EUREKA – A Minimal Operational Prototype of a Blockchain-based Rating and Publishing System

Andreas Schaufelbühl[1], Sina Rafati Niya[1], Lucas Pelloni[1], Severin Wullschleger[1], Thomas Bocek[2]
Lawrence Rajendran[3], Burkhard Stiller[1]
[1]Communication Systems Group CSG, Department of Informatics IfI, University of Zürich UZH
Binzmühlestrasse 14, CH-8050 Zürich, Switzerland
[rafati|stiller@ifi.uzh.ch], [lucas.pelloni|severin.wullschleger|andreas.schaufelbuehl@uzh.ch]
[2]HSR University of Applied Sciences Rapperswil, thomas.bocek@hsr.ch
[3]King's College London, lawrence.rajendran@kcl.ac.uk

***Abstract*—Today's number of reputable academical publishers is dominated by few key players. This imbalance of supply and demand in publishing academic work makes the entire process inefficient. EUREKA is a blockchain-based scientific publishing platform, developed to address this imbalance. It offers the opportunity of a fair reward distribution for all contributors and immediate ownership rights to authors of an article. For the demonstration, the platform including the back-end and front-end integrated into the Ethereum blockchain is shown, and the interaction processes of users *i.e.*, authors and reviewers are presented.**

I. Introduction

Current studies show that publishing systems face several deficits in terms of inefficient processes, long delays in publishing, and no fair contribution of financial incentives among different stakeholders [1]. While existing publishing platforms provide services in open-research-and-access environments, there is none that serves users in a decentralized manner, assuring transparency and integrated credit distribution by the technology itself.

EUREKA supports open-access research, while ensuring the quality of the research and a fair credit distribution by using Blockchains (BC) and Smart Contracts (SC). EUREKA is designed by a novel incentive model, which guarantees direct rewarding via SCs and micro-payments. Within this platform editors, reviewers, and linked and cited authors will be rewarded for their contribution in the context of an article submission. The SC deployed in the Ethereum BC [2] uses the crypto-currency of EUREKA Tokens (EKA) for credit distribution. Ownership backtracking is effectively facilitated from the very first moment on by saving a hash of an article, immediately after submission, into the BC.

One of the most critical factors in the design of a publishing platform is to enable means of easy access with a minimum barrier. This demonstrator indicates the user-friendly Web application of EUREKA, where users can publish, review, or supervise articles, while the access to SCs within the BC are handled transparently. By monitoring events emitted in the SC, the platform can notify its users conveniently via email, leading to an increase of usability.

978-1-7281-1328-9/19/$31.00 ©2019 IEEE

II. Design and Implementation

The overall token flow, as shown in Figure 1, represents processes and actions within the EUREKA platform.

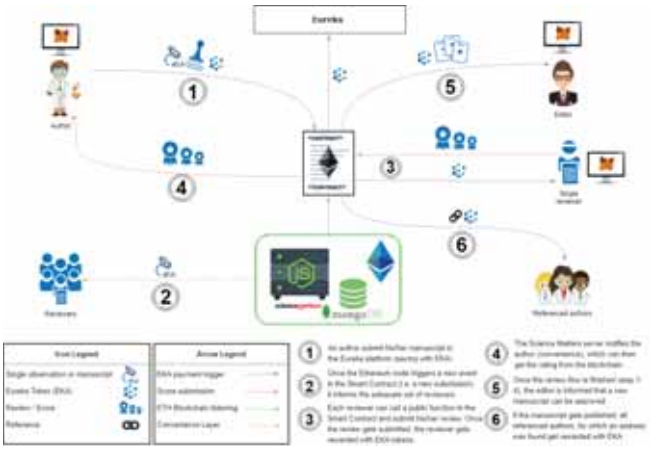

Fig. 1: Token Flow of EUREKA

(1) A new submission flow is always initialized by an author submitting an article and paying the submission fees. (2) Ethereum addresses of co-authors and of authors referenced within the paper are sent along with the submission. A monitor application (convenience layer) notices the new article submission and informs expert-wise applicable editors and reviewers. (3) Editors can assign reviewers and are responsible for supervising the peer-review process and performing the first sanity check. (4) Elected reviewers can review the submission. (5) Once the submitted article received a sufficient number of positive reviews, the editor can close the peer-review process, and the article receives a final score. (6) After publishing the article, all contributors (reviewer, referenced authors, and editor) will receive their reward paid out by the SC automatically.

