Decentralized Robinson List

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Introduction

Robinson List

User contact information are precious gold to marketing strategists.

- End of 2019, 44% scam calls (Source: first Onion)
- Americans lost nearly $9 billion from phone scams in 2018 (Source: First Orion)
- Between 2017 and 2018, scam calls increase by 300%

Robinson List

- *Robinson Lists* are an opt-out list of people who do not wish to receive marketing calls.
- At the same time, it is a tool to provide marketing operators with a more transparent market.
- Centralized service existing in a various countries (e.g. Belgium, UK, Canada, Australia, ...)

Robinson List

- The Italian Robinson List is the *Registro Pubblico delle Opposizioni* (RPO) and it is managed since 2011 by Fondazione Ugo Bordoni.
- Today the RPO manages 1.5Mln records but it is expected to handle 100Mln records by 2021 (due to the introduction of mobile phones).

Why Decentralized Robinson List?

The purpose of this work is the design and evaluation of the RPO as a fully-decentralized service on top of a blockchain technology.

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- Empower Citizens giving them fully control of their choices
- Reduce maintenance cost
- It is possible to show cryptographic proof of the subscriber option.
- Transnational deployment

Problem Model and Requirements

Model

The Robinson List

$< tel, opt >$

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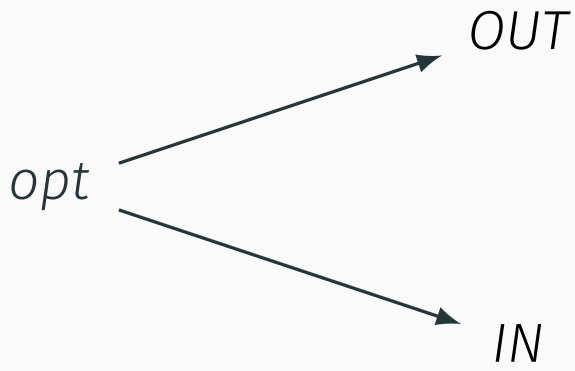

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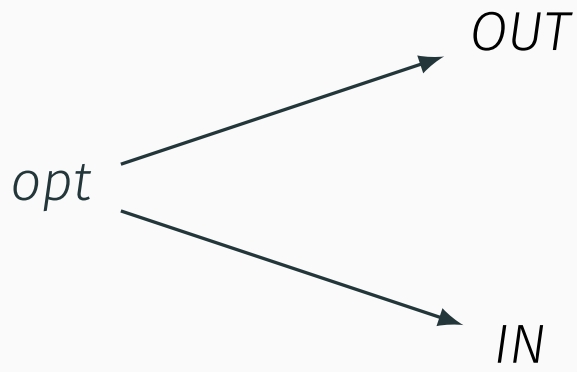
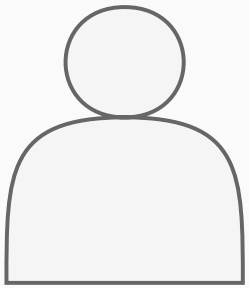


Actors



Subscriber

Model

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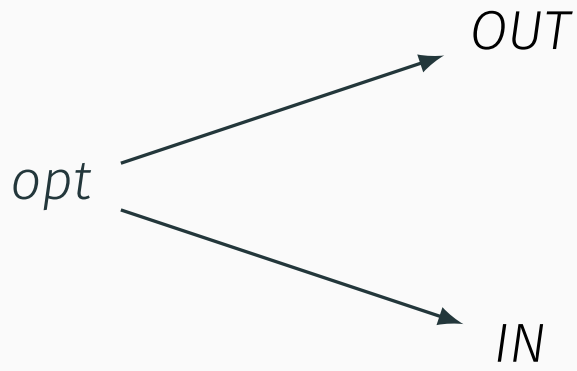

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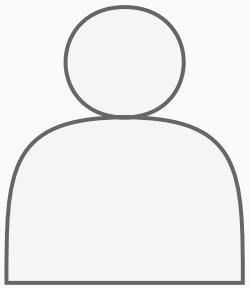

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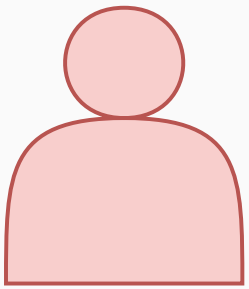

Operator

Model

The Robinson List

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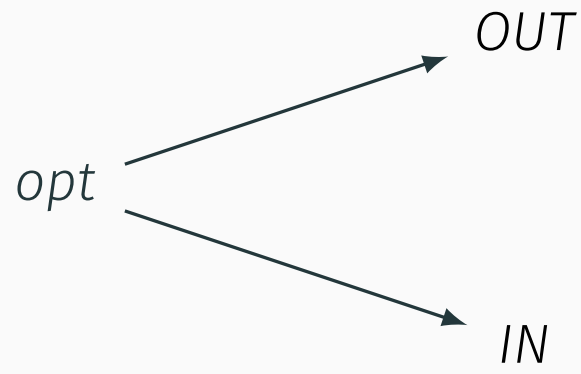

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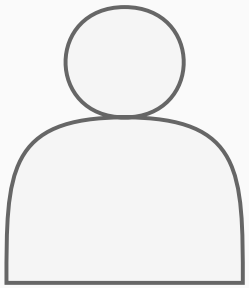
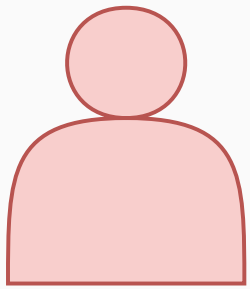


