Akachain

The enterprise blockchain platform

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Abstract

Enterprise blockchain is a new technology trend that brings the power of blockchain technology to the enterprise domain. However, developing and maintaining a blockchain system is not an easy task. These types of systems are very complex with many layers of networking and software components. State-of-the-art solutions are fragmented into different independent layers and mostly do not offer a complete workflow of developing, deploying, operating and maintaining an enterprise blockchain application.

This paper introduces Akachain, an enterprise Blockchain as a Service platform. Based on Hyperledger Fabric, Akachain provides a portable solution for deployment on different infrastructures, software development kits for developers, middleware utilities for administrators and off-the-shelf application templates for businesses to quickly release new products. Akachain is currently running multiple live enterprise blockchain networks that serve more than 20 thousand users in three main practical use cases: Loyalty and Rewards Network, electronic Know your Customer and Assets Traceability.

This paper is organized into five sections: Section 1 provides a brief introduction about the context and Akachain driving motivation. Section 2 presents the current enterprise blockchain landscape and a quick discussion on missing puzzle pieces. Section 3 encapsulates the complete Akachain solution package. Section 4 presents one of Akachain application templates that has been developed and running on live blockchain networks. Finally, Section 5 recaps important information that we have presented throughout the paper.

1 Introduction

For a long time, along with the growth of cryptocurrencies such as Bitcoin or Ethereum, Blockchain technology has rapidly gained the attention of enterprises seeking how to apply it to other domains beyond financial transactions such as distributed storage or Internet of Things. However, even when we have blockchain suitable use cases, employing such technology is not a trivial task.

We have seen little success with either public or private blockchain in different domains. The public is raising many questions on the actual outcome of the blockchain technology after so much investment and research efforts. Scholars pointed out one of the many reasons for this slow adaptation:

> *"Open platforms can't win by directly appealing to users on philosophical grounds, or even cost (see Linux on the desktop). Mainstream users have no good reason to directly interact with blockchain technology—or any piece of code—without intermediaries involved ..." – Arvind Narayanan, professor of computer science at Princeton University*

Indeed, we must consider that many of the current blockchain technology platforms are too complex for mainstream users. Even to technology companies, successfully employing blockchain technology imposes great challenges both in terms of economic as well as technical issues.

Inspired by such challenges, we introduce Akachain, a blockchain-as-a-service solution that brings the power of the blockchain to modern businesses. Akachain simplifies the development and managing enterprise blockchain systems by providing an automatic deployment solution on different infrastructures, ready-made business application templates, and professional support services.

2   Background

This section briefly describes the enterprise blockchain landscape over the last 3 years, many factors are affecting our decision making in developing the Akachain platform. What should be prioritized and how we deal with different circumstances.

Cryptocurrency aside, there were considerable changes in the enterprise blockchain landscape over the last 3 years. The report "2ND GLOBAL ENTERPRISE BLOCKCHAIN BENCHMARKING STUDY" (Rauchs, 2019) captures perfectly the big picture of the whole enterprise blockchain worldwide. Below are a few points that we are particularly interested in:

The Banking, Financial Markets, and Insurance industries are responsible for the largest share of live networks: It is not a big surprise that the original use case of Bitcoin and other types of cryptocurrency in the financial and banking industry is still dominant even in the enterprise context. The Insurance industry is prevailing as many of their use cases are very relevant to the financial use case.

Founder-led networks between partnering organizations are prevalent: 71% of live networks have been initiated by a single founder leading the initiative. Thus, we see that it is extremely important for a blockchain platform to *focus* on solving problems of one organization/enterprise first, *then*, it must have the *capability* to extend the system to connect other enterprises.

Unclear terminology and marketing hype has contributed to the "blockchain meme": