BLOCKCHAIN FOR LIFELONG LEARNING RECORD MANAGEMENT

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Abstract: *Lifelong learning is fragmented and in different spectra according to users, organizations, lectures and so on. The desire to study is different from children to the elderly and any of them cannot be ignored. Accordingly, the characteristics of the organization and the purpose of a lecture are different by the desired users and this makes lifelong learning data impossible to be included in a standardized framework. That's why we propose a Blockchain-based solution to manage lifelong learning records in a decentralized way. We call it BlockBadges. In the BlockBadges ecosystem, users simply create wallet badges and automatically collect badges from the organization. In this context, a series of data appears because it is created according to the types and attributes of the badges provided by each organization. Lifelong learning statistics can be extracted if this data is organized and analyzed effectively.*

Keyword*: Blockchain, Lifelong Learning, Open Badge.*

1. INTRODUCTION

1.1. Lifelong Learning

Lifelong learning implies lifelong learning, from birth to death. Conceptually, lifelong learning includes all forms of learning that people can do. Lifelong learning is all about activities such as learning from parent's behavior, learning through educational institutions, and areas of interest in search and learning. Lifelong learning is lifelong learning, regardless of gender, age, form of study or hobby.

There are many different purposes of lifelong learning, including personal study, job learning, trying to meet curiosity in a new field and discovering its own existence through learning. Lifetime means more than these goals. For a short time, he kept learning to lead his life.

Each country defines different forms of learning for effective and effective learning. First, formal learning is a form that the state organizes and recognizes learning outcomes. It is made with a regular curriculum to get a degree. The official place to study happens is the school. Secondly, structured learning occurs outside the school ecology called informal learning. In addition, there are many different forms of learning that are not eligible for formal diplomas. Learning does not take place in a specific form, but in life and / or at work. Learning something yourself is enough, called informal learning.

Although different across countries, in the case of distinguishing lifelong learning systems from the law, formal learning tends to be separate from lifelong learning systems. For the lifelong learning mentioned in this white paper according to this difference, we do not discuss formal learning with a state-recognized school education framework. There is no need to borrow the form of badge for formal learning because formal learning has been implemented by various methods and systems and because the state determines its method of confirmation.

In the past, formal learning had a big impact. However, with the increase in the average life expectancy of people and the opportunity of social construction, it has begun to emphasize the importance of informal and informal learning. Although that does not mean that formal education is less important, but there is a limit to what can be learned within the framework of formal learning and therefore tends to pay more attention to informal learning and Non-formal.

The primary purpose of formal education is to provide universal education. It has been developed to learn things that people deserve without being limited in specific knowledge or skills, and the minimum criteria in formal learning will be solved. However, it seems that the purpose of formal learning is usually to go to a university. Perhaps this problem is valid for all global. Due to the fact that formal learning is organized according to college admissions, other things are often overlooked.

Although education for college entrance examination is mostly done for practical purposes, but the impact of learning remains, in addition to higher education, for a person not to be missed. All learning activities and lectures have significant significance because the values collected from learning immediately create a BIG personality. People are quite social in the way we upgrade character by learning through continuous interaction with society.

In short, attention must be paid to non-formal and informal learning, including the creation of lifelong learning. Because the purpose of life is not just a college entrance examination, it is necessary to look at the original form of lifelong learning.

1.2. Blockchain

Blockchain is a technology used to store and distribute small sized data in series, called blocks. Thanks to Blockchain data blocking technology, based on distributed computing technology, no one can arbitrarily modify or delete data stored in a block. That is why

transaction processes can be managed transparently with Blockchain. Blockchain was invented to have the decentralized electronic ledger function so that hierarchical allocation was important to understand Blockchain technology. Using Blockchain technology can be beneficial in a decentralized place and otherwise it is not necessary to use Blockchain technology.

Because current digital transactions are based on trust, a third-party verification agency needs to collect personal information. It means that someone must verify the transaction at the center. So far, financial transactions are one of the representative centralized models. On the other hand, Bitcoin does not require central verification. Both parties can trade directly without third party verification. The reason for the integrity of the transaction without the trust of third parties is due to evidence of the job algorithm.

