
A DECENTRALISED APPROACH TO TASK ALLOCATION USING BLOCKCHAIN

Tulio L. Basegio, Regio A. Michelin,
Avelino F. Zorzo and Rafael H. Bordini



Outline

- Introduction
- Background
- Task Allocation Approach
- Case Study
- Conclusions



Introduction

- **Task allocation**
 - several features should be considered by a mechanism for allocating tasks to multiple robots in real-world scenarios
- **Inspiration:** typical tasks in flooding disaster scenario
- Dynamic and decentralised task allocation **mechanism**
 - different types of tasks
 - heterogeneous robot teams
 - different roles
- **Blockchain Technology**



Proposal

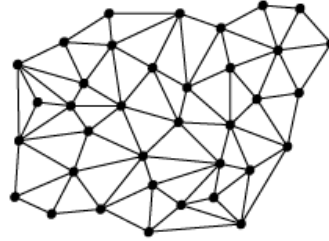
An architecture for dynamic and decentralised allocation of tasks built on the idea of having communication and coordination through a private blockchain.



Background



database



distributed



public

private

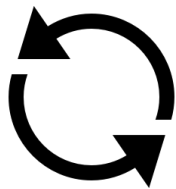
Blockchain

Immutability

Transparency

Data Integrity

Resilience



synchronised



criptography



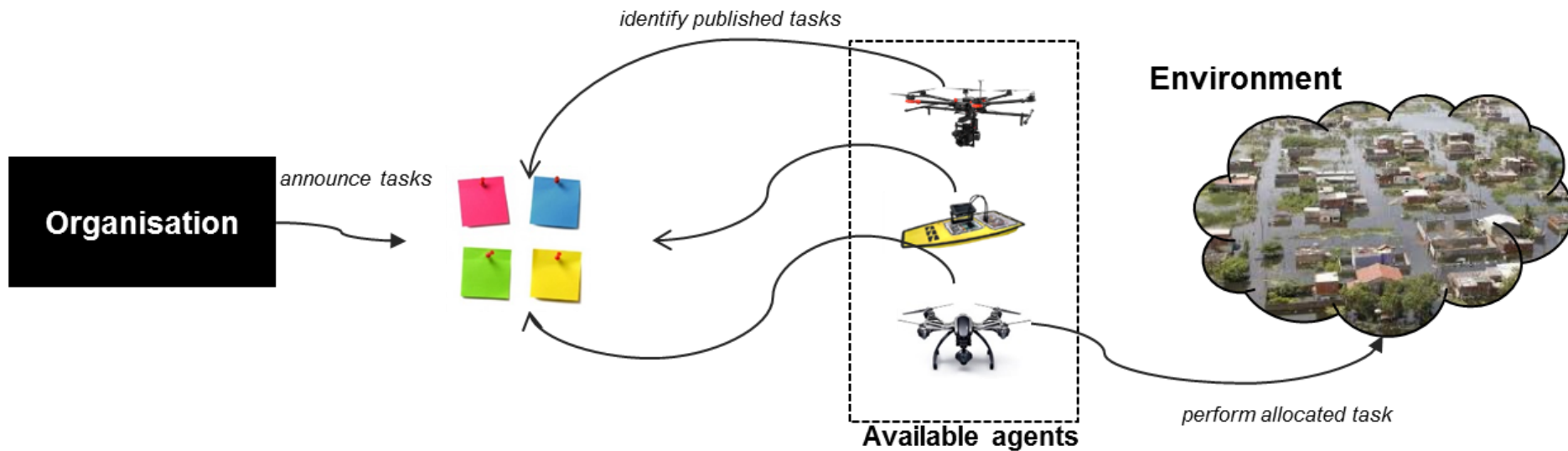
Background

Task Allocation

Given a set of robots and tasks, with each robot obtaining some utility value (payoff to be received, the costs incurred, etc.) for each task, find an allocation of robots to tasks so that the overall utility of all the robots is maximized.