Subscriber



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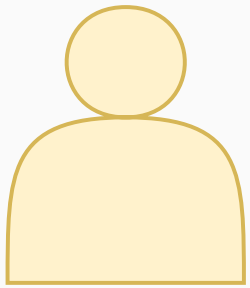

Initializer

Requirements

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Centralized solution

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DLT solution

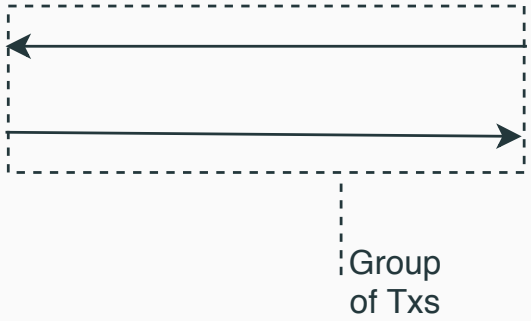
Solution

Ingredients

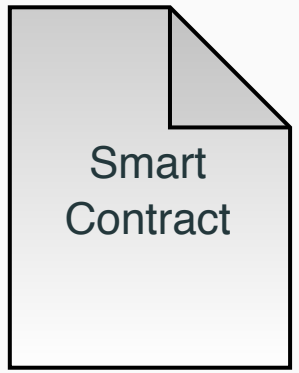
High Scalability

Wallet

Tokens



Group of atomic transactions

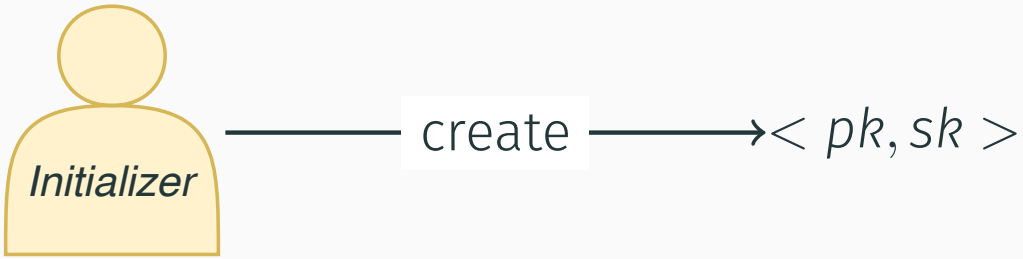


Smart Contract

Main operations

- Robinson List Initialization
- Addition of a new telephone number t
- Option switching

Robinson List Initialization



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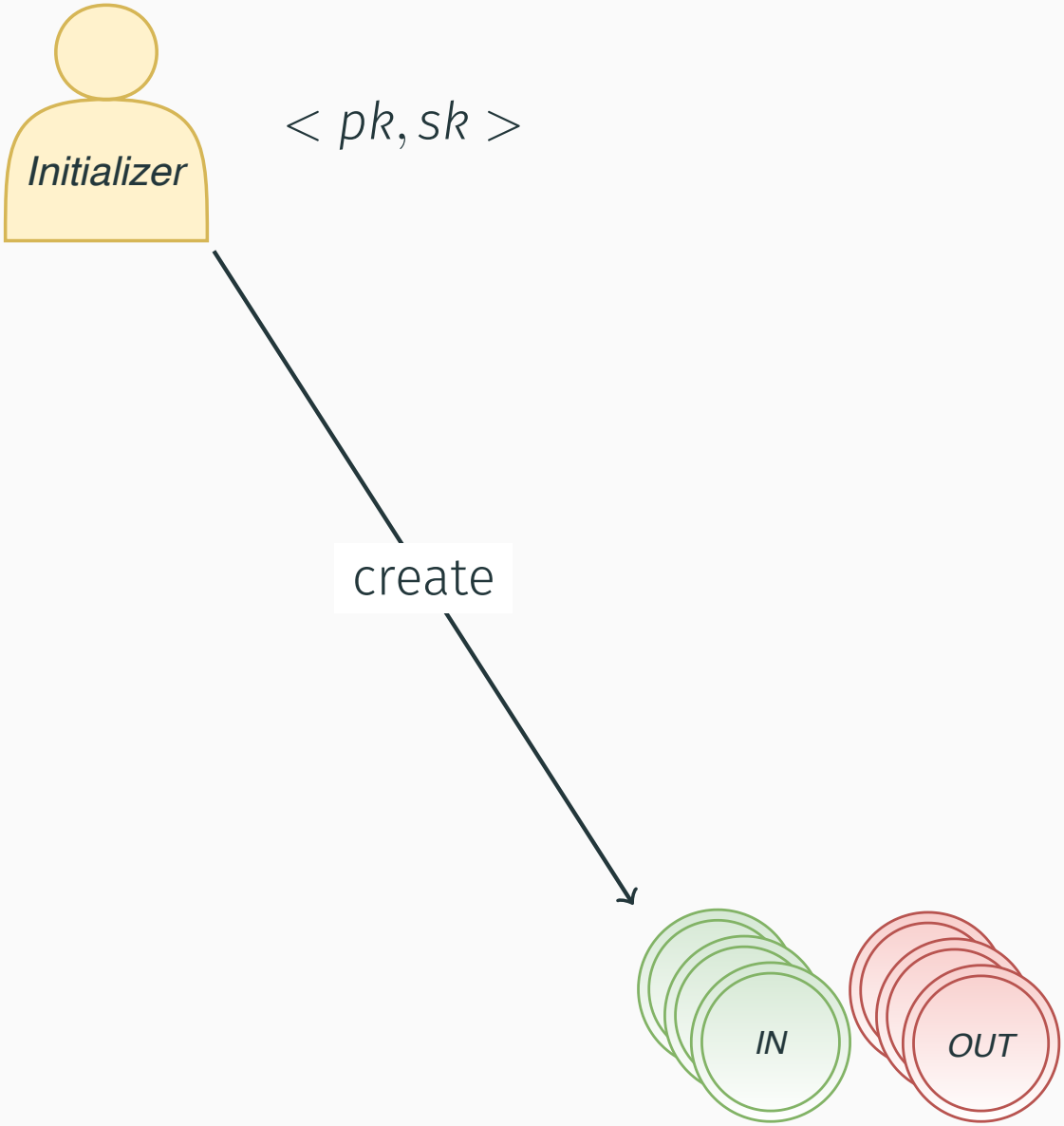

