Law, Science and Technology
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RI E
Rights of Internet of Everything

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Intelligent Human-input-based Blockchain Oracle (IHiBO)

Overview

1. Introduction
2. Conflict Resolution
3. Blockchain
4. IHiBO
5. Evaluation
6. Conclusion

Introduction

The Problem

General Problem → *Trust in decision-making process*

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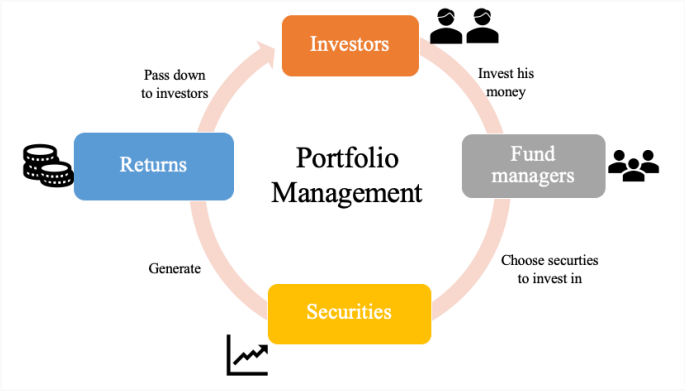
- **Trust service** ← persons or organization *acting on behalf of* another person to deal with the tasks involving finances.
- **Fund management** ← fund managers *manage on behalf of* their investors a portfolio of securities (stock, bonds, etc.) and perform risk management.

Specific: Trust problem that emerges in the fund management



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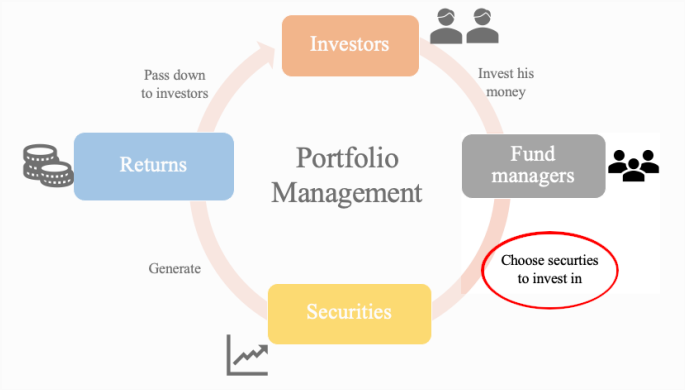

- **reservation** and **lack of documentation** of the decision-making process of investments
- legislators declare investors **right to check the relevant activities** in order to give

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- Blockchain and Smart Contracts

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- Is *formal argumentation* **suited for modelling the decision-making process** of fund management?

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- *Blockchain* used **not only** to trace the output of a decision-making process
  $\rightarrow$ **trace argumentation and negotiation and make it auditable**

Conflict Resolution

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- **Agent Argumentation Framework(AAF)** ← argument belongs to one or more agents

Portfolio Management Example

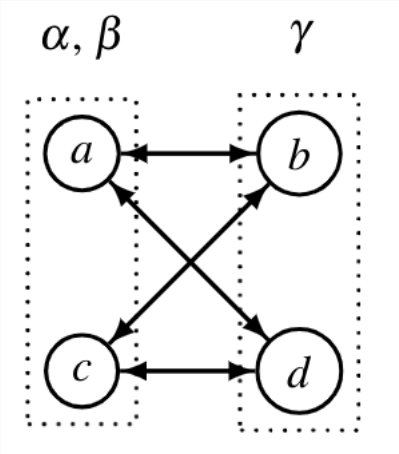

Figure 1: Agent Argumentation Framework

- $\{\alpha, \beta, \gamma\}$ = fund managers' agents
- *a*: ***Buy*** *the stocks, since the company just donated to* ***charities***
- *b*: ***Sell*** *the stocks, since the company has* ***poor sales*** *performance.*
- *c*: ***Buy*** *the stocks, since the company is going to adopt a* ***new technology*** *which will bring huge benefit.*
- *d*: ***Sell*** *the stocks, since there is evidence of charity* ***fraud***

