor	Acknowledged
CSI-05	LockWarehouse Can Be Added AfterUser Investment	Logical Issue	Minor	Acknowledged
CSI-06	Condition Can Be Simplified	Volatile Code	Informational	Resolved
FID-01	Incorrect Logic In FunctioncustomProductionIDO	Logical Issue	Medium	Acknowledged
ITP-01	Possible Loss Of Accuracy In FunctionjoinInsurance	Logical Issue	Medium	Resolved
ITP-02	Incorrect Operator Used	Logical Issue	Medium	Resolved
ITP-03	Inadequate Validation	Logical Issue	Medium	Resolved
TPC-01	Permission Issues For Super Admin	Logical Issue	Major	Resolved



TPC-02	Missing Input Validation	Volatile Code	Minor	Acknowledged
TPC-03	Unlocked Compiler Version	Language Specific	Informational	Acknowledged
TPC-04	Missing Emit Events	Coding Style	Informational	Acknowledged
TPC-05	Variables That Could Be Declared AsImmutable	Gas Optimization	Informational	Acknowledged
VNT-01	Missing Creation In FunctionqueryUserAllNft	Language Specific	Major	Resolved



# Major

## GLOBAL-01 | Centralization Related Risks

Category	Severity	Location	Status
Centralization / Privilege	Major		Acknowledged

### Description

In the contract `CoinSalesIDO`, the role `superAdmin` has the authority over the following function:

1. function adminSafeTransfer()
2. function updateInsuranceAddress()
3. function updateIsPrivate()
4. function updateTime()
5. function updatePoolQuota()
6. function updateQuantitySold()
7. function updateWhiteListQuota()
8. function addWhiteList()
9. function addLockWarehouse()
10. function updateSellingToken()
11. function updateSellingTokenName()
12. function cancelProject()
13. function identification()
14. function transferCoin()

In the contract `CoinSalesIDO`, the role `secondParty` has the authority over the following function:

1. function addWhiteList()
2. function addLockWarehouse()
3. function updateSellingToken()



4. function updateSellingTokenName()
5. function cancelProject()
6. function secondPartyClaim()

In the contract `CoinSalesIDO`, the role `firstParty` has the authority over the following function:

1. function identification()
2. function transferCoin()
3. function firstPartyClaim()

In the contract `FactoryIDO`, the role `superAdmin` has the authority over the following function:

1. function adminSafeTransfer()
2. function updateAdmin()
3. function updateInsurance()
4. function updateAssemblyLine()
5. function addAssemblyLine()
6. function deleteAssemblyLine()

In the contract `FactoryIDO`, the role `voucherBoss` has the authority over the following function:

1. function updateProxyInvestment()
2. function foundCoinSalesIdo()
3. function customProductionIDO()

In the contract `FactoryIDO`, the role `operator` has the authority over the following function:

1. function updatePayee()
2. function updateBusinessToken()
3. function updatePrice()
4. function updateClosePrice()
5. function addFundRaisingToken()
6. function deleteFundRaisingToken()
7. function poolAuthentication()

In the contract `Insurance`, the role `superAdmin` has the authority over the following function:

1. function adminSafeTransfer()
2. function updateAdmin()



### 3. function setFactoryDoAddress()

In the contract `Insurance`, the role `operator` has the authority over the following function:

1. function adminAllSafeTransfer()
2. function updateInsuranceRate()
3. function settlementOfClaims()

In the contract `VoucherNft`, the role `operator` has the authority over the following function:

1. function setNftUri()
2. function mintNft()

Any compromise to the accounts may allow a hacker to take advantage of this authority and causes security problems.

## Recommendation

---

The risk describes the current project design and potentially makes iterations to improve in the security operation and level of decentralization, which in most cases cannot be resolved entirely at the present stage. We advise the client to carefully manage the privileged account's private key to avoid any potential risks of being hacked. In general, we strongly recommend centralized privileges or roles in the protocol be improved via a decentralized mechanism or smart-contract-based accounts with enhanced security practices, e.g., multi-signature wallets.

