SCI

Secure Contract Interactions

Whitepaper

v1.0 May 2024

SCI Website

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Abstract

The Secure Contract Interaction (SCI) Protocol is an open-source initiative aimed at enhancing security within the web3 ecosystem. Recognizing the increasing risk of interacting with malicious smart contracts, SCI introduces a decentralized verification system allowing domain owners to authorize specific smart contracts to interact with their domains.

Its flexibility and simple architecture supports easy integration for users, wallets, security apps, and on-chain contracts. SCI is open-source, free to use, and committed to providing a vital layer of protection for users dealing with smart contracts in the web3 ecosystem.

Introduction

Secure Contract Interaction (SCI) is an open-source protocol designed as a public good to improve security within web3.

We aim to bolster security measures within the web3 ecosystem by establishing an on-chain registry that allows owners to verify which smart contracts should be allowed to interact with their web domains.

SCI's purpose is to verify that websites are interacting with validated and authorized smart contracts minimizing user risks and exploits.

Why do we exist?

In the realm of web3, ensuring robust security is a paramount challenge that must be addressed to facilitate the onboarding of the next billion users. Numerous incidents, such as those involving Balancer, Badger, and KyberSwap, highlight the vulnerability of users interacting with malicious contracts unknowingly.

Quote from **KyberSwap**'s exploit:

> **"Using the injected malicious script via GTM, the hackers made users approve their funds and sent them to the hacker's address"**

In response to these threats, the SCI protocol introduces a verification system. Here, domain owners (for example the owner of kyberswap.com) can add all contracts permitted to interact within their domains and app users can get insights on whether the contract they are engaging with is verified (within the domain) or not.

The SCI protocol stands as a public good, offering a completely open-source, permission-less, and free-to-use solution. By providing a unified system that exposes on-chain data, SCI serves as an essential layer of protection for users interacting with smart contracts across the entire ecosystem.

How it works

Key components

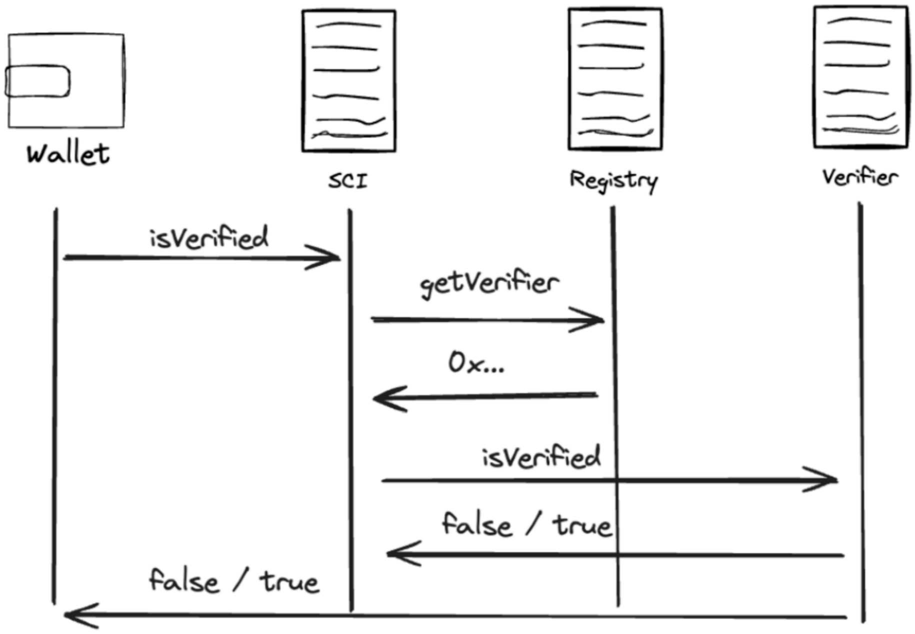
There are four key smart contract:

- **SCI:** It is use to interact with the protocol
- **Registry:** It keeps track of domains, owners and Verifiers
- **Verifiers:** It resolves if a contract is allowed on the domain
- **Authorizer:** It is equipped to identify whether an address is the owner of a domain beyond the confines of the protocol or not.

Verifying that a contract can interact with a domain

When a user initiates a contract interaction within a web application hosted on a specific domain, the wallet verifies if the contract is allowed on that domain by consulting the SCI contract.

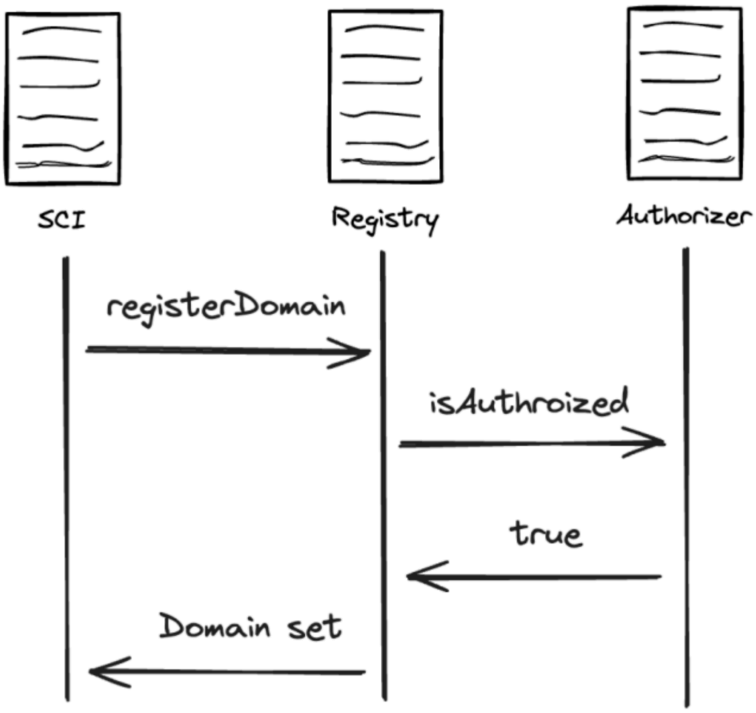
The SCI contract, in turn, queries the Registry to obtain the Verifier, and subsequently, it queries the Verifier to determine the validity of an address on that domain.



Registering a domain

When a domain owner seeks to register a domain for the purpose of verifying contract addresses, they use the **Registry**. Upon successful execution, the **Registry** will record the domain along with its owner and the associated **Verifier**.

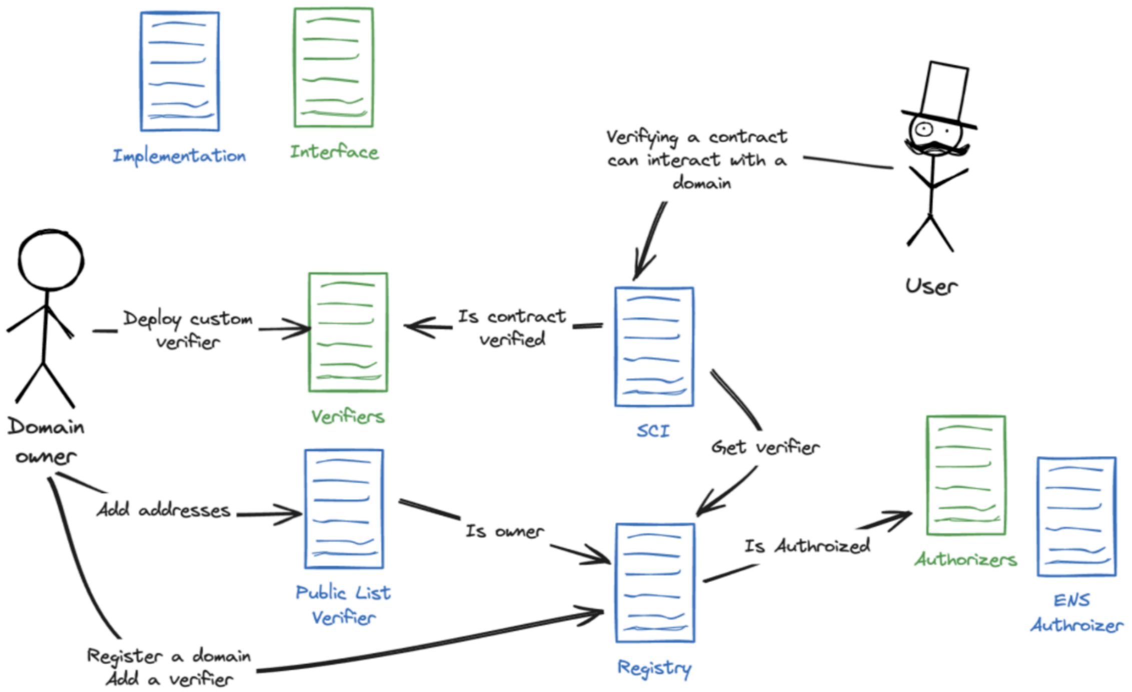
To register a domain, the owner of the domain sends a transaction to the **Registry** contract, providing the desired domain, the associated **Authorizer** and a **Verifier**. The **Authorizer** responds with a boolean indicating whether the owner is authorized to manage that domain or not. If the result is true, the domain is registered with the **Verifier**.



