



# Blockchain Technology Creates a New Ecology of Cadre Education and Training

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**Abstract.** The phenomenon of low data security and sharing exists in the existing cadre education and training platform. And blockchain technology has the advantages of information tamperability and so on so that it can solve the problem well. This paper proposes to establish a cadre education and training platform based on blockchain, and carries out the program design of the important cross-chain contract in the cross-chain module, which depicts the applicable scenario of blockchain in cadre education and training. The application of blockchain technology in cadre education and training has a broad prospect and will play a vital role in maintaining information security and other aspects, creating a new ecology in the field of cadre education and training.

**Keywords:** cadre education and training, blockchain, platform

## 1 Introduction

At present, there are two major pain points in cadre education and training. The first is the difficulty and high cost of information matching and the problem of falsification caused by the lack of data circulation and information asymmetry. The second is the problem of copyright infringement caused by the purchase and sharing of pirated educational resources.

Blockchain technology has the characteristics of security and trustworthiness, accurate record and no tampering, which is very suitable for the information management in cadre education and training. By establishing an education blockchain foundation platform and storing various learning records, training experiences and teaching resources on the chain. On the one hand, it realizes the interoperability of data among different organizations and solves the problems of education data convergence and difficulty in complete recording of information; on the other hand, it ensures the authenticity and transparency of data and can effectively prevent various forgery problems and intellectual property disputes. Therefore, it helps to build a more open and credible cadre education and training management system.

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In China, the application fields of blockchain are mainly concentrated in the financial fields such as digital currency and Internet finance. Although the exploration of blockchain application in the education industry is still in the embryonic stage, it has also achieved certain results. Literature <sup>[1]</sup> points out that the application of blockchain in online education is still in its initial stage. Literature <sup>[2]</sup> clarifies the direction of smart education development from the perspective of Industry 4.0 education transformation. Literature <sup>[3-5]</sup> summarized the development status of "blockchain + education" at home and abroad. Meanwhile, the application of blockchain in the field of education and training is also gaining more attention. Literature <sup>[6-8]</sup> proposed a blockchain technology application scheme according to the characteristics of education and training industry. The literature <sup>[9]</sup> designed a blockchain-based electricity training system. Literature <sup>[10]</sup> proposed a new model of cadre education and training with the technical advantages of big data and blockchain.

This paper explores the application scenarios of blockchain technology in the field of cadre education and training, which will help stimulate the intrinsic vitality of cadre education and training institutions and trainees, establish an effective mutual trust platform, and at the same time provide personalized teaching resources recommendation for trainees.

## **2 Blockchain-based cadre education and training platform**

### **2.1 Platform architecture**

The basis of blockchain application in cadre education and training is a secure and mutual trust cadre education and training platform. As shown in Figure 1, the overall architecture of the cadre education and training platform is divided into a four-layer structure. The first layer is the underlying protocol layer, which provides the underlying technical support for the education and training platform and the operating environment for the upper-layer architecture components. The second layer is the business support layer, which provides various necessary technical components for each business module. The third layer is the business application layer, which is a series of business systems formed for various business functions. The trustworthy data uploading system provides the functions of training institution information, training effect evaluation and training result uploading and storage. The training contract system is to form a smart contract for the agreement formed between trainees and training institutions to ensure the trustworthy execution of the agreement. The credit system displays the credit situation of the training institution according to the result of the smart contract execution. The fourth layer is the service interface, which is the system interface directly displayed to users and provides them with various required services.

