Towards Blockchain Interoperability with Hyperledger

Title	Towards Blockchain Interoperability with Hyperledger
Status	COMPLETED
Difficulty	HIGH

Description

Why is blockchain interoperability important?

The adoption of permissioned networks has seen a significant increase in the last years, with Hyperledger technologies highlighting this adoption. For the case of permissioned blockchains, e.g., Hyperledger Fabric, smart contracts can be leveraged to a wide range of use case scenarios, where entities /organizations need to cooperate, sharing data and/or other assets. However, smart contracts (and the respective ecosystems they support) are tied to a specific blockchain implementation, and the services they can provide rely on the survivability of a particular blockchain, even in the same infrastructure. These types of problems raise the need for blockchain interoperability.

The Hyperledger Quilt already enables a specific type of blockchain interoperability using the Interledger Protocol, i.e., allows payments across any payment network using the Interledger protocol. A relatively recent Hyperledger Lab, "Hyperledger Labs Blockchain Integration Framework" is creating a communication model to enable permissioned blockchain ecosystems to exchange on-chain data or custom assets independently of the platform (e.g., Hyperledger Fabric, Quorum, etc.).
Nevertheless, to the best of our knowledge, no Hyperledger project is tackling general blockchain interoperability for both public and private blockchains or studying the impact of blockchain interoperability, particularly on the Hyperledger ecosystem.

What is this project about?
This project intends to propose a solution to this real-world problem, and it is research-focused. The goal is to give a strong contribution to the Hyperledger ecosystem in terms of the state of the art in blockchain interoperability. Some questions that this project aims to answer are:

- How can we interoperate Hyperledger technologies with other blockchains?,
- How can Hyperledger initiatives position themselves to tackle blockchain interoperability?,
- What standards we require to define middleware between blockchains?
- What are the consequences of employing smart contracts with external processes and data (the external part means another connected blockchain)?,
- The key to the survivability of this technology?

In other to try to answer those questions, in this project the mentee(s) will start by studying some of the most prominent blockchain interoperability solutions already available or being proposed, and how they can be used to promote and strengthen Hyperledger technologies. Then, the mentee will design and develop a framework for creating, deploying and maintaining services with several blockchains. The applicability of the solution to be proposed is to be demonstrated through the exploration of a use case, implementing several blockchains (including Hyperledger Fabric) to increase the dependability of blockchain-powered services administrated by several stakeholders, serving as a proof-of-concept.

The Use Case: Digital Media dApp
The scenario corresponds to a decentralized ecosystem for Digital Media contents, that empowers the creators of those contents and delivers to consumers a diverse collection of classic and original contents.
That ecosystem is based on an artist-centric model, in which the creators are paid fairly for their contents (music, video, images, texts…), and their fans consume, share and enjoy what they like, and pay fair value. This model considers that publishers, labels or digital distributors are equal to creators, rather than dominant members of the ecosystem.
This dApp concept aims to demonstrate a hypothetical solution to help artists monetize their work in a transparent and secure peer-to-peer marketplace by implementing and enabling interoperable blockchains throughout the whole Digital Media production, distribution, and management processes, ensuring that the artist work is correctly recorded (including rights management and tracking) and that they receive fair royalty payments (through the use of smart contracts and cryptocurrencies).

Wrap up

In short, this project is a preliminary attempt to solve a real-world problem, and it will be research-focused. The goal is to give a strong contribution to the Hyperledger ecosystem, by learning the state of the art of blockchain interoperability and proposing a framework for creating, deploying and maintaining services with interoperable blockchains. Some advances in the state of the art are also made through the exploration of the use case.

Additional Information

The mentee should have read the reference papers, to build a basic understanding of:

Blockchain:

http://vukolic.com/fabric.pdf

https://www.hyperledger.org/wp-content/uploads/2017/08/Hyperledger_Arch_WG_Paper_1_Consensus.pdf

https://www.hyperledger.org/wp-content/uploads/2018/04/Hyperledger_Arch_WG_Paper_2_SmartContracts.pdf

https://www.hyperledger.org/wp-content/uploads/2018/08/HL_Whitepaper_IntroductiontoHyperledger.pdf

Interoperability:

 and https://github.com/hyperledger-labs/blockchain-integration-framework

https://github.com/hyperledger/quilt/wiki and https://interledger.org/interledger.pdf

https://polkadot.network/PolkaDotPaper.pdf

https://cosmos.network/

Learning Objectives

This internship intends to yield a fruitful learning experience, with several dimensions:

1. **Open-source and teamwork**

You will learn how to contribute (and hopefully lead) an open-source project, and to document your work.

You will be aware of the main efforts of the Hyperledger technologies, and how blockchain interoperability relates to that

You will interact with the Hyperledger community

2. **Technical**

You will refine your understanding of blockchain technology

You will strengthen your understanding of blockchain interoperability, taking a step forward to become an expert

You will refine your programming skills, both in client-side applications and chaincode

3. **Scientific**

You will learn how to research a topic like a researcher (if you are not already!)

You will have the opportunity to write a paper, that may have an impact on academia

Expected Outcomes

1. Framework for creating, deploying and maintaining services with several blockchains, including Hyperledger Fabric
2. Proof of concept/implementation
3. Scientific paper (or technical report) on how blockchain interoperability can provide a competitive advantage to Hyperledger

Relation to Hyperledger

The expected outcome tackles the whole Hyperledger Ecosystem. In particular, the project includes studying Hyperledger Fabric, the Hyperledger Labs Blockchain Integration Framework, and possibly Hyperledger Quilt. Apart from Hyperledger technologies and tools, this project might require working with technologies such as Polkadot.

Education Level

Masters or Ph.D. level students are preferred. Experience in research is highly recommended.

Skills

Must:

- Willing to contribute to a meaningful mission, in an open-source mentality
- Teamwork skills, as synergies and cooperations with other parts are needed to successfully complete the project
- Solid understanding of blockchain technology
- Experience with one programming language (javascript, python, rust, or go are preferred)

Nice to have:

- Experience with Hyperledger Fabric
- Research experience (if you don't, no worries - we can help)

Future plans

The end of the internship does not need to mean an end to collaboration. The idea is to the mentee to be connected to Hyperledger's ecosystem, contributing to blockchain interoperability solutions.

Preferred Hours and Length of Internship

Both Full-time or Part-time are possible options.

Mentor(s) Names and Contact Info

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Mentee Name and Contact Info

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Project Results

GitHub Repository: https://github.com/hyperledger-labs/pubsub-interop

Final Report

HyperledgerMent...nterop-2020.pdf

Lightning Talk Recording

Towards Blockch...Hyperledger.mp4