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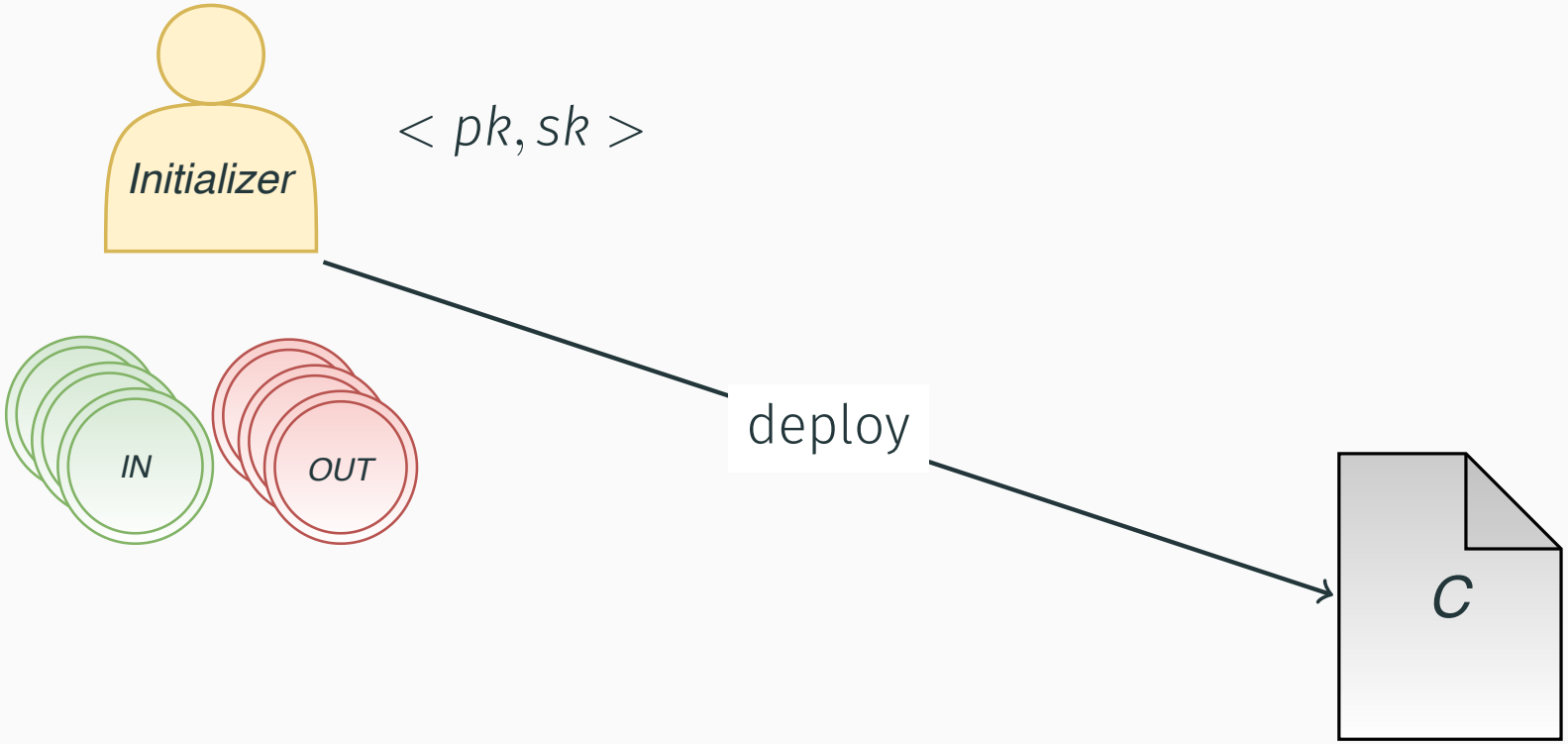