Block technology is designed to ensure bitcoin integrity. Bitcoin is a digital currency of digital bitcoin as an alternative to digital transactions based on existing financial institutions. Due to the fact that current digital transactions are trust-based systems, a third-party verification organization that collects personal information is required. It implies that there must be someone to verify the transaction at the center. Financial transactions are one of the centralized models represented so far. On the other hand, Bitcoin does not require a centralized verification system. With Bitcoin, both parties can make transactions directly without the need for a third party to verify. The reason for the integrity of secured transactions without a trusted third party is due to the job proofing algorithm (PoW).

A block of currency is provided to customers in exchange for proof of work to ensure the integrity of transactions with Blockchain technology. To prove a task, a complex problem must be solved, requiring a lot of computing power. It's a bitcoin to make up for people doing this job. The relationship between job evidence and compensation is considered the relationship between Blockchain and Bitcoin techniques.

Internet technology is changing our lives. The changes are still happening in areas such as trading, communication, information sharing, business, learning and entertainment. Many experts predict that Blockchain technology has the ability to change our lives like the Internet did. Tapscott, a famous technology writer, estimates that if Internet technology is the first digital conversion generation, Blockchain is the second generation. And argues that Internet information is generated by Internet technology.

Blockchain is still growing. Ethereum, called Blockchain 2.0, has proven that Blockchain's use purpose can be extended from decentralized ledgers to contracts, badgeificates, etc. The use of Blockchain technology is gradually expanding as a means of replacing transactions and offline evidence. In addition, much improved Blockchain models are emerging by addressing existing Blockchain technology problems, including performance issues and simplified compensation policies. There are even social networking services that deploy Blockchain and video services created using Blockchain. Along with these advances, the ability to apply Blockchain to EdTech services is also increasing.

2. CONTENT

2.1. Blockchain in learning record management

Open Badge was first mentioned under the banner "Learning, Freedom and Web", in Mozilla's Drumbeat Festival 2010. It is the idea that comes with the thought that the development of the web is affecting education. It is starting from the problem of learning outcomes not getting attention in existing educational systems. Therefore, Open Badge allows learning history and learning outcomes to be expressed in mobile, digital form. Learning outcomes can be badgeified in the form of badges by applying the internal standards of the Open Badge including data on the place, time and mode of learning.

After the Mozilla festival, a related project was initiated with the support of the MacArthur Foundation and IMS Global took over this project in 2017 and was upgraded to Open Badge 2.0. Open badges are still being developed with the support of many organizations around the world.

Open Badges' site: https://openbadges.org/
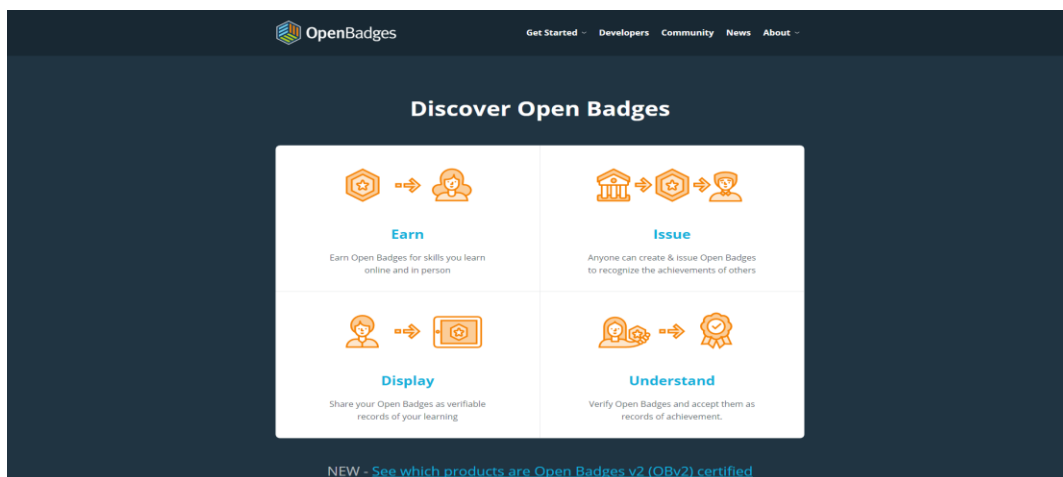
In general, badges are linked to three types of stakeholders: issuers (issuers), learners (money earners) and user organizations (consumers). A learner acquires a badge as the learning outcome of a course from a badge promoter, who demonstrates his or her academic results by sending his or her badge to the organization / company. use those badges. The relationship between issuer - learner - user organization forms the basic frame of the badge.