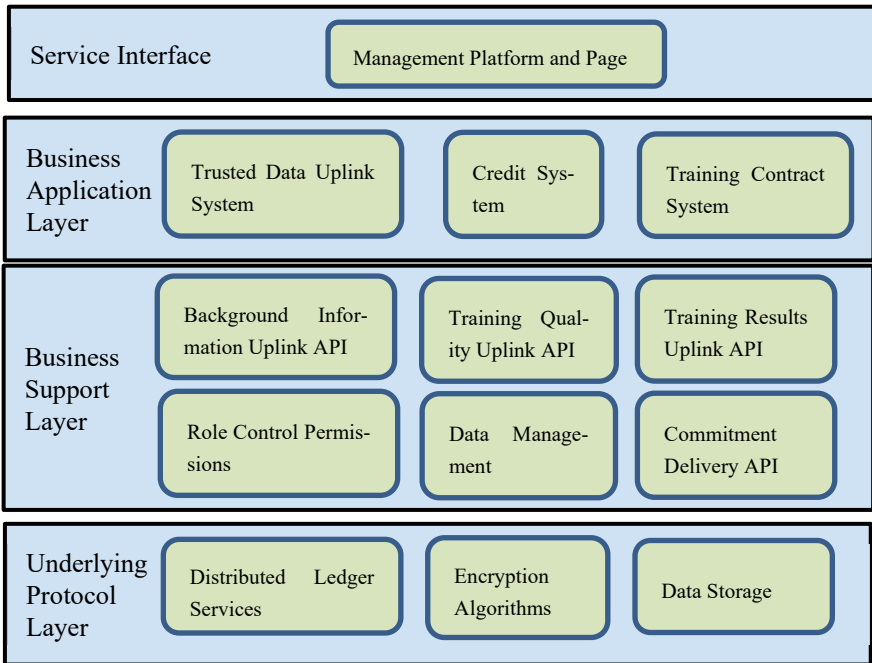


Fig. 1. Blockchain-based cadre education and training platform architecture diagram

## 2.2 Platform design

The system design follows the principles of openness, system compatibility, and decentralization. It adopts a progressive development process, different from the linear structure of the traditional software design model, and the modification and iteration of system logic, performance and interface accompany each development phase. The current system is evaluated and analyzed after each phase is completed. The system development process is divided into five major steps: requirements analysis, data model design, system design, system implementation, and system testing.

## 3 Cross-chain contract solution design

The purpose of cross-chain is to solve the obstacles of value circulation between chains, promote value circulation and ecological docking, and break the information silo between chains. Notary mechanism is one of the most widely used modes at present, and it is one of the technical solutions to realize cross-chain with lower implementation difficulty, which can be expanded to a large number of heterogeneous blockchain scenarios. The cross-chain module is divided into three components: cross-chain contract, cross-chain gateway and cross-chain network, and this paper only illustrates the design of cross-chain contract scheme.

The cross-chain contract is responsible for interacting with the application contract and simplifying cross-chain calls, it is the connector between the application contract and the cross-chain, and is used to handle the writing and issuing of cross-chain events in the local ledger. The core contract function in the chain code of cross-chain contract is CrossInvoke() function, which is responsible for executing the cross-chain invocation function, it first checks whether the business contract has cross-chain privileges, and then encapsulates the parameters passed by the business contract into a cross-chain event and writes it into the local ledger, and the core code of which is shown in Figure 2.

```

1 func (c *CrossChainCode) CrossInvoke(stub shim.ChaincodeStubInterface, args []string) pb.Response {
2     if len(args) < 5 {
3         return shim.Error("Incorrect number of arguments.")
4     }
5
6     chaincodeID, err := getChaincodeID(stub)
7     if err != nil {
8         return shim.Error("get chaincode id failed: " + err.Error())
9     }
10
11     channelID := stub.GetChannelID()
12
13     err = c.checkPermission(stub, channelID, chaincodeID)
14
15     if err != nil {
16         return shim.Error("check permission error: " + err.Error())
17     }
18
19     event := &CrossEvent{
20         FromAddr: Addr{
21             Namespace: "",
22             ChannelID: channelID,
23         },
24         ToAddr: Addr{
25             Namespace: args[1],
26             ChannelID: args[0],
27         },
28         Type: REQUEST_EVENT,
29         Contract: Contract{
30             ToCC:      args[2],
31             ToFunc:    args[3],
32             ToFuncArgs: args[5:],
33         },
34         CallBack: CallBack{
35             FromCC:      chaincodeID,
36             CallBackFunc: args[4],
37         },
38         //Index:      "",
39     }
40
41     err = c.setEvent(stub, event)
42     if err != nil {
43         return shim.Error("set event error: " + err.Error())
44     }
45
46     return shim.Success([]byte("cross message send success"))
47 }

```

Fig. 2. Core code of CrossInvoke function for cross-chain contract

## 4 Typical application scenarios of blockchain in cadre education and training

### 4.1 Establishing a new mode of cadre education and training management

Build a cadre education and training management system that integrates online teaching and offline teaching and covers learning, archives and background management. This

system covers various databases such as course library, teacher library, courseware library, case library, etc. The data of the whole process of cadre training will be accurately recorded in the whole process and cannot be tampered with or deleted once confirmed, and the whole process of relevant data operations (addition, modification and deletion) will be recorded in real time. The security and credibility of the training program and the whole process of training management are then guaranteed by supervision, which is conducive to promoting the sharing of teaching resources among all parties in society.