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  intermediary step for social agent semantics, given an $AAF = \langle \mathscr{A}, \rightarrow, \mathscr{S}, \sqsubset \rangle$:
  - **SAP(AAF)** $= \langle \mathscr{A}, \rightarrow, \succ \rangle$, with
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- **[SR] Social Reductions of AAF to AF**
  $SR(AAF) = PR(SAP(AAF))$, where PR is a reduction PAF to AF such as:
  - **PR(PAF)** $= \langle \mathscr{A}, \rightarrow' \rangle$, where
    $\rightarrow' = \{a \rightarrow' b | a \rightarrow b, b \not\succ a, \text{ or } b \rightarrow a, \text{ not } a \rightarrow b, a \succ b, \text{ or } a \rightarrow b, \text{ not } b \rightarrow a\}$.

Portfolio Management Example Social Reduction

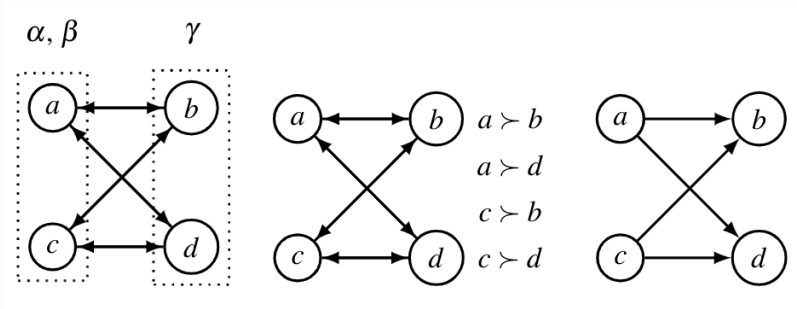

Figure 2: Social reduction

Then we can calculate the only acceptable set $\{a, c\}$.
The set tells the final decision is to buy the stocks.

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- The problem being negotiated can be described by one or more **issues** and the **priority** given to each issue can differ from one negotiator to another.

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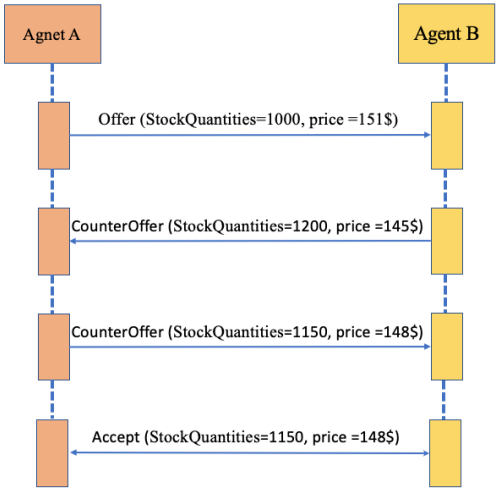

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- **Distributed Ledger Technologies** → potential to revolutionize *financial agreements*.
- fund managers can trade securities on behalf of the investors.

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  3. *human*: individuals manually insert data to DLT, e.g. dispute resolution judge.

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- store data in the (immutable) ledger

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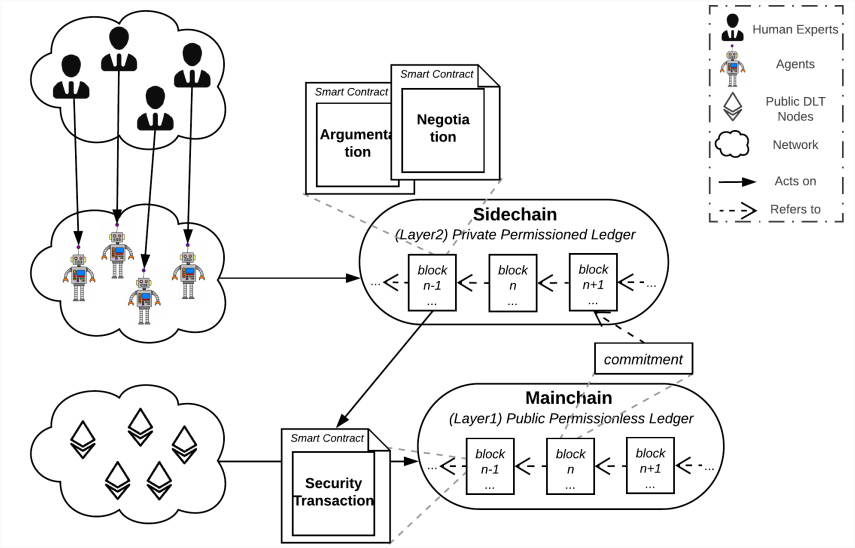
- Involves the intervention of *human experts*