Issuing organizations (issuers) are educational institutions. Educational institutions provide badges for learners (earner) with proof of their study results / results. Often, learners will try to prove their study skills by sending the badge to the needs of the user organization (consumers). The badge is usually sent in a printed form.
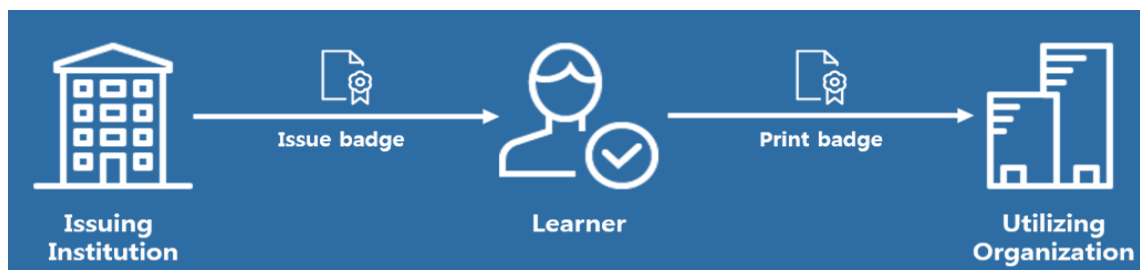
Open badges are an attempt to solve this problem. In the process of issuing a badge to learners, it creates an official badge in the standards and this badge has a secured role. When the badge is provided, the Open Badge plays the role of verifying this badge by creating and distributing it as a digital badge. A standard badge of the Open Badge has a reliable foundation. This means that learner's learning capacity can be recognized through the confidence of the Open Badge. Open badges are created from image formats, kept in a link form. If necessary, learners can send the image link of the issuer's Open Badge to the user organization. However, there is another problem, that the image link of the previously released open badge will disappear when the issuer disappears or its website address is changed. Therefore, ensuring the credibility of the open badge sent by the learner becomes difficult for the organization to use because the link is broken. This type of badge is called 'zombie badges. To deal with the zombie badges issue, badge wearing service has appeared.
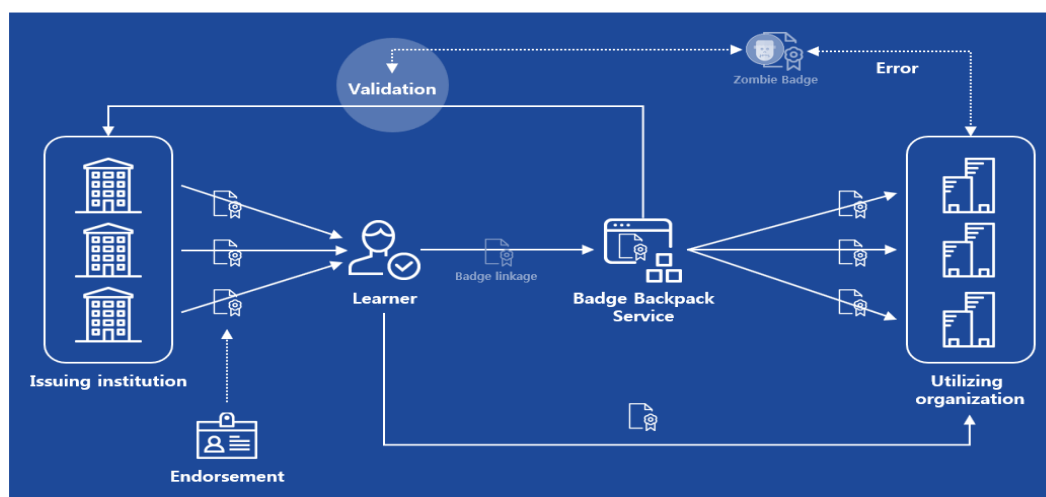
The Open Badges 2.0 specifications also include a way to store all the badge's relevant information to prevent the zombie badge. In Open Badges 2.0, all relevant data is obtained when the badge issuer is saved as an open badge and it is sent and stored in the badge backpack service. Therefore, even if the issuer disappears, the badge continues to exist in