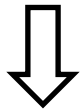


Approach - overview



Task Allocation Mechanism

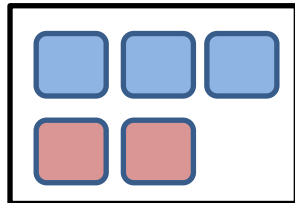
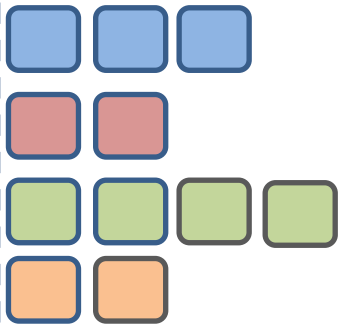
Organisation



r1

r2

Tasks



possible tasks

select best
tasks



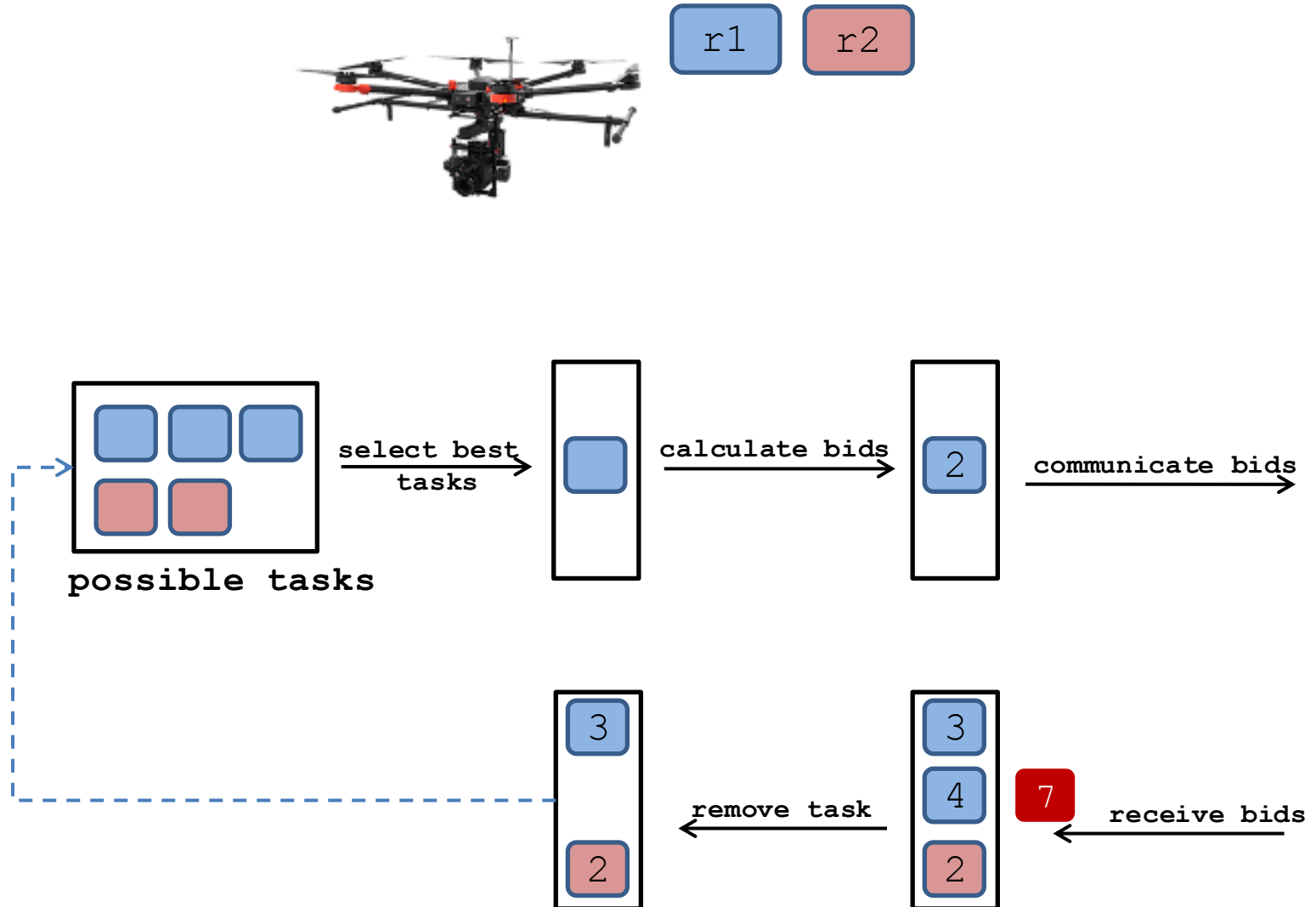
calculate bids



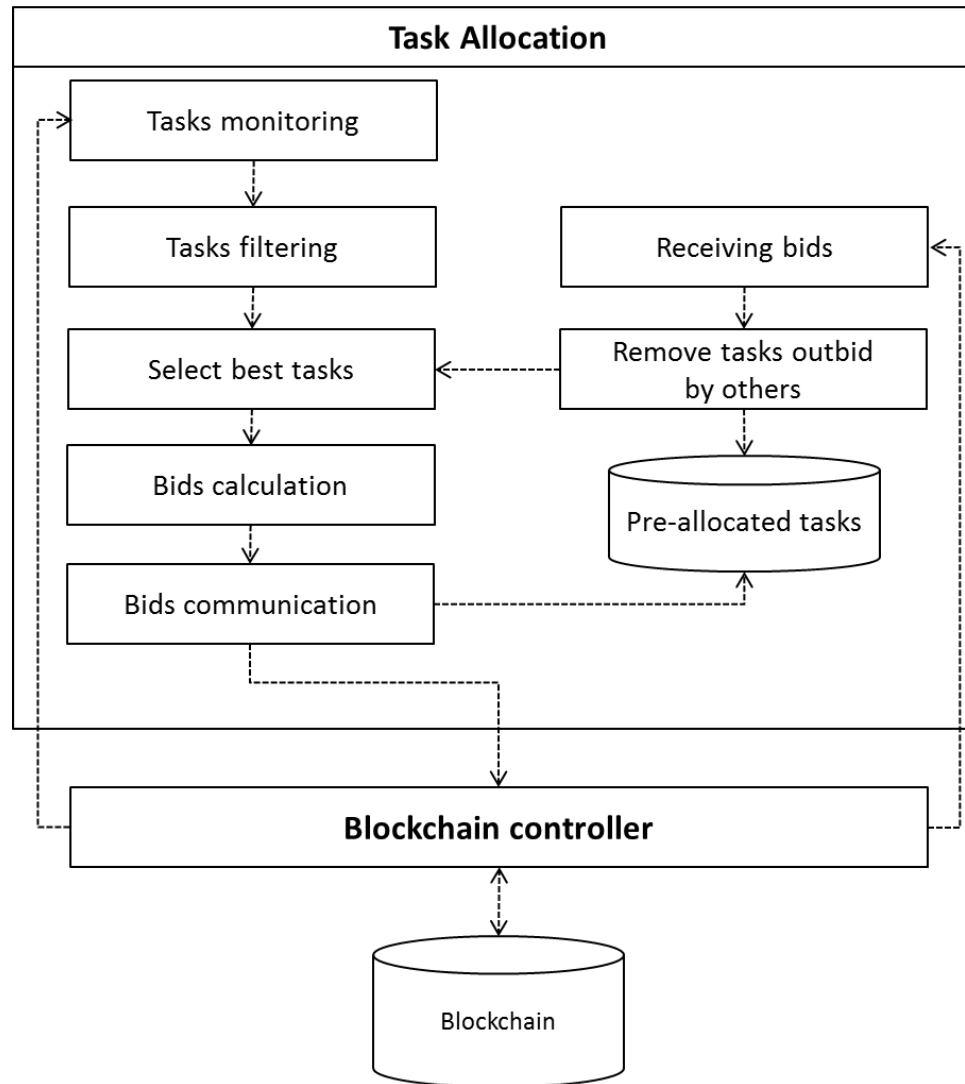
communicate bids



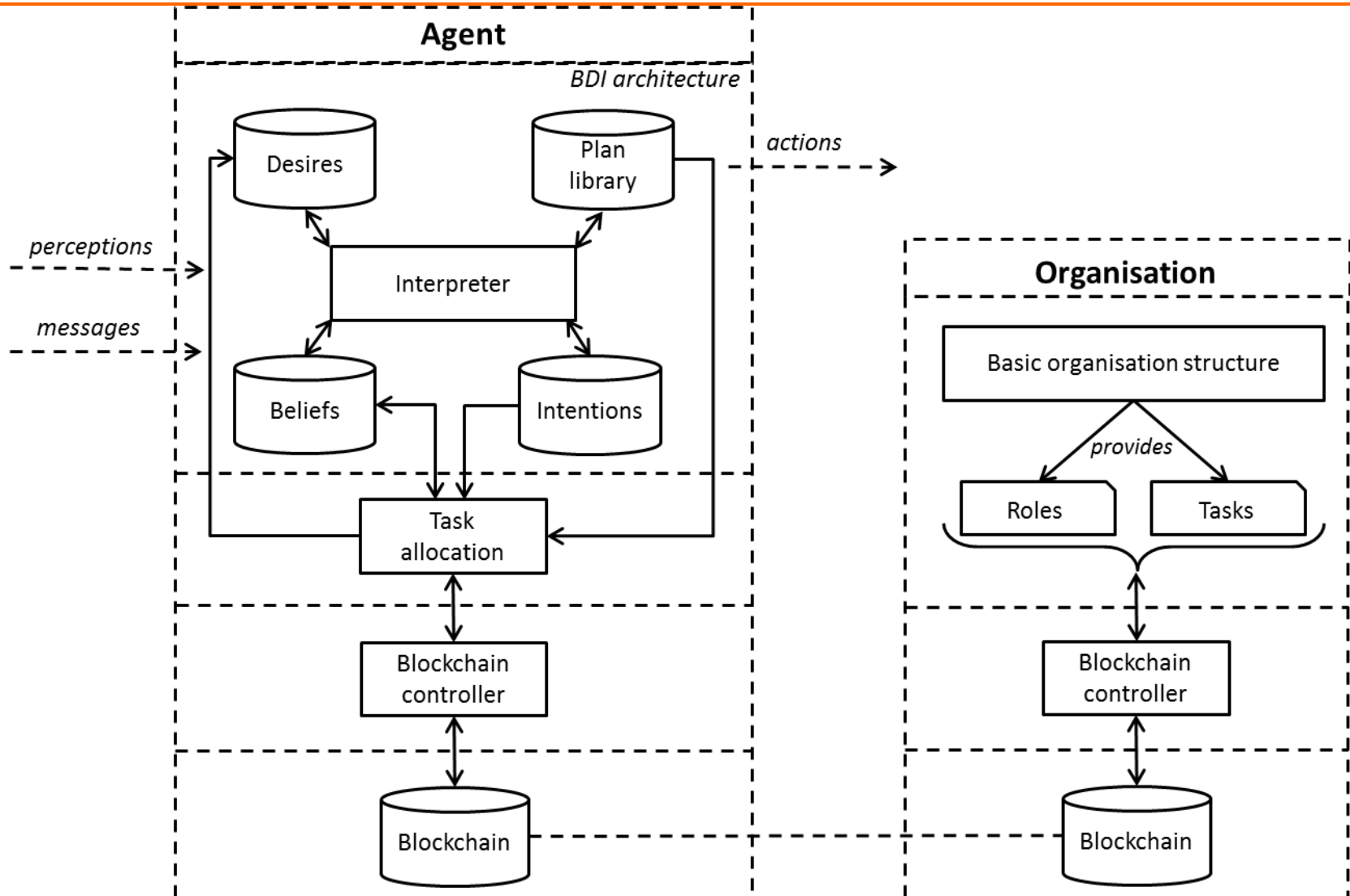
Task Allocation Mechanism



