

Thesis
B.Sc.

IDP

Blockchain-Support for Scientific Testbed Management

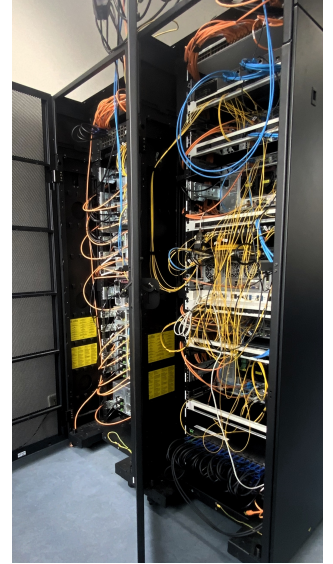
Motivation

Our chair operates a testbed infrastructure that allows staff and students to perform scientific experiments, such as measuring the performance of a networked application in a repeatable way. The testbed consists of several servers and additional hardware, such as programmable switches, high-speed programmable NICs, and GPUs. Users with access to the testbed can use a tool developed at the chair called *pos* (*plain orchestration service*) to reserve, allocate, configure, and manage testbed nodes.

To avoid undesired user behavior, e.g., allocating too many resources for too long, we developed a tool that adds a simple quota mechanism to *pos*. The basic idea is that users get a certain amount of “tokens,” which they can spend to allocate resources. The price of resources depends on the hardware specification of the resource.

Dynamic pricing increases the cost of resources in times of high demand, while cost is reduced in times of low demand. So far, the tokens are managed by a central system and stored in a conventional database. This, of course, comes with problems as, for instance, a malicious entity might tamper with the database, the database is lost due to some unforeseeable event, etc.

In the future, we plan to extend *pos* with the functionality to allocate resources in testbeds of different research groups at multiple locations. With this step, a user can perform experiments on more nodes than available locally, on nodes that are geographically distributed, or using hardware that is likely not available on the own research site. However, a simple database-based accounting approach cannot be approved in such a scenario. Instead, some form of a independent notary is required to ensure everything runs orderly. For this purpose, we propose using blockchain technology, more precisely, Algorand. This thesis aims to take the first steps towards blockchain-based token management.



Your Tasks

- Familiarize yourself with *pos*, the current token management system, and Algorand
- Analyze use cases where blockchain technology is beneficial in a scenario where multiple test beds belonging to different research sites offer resources to users
- Analyze how the current (local) token management system can be implemented using blockchain technology
- Design, implement, and evaluate these functions

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