the badge backpack and the learner can easily send it to the agency for use. However, another problem still has to be solved.

What happens if the Badge Backpack service disappears? How will the learner badge be verified when the issuer disappears?. Even the institutions have their own information systems to store learner's data, those systems also can disapear for many unwanted reasons. These types of problems need to be addressed so that badges will truly become a means to demonstrate academic competence. For this reason, different badgeification services are being offered in a centralized manner or in the form of specific organizations. In short, it can be said that an environment has formed, in which organizations using badges only accept forms such as badgeificates. If there is an opportunity to explicitly confirm the learners 'different learning outcomes and to be able to assess learners' learning capacity through this validation process, many changes have occurred.

Block chain technology has started with a transparent and stable ledger technology, and its fields of use have been developed, including smart transactions and even network services. society. Combining Blockchain technology with the badge will be able to solve the basic issues of open badges. That is because documents that prove an individual's academic ability can be stored permanently in the blocks. That is also the reason for us to start the Blockchain-based open badge service.

2.2. Proposal for blockbadges

(1) Blockchain-based Open Badge Service

Here we propose an open badge service based on Blockchain, which we call BlockBadges. BlockBadges is a lifelong learning management service that uses open badges with Blockchain technology. Block chain technology will fix these problems in a way that when an organization grants a badge, it will be permanently stored within a block with relevant information and the badge backpack service will be provided to learners and use organizations to verify badges. So, if the learner needs a badge, he / she just takes it out of the badge backpack. Form of BlockBadges badge, like the attributes of the open badge with images and links. There will be no need to worry about missing badges when the badge image is stored on the distributed file system. This alleviates that distributed data portions stored in badge wallets can be formed as a badge.

Verification is done by a group of organizations or only one organization that maintain the private BlockBadges. When the issuing institute requires the organization to create an account, the organization will provide it. Issuers can create and store new badges according to their needs by complying with international standards of Open Badges 2.0. The learner must create a badge wallet, in which the issued badges are stored. In addition, it is necessary to link issuer accounts to learners' wallets. So all the learners have to do is send a badgeification link to the employer (user organization) to prove their academic ability.

(2) Establishment of BlockBadges Ecosystem

An ecosystem focused on BlockBadges should also be created. The main stakeholders of the ecosystem are the issuer and the user organization. While the issuer must hold BlockBadges, the user organization must recognize the BlockBadges badge. Learners can use appropriate badges according to the movement of the issuing organization and organization. The properties of a badge are ecosystem orientation. The Open Badge 2.0 standards themselves are only standard and it is important to shape the badge into a visual format and grant it to learners. The more educational institutions agree on the usefulness of the badge, the higher the probability of survival of the BlockBadges ecosystem. Also, introducing BlockBadges in organizations is a prerequisite. BlockBadges will be developed to be easy to use so that many organizations can use it without burdening.

(3) Provides statistical data on lifelong learning based on BlockBadges

Suppose the number of educational institutions using BlockBadges increases and the number of badges issued by each organization is growing rapidly. Data on badges will accumulate more and more. Most educational institutions are still making decisions with sales and number of students. What the most popular courses will be an important factor in decision making. In this situation, if the badge release data can be collected very quickly, organizations will be able to make effective decisions using this data. Therefore, if educational institutions use BlockBadges, they will be able to achieve overall statistical data in the field of lifelong learning.

