

Initiation of Blockchain Technology based Open Framework for e-Government Development in Myanmar

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Abstract— In Myanmar, necessary e-government services are not fully implementing yet. The several challenges and issues are still facing in e-government developments such as the new trend of technology, legal enforcement, and individual awareness. Currently, some ministries and institutions in Myanmar are implementing their own systems independently. The last decade, infrastructure and software development for the e-government system have invested. However, the dedicated open framework for e-government services still needs to consider. The author proposes an open framework called "Blockchain based Open Framework for e-Government Services" in this paper. That will be helpful for the standard implementation of Myanmar e-government services efficiently and effectively.

Blockchain technology is one of the megatrends for recent years. It is potentially a revolutionary means of secure and transparent data sharing and processing in a wide variety of sectors. The important concept of Blockchain technology is a combination of secured distributed ledger, cryptocurrency (or) bitcoin and smart contract system. That concept is very appropriate at: (i) creating trusted and secured information processing for large and heterogeneous sets of stakeholders; (ii) creating trusted audit trails of information; (iii) creating robustness and cost-saving data processing platform. The government agencies around the world are looking forward to Blockchain technology for secured e-government services efficiently and effectively.

The proposed framework would consist of five layers. Development platform Layer (Layer 1) is the interface layer for applications development. There are several e-Government applications depends on the services categories of G2G, G2C, G2B, and G2E services. The most e-government services activate depends on the legal law and regulations of individual government.

Blockchain-based Services Layer (Layer 2) provides core services of cryptocurrency, blocker service, shared distributed ledger, smart contract, auditing, identification, verification, cybersecurity, payment, authentication, and authorization. Data standardization is the most important part of the e-government system. All data of ministries are storing in heterogeneous and distributed forms. AI-based machine learning algorithms, database methodologies, and standardization methods are involved in Data Standardization and Distribution Layer (Layer 3). Data Storage Service Layer (Layer 4) and Secure and Distributed Infrastructure Layer (Layer 5) are underlying layers for data center services, storage service, distributed computing services, and secure protocol services.

The intended outcomes of the proposed framework would be (i) ensure the secure, reliable and robustness services (ii) support unique standardization for data between all institutions and ministries (iii) provide interoperability and efficient for collaborative processes between sub-systems.

Keywords: *Blockchain Technology, e-Government services, Smart Contract system, Cryptocurrency, Secured Distributed Ledger System.*

I. INTRODUCTION

The e-Government Master Plan 2016-2020 in Myanmar has described some objectives that highlight the facts: this master plan intends to be aware of existing implementation progress of e-Government in Myanmar. For that reason, we need to analyze the best practices in the world countries with successful e-Government system. Moreover, we need to create a better and more comprehensive system by reviewing existing ICT infrastructure and condition of applying the e-Government system in Myanmar. However, in Myanmar, the necessary e-government services are not fully implementing yet.

There are several challenges and issues are still facing in e-government developments such as the new trend of technology, legal enforcement, and individual awareness. Currently, some ministries and institutions in Myanmar are implementing their own systems independently. The last decade, infrastructure and software development for the e-government system have invested. However, the dedicated open framework for e-government services still needs to consider.

In order to fulfill those requirements, this paper proposed an open framework called Blockchain based Open Framework for e-Government Services. This framework will be helpful as the standard development framework for e-government services efficiently and effectively. In this paper, there are two different perspective views on literature surveys: (i) e-Government Services (ii) Blockchain Technology. The main contribution of this paper is describing the proposed design and structure of Blockchain based Open Framework for e-Government Services. In the next sections, we will explain in details.

II. E-GOVERNMENT SERVICES

e-Government Services are generally the Internet-based application systems that are providing to government functions using information and communication technology. It is the way the Government provides public information and updated information and delivery of online services which enable a more transparent to the public of stakeholders such as citizens, employees, and other related business function as well as government agencies of other countries.

Four kinds of e-Government services can be categorized based on the functions provided to target stakeholders such as Government to Employee (G2E) Services, Government to Citizen (G2C) Services, Government to Business (G2B) Services and Government to Government (G2G) Services.