IHiBO Architecture



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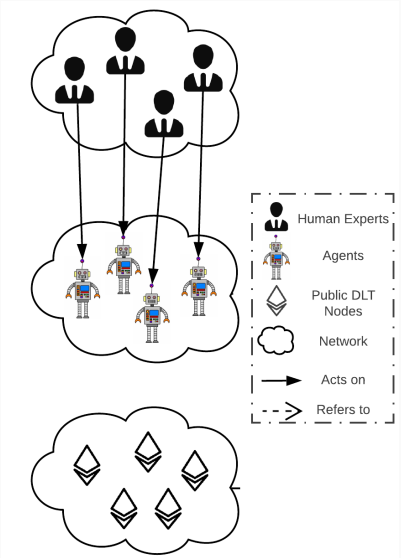
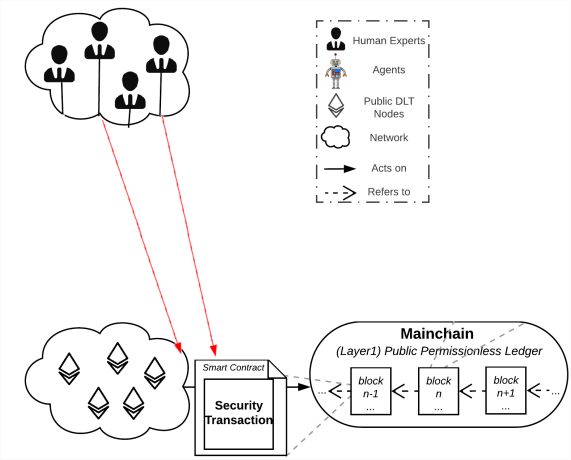


- **Human Expert**, the one who takes most of the decisions and that gives inputs to the agent;
- **Agent**, the one that can assist human experts and that directly interact with the DLT.
- **Public DLT Node**, a node that builds the network of a public DLT, such as the **Ethereum** blockchain

Decentralized Finance (DeFi)



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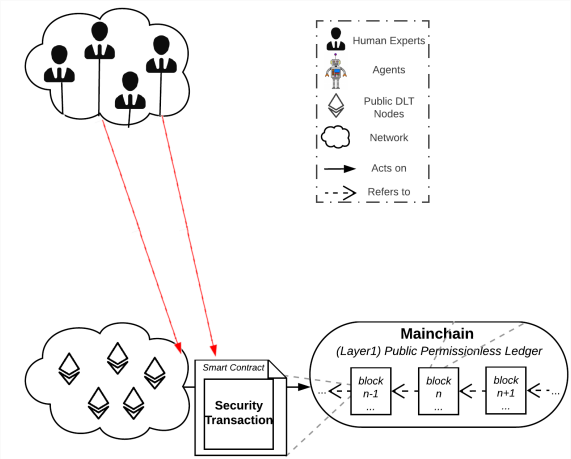

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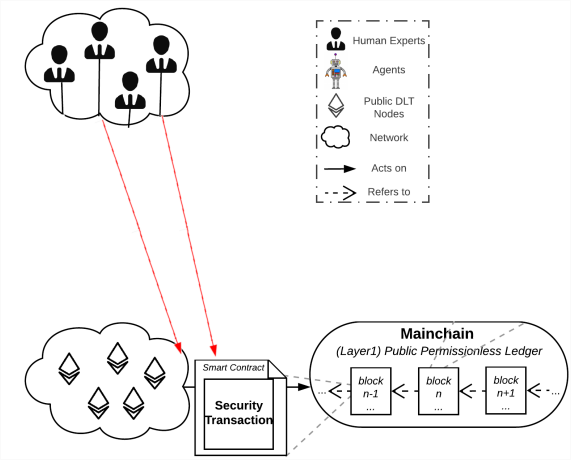