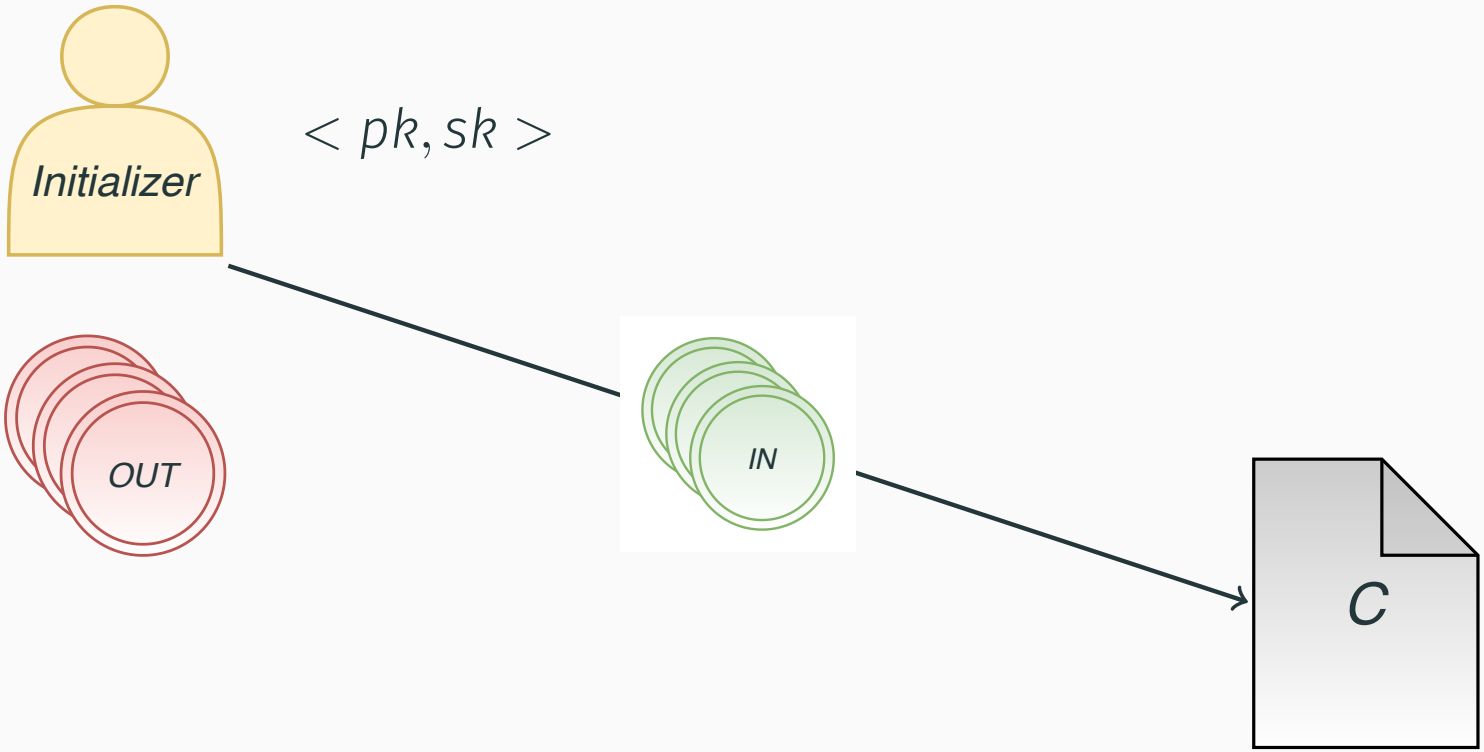
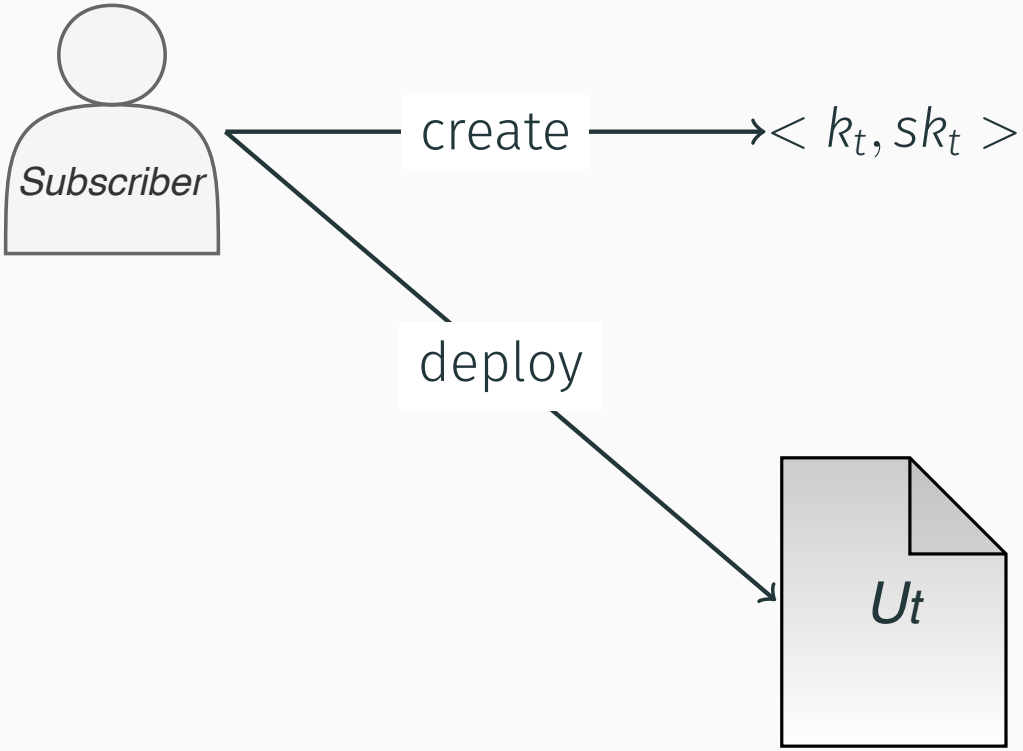