Indicatively, here are some feasible suggestions that would also mitigate the potential risk at a different level in terms of short-term, long-term and permanent:

### **Short Term:**

Timelock and Multi sign ( $\frac{2}{3}$ ,  $\frac{3}{5}$ ) combination mitigate by delaying the sensitive operation and avoiding a single point of key management failure.

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;  
AND



- Assignment of privileged roles to multi-signature wallets to prevent a single point of failure due to the private key compromised;  
AND
- A medium/blog link for sharing the timelock contract and multi-signers addresses information with the public audience.

### **Long Term:**

Timelock and DAO, the combination, mitigate by applying decentralization and transparency.

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;  
AND
- Introduction of a DAO/governance/voting module to increase transparency and user involvement;  
AND
- A medium/blog link for sharing the timelock contract, multi-signers addresses, and DAO information with the public audience.

### **Permanent:**

Renouncing the ownership or removing the function can be considered *fully resolved*.

- Renounce the ownership and never claim back the privileged roles;  
OR
- Remove the risky functionality.

Noted: Recommend considering the long-term solution or the permanent solution. The project team shall make a decision based on the current state of their project, timeline, and project resources.

### **Alleviation**

---

The team response: Some permissions have been cancelled, and the remaining permissions are due to business needs.



## CSI-01 | Missing Validation

---

Category	Severity	Location	Status
Logical Issue	Major	CoinSalesIDO.sol: 418~427, 429~431	Resolved

### Description

---

The `sellingToken` can be changed after `startTime`. So `sellingToken` can be changed after the user has made a purchase. The user may not get the `sellingToken` that he wanted to buy.

### Recommendation

---

We recommend adding a check to ensure the `sellingToken` can only be changed before `startTime`.

### Alleviation

---

The development team has resolved this issue in commit  
`a38539d19c200c900888315ad35dcd9acf938470`.



## TPC-01 | Permission Issues For Super Admin

---

Category	Severity	Location	Status
Logical Issue	Major	FactoryIDO.sol: 150~154; Insurance.sol: 111~116	Resolved

### Description

---

The function `updateAdmin` can only be called by the `superAdmin`. The functions `removeAuth` and `addAuth` can only be called by the `owner`. But the `superAdmin` is set in `constructor`, maybe not the `owner`. So the `superAdmin` may not have the permission to call the functions `removeAuth` and `addAuth`.

### Recommendation

---

We recommend assigning `owner` to `superAdmin` in `constructor`.

### Alleviation

---

The development team has resolved this issue in commit `a38539d19c200c900888315ad35dcd9acf938470`.



## VNT-01 | Missing Creation In Function `queryUserAllNft`

---

Category	Severity	Location	Status
Logical Issue	Major	token/VoucherNft.sol: 74~79	Resolved

### Description

---

In function `queryUserAllNft`, `nftArray` is not created. When this method be called there will be an error.

### Recommendation

---

Consider modifying as below:

```
1  nftArray = new NftInfo[_ids.length];
2  for (uint256 i = 0; i < _ids.length; i++) {
3      nftArray[i] = nftInfo[_ids[i]];
4  }
5  return nftArray;
```

### Alleviation

---

The development team has resolved this issue in commit  
`a38539d19c200c900888315ad35dcd9acf938470`.



# Medium

## FID-01 | Incorrect Logic In Function `customProductionIDO`

Category	Severity	Location	Status
Logical Issue	Medium	CoinSalesIDO.sol: 403~435	Acknowledged

### Description

function `foundCoinSalesido`:

```
1  _addressArray[3] = msg.sender;
2  _addressArray[4] = superAdmin;
3  _addressArray[5] = insurance;
4  _addressArray[6] = address(this);
5
6  require(isInsuranceToken(_addressArray[1]), "Illegal token!");
7  _intArray[9] = uint256(ERC20(_addressArray[1]).decimals());
```

function `customProductionIDO`:

```
1  _addressArray[0] = msg.sender;
2  _addressArray[1] = superAdmin;
3  _addressArray[2] = insurance;
4  _addressArray[3] = address(this);
5  _addressArray[4] = _assemblyLine;
6
7  require(isInsuranceToken(_addressArray[5]), "Illegal token!");
8  _intArray[0] = uint256(ERC20(_addressArray[5]).decimals());
```