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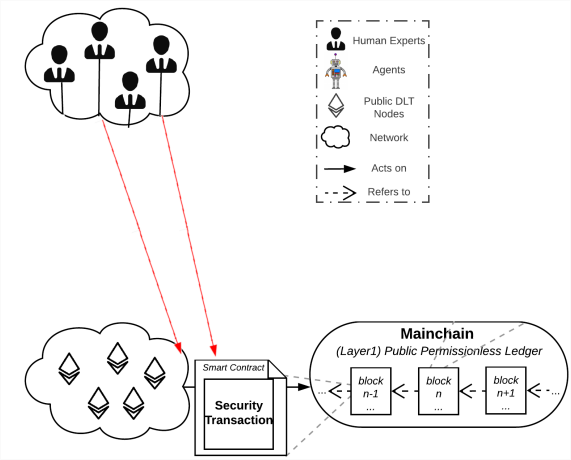

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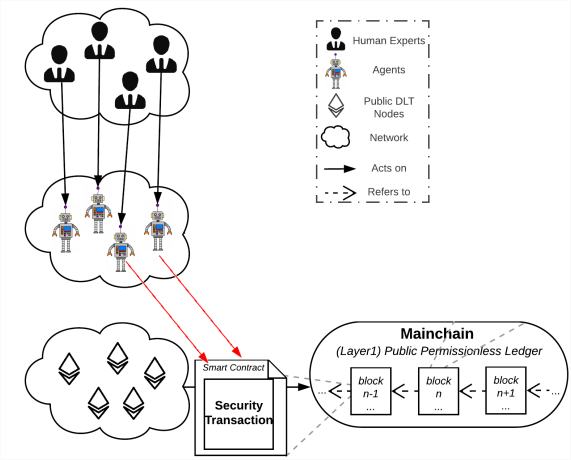

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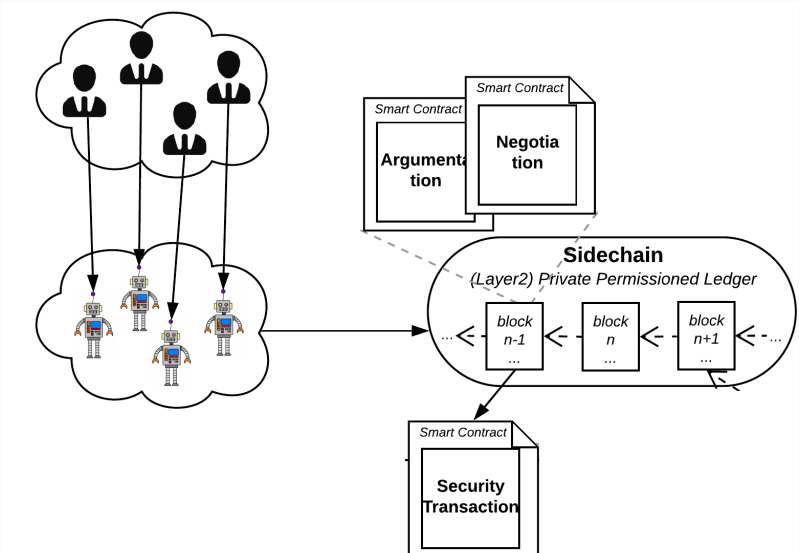