C checks whether the switch operation is well-formed. The switch operation is a group of transaction where (1) transfers 1 *OUT* token to *C* (2) transfers 1 *IN* token from *C* or viceversa.

Robinson List Initialization



Addition of a new telephone number t



U_t is a standard contract template associate with each subscriber t. It has been designed to avoid exchange of tokens between subscribers in order to respect the *Option Constraint*, defined as follows:

For each telephone number t, the contract U_t contains only either only one *IN* token or only one *OUT* token.

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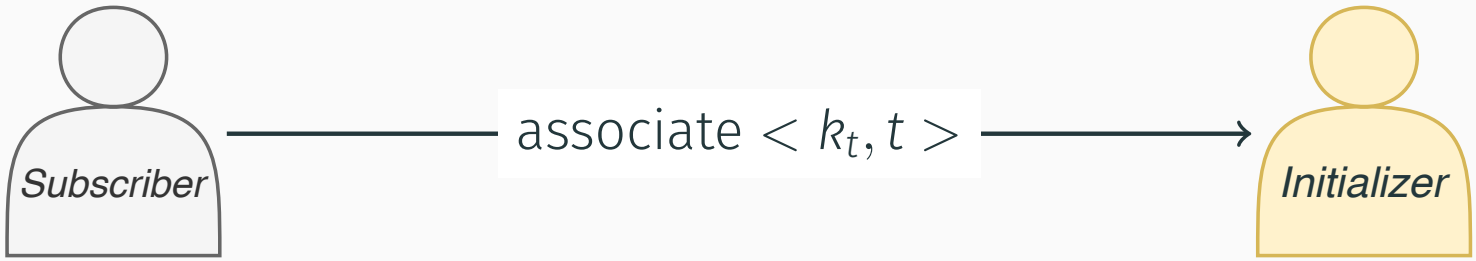
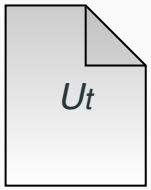


$< k_t, sk_t >$



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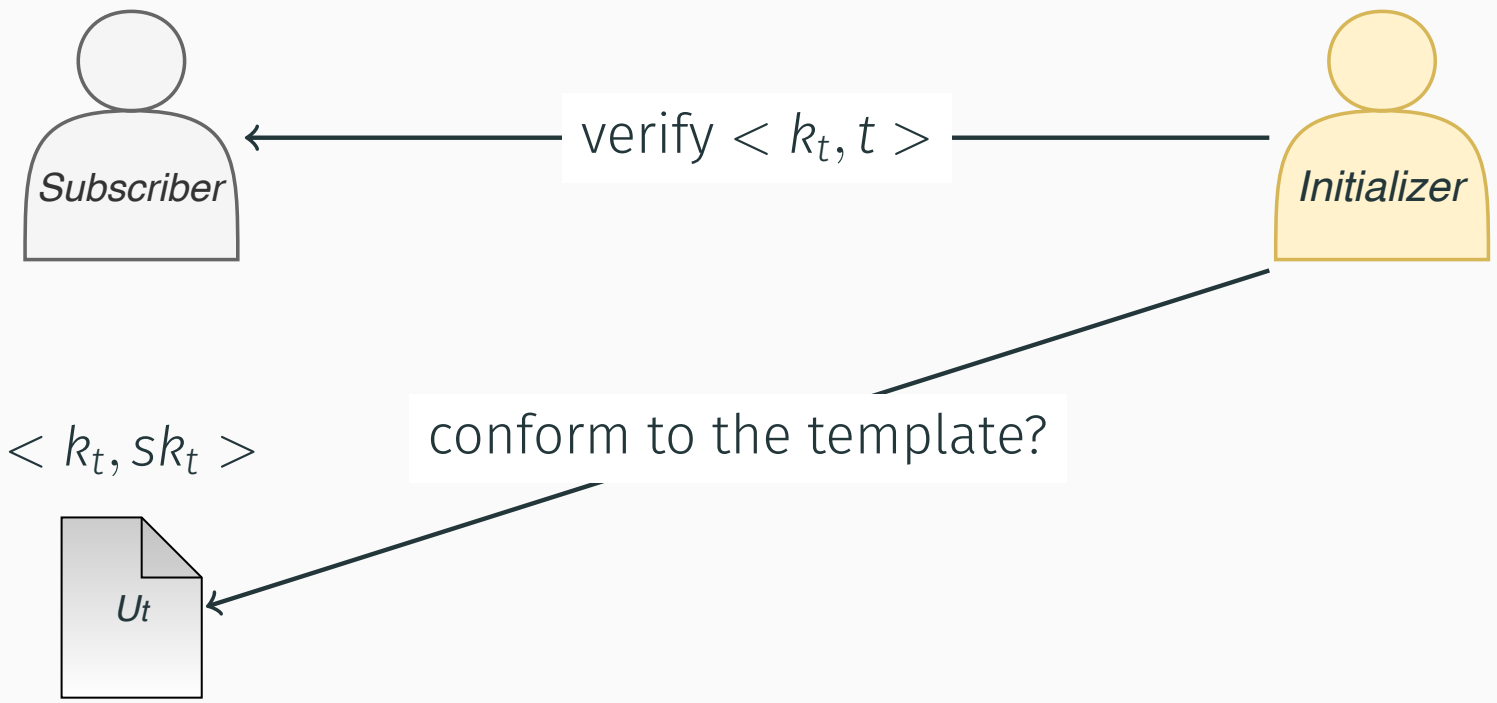