Architecture

General Overview

The protocol is structured in different smart contract components:



SCI Contract

The **SCI contract** serves as an upgradable smart contract designed to streamline interactions within the protocol. It will continuously evolve by incorporating new features introduced in future updates.

Users of the protocol can implement their own logic independently and can interact with the protocol without using the **SCI Contract**. However, the contract is designed to simplify the integration process and enhance the user experience.

For instance, the verification process to determine if a contract is permitted to interact with a domain involves two separate calls—one to the **Registry** and another to the **Verifier**. The **SCI Contract** abstracts these complexities, providing a single function that enables users to easily verify if a contract is allowed to interact with a domain. More on these interactions can be found in the "*How it works*" section.

Authorizers

To ascertain domain ownership, the protocol can employ different strategies which include relying on established systems such as the Ethereum Name Service (ENS) or validating Domain Name System Security Extensions (DNSSEC) records on the blockchain. By implementing these strategies, SCI identifies, in a robust and decentralized way, that an address is the owner of a domain.

The **Authorizers** are contracts that implement the following interface:

```
/**
* @dev Required interface of an Authorizer compliant contract
*/
interface Authorizer {
/**
* @dev Validates if an address is authorized to register
* @param sender The address trying to register the domain
* @param domainHash The name hash of the domain.
* @return a bool indicating whether the sender is author
*/
function isAuthorized(address sender, bytes32 domainHash)
}
```

The function `isAuthorized` must return a boolean whether the user is authorized or not.

As part of the initial rollout of the project, authorizers are created and added to the registry by SCI's core team. The initial implementation introduces the ENS Authorizer. However, future authorizers can employ diverse strategies and the protocol won't rely solely on ENS for domain verifications.

ENS Authorizer

The ENS Authorizer takes the provided domain hash and subsequently retrieves the owner information from the ENS registry. Following this, it conducts a comparison with the sender parameter. If the owner of the node matches the sender parameter, the authorizer returns a “true”; otherwise, it returns “false”.

More on ENS DNS registrar: https://docs.ens.domains/dns-registrar-guide

Verifiers

Verifiers are smart contracts that resolve which contracts are allowed on the domain.

To be a verifier, a smart contract needs to support the following interface:

```
/**
* @dev Required interface of a Verifier compliant contract f
*/
interface Verifier {
/**
* @dev Verifies if a contract in a specific chain is aut
* to interact within a domain.
* @param domainHash The domain's name hash.
* @param contractAddress The address of the contract try
* @param chainId The chain where the contract is deployed
* @return a bool indicating whether the sender is author
*/
function isVerified(
bytes32 domainHash,
address contractAddress,
uint256 chainId
) external view returns (bool);
}
```

They are only required to implement the `isVerified` function, so that the registry can determine whether the contract is verified for that domain or not.

Public List Verifier

The protocol provides a **Public List Verifier** which is an address-to-domain mapping. It consists of a simple contract that stores the list of addresses permitted to interact with a specific domain. The contract looks up the list when determining if the contract is verified or not.