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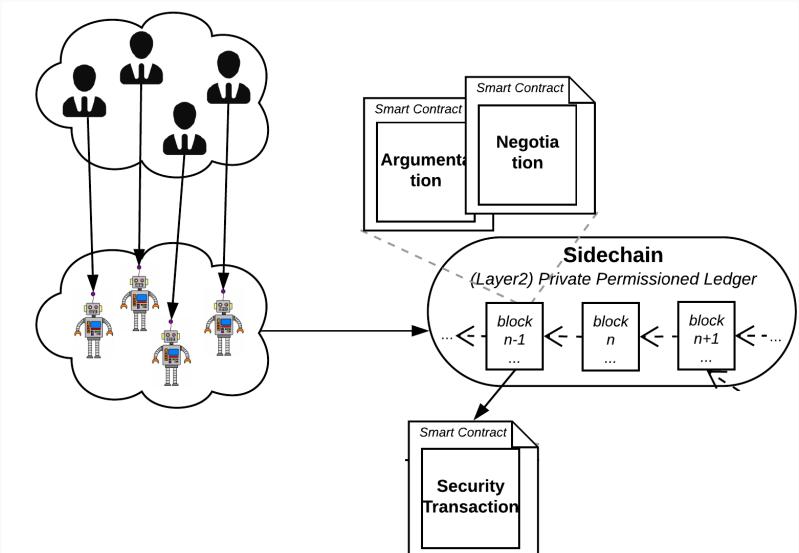

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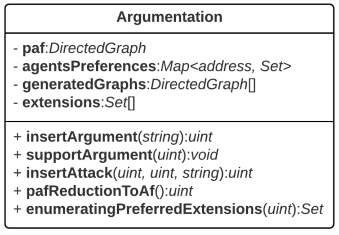

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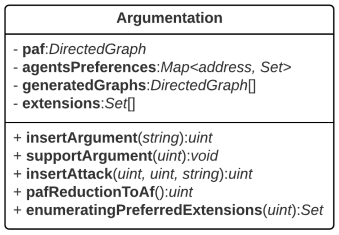

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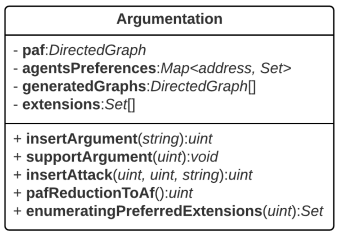

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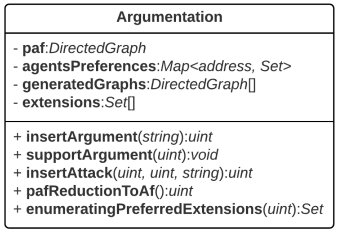

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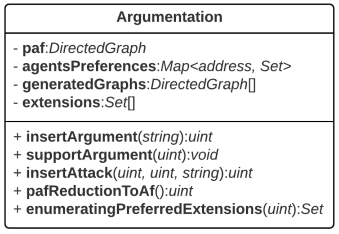

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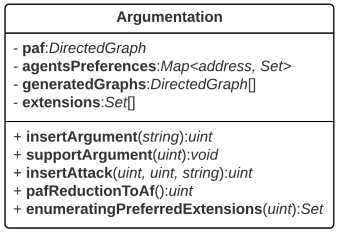

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- This possibly provides a set of **arguments that lead to a final decision**.

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  - **makes a new offer** (*newOffer()*) providing a new set of values related to the issues

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- For automated negotiations on several issues on the arguments provided by the argumentation process
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- The *accept()* method **directly enact the process** of interaction with the SecurityTransaction smart contract on the **mainchain**.

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- Gas is a unit that measures the amount of computational effort that takes to execute operations in Ethereum smart contracts