The functions `foundCoinSalesido` and `customProductionIDO` have similar features. So the parameters passed to `assemblyLine` should be the same. But the real parameters shown above are different. The parameters in `customProductionIDO` are incorrect. Please correct the parameters. Additionally, The newly created ido is not added to the `firstPartyPoolArray` in function `customProductionIDO`, like in `foundCoinSalesido`.



## Recommendation

---

We recommend to correct the logic in function `customProductionIDO`.

## Alleviation

---

The team response: `customProductionIDO` is a later reserved extension function and does not correspond to the `productionIdo` function in `AssemblyLine`, it is a reserved interface for the new `AssemblyLine` later.



## ITP-01 | Possible Loss Of Accuracy In Function `joinInsurance`

---

Category	Severity	Location	Status
Logical Issue	Medium	Insurance.sol: 169, 172	Resolved

### Description

---

Variables `totalInsuredAmount`, `userInsuredTotal` are without precision. The default value of `insuranceRate` is 1%. When the investment amount is not an integer multiple of 100, `totalInsuredAmount` and `userInsuredTotal` will have a loss of precision.

For example: `_investedAmount = 99 * 10 ** decimals; _amount = 0.99 * 10 ** decimals; _amount.div(10 **decimals) = 0;`

### Recommendation

---

We recommend retaining the precision of `totalInsuredAmount` and `userInsuredTotal`.

### Alleviation

---

The development team has resolved this issue in commit `a38539d19c200c900888315ad35dcd9acf938470`.



## ITP-02 | Incorrect Operator Used

Category	Severity	Location	Status
Logical Issue	Medium	Insurance.sol: 169, 172	Resolved

### Description

```
1     totalInsuredAmount = totalInsuredAmount.add(_amount.div(10 * decimals));
2
3     userInsuredTotal[_user] = userInsuredTotal[_user].add(_amount.div(10 *
decimals));
```

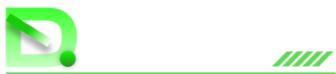
The operator in Line169 and Line172 should be \*\*, but not \*.

### Recommendation

We recommend using the correct operator.

### Alleviation

The development team has resolved this issue in commit  
[a38539d19c200c900888315ad35dcd9acf938470](#).



## ITP-03 | Inadequate Validation

---

Category	Severity	Location	Status
Logical Issue	Medium	Insurance.sol: 150~179	Resolved

### Description

---

The validation in `Insurance.joinInsurance` is not sufficient. Users can forge their own contracts into `CoinSalesIDO` to mint themselves NFT.

### Recommendation

---

We recommend using of more adequate calibration `FactoryIDO.isVoucherIdo(msg.sender)` to ensure the `CoinSalesIDO` is a valid one.

### Alleviation

---

The development team has resolved this issue in commit `a38539d19c200c900888315ad35dcd9acf938470`.



# Minor

## CSI-02 | Missing Input Validation

Category	Severity	Location	Status
Volatile Code	Minor	CoinSalesIDO.sol: 264~265	Resolved

### Description

The `userFloor` means the minimum amount of tokens one user can buy. The `userQuota` means the maximum amount of tokens one user can buy. So the `userFloor` should be less than `userQuota`.

### Recommendation

Consider adding a check as below:

```
1     require(intArr[7] > intArr[8], "userQuota should be greater than userFloor!");
```

### Alleviation

The development team has resolved this issue in commit  
`a38539d19c200c900888315ad35dcd9acf938470`.



## CSI-03 | Lack Of Reasonable Boundary

Category	Severity	Location	Status
Volatile Code	Minor	CoinSalesIDO.sol: 277, 372~416	Partially Resolved

### Description

1. The variable `yield` means the percentage a second party can get from a `CoinSalesIDO`. Its current range values is `yield<=100` . We think its range of values should be more reasonable.
2. If `_isLockWarehouse == 2` , the selling token may be locked for a certain period of time. This time should be within a reasonable range.

