MAS, DAO and DLT: a 3 Legs Architecture for Intelligent Services

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Abstract

Trust in the behavior of non-human Intelligent Agents is one of the most significant challenges in Artificial Intelligence. This is influenced by key factors such as Data Bias, Transparency, and Accountability, also the complexity of Explainability tasks skyrockets when number of agents raises. An architecture that offers Transparency of decisions, Accountability of actions, and Immutability of data becomes thus extremely important, especially in human-in-the-loop scenarios. This oral presentation aims to integrate Multi-agent Systems, Decentralized Autonomous Organizations and Distributed Ledger Technologies Technology to solve aforesaid problems. We will also present a general software architecture to develop Web3 applications, integrating intelligent Multi-agent systems, operating over a Decentralised Autonomous Organisation by forming consensus, based on any ERC-20 complaint Blockchain.

Keywords

Decentralised Autonomous Organisations, Multi-agents systems, Blockchain, Distributed Ledger Technologies

1. Intelligent Systems and Human Interaction

During last decade, there has been a significant surge in interest in the applications of Artificial Intelligence (AI) and Intelligent Systems in several research domains. As scientific results transfer to commercial applications, they are capable of performing more and more sophisticated tasks and functionalities. These systems are approaching human-level performance, thus raising concerns of security and controllability in particular when everyday use involves humans beings more heavily. It's at this point that concepts of Trust, Transparency, Accountability and more in general Explainability of "black-box" systems, must find a way to be applied to Intelligent Agents to make commercial applications compliant to recent legal frameworks.

2. Innovative Approach: three Pillars of Explainability

To obtain such properties we have to define a new approach to software architecture able to integrate heterogeneous systems born in different context and for other purposes; the technologies involved in our architecture are: (i)Multi-agent Systems (MAS), (ii) Distributed Autonomous Organizations (DAOs) and (iii)Distributed Ledger Technologies (DLTs). MAS allow to model complex architectures where human and non-human actors may pursue their

goals in a cooperative or competitive way, they are a natural platform to deploy distributed architectures, where independent programs interacts between them and as a whole with the environment. In our perspective, MAS are interesting when coupled to DAOs; here is possible to allow participants to vote resolutions on decisions taken by single agents regarding the behaviour of the whole system like adding a new agent or approving the direction to take in case of Swarm Robots. This introduces Transparency in decision making, while being DAOs essentially Smart Contracts deployed on Blockchain also DLTs properties, like Immutability of data and Accountability of transactions, are inherited by the system. In previous work we applied specialization of general architecture of Figure 1 to Tax credits tracking [1], [2], Public Sector services [3] and Swarm Robotics (in publication).
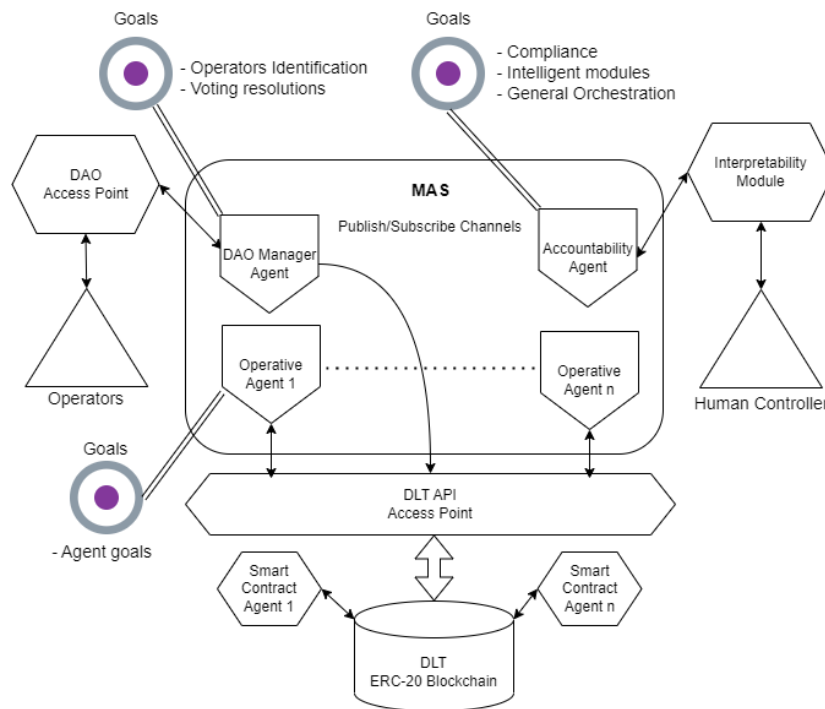

Figure 1: MAS architecture to foster Explainability. Three types of agents oversee Accountability, DAO management and Smart Contracts interaction on DLT.

References

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