III. Architecture Overview

The proposed platform is implemented relying on those technologies shown in Figure 2. Users register using a Web interface upon an article submission. Next, user credentials

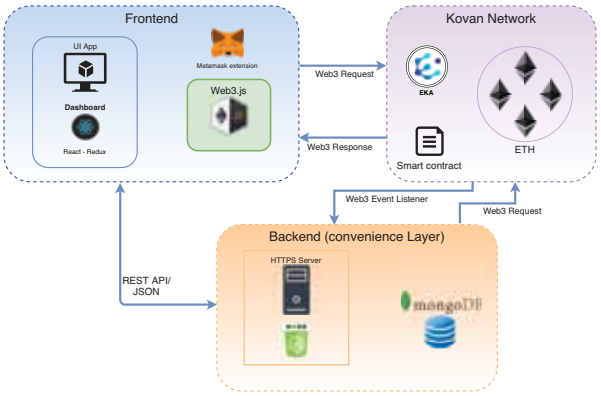

Fig. 2: System Architecture

are transmitted to the back-end via a REST API to create the user account. The Web application calls the SC, providing the required amount of EKA tokens as submission fees. Access for review, correction, and supervision of an article are regulated by the SC within the BC. With an article submitted, the SC allows a user with editor privileges to assign themselves as a supervising editor for an article.

Editors assigned to an article are engaged to invite selected reviewers to review the article. Since the invited reviewers address is saved in the SC, the corresponding reviewer is notified by the back-end application and can start the peer review process (*cf.* Figure 3b). When a sufficient number of reviewers has considered the article as valuable, the editor can finish the process by accepting it for publication.

All further interactions with an article, involving authors, reviewers, or editors, are performed by the SC function calls requiring the user to proof his/her identity by providing the personal Ethereum address. Changes on the SC considering the state of an article submission are monitored by subscribing to events [3].

The back-end informs the user by a notification (on-screen and via email) if new actions are completed on the SC, such as receiving an invitation as an editor/reviewer. Furthermore, the SC deals with cases when someone is removed from an article's reviewers list or when no action within a given time-interval is performed. The detailed platform design and implementation is documented and explained in [4].

IV. Demonstration Scenario

For the demonstration the BC-enabled processes of submitting an article, editor assessments, and reviewer assignment steps are shown. The entire process was already recorded in full and explained in a demonstration video [5].One screen will show the author and editor view (side-by-side), an other screen will show two reviewers. First, the author writes an article and submits the article to be reviewed (*cf.* Figure 3a). The editor can assign the article under his supervision. After a positive sanity check, the editor releases the article

(a) Submission Editor For Author

(b) Peer Review Invitation

Fig. 3: User Interface

for review. Elected expert reviewers are able to see articles (*cf.* Figure 3b), confirm the assignment, and review it. The editor can invite additionally expert reviewers by sending an email to them. A reviewer has to leave feedback in his review and submit it when finished. Once the number of necessary positive reviews is reached, the supervising editor can accept the article and publish it on the open-access platform. In addition to the demonstrated submission process, a time-based dropout of a non-replying user is shown, too. Here, an editor assigned an article, is not performing the sanity-check on this article. Thus, the article is assigned again to another editor. This reversion is triggered by the convenience layer calling the corresponding function on the SC. This blockchain-based rating and publishing system with EKA tokens is the first one, which exploits BC benefits for a distributed and trusted data storage as well as pay-outs of respective rewards for participating actively in any of those roles discussed above.

References

[1] M. Baker, "1,500 Scientists Lift The Lid On Reproducibility," *Nature*, Vol. 533, pp. 452–454, 2016.

[2] "What is Ethereum?" http://ethdocs.org/en/latest/introduction/what-is-ethereum.html, last accessed: March 10, 2019.

[3] "Web3.eth.subscribe: Lets You Subscribe to Specific Event In The Blockchain," https://web3js.readthedocs.io/en/1.0/web3-eth-subscribe.html, last accessed: March 10, 2019.

[4] S. R. Niya, L. Pelloni, S. Wullschleger, A. Schaufelbuehl, T. Bocek, L. Rajendran, and B. Stiller, "A Blockchain-based Scientific Publishing Platform," to be published in the 1st IEEE International Conference on Blockchain and Cryptocurrency (ICBC 2019), Seoul, Korea, May 2019.

[5] "Eureka demonstration video," https://files.ifi.uzh.ch/CSG/staff/Rafati/EurekaPlatform1.mov, 2019.