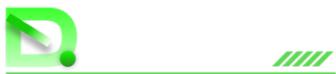
### Recommendation

We recommend adding reasonable upper and lower boundaries to all the configuration variables.

### Alleviation

1. The range of values changed to `0<yield<100` .
2. The final unlock time limit is 10 years after the current time.

Code was applied in commit `a38539d19c200c900888315ad35dcd9acf938470`



## CSI-04 | Missing Input Validation

---

Category	Severity	Location	Status
Volatile Code	Minor	CoinSalesIDO.sol: 317~335	Acknowledged

### Description

---

According to the logic, `startTime` should be less than `endTime` , `endTime` should be less than `claimTime` and `closeTime` . So there need a check before updating the variables `startTime` , `endTime` , `claimTime` and `closeTime` .

### Recommendation

---

Consider adding a check to ensure the variables mentioned above have a reasonable value.

### Alleviation

---

The team response: Because of the needs of business needs, there is no need to solve them.



## CSI-05 | LockWarehouse Can Be Added After User Investment

---

Category	Severity	Location	Status
Logical Issue	Minor	CoinSalesIDO.sol: 372~416	Acknowledged

### Description

---

The LockWarehouse can be added after user investment, so users may not know the lockdown program when they participate exchange.

### Recommendation

---

It's best to add LockWarehouse before users participate exchange.

### Alleviation

---

The team response: Because of the needs of business needs, there is no need to solve them.



## TPC-02 | Missing Input Validation

Category	Severity	Location	Status
Volatile Code	Minor	AssemblyLine.sol: 20, 25; CoinSalesIDO.sol: 420; FactoryIDO.sol: 99, 102~106, 152; Insurance.sol: 61~63	Acknowledged

### Description

The given input is missing the check for the non-zero address.

### Recommendation

We advise adding the check for the passed-in values to prevent unexpected error as below:For example:

```
1     require(_lineLeader != address(0), "lineLeader can not be zero address!");
```

### Alleviation

The team response: No need to resolve.



# Informational

## CSI-06 | Condition Can Be Simplified

Category	Severity	Location	Status
Volatile Code	Informational	CoinSalesIDO.sol: 481	Resolved

### Description

In Line481, `_amount <= investment.add(_amount)`. So Line481 can be simplified.

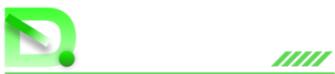
### Recommendation

Consider adding a check as below:

```
1     require(investment.add(_amount) <= quota, "Err_46");
```

### Alleviation

The development team has resolved this issue in commit [a38539d19c200c900888315ad35dcd9acf938470](#).



## TPC-03 | Unlocked Compiler Version

Category	Severity	Location	Status
Language Specific	Informational	AssemblyLine.sol: 2; token/VoucherNft.sol: 2; CoinSalesIDO.sol: 2; Insurance.sol: 2; FactoryIDO.sol: 2	Acknowledged

### Description

The contract has unlocked compiler version. An unlocked compiler version in the source code of the contract permits the user to compile it at or above a particular version. This, in turn, leads to differences in the generated bytecode between compilations due to different compiler versions. This can lead to an ambiguity when debugging as compiler specific bugs may occur in the codebase that would be hard to identify over a span of multiple compiler versions rather than a specific one.

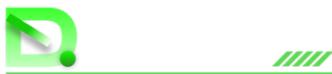
### Recommendation

We advise that the compiler version is instead locked at the lowest version possible that the contract can be compiled at. For example, for version v0.6.2 the contract should contain the following line:

```
pragma solidity 0.6.2;
```

### Alleviation

The team response: No need to resolve.



## TPC-04 | Missing Emit Events

---

Category	Severity	Location	Status
Coding Style	Informational	AssemblyLine.sol: 23, 28; CoinSalesIDO.sol: 228, 300, 308, 313, 317, 337, 341, 345, 356, 372, 418, 429, 433, 438, 452, 515, 530; Insurance.sol: 88, 111, 118; FactoryIDO.sol: 142, 150, 176, 181, 215, 222, 252, 295	Acknowledged

### Description

---

There should always be events emitted in the sensitive functions that are controlled by centralization roles.

### Recommendation

---

It is recommended emitting events for the sensitive functions that are controlled by centralization roles.

### Alleviation

---

The team response: No need to resolve.



## TPC-05 | Variables That Could Be Declared An Immutable

---

Category	Severity	Location	Status
Gas Optimization	Informational	AssemblyLine.sol: 11; CoinSalesIDO.sol: 27; Insurance.sol: 20, 22; FactoryIDO.sol: 19	Acknowledged

### Description

---

The linked variables assigned in the constructor can be declared as `immutable`. Immutable state variables can be assigned during contract creation but will remain constant throughout the lifetime of a deployed contract. A big advantage of immutable variables is that reading them is significantly cheaper than reading from regular state variables since they will not be stored in storage.

### Recommendation

---

We recommend declaring these variables as immutable. Please note that the `immutable` keyword only works in Solidity version v0.6.5 and up.

### Alleviation

---

The team response: No need to resolve.



## Disclaimer

This report is based on the scope of materials and documentation provided for a limited review at the time provided. Results may not be complete nor inclusive of all vulnerabilities. The review and this report are provided on an as-is, where-is, and as-available basis. You agree that your access and/or use, including but not limited to any associated services, products, protocols, platforms, content, and materials, will be at your sole risk. Blockchain technology remains under development and is subject to unknown risks and flaws. The review does not extend to the compiler layer, or any other areas beyond the programming language, or other programming aspects that could present security risks. A report does not indicate the endorsement of any particular project or team, nor guarantee its security. No third party should rely on the reports in any way, including for the purpose of making any decisions to buy or sell a product, service or any other asset. To the fullest extent permitted by law, we disclaim all warranties, expressed or implied, in connection with this report, its content, and the related services and products and your use thereof, including, without limitation, the implied warranties of merchantability, fitness for a particular purpose, and non-infringement. We do not warrant, endorse, guarantee, or assume responsibility for any product or service advertised or offered by a third party through the product, any open source or third-party software, code, libraries, materials, or information linked to, called by, referenced by or accessible through the report, its content, and the related services and products, any hyperlinked websites, any websites or mobile applications appearing on any advertising, and we will not be a party to or in any way be responsible for monitoring any transaction between you and any third-party providers of products or services. As with the purchase or use of a product or service through any medium or in any environment, you should use your best judgment and exercise caution where appropriate.

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# Appendix

## Finding Categories

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### **Centralization / Privilege**

Centralization / Privilege findings refer to either feature logic or implementation of components that act against the nature of decentralization, such as explicit ownership or specialized access roles in combination with a mechanism to relocate funds.

### **Coding Style**

Coding Style findings usually do not affect the generated bytecode but rather comment on how to make the codebase more legible and, as a result, easily maintainable.

### **Volatile Code**

Volatile Code findings refer to segments of code that behave unexpectedly on certain edge cases that may result in a vulnerability.

### **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.

## Checksum Calculation Method

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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.



# About

DeHacker is a team of auditors and white hat hackers who perform security audits and assessments. With decades of experience in security and distributed systems, our experts focus on the ins and outs of system security. Our services follow clear and prudent industry standards. Whether it's reviewing the smallest modifications or a new platform, we'll provide an in-depth security survey at every stage of your company's project. We provide comprehensive vulnerability reports and identify structural inefficiencies in smart contract code, combining high-end security research with a real-world attacker mindset to reduce risk and harden code.

## BLOCKCHAINS

	Ethereum
	Eos

	Cosmos
	Substrate

## TECH STACK

	Python
	Rust

	Solidity
	c++

## CONTACTS

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**DeHacker**

June 2022