THE USE OF BLOCKCHAIN TECHNOLOGIES TO ISSUE AND VERIFY MICRO-CREDENTIALS FOR CUSTOMISED EDUCATIONAL JOURNEYS: PRESENTATION OF A DEMONSTRATOR

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Abstract

In recent years, a clear trend towards personalised learning experiences has emerged. Individual preferences are in the foreground and should be made possible, for example, through selectable choices. If these courses take place in the same educational institution, the handling of credit and the clear allocation to learning outcomes is usually possible. However, it becomes difficult when the options also extend to courses outside the main educational institution. It is even more difficult when the study opportunities occur, for example, at educational institutions abroad or at businesses with a strong focus on practice. Here, accreditation is often very difficult, dependent on the case and a painstaking process, unless it is regulated by law, for example through the Bologna Process in the case of universities. New ways in adult education go a whole step further, especially via the so-called second-chance education, when the trainee has a choice of often hundreds of possible courses at various educational and vocational institutions. However, the diploma or work permit is ultimately awarded by the authorities and not a specific university or college. This is an ideal example for the concept of micro-credentials or the possibility of partial achievements being made through various channels, whereby each of these micro-credentials clearly defines the educational goal that is required and the extent to which this has been achieved by the learner. The most important factor regarding micro-credentials is a standardised form of storage, presentation, verification and approval processes. By discussing a demonstrator, this paper shows how blockchain technologies in combination with digital identities represent a feasible approach to mapping and comparing micro-credentials.

Keywords: Micro-credentials, blockchain, digital identities.

1 INTRODUCTION

A definite trend toward personalized learning experiences has arisen in recent years. Individual preferences should be prioritized and made possible, for example, through a range of choices. Credit handling and explicit allocation to learning outcomes are usually possible if these courses take place in the same educational institution. It becomes more challenging, however, when the possibilities include courses outside of the main educational institution. It's much more difficult when study possibilities arise in places like foreign educational institutions or organizations that place a heavy emphasis on practice. Unless accreditation is governed by legislation, such as the Bologna Procedure in the case of institutions, accreditation is frequently complicated, case-by-case, and a time-consuming process. New approaches to adult education go even farther, particularly through so-called second-chance education, in which the trainee can choose from hundreds of courses offered by various educational and vocational institutions. The diploma or work permit, on the other hand, is granted by the authorities rather than a single university or college. This is a perfect example of micro-credentials, or the potential of partial successes through numerous channels, where each of these micro-credentials explicitly outlines the educational aim that is required and the extent to which the learner has achieved it.

In this short paper, we would like to present a demonstrator, which was discussed and developed with experts during a focus group, to demonstrate the possibilities that the storage of services and partial services on identity-linked, non-tradable blockchain tokens might have for the future of certificate and credential recognition.

2 RELATED WORK

Agustin et. al [1] describe the application of Blockchain technology in e-certificates in the open journal system. The study reports that issuance of e-certificates in an open journal system is a way to manage and verify, prevent duplications or even falsification of e-certificates and the reputation of the open

journal system is already given. This project is based on Blockcerts by Learning Machine (originally developed at MIT). Merija and Kapenieks [2] compare Blockerts with Ethereum Smart Contracts developed by Open University, UK, while Baldi et al [3] describe how to impersonate a legitimate issuer of Blockcerts certificates with the aim to produce certificates that cannot be distinguished from originals by the Blockcerts validation procedure. The “JR science for policy report: Blockchain in Education”, by Grech and Camilleri for the European Commission [4] is regarded as the most significant contribution to the area of Blockchain in education in general.

3 RESEARCH QUESTIONS

This short paper will look into the following research question:

- What requirements must blockchain-based systems fulfil in order to be suitable for the storage of micro-credentials across national borders?

4 METHODOLOGY

To achieve our research goal, we conducted a focus group discussion with 5 participants. Table 1 details the gender and respective background of each participant. The core question of the discussion equals the research questions as described above. The realization of the focus group is based on the method of the problem-centered interview following Witzel [6]. The evaluation of the key statements was conducted according to Mayring's [5] approach in regard to content-analyses. Note: All participants of the focus group have a good to very good knowledge on the topic of Blockchain technologies. As part of the focus group, a demonstrator was developed which outlines suggestions live on the Ardor blockchain (Testnet).

Table 1. Participants of the Focus Group.