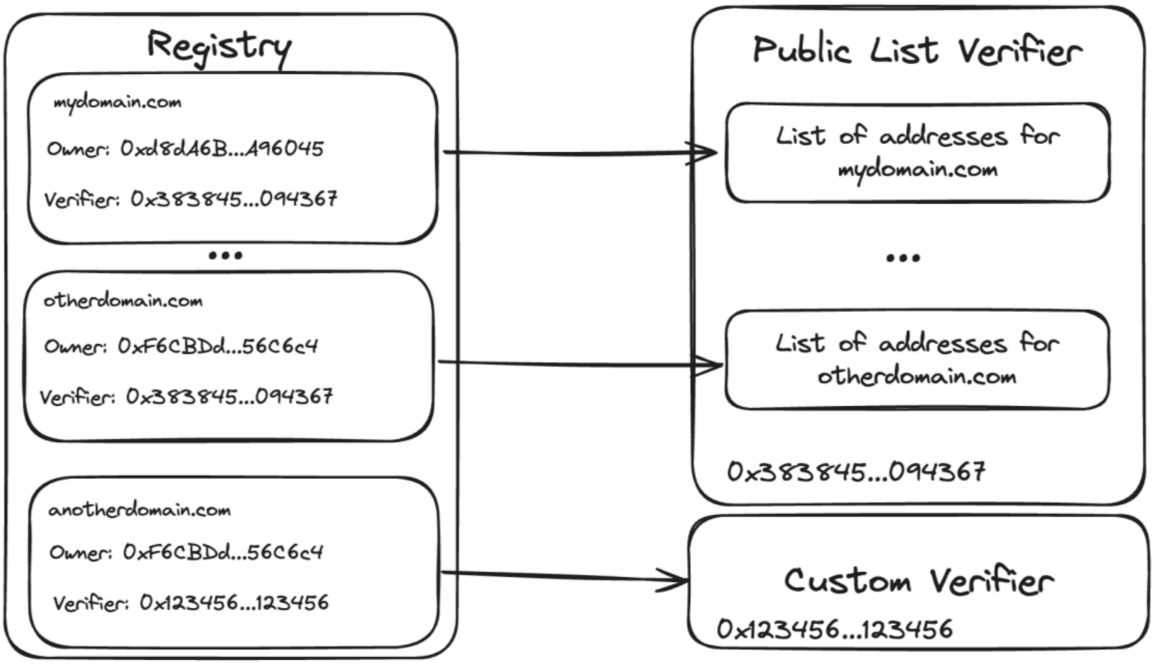
When adding an address, the **Public List Verifier** will confirm ownership of the domain through the **Registry**. The chain id needs to be provided. It can be set to max uint256 to signal that the contract is available on all chains.

Custom Verifiers

More complex verifications could be developed in the future. Any domain owner could create their own verification system. If necessary, verifiers could also implement ERC-3668 to perform off-chain verification logic.

Any custom verifier has the flexibility to inherit or combine functionality from various verifiers. This is why the protocol supports only one verifier per domain.

The following diagram gives a simple representation on how the **Registry** interacts with the **Public List Verifier** or a **Custom Verifier**.



Registry

The **Registry** smart contract records the domain owner's address and the associated **Verifier** for a specific domain.

Smart contract interface:

```
interface IRegistry {
/**
* @dev Emitted when a new `domain` with the `domainHash`
* registered by the `owner` using the authorizer with id
*/
event DomainRegistered(
uint256 indexed authorizerId,
address indexed owner,
bytes32 indexed domainHash,
string domain
);
/**
* @dev Emitted when the `owner` of the `domainHash` add
*
* NOTE: This will also be emitted when the verifier is c
*/
event VerifierSet(address indexed owner, bytes32 domainHa
/**
* @dev Emitted when the `msgSender` adds and `authorizer
*
* NOTE: This will also be emitted when the authorizer is
*/
event AuthorizerSet(uint256 indexed authorizerId, Authori
/**
* @dev Thrown when the `account` is not authorized to re
*/
error AccountIsNotAuthorizeToRegisterDomain(address accou
/**
* @dev Returns the owner and the verifier for a given do
* @param domainHash The name hash of the domain
*/
function domainHashToRecord(
bytes32 domainHash
) external view returns (address owner, Verifier verifier
/**
* @dev Register a domain.
*
```

```
* @param authorizerId The id of the authorizer being use
* @param owner The owner of the domain.
* @param domain The domain being registered (example.com
* @param isWildcard If you are registering a wildcard to
*
* NOTE: If wildcard is true then it registers the name h
*
* Requirements:
*
* - the owner must be authorized by the authorizer.
*
* May emit a {DomainRegistered} event.
*/
function registerDomain(
uint256 authorizerId,
address owner,
string memory domain,
bool isWildcard
) external;
/**
* @dev Same as registerDomain but it also adds a verifie
*
* @param authorizerId The id of the authorizer being use
* @param domain The domain being registered (example.com
* @param isWildcard if you are registering a wildcard to
* @param verifier the verifier that is being set for the
*
* Requirements:
*
* - the caller must be authorized by the authorizer.
*
* May emit a {DomainRegistered} and a {VerifierAdded} ev
*/
function registerDomainWithVerifier(
uint256 authorizerId,
string memory domain,
bool isWildcard,
Verifier verifier
) external;
/**
* @dev Returns true if the account is the owner of the d
*/
function isDomainOwner(bytes32 domainHash, address accoun
/**
* @dev Returns the owner of the domainHash.
* @param domainHash The name hash of the domain
* @return the address of the owner or the ZERO_ADDRESS i
*/
function domainOwner(bytes32 domainHash) external view re
/**
* @dev Returns the verifier of the domainHash.
* @param domainHash The name hash of the domain
* @return the address of the verifier or the ZERO_ADDRES
* the verifier are not registered
*/
function domainVerifier(bytes32 domainHash) external view
/**
* @dev Sets a verifier to the domain hash.
* @param domainHash The name hash of the domain
* @param verifier The address of the verifier contract
*
* Requirements:
*
* - the caller must be the owner of the domain.
*
* May emit a {VerifierAdded} event.
* NOTE: If you want to remove a verifier you can set it
*/
function setVerifier(bytes32 domainHash, Verifier verifie
/**
* @dev Sets an authorizer with id `authorizerId`.
* @param authorizerId The id of the authorizer
* @param authorizer The address of the authorizer contra
*
* Requirements:
*
* - the caller must have the ADD_AUTHORIZER_ROLE role.
*
* May emit a {AuthorizerAdded} event.
*
* NOTE: If you want to remove an authorizer you can set
*/
function setAuthorizer(uint256 authorizerId, Authorizer a
}
```