A. Government to Employee (G2E) Services

The intended users of G2E services are employees from government ministries and institutions. There are several applications systems to provide online service for

government employees such as (i) online payroll service (ii) tax information systems; (iii) online pension services; (iv) administrative service for government institutions; (for example: order, rules, circulations); (v) online training for employee' capacity building. Some ministries in Myanmar have already developed some parts of G2E services, however, they are running individually by each ministry and they are still needed to integrate with other ministries' G2E Services.

B. Government to Citizens(G2C) Services

G2C services are essential parts of the e-Government System:

- Citizen identity system will include the national identification system, car license system and ownership registration of land and building.
- Healthcare system includes electronic records keeping systems, statistical analysis of diseases and medicines used, medical diagnosis systems and medical treatment records.
- Education verification systems will support for quality assessment of Educational institutes like university and colleges. Education records keeping systems to verify educational issues. Educational certificates verification could prove educational credentials.
- e-Election plays a vital role in G2C services. In an electronic voting system, the citizens could easily and securely vote from any locations using any devices using smartphones or PCs, need-preprocessing and verification for voting systems and need to use secure authentications channel.

Ministry of Labor, Immigration and Population in Myanmar has already implemented some part of the e-Id system and e-Passport system as G2C services. Ministry of Transport and Communication in Myanmar has already developed Car License database system as G2C service.

C. Government to Business(G2B) Services

The developed countries like Korea, Japan, and Singapore have already implemented G2B services such as online tax collection for business organizations, e-Procurement for auction and tender processes automatically. Those G2B services impact on country development in the area of anti-corruption. Moreover, it tends to reduce unnecessary expenses. Government ministries and business organizations require awareness of the system. Legal enforcement is needed to act for G2B operations by the government. In Myanmar, there are some challenges to initiate G2B services.

D. Government to Government (G2G) Services

G2G services are electronic sharing of data and information systems between government agencies, departments or organizations. G2G initiatives drive budgets and funding. The example of G2G services are: Automation Processes between local and central government and between two governments which are agreed to interoperate G2G services legally.

- Electronic Workflows System: Cross-border trading, negotiation, processing are examples of it.

- Monitoring system for civil servants

III. BLOCKCHAIN TECHNOLOGY

There are several questions about e-Government services and blockchain technology:

- Why should Blockchain technology use in the development of e-Government services?
- Which e-Government Services will initiate with blockchain technology?
- How to implement blockchain technology into e-Government Services?

In order to answers the above questions, Blockchain technology should be introduced first. Blockchain technology is one of the megatrends for recent years. It is potentially a revolutionary means of secure and transparent data sharing and processing in a wide variety of sectors. The important concept of Blockchain technology is a combination of secured distributed ledger, smart contract system, and cryptocurrency. The blockchain is appropriate at: (i) creating trusted and secured information processing for large and heterogeneous sets of stakeholders; (ii) creating trusted audit trails of information; (iii) creating robustness and cost-saving data processing platform. The government agencies around the world are looking forward to blockchain technology for secured e-government services efficiently and effectively. The following sections will explain the blockchain, distributed ledger, smart contract system and cryptocurrency in detail.

A. Blockchain

Some researchers said that blockchain is unhackable technology because of the concepts of distributed ledger, smart contract system, and cryptocurrency. Blockchain technology would appropriate to apply for trusted data processing between various type of users and stakeholders. Blockchain construct as a linked chain of blocks in which a group of validated transactions has hashed. First, those transactions have converted into a block by calculating with hash functions. Then it produces a unique hash code of that block. The block will link to the existing blockchain of the system.

A transaction of a block has calculated a unique hash code. A block in the blockchain has read-only privilege. Nobody can modify any block of the blockchain. If someone tries to modify the block, the hash code will be changed. This block will be discarded automatically from the blockchain link. That fact makes blockchain to become unhackable technology. Standard cryptographic algorithms are applying as hash functions in blockchain technology. B. Distributed Secured Ledger System

The blockchain distributes to the nodes of a dedicated network that is either a distributed network or a peer-to-peer network. The users can access the blocks from the blockchain for additional processes. They can create a new block of the transaction then it links to the blockchain. That is called the distributed and secured ledger system.

In the blockchain network, some users have the authority to validate and confirm whether transactions in the block are corrected or not. Then they proved it as an auditing process. A new block creates after auditing of the previous block. A new block links into existing blockchain and then distribute to others. As a consequence, the person

who proved the blocks of blockchain can reward for their proof work like consultant fees. Therefore, blockchain technology should apply for proof of work and proof of authority.