Portfolio Management Example

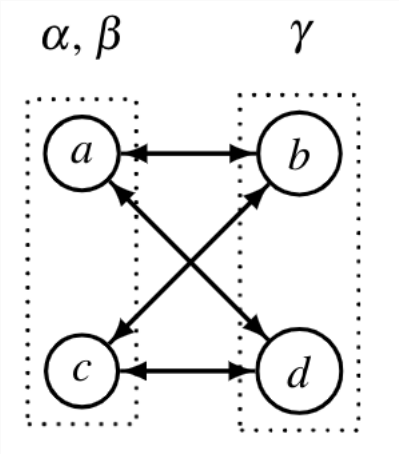


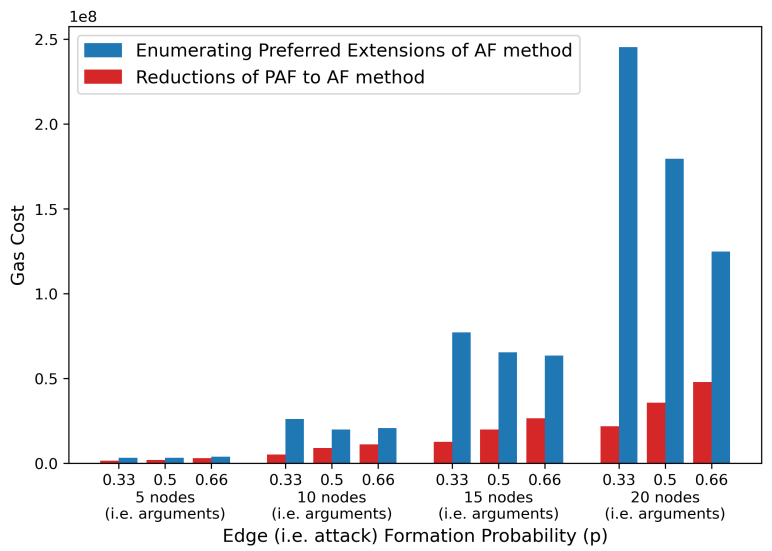
Figure 3: Agent Argumentation Framework

- $\{\alpha, \beta, \gamma\}$ = fund managers' agents
- *a*: **Buy** *the stocks, since the company just donated to* **charities**
- *b*: **Sell** *the stocks, since the company has* **poor sales** *performance.*
- *c*: **Buy** *the stocks, since the company is going to adopt a* **new technology** *which will bring huge benefit.*
- *d*: **Sell** *the stocks, since there is evidence of charity* **fraud**

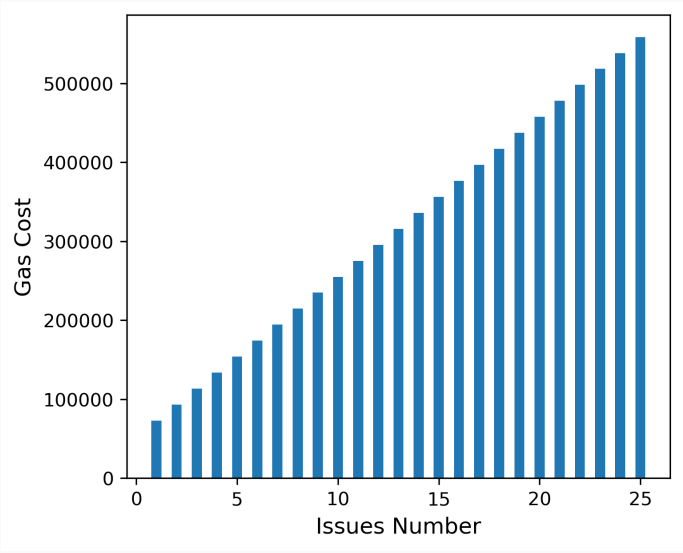
Portfolio Management Example Gas Cost

Smart Contract	Method	Occurrency	Gas Cost
Argumentation	insertArgument()	a	157 470
Argumentation	supportArgument()	$\leq a \times (n-1)$	80 491
Argumentation	insertAttack()	$\leq a \times (a-1)$	215 011
Argumentation	pafReductionToAfPr()	1	1 877 277
Argumentation	enumeratingPreferred Extensions()	1	1 412 065
Negotiation	newNegotiation()	1	104 961
Negotiation	newOffer()	t	52 438
Negotiation	accept()	1	64 211

Arguments Number



Negotiation Issues Number



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- Future work:
  - Provide and adapt to a high level of adaptability in the decisions of the fund management (investors' preferences, attitude (aggressive or moderate) and the financial environment bull or bear)
  - Explainable AI, how we can make the decision-making process explainable for different types of users (experts, non-experts, etc.) and for different purposes (e.g. transparency, debugging, etc.).