Namehash

Instead of using human readable domains, the Registry contract uses the namehash algorithm to transform them into 256-bit cryptographic hashes. This algorithm is the same used by ENS to represent domains in their architecture.

We call the namehash of a domain a domain hash

More on ENS namehash:
https://docs.ens.domains/contract-api-reference/name-processing

Applications

We can see multiple products that could leverage the protocol to enhance the security of their users. In this section we will list a few examples.

Wallets

Due to the nature of the protocol we propose, it is fairly simple to integrate this protection/prevention layer into any wallet.

An example of this can be seen using a Metamask snap that verifies whether the interaction with the contract is validated in the domain it is happening.

Furthermore, any wallet that can verify the domain where the call is taking place can do a security layer check pulling SCI information and providing the user with a safe and intuitive experience.

Standalone Security Applications

Applications can be built to easily verify contracts allowed to interact with specific domains, serving as a valuable additional security measure alongside what the wallet provides.

Any back-end service can use SCI before submitting any transaction and prevent any malicious or fraudulent transactions. SCI enables you to protect your own protocols, services and the infrastructure you offer to other businesses.

Examples of this would be our main SCI web page, where you can search the domains and the addresses that are verified, browser plugins or transaction relayers.

On-chain applications

Smart contracts can utilize our protocol before transferring funds to ensure the recipient address is verified, preventing losses.

Currently, several applications manage their funds, requiring the protocol team to handle asset collection or transfers regularly. Mistakenly sending funds to the wrong address, causing permanent loss can be avoided by using the SCI Protocol.
https://consensys.io/open-roles/5645608

Other Implementations

During our research phase for designing the protocol, we encountered some existing proposals such as ERC 6897 and ERC 7529, aiming to address similar issues. While these proposals offer valuable insights, we found certain limitations that could hinder their widespread adoption.

ERC-6897

Although resembling our design, this EIP lacks support for passing a domain during verification calls, which poses challenges for reusing Verifiers (or DRC as they are called in the EIP) across multiple domains. Consequently, deploying a separate Verifier for each domain significantly increases costs for domain owners. Employing a JSON file in the /.well-known root for double verification presents an intriguing idea that we might consider incorporating into our protocol in the future.

ERC-7529

This EIP proposes embedding contracts into a TXT record within a DNS domain and retrieving them via DoH (DNS over HTTP). However, this approach relies on a centralized provider for DNS over HTTP, introducing potential vulnerabilities such as data withholding or service downtime. In contrast, our on-chain registry leverages existing node infrastructure, enabling users to access information from any node provider including their own node. Additionally, ERC 7529's reliance on a simple list of addresses on-chain overlooks the composability benefits offered by smart contracts. Our Verifiers, being complex smart contracts, can provide additional security checks beyond mere address listings.

While the idea of smart contracts managing a list of allowed domains is intriguing, it fails to address the fundamental issue of potential vulnerabilities when frontends interact with malicious smart contracts. Malicious actors could manipulate the domain allowance within their contracts, undermining the security of the system.