For that reason, blockchain technology appropriate to apply into for G2C and G2B e-Government services such as proof of health records, National identification, e-Voting systems need to prove whether it is confirmed.

C. Smart Contract

The government agencies and ministries are developing applications based on the institutional principles, legal rules and official procedures of the organizations. The e-government services are developing under terms and conditions agreed between developers, users, and stakeholders. Moreover, specific users will access relevant services. For example, Immigration officers access services for proof of authority whether national identity issued by the Ministry of Immigration.

In blockchain technology, smart contract plays a vital role for proof of work and proof of authority in e-government services. The concept of the smart contract has relied on the agreement between different agencies, organizational principles and legal rules of those agencies. Technical perspective view, a smart contract concept will be applied with AI technology based on prior knowledge of services.

Smart contract system acts as the work of the lawyer. The smart contract also processes for proof of work or proof of authority. Then it rewards as a consultant fee. Here cryptocurrency concept is introduced.

D. Cryptocurrency

Cryptocurrency is the digital currency in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds, operating independently of a central bank. However, government agencies need to support legal actions to generate cryptocurrency in a central bank of the country. Otherwise, cryptocurrency could not illegally generate.

The explanations and concepts of **blockchain**, **distributed secured ledger system**; **smart contract** and **cryptocoeerncy** are the answers for previous questions described in this section.

IV. REVIEW WORKS

In this section, we will review the e-government strategy of developed countries in Asia and South East Asia such as South Korea, Japan, Singapore, and Thailand. Moreover, e-government initiatives in the European Union in detail

A. e-Government strategy in Korea

In the case of Korea, many Korean e-Government systems have received awards and citations for best practices from international organizations. G2C services of Immigration Review, G2G service of E-Procurement System and G2B services such as e- Architecture Information System awarded by many international organizations.

Moreover, Korean G2C e-Government systems such as Home Tax, Urgent Disaster and G2E system such as e-

Trade system cited from other organizations for successful practices.

Five key success factors of Korean e-government are:

(i) Strong leadership of a government that encouraged being a success. There are 20 years of the strategic and sustainable plan by the government. Prepare for Nationwide change management program; (ii) customer-oriented services are mainly focused to develop based on users need; (iii) technical supports from participation of experienced SI companies and specialized solution vendors; (iv) National level E-Government strategies and technical assistance by revising of laws and regulations in line with government process reform; (v) Clear goals, objectives, short and long-term plans, with expected expenditure, income streams and deadlines using qualitative, quantitative performance index (KPI) for nationwide level and each project level. [6]

B. e-Government strategy in Japan

In the case of Japan, the development of e-government in Japan began with the e-Japan Strategy (2001). Then Japan reformed their e-government strategy as e-Japan Strategy II (2003), the New IT Reform Strategy (2006), i-Japan Strategy II (2009), New strategy in IT(2010) continuously. In 2016, Japan enforced basic act for data on the advancement of utilizing public and private sector data. Japan changed its e-government strategy as digital government strategy in 2017. The Japanese government has been implementing the "My Number" system during 2016 and 2017 as a key tool for administrative procedures related to social security, taxation, and disaster response. [2][3]

C. e-Government strategy in Singapore

Singapore is the most IT developed country in South East Asia. The Singapore Government has made bold strides in the computerization and e-Government journey. Rapid technological advances such as big data, Internet of Things (IoT) , and Artificial Intelligence (AI), have the potential to fundamentally transform Government for the better. [7]

D. e-Government strategy in Thailand

In the case of Thailand, The Thai government particularly has been a leader in enacting ICT-enabled transformation of government; many initiatives have been developed, including the recent notion of 'e-Government 4.0'. The first aspect is Government Integration, which involves the integration of information and operations across different agencies, towards a goal of establishing a single governmental perspective of citizens, leading to efficiency from shared services. The second aspect is Smart Operations, which utilizes ICT and related technologies, through Big Data and the Internet of Things, to support the work of public employees. The third aspect is Citizen-Centric Services, which aims to provide services based on the needs of individual citizens. The fourth aspect is Driven Transformation, which focuses on organizational change across several dimensions, including human resources, work processes, technology, and regulation. [4].