#### **4.2 Creating rich resources for cadre education and training**

Once the new ecology of cadre education and training is formed, the cadres will be in an all-round, three-dimensional and multi-channel training system, and will have more ways to choose their own learning and enjoy richer training resources. Various cadre education institutions at all levels can better set training objectives, training forms and training courses, and break the physical boundaries of cadre education and training to realize training in virtual space.

#### **4.3 Establishing a big data system for cadre training and learning files**

Cadre education and training institutions at all levels have different standards and ways of recording data (shifts, hours, etc.), and different and incompatible learning and training management platforms, making it difficult to accurately record the learning process. The use of blockchain technology can store scattered training experiences and realize the interconnection of data among training institutions; at the same time, it allows cadre education and training institutions and trainees to use and share data across platforms and organizations, forming a complete cadre training and learning big data file throughout the trainees' working life and providing a basis for cadre evaluation and assessment and promotion and appointment.

#### **4.4 Frontier information technology to create intelligent cadre education and training**

Promoting the deep integration of blockchain and artificial intelligence, big data, Internet of Things and other technologies helps build the blockchain industrial ecology and promote the integrated innovation and fusion application of frontier information technology. The application of blockchain technology and frontier information technology in cadre education and training is not independent of each other. In the future, cadre education and training will enter the stage of intelligence based on "smart chain". From the micro level, blockchain and "education big data" complement each other, and the two constantly promote each other from the perspectives of technical support and data drive, and jointly promote the deep integration of "blockchain + education". From the macro level, the combination of blockchain with digital technologies such as artificial intelligence, digital twin, AR/VR/MR/XR and 5G will help the formation of "blockchain+education" technology ecology. This will promote the interoperability and

mutual trust between data and platforms, promote the integrated development of cadre education and training resources, and help form a new model of adaptive learning in an open education environment, forming a new field of cadre education and training.

## 5 Conclusion

Blockchain technology application brings disruptive changes to related industries and can promote the improvement of education quality in many aspects, and will certainly have a profound impact on cadre education and training. This paper describes the architecture of cadre education and training platform based on blockchain, studies the contract mechanism in the cross-chain module, and gives the application scenarios of blockchain technology in cadre education and training, which helps to create a new ecology of cadre education and training.

## References

1. Wang Li, Zhang Zhihua, Ji Kai. Motivation, dilemma and path analysis of blockchain application in online education[J]. *Software Guide*, 2021, 20(12):15-21.
2. Hu Qintai, Liu Liqing, Zheng Kai. The new pattern of intelligent education in the context of industrial revolution 4.0[J]. *China Electrochemical Education*, 2019(03):1-8.
3. Jia Weiyang, Li Xinyu, Li Yuannong. A review of research on the application of blockchain technology in China's education sector[J]. *China Forestry Education*, 2021, 39(05):15-21.
4. Xu Tao. Research on the development status of "blockchain+" education and its application value[J]. *Journal of Distance Education*, 2017, 35(02):19-28.
5. Wu Yonghe, Cheng Gexing, Chen Yayun, et al. Research status, hotspot analysis and development thinking of "blockchain+education" at home and abroad[J]. *Journal of Distance Education*, 2020, 38(01):38-49.
6. Peng Yanping. A preliminary investigation on the application of blockchain technology in education and training industry[J]. *Chinese and foreign entrepreneurs*, 2020, No.669(07):161.
7. Xing Fengmin, Song Zhiming, Mou Li, et al. Analysis of the application of blockchain technology in "Internet+education" training[J]. *China Electricity Education*, 2022(12): 79-80.DOI:10.19429/j.cnki.cn11-3776/g4.2022.12.033.
8. Yuan Fang, Wei Ang, Wei Anlei. Exploration of combining blockchain with education and training[J]. *Cyberspace security*, 2020, 11(07):145-149.
9. Ma Jun, Wang Dehai, Fu Hongquan, et al. Design and implementation of a blockchain-based electric power training system[J]. *Electrical Engineering Technology*, 2020(23): 147-149.DOI:10.19768/j.cnki.dgjs.2020.23.050.
10. Meng Xianglai, Li Juan. Big data-based "blockchain+" cadre education and training management[J]. *China Adult Education*, 2022(08):19-22.

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