2.3. Technology deployment orientation

(1) Open Badges

Open badges provide the necessary specifications to digitize learning outcomes data. Information about learners' learning results is placed into a digital image in the form of metadata. All information about who, when, where, what and how to get the badge is included in that image. Therefore, Open Badges itself can be used as a complete badgeificate. The Open Badge metadata is configured in the form of JSON-LD (JavaScript object notation for linked data). JSON is often used as a data storage method and JSON-LD is used to easily interact with JSON-based data on the web. LD can be used to create a data network between issuer and organization using around the badge. Can check in case any badge has been issued. Currently, the open badge is configured by applying the context of JSON-LD (v2.0).
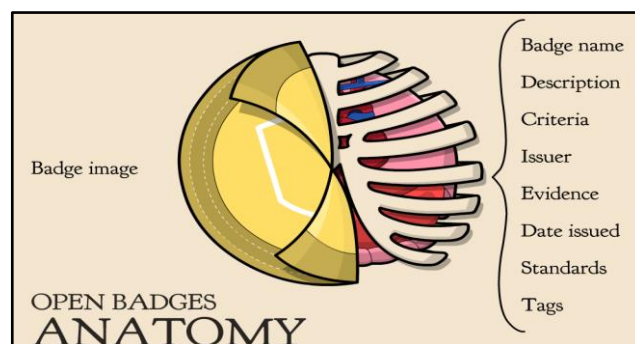
The following is an example from IMS Global Open Badge site:

```
{
    "@context": "https://w3id.org/openbadges/v2",
    "id": "https://example.org/assertions/123",
    "type": "Assertion",
    "recipient": {
        "type": "email",
        "identity": "alice@example.org"
    },
    "issuedOn": "2016-12-31T23:59:59+00:00",
    "verification": {
        "type": "hosted"
    },
    "badge": {
        "type": "BadgeClass",
        "id": "https://example.org/badges/5",
        "name": "3-D Printmaster",
        "description": "This badge is awarded for passing the 3-D printing knowledge and safety test.",
        "image": "https://example.org/badges/5/image",
        "criteria": {
            "narrative": "Students are tested on knowledge and safety, both through a paper test and a supervised performance evaluation on live equipment"
        },
        "issuer": {
            "id": "https://example.org/issuer",
            "type": "Profile",
            "name": "Example Maker Society",
            "url": "https://example.org",
            "email": "contact@example.org",
            "verification": {
                "allowedOrigins": "example.org" },
```

The badge in the above example is released as Open Badge 2.0. Id can be used to check BlockBadges records of issuers. Information on badge types and badge recipients is also included. It is also available to check the date when the badge is released and the information is authentic. In addition, it contains information about the badge itself in the way the badge name, detailed explanation, image file location, achievement criteria, etc. are stored as the metadata of the badge. The badge itself can be used as a badgeificate.