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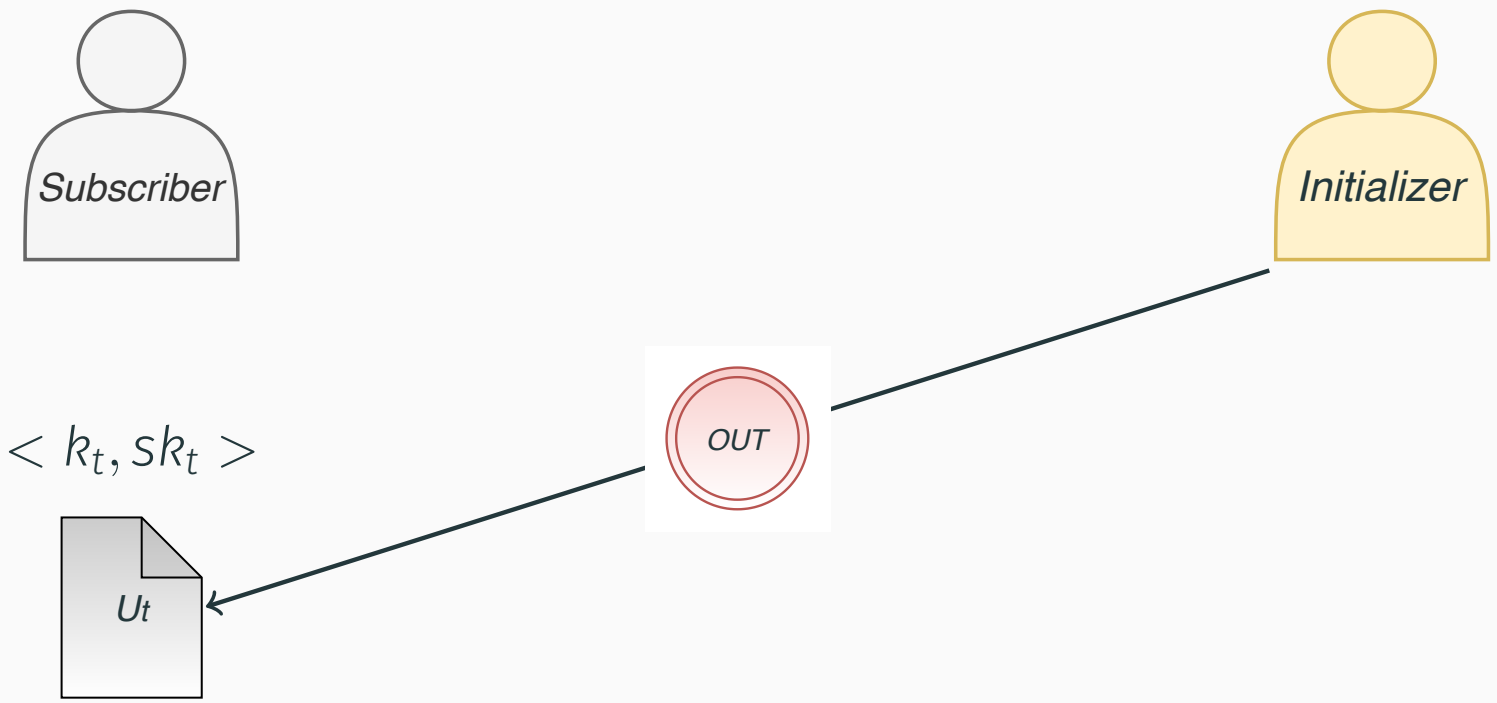
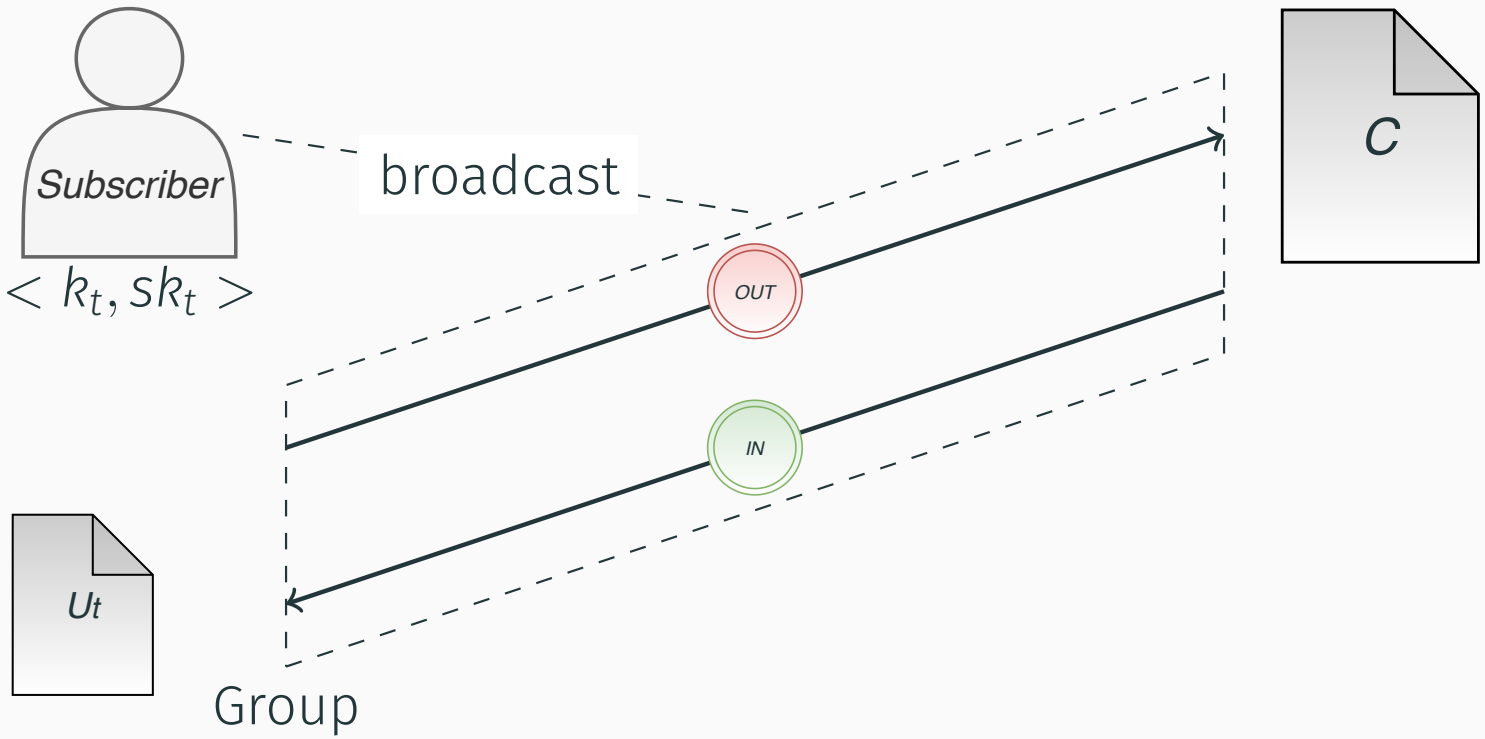