Person	*Gender*	*Background*
1	m	IT sector
2	f	IT sector
3	m	Educational sector
4	m	HR management
5	f	Librarians

5 INTRODUCING THE DEMONSTRATOR

During the live demonstration, the following functions were created in the Ardor blockchain testnet in collaboration with the participants of the focus group:

Blockchain addresses representing the educational institution, a company, a library and the learner.

Linking blockchain addresses to digital identities.

On the address of the educational institution, the 3 other addresses with the respective function were recorded in the form of a "message to self".

A catalogue of learning objectives was created. This contains which partial performance must be fulfilled at which educational institution in order to receive the grade for a specific subject.

The company and the library sent an encrypted message to the educational institution, each with the meta-data of the partial performance and the ID of the learner. A shared key was generated so that the learner could access this message. Apart from that, the issuer and the recipient can read it with the respective key.

The educational institution has sent a message to itself, also in the form of an encrypted message, which contains the meta data. A shared key for the learner has also been generated.

Based on these 3 messages, a Singleton Token, also called NFT in technical language, is generated. This token combines the partial performances, meaning the micro-credentials, in order to produce the

qualification grade. This token is sent to the learner's address. Again, a shared key is generated. The learner can use this to share access to the meta data of the token with third parties.

6 RESULTS

We would now like to summarize the core statements of the focus group participants in respect to the guiding question:

E1 comes from the IT sector and has some experience with the development of blockchain-based systems. He still sees a big problem in the interaction of non-secure data, such as a paper certificate, digital identities and blockchain as a secure data store. For him, there are still too many problem areas, starting with how to verify an insecure piece of analogue data. If this is done incorrectly, we could defacto legalise non-valid documents via the allegedly secure data storage. But of course that is only the historical side. If we draw a line and store certificates analogue and digitally from a certain date, without the compulsion to also safeguard existing data, then the switch to secure storage and verification could succeed, even if one then thinks in decades rather than months or years until a worldwide recognition of data actually becomes possible. He found the live role play for the creation of the prototype very exciting and it showed how advanced modern systems like Ardor are. At the same time, however, it is sad from his point of view that hardly anyone is familiar with them and uses the technology.

E2 agrees with E1. For her, the human factor also comes into play. Errors can happen when entering data. With blockchain, you cannot simply delete the data, a new record is generated which co-exists instead of overwriting a database entry. This is a certain change in the way we think about how processes work. She still sees the awareness on the part of users as particularly difficult. If developers don't always find the best solution, and politicians are perhaps not always interested in technology, how are consumers supposed to understand and use the technology? In particular, the following points are important to her: data origin, data ownership, data security and a multi-chain solution.

E3 comes from the education sector. For him, it is simply a matter of confidence in what will be coming from the government and administration. Although he thought his knowledge of blockchain was good, he was pleasantly surprised by the live demo. For him, however, it is still a long way from a live demo to a functioning product. Above all, a functioning product must receive unreserved recognition from all sides.

For E4, the international recognition and issuing of certificates is a major issue. Often a massive amount of research has to be done to check certificates. Micro-credentials play a big role for him. He suggests that such systems as in the live demo should first be set up and tested within a company. This should be done in parallel to existing systems. In this way, one could successfully test that such applications work. This should ideally be done in parallel at companies that already cooperate with each other in training processes, so that the blockchain systems can be linked in a second step. In this way, trust can be gained in the system as it steadily grows and then, in the medium term, becomes a standard that can no longer be overlooked.

For E5, a system like the one presented in the live demo, only featuring a good user interface and explanations for the users, would be a great help. As a library, they are often involved in training processes of different educational institutions and companies. They have to spend the proof on not standardised forms depending on the respective partner. Often this is administratively desperate, especially when certificates are issued analogue and then lost by the learners. A uniform system would therefore be a dream for them and a solution equipped with digital identities and with deposited examination results, while fully preserving privacy, would be very promising.

7 CONCLUSIONS

Blockchain technologies can be assuring under certain conditions to solve the problem of micro-credentials in the medium to long term. Cooperation between different institutions, even across countries, for a particular certification process seems to be easier to administer with the help of blockchain technologies. But above all, it is also more secure and easier to verify for all parties involved. However, there is still a long way to go until this is achieved, and the main task is to raise awareness of the benefits and application of the technology.

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