(2) Hyperledger Fabric

The core of BlockBadges is based on v1.0 Hyperledger Fabric. Hyperledger is a Blockchain-based open source project initiated by the Linux Foundation. It is growing rapidly as global companies around the world participate in project development. Besides, Hyperledger project contains five subprojects: Blockchain Explorer, Fabric, Iroha and Sawtooth Lake. Fabric, one of them, is the basic technology that makes Blockchain's engine.
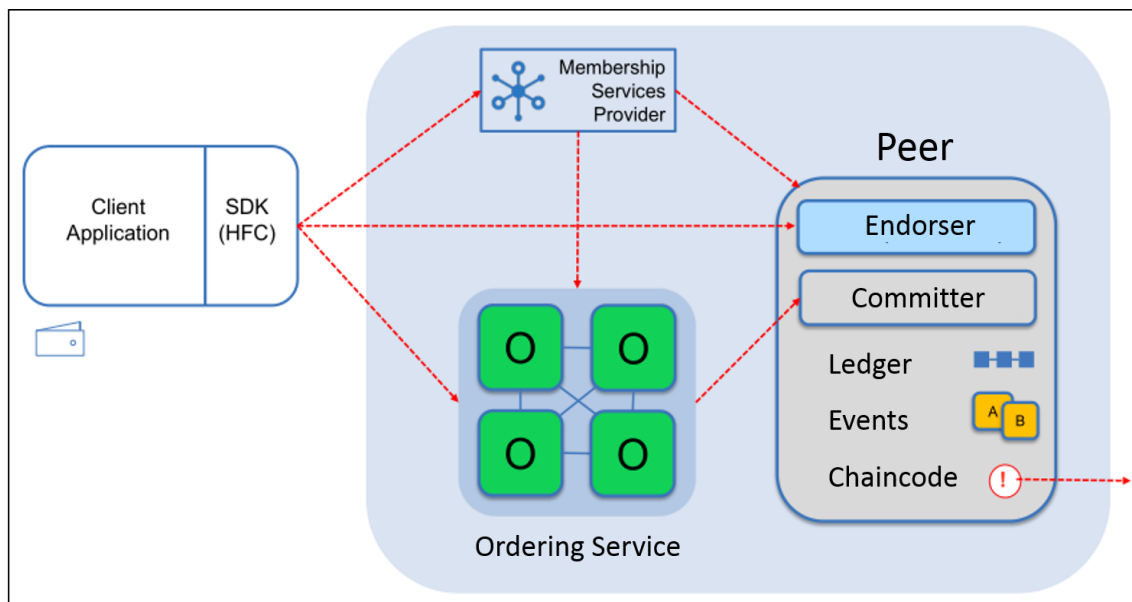
Hyperledger Fabric's website: https://www.hyperledger.org/projects/fabric

Hyperledger's website: https://www.ibm.com/Blockchain/hyperledger.html

Hyperledger Fabric is an enterprise modular Blockchain technology. It provides enough security, scalability, confidentiality, and functionality for the use of Blockchain in an enterprise environment. Hyperledger fabric provides administrative functions such as controlling user accounts and granting privileges. It also provides privacy and confidentiality and can handle requests quickly.

Source : http://hyperledger-fabric.readthedocs.io/en/release-1.1/key_concepts.html

There are three types of nodes in Hyperledger Fabric.

● Client: a node that requests a transaction

● Peer: a node that forwards a transaction request and performs an agreement

● Orderer or Ordering-service-node: a node that performs consensus algorithms, defines the transaction sequence, and then generates a block


<Source: SPRI Forum "Hyperledger Fabric Structure and Major Establishment Cases" Presentation>

Permissioned network	Confidential transactions	No cryptocurrency	Programmable
Provides collectively defined membership and access rights within your business network	Gives businesses the flexibility and security to make transactions visible to select parties with the correct encryption keys	Does not require mining and expensive computations to assure transactions	Leverage the embedded logic in smart contracts to automate business processes across your network

<Source: https://www.ibm.com/Blockchain/hyperledger.html>

Hyperledger Fabric supports smart contracts, digital assets, archives, storage systems, distributed consensus-based networks, plugin-based a algorithms, and password security. The smart contract function is implemented with a chain code. Hyperledger Fabric also supports various transactions because chain code can be created and used according to the type and method of the contract. Besides, these various functions are modular, and Hyperledger Fabric supports plug-and-play functionality.

The service areas of Hyperledger Fabric are categorized into 3 types: membership services, Blockchain services and chain code services. Membership services provide the ability to create, manage, and verify accounts. Blockchain services provide consensus management to approve transactions, distributed ledger management, protocol management among individuals, and ledger storage function. Chain-code services provides the ability to record and store contents for smart contracts.

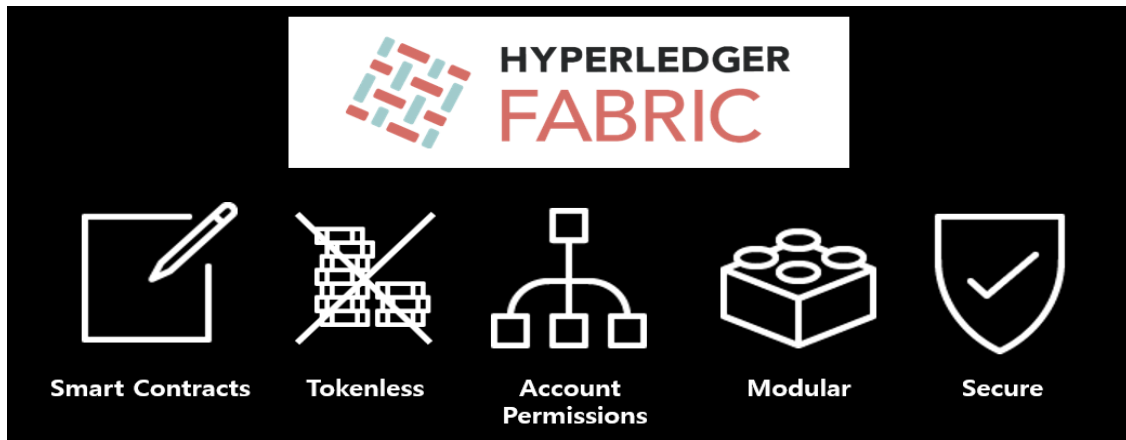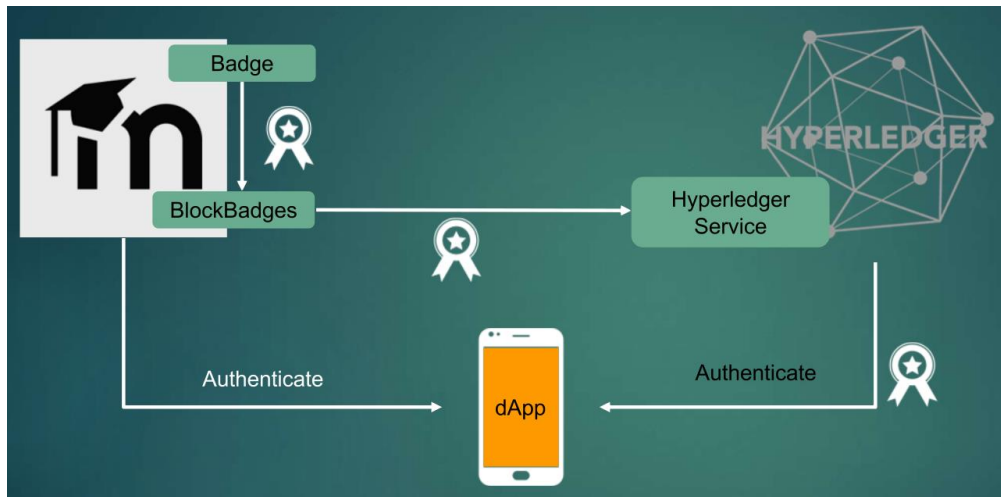<Source: https://jira.hyperledger.org/browse/FAB-37>
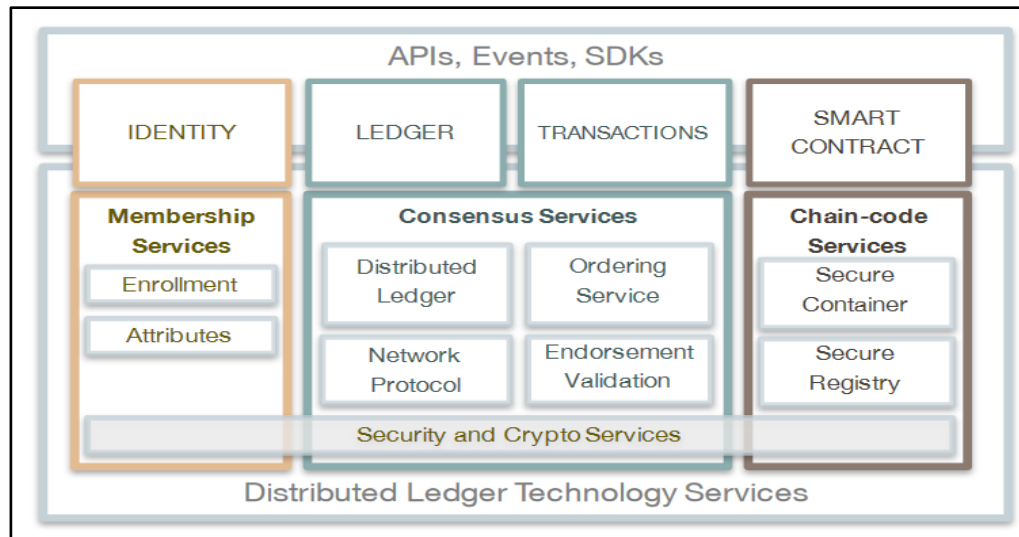
There are five reasons for choosing to utilize Hyperledger Fabric:

1. Provides smart contracts feature,

2. No tokens are required,

3. Provides various account authorization functions,

4. Easy to expand with modular structure,

5. Excellent security.

3) BlockBadges ideation architecture

We proposed an architecture for BlockBadges above with Hyperledger Service, Moodle as LMS and dApp to provide badges data. Moodle is the most popular LMS around the world, it has very flexible modular design. We based on its plugin guideline to make a badges collector agent to Hyperledger service. This implementation changed the previous of Moodle's procedure to issuing a badge with involvement of dApp and Hyperledger.

4) BlockBadges use case at Hanoi Open University

Hanoi Open University (HOU) has many faculties and remote training centers around Vietnam. We are providing distance education (both offline and online), also belong to lifelong learning concepts. Student information in HOU need to be consitency between parties (inside HOU). Blockchain will help us to unify student information with strongly consistency. Badges (or certificates) need to record in a distributed way. This solution will help us to store badges independently with any information system of faculties and remote training centers.

3. CONCLUSIONS

BlockBadges has three main goals: Promote lifelong learning, establish lifelong learning ecosystem and provide lifelong learning data. By application of newest technology in Industrial Revolution 4.40, BlockBadges will help anyone create his/her own learning roadmap via the accurate recoreds, it will be a 'true' learning portfolio. Base on that, A variety of learning ecosystems, business ecosystems and third-generation creative ecosystems will emerge around the rules of BlockBadges. BlockBadges will faithfully act the role of reasonable rulers at the center. There are not many institutions who can do everything itself. The institutions will be assisted with the experts in the case of they needed. Anyone who needs will be able to utilize this data. BlockBadges ensure the publicness of the data so that it can be used to develop policies for lifelong learning. One of the biggest tasks BlockBadges needs to solve is to discover business values and to help run the related businesses in the ecosystem.

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ỨNG DỤNG BLOCKCHAIN QUẢN LÝ HỒ SƠ HỌC TẬP TRONG HỌC TẬP SUỐT ĐỜI

Tóm tắt: *Trong cuộc đời của mỗi cá nhân, việc học tập được diễn ra không liên tục và gắn với nhiều giáo viên, tổ chức, khóa học khác nhau, mục đích học tập của mỗi người cũng khác nhau từ trẻ em đến người lớn. Các cơ sở đào tạo cũng tổ chức các khóa học theo mục đích và tiêu chí khác nhau của người học, vì vậy, các thông tin liên quan tới kết quả học tập của mỗi cá nhân trong suốt cuộc đời của họ không thể được lưu trữ trên một nền tảng thông thường. Chúng tôi đề xuất một giải pháp ứng dụng công nghệ Blockchain giúp tổ chức quản lý dữ liệu học tập suốt đời của mọi người theo hình thức phi tập trung gọi là BlockBadges. Trong hệ sinh thái BlockBadges, người dùng chỉ cần tạo ra các ví chứa đựng kết quả và các kết quả - quá trình học tập sẽ được tự động cung cấp bởi các cơ sở đào tạo. Trong phạm vi của đề xuất, các chuỗi dữ liệu được tạo ra với các thuộc tính được quy định bởi các cơ sở đào tạo này. Với hệ thống này, các dữ liệu học tập suốt đời của mỗi người khi lưu trữ trên hệ thống sẽ được bảo vệ và có thể được truy xuất, tổ chức và phân tích một cách hiệu quả.*

Từ khoá: *Blockchain, học tập suốt đời, Open Badge.*