Option switching



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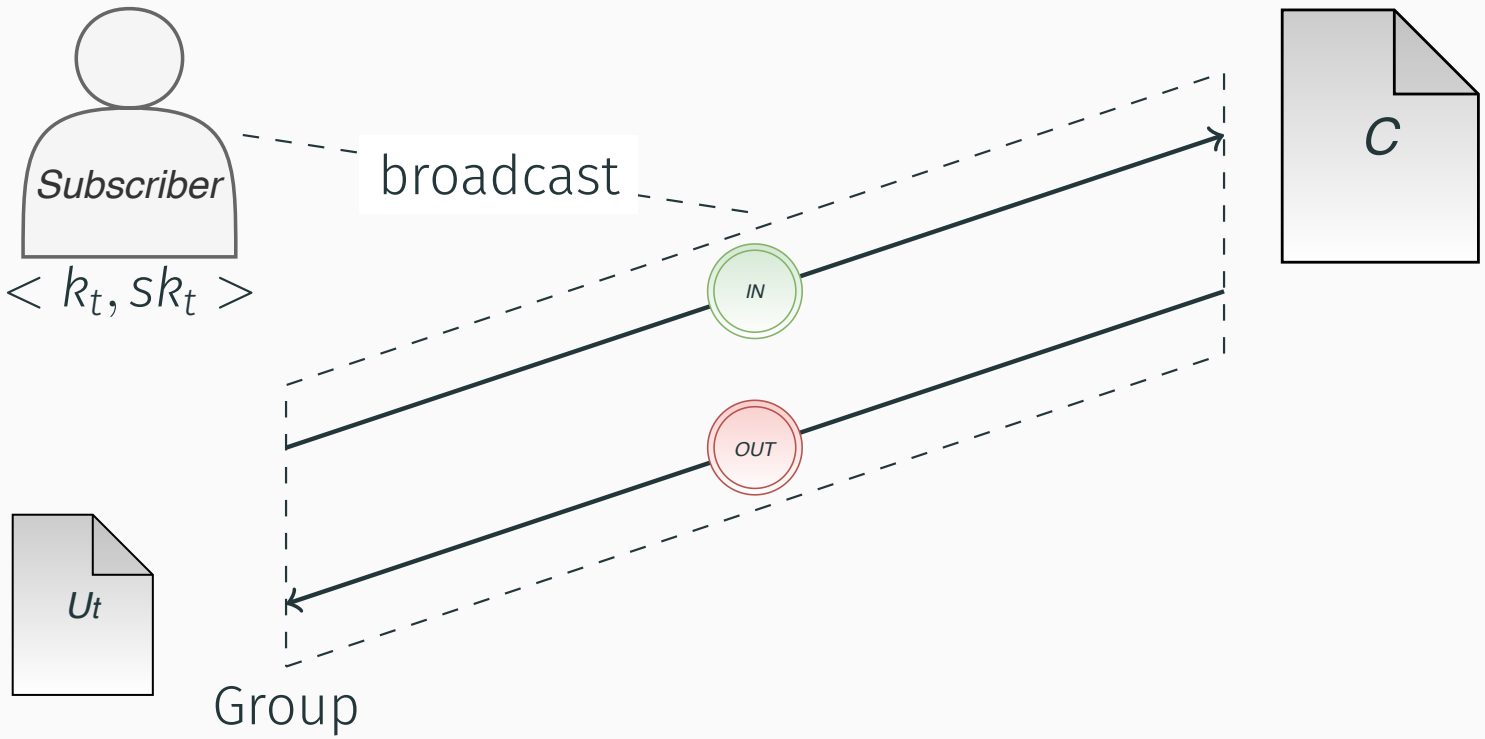