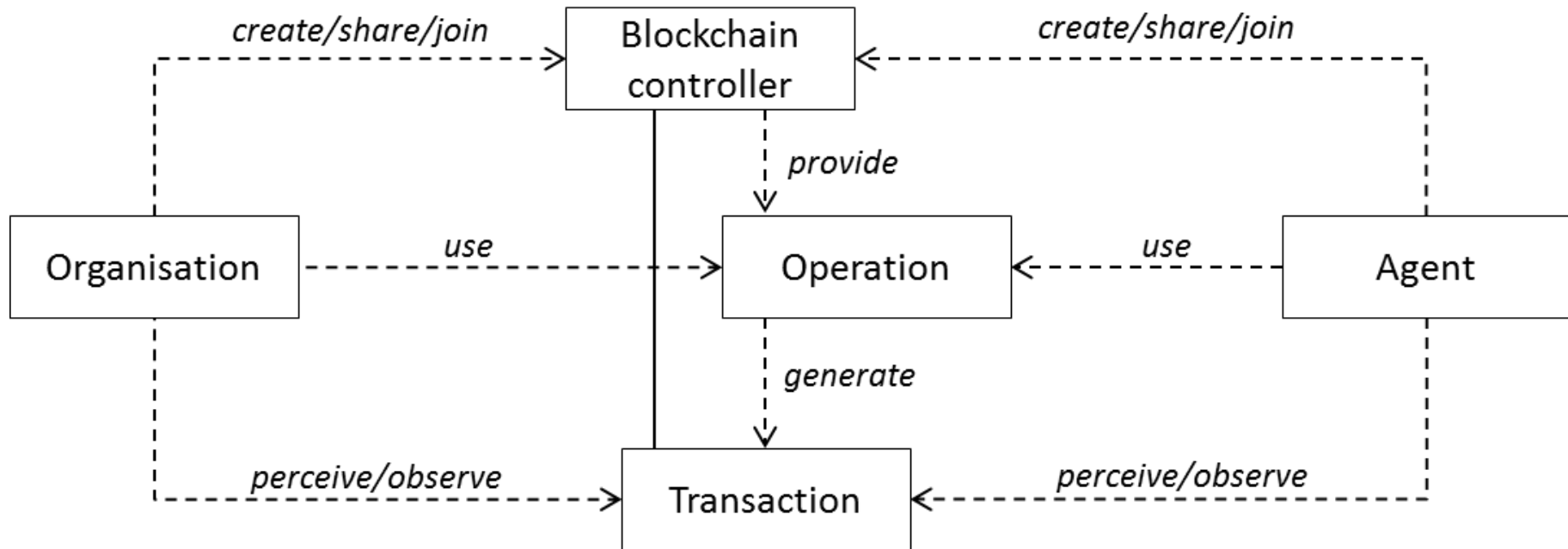
Task Allocation Mechanism



Agent and Organisation Architectures



Blockchain controller



Case Study

■ Flooding scenario - Roles, Robots and Tasks

- Mapping
- Search
- Delivery items
- Collect water sample
- Collect data
- ...



Case Study

USV1: capabilities([sail;waterCollector])

UAV1: capabilities([fly; camera])

UAV2: capabilities([fly; camera])

role(mapper; [fly; camera])

role(collector; [sail;waterCollector])

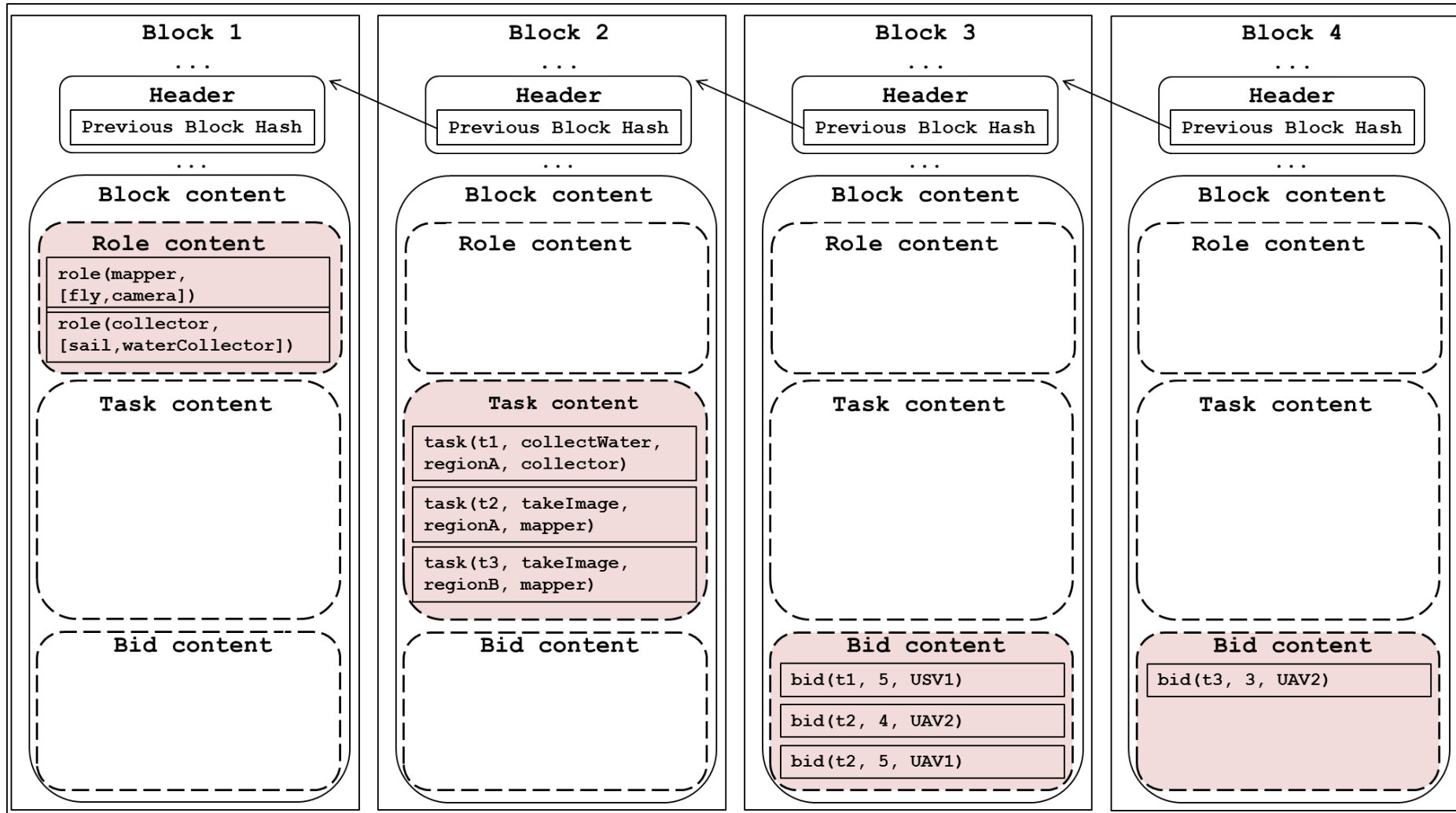
task(t1; collectWater; regionA; collector)

task(t2; takeImage; regionA; mapper)

task(t3; takeImage; regionB; mapper)



Case Study



Conclusions

- We presented an architecture for allocation of tasks built on the idea of having communication and coordination through private blockchain.
- Blockchain - promising way to deal with issues such as consistency, data integrity, resilience, security, and others;
- Allows all the participants to share the same knowledge about the task allocation process;
- New robots can be added to the process at any time.
- Future work
 - review the block structure;
 - measure the traffic of messages;
 - measure the CPU consumption to process blockchain transactions;
 - evaluate the mechanism with blockchain.



A DECENTRALISED APPROACH TO TASK ALLOCATION USING BLOCKCHAIN

Tulio L. Basegio, Regio A. Michelin,
Avelino F. Zorzo and Rafael H. Bordini

