An open-source framework for the automated deployment of Ethereum based DApps

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At the first stages of an Ethereum application development, well-known frameworks such as Hardhat or Go-Ethereum (Geth) are used to test smart contracts in local blockchains. When the Dapp is near to be production-ready, many public testnets are available to test crucial aspects such as network performance, transaction latency or execution cost. Thus, testnets provide a way to test Dapps in a realistic Ethereum network.

However, if the deployment is planned to be in a permissioned or semi-permissioned scenario such as in Decentralized Autonomous Organizations (DAOs), setting up customized Ethereum networks can become a slow and inefficient process. Even though Geth offers many options to customize local blockchains, DAO setups may need to be scaled to perform the previously mentioned metrics.

Moreover, decentralized storage technologies like Inter-Planetary File System (IPFS) are necessary to achieve a full decentralization, since many applications need to store persistent data that cannot be handled by the blockchain. In fact, integrating an IPFS infrastructure within the developed Dapp is a barrier for many developers. There are many repositories available that allow for deploying decentralized storage subsystems fast with tools like Docker, but, unfortunately, they quickly become deprecated, as blockchain-based frameworks are constantly evolving and upgrading.

To tackle the previous issues, the proposed paper will describe a system able to automate and accelerate the creation of Ethereum-based test environments using Docker. Such an automation is based on bash-scripts, which give the possibility to deploy a network of Ethereum nodes and a different network of IPFS nodes with the possibility to synchronize IPFS-based databases like OrbitDB. Thus, deployments can be reduced to install the developed framework and then to type just one command that includes the most important parameters for testing, such as the number of nodes, their type and the used consensus protocol.

Since the presented tool will be available in a public repository as open-source software, future developers and researchers can adapt it to many different scenarios and specific settings. To show the usefulness of the developed software, this paper describes how to use it for deploying a healthcare Dapp where all the relationships between patients and validator nodes (e.g., research laboratories, hospitals) and their permissions can be configured to follow the laws of a specific region or country, including those related to data access and encryption.

The provided example would allow developers to create healthcare applications and to test them under a realistic scenario without the need to manage and set up all the inner-complexity. Moreover, the provided example will consider the deployment in resource-constrained devices (e.g., Internet of Things (IoT) devices, mobile phones),

which can participate in Dapps thanks to the recent progress made on the use of low-consumption protocols and to the flexibility of the developed framework to choose between multiple parameters to create lightweight implementations. This kind of implementation will open the door to many use-cases in different sectors, as these fully-decentralized networks can benefit from the security of Distributed Ledger Technologies (DLTs) while preserving the performance of traditional architectures.