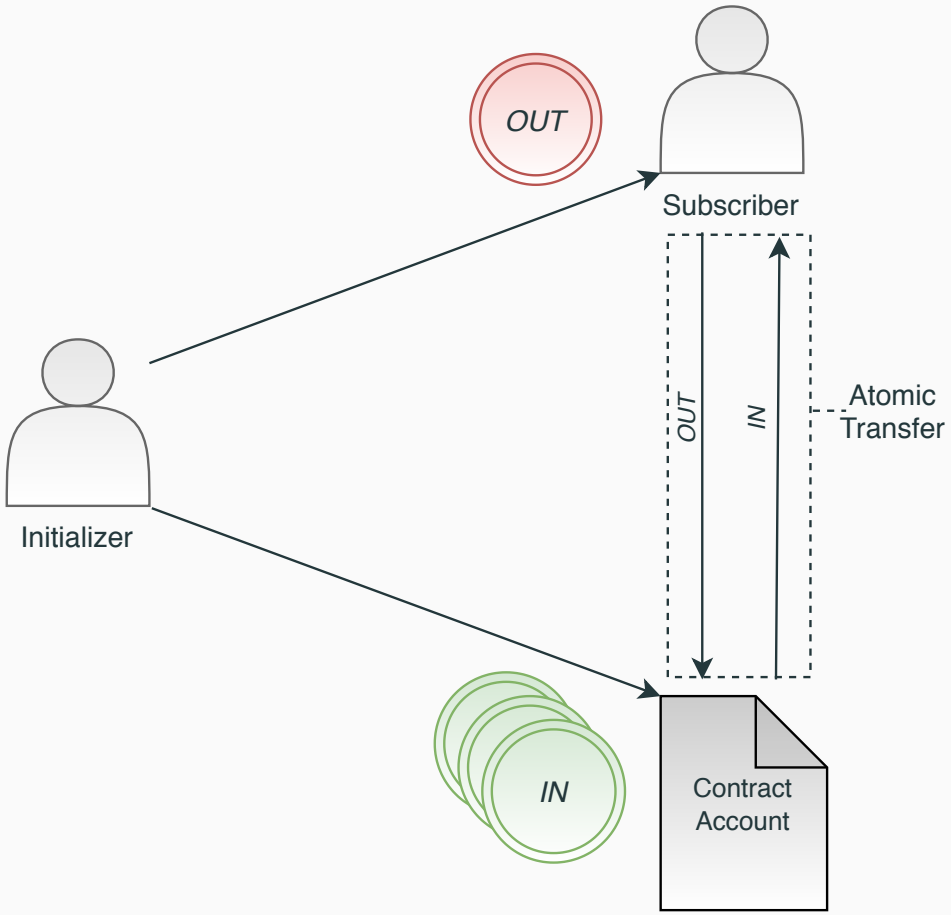
Proof of Concept and Evaluation

Proof of Concept (PoC)

PoC has been realized on *Algorand* because:

- It is one of the best performers in terms of transaction throughput and scalability
- It provides all the technological ingredients required for our application (Atomic Standard Asset, Atomic Transfer and Algorand Smart Contract)

Architecture



Performance Evaluation

- For creating 1000 subscribers' wallet and storing the association public key-phone number in a local database –> 2.67 seconds per user.
- For authenticating and initializing users –> 24 seconds per user.
- For swapping –> 6 seconds.
- For *pruning* the list of phone numbers provided by marketing operators:

Users	1000	500	100
Average	3,533582604	1,813632202	0,3662767768
Variance	0,04431163425	0,008486357303	0,001594493799

Privacy and Identity

Privacy

Subscriber choices are *personal data*. System needs to be complaint with *privacy regulation*, like GDPR.

Pseudoanonymization of personal information and data is widely used. In our scenario consists in not writing in-chain any association among the phone number and subscriber choices.

Only *operators*, and few other entities, needs to know both telephone number and choices

Identity management: possible enhancements

Binding phone numbers and public keys is an *Identity management* problem. With the current solution, the Initializer handles it, so we are using a centralized approach.

Identity management: possible enhancements

We wish to decentralize three tasks of the initializer:

1. Verification of bindings of telephone numbers to public keys

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1. **Verification of bindings of telephone numbers to public keys**

The work[1] describes two approaches to perform this operation in a decentralized manner.

It selects randomly a committee of validators that is hard to predict. Each member performs the check autonomously and write in-chain the *proof* of the binding.

[1] Diego Pennino et al. *Binding of Endpoints to Identifiers by On-Chain Proofs*. 2020. arXiv: *2005.00794 [cs.DC]*.

Identity management: possible enhancements

We wish to decentralize three tasks of the initializer:

2. **Storing the bindings into a private identity management database**

Identity pairs $< t, k_t >$ can be easily stored on-chain but they cannot be plaintext due to *privacy regulations*.

Identity management: possible enhancements

We wish to decentralize three tasks of the initializer:

3. **Reply to operator queries**

We aim to define a scheme that allows to access identity pairs autonomously.

Operators can be added and removed dynamically.

Next steps

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Open questions:

- Performance evaluation

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- Cross-border deployment
- Analysis of other use cases
- Selective opt-in/opt-out

Thank you for the attention!