E. e-Government strategy in European Union

In In the case of the European Union, there are more than 28 countries have been formed as the European Union (EU) countries. As they form as a group of government agencies, their e-government strategies focus on the following factors: (i) User centricity: a constant improvement (ii) Transparency: embedding transparency in government routines (iii) Cross-border mobility: easier for businesses than for citizens (iv) the foundation for user-centric eGovernment services. The European Union Blockchain Observatory and forum encouraged to initiate blockchain technology to e-government services. [14]

V. BLOCKCHAIN BASED OPEN FRAMEWORK FOR E-GOVERNMENT SERVICES

In this section, the design of the proposed open framework describes. There are five layers in the framework:

Layer 1	Development Platform Layers for e-Government Services and Applications
Layer 2	Blockchain Technology Services Layer
Layer 3	Data Standardization and Distribution Layer
Layer 4	Data Storage Service Layer (Data Center Service)
Layer 5	Secure and Distributed Infrastructure Layer

Figure 1. Five layer architecture of open framework

A. Development Platform Layers for e-Government Services and Applications

This layer supports e-government application developers for the standard developing platform of front end and back end applications. In this layer provide front-end services such as UI template, application template and data template for G2C, G2E, G2B and G2G services’ developers. Application developers can develop on this layer based on legal procedures of organizations. The user database and system privileges can set in this layer.

Standard templates for user authentication service, access control of user privileges, interface libraries, and report templates are available to use for development layer. The examples of e-Government applications are:

G2G Applications

- Cross-border trading
- Cross-border legally negotiation
- Automation Processes

G2C Applications

- Citizen identification
- Healthcare
- Education credential verification
- e-Voting

G2B Applications

- Tax collection
- e-Procurement

G2E Applications

- Online payroll services
- Tax information services
- Pension services
- Administrative services

- HR Capacity Building Online training services

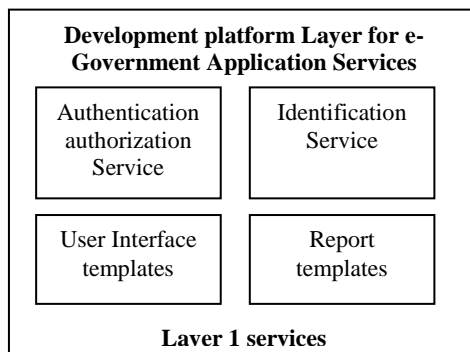


Figure 2. Layer 1 architecture of open framework

B. Blockchain Technology Services Layer

This layer is the most important layer for the proposed framework. Layer 2 is supporting layer for blockchain technology and related services such as **Blocker Service**, **Distributed Ledger Service**, **Smart Contract Service**, **Cryptocurrency Services**, **Verification Service** for legal laws and organizational rules, **Auditing Service**, (**Proof of Authority**), **Auditing Service**, (**Proof of work**), **Cyber Security Services** as following:

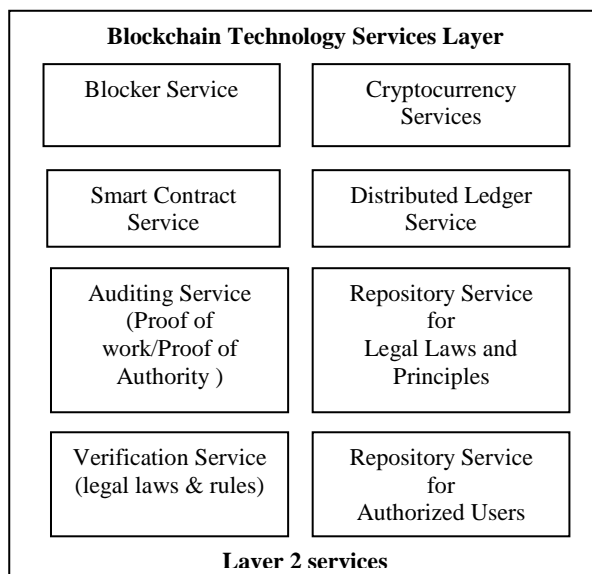


Figure 3. Layer 2 architecture of open framework

Blocker service

The blocker service generates the transaction using secured cryptographic algorithms and returns hash code for that transaction.

```

Algorithm Blocker (Blockchain, Block, Transaction)
{
    hash-code= Encrypt(Transaction);
    Add(Block, hash-code, Blockchain);
}
Algorithm Encrypt(Transaction)
{
    hash-code= Cryptographic_fun(Transaction);
    retune hash-code;
}
    
```

Figure 4. Blocker Algorithms

Auditing Services(Proof of Work/Proof of Authority)

The main tasks of these services are auditing and confirming for a given transaction. In order to do these services, Repository for Legal Laws and Principles plays a vital role in transaction confirmation.

Distributed Ledger Service

The blockchain will be distributed to the appropriate node to process for “proof of work” and “proof of authority”. Then, a new block has been created and links it into blockchain again.

```
Algorithm Distributed_Ledger(blockchain,transaction)
{
  new-block= Proof_of_Work(transaction);
  Blocker(blockchain,new-block,transaction);
  return blockchain;
}
```

Figure 5. Distributed Ledger Algorithm

Repository Service for Legal Laws and Principles

In order to support Smart contract system for e-government applications, the approved government legal laws and organizational rules and principles are storing into a dedicated repository. It will support to Verification Service (legal laws & rules) and Smart contract Service. The repositories design with an ontology-based hierarchal structure that can amend when new legal actions approved.

Repository Service for Appropriate Users

This service provides to extract the appropriately authorized users who can perform the actions of proof of work /proof of authority. It also designs with the ontology-based hierarchal structure that can amend when new appropriate authorized persons who do the proof of actions.

Smart Contract Service

The most important service of blockchain technology is the Smart Contract service. It makes the trusted agreement between processes based on Repository Service for Legal Laws/Principles and Repository Service for Appropriate Users. Two functions of Smart Contract Service are: (i) Find the appropriate persons to work auditing processes; (ii) Make trusted agreement between processes.

Cryptocurrency Services

The policy for cryptocurrency is approved by the central bank of the government. Cryptocurrency service is a simple process to convert from digital currency to other types of currency.

C. Data Standardization and Distribution Layer

Data standardization is the most important part of the e-government system. All data of ministries are storing in heterogeneous and distributed forms. AI-based machine learning algorithms, database methodologies, and *standardization methods* are involved in this layer. The data of e-government applications by different ministries are stored and formed heterogeneously. Example Data for e-government applications are:

Educational data

Education records from institutions, students and staff data are stored into it.

Healthcare data

Patient record, medical treatment record, disease database, medical staffs’ database, hospital database and etc. are stored into it.

Citizen data

All citizen records by township, distrust, state and region are stored into it.

Some other data such Land-used data, Political transaction data, Crime data, Agriculture Data, Business transaction data, Bank information and transaction data, Stock-share data, Birth and Death data, Election data, and etc. are also stored into it.

D. Data Storage Service Layer (Data Center Service)

This layer is also a physical layer to support data center service. The database systems for respective ministries are stored in the heterogeneous form in a distributed network. In this layer, all data system are storing into the data storage layer as virtual storage or cache storage. Some data are physically stored as well.

E.Secure and Distributed Infrastructure Layer

This layer is the underlying layer of secure communication for the blockchain network. The special purpose protocols are supporting to communication channel and blockchain network. The additional researches for blockchain network and related protocols will be addressed in this layer.

The intended outcomes of the proposed framework would be (i) to ensure the secure, reliable and robustness services (ii) to support unique standardization for data between all institutions and ministries (iii) to provide interoperability and efficient for collaborative processes between sub-systems.

VI. CONCLUSION

Blockchain technology can impact and appropriate on the auditing processes (proof of work/proof of author) in e-government applications. With the increase of the knowledge and awareness of its importance, blockchain initiatives are starting to develop applications in countries not only for e-government applications but also for another area of applications. By the literature survey of blockchain initiatives in 2017, there are 117 initiatives in 26 countries. In 2018, 202 initiatives increase to 45 countries.

In the case of the blockchain initiative countries in South East Asia, Singapore is the first country of blockchain initiatives in 2017. In 2018, Thailand and Cambodia become the countries of the blockchain initiatives in South East Asia. If our country Myanmar will start to introduce blockchain technology in e-government applications, Myanmar will become the 4thcountry of the blockchain initiative in South East Asia.

However, by the result of the statistical analysis in success stories of e-Government systems around the world, there are only 20% impacts on technology, 35% impacts on Government Processes Reengineering (GPR) initiatives and the rest of 45% is impacts on change management in institutional, individual and legal regulations.

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Appendix Detail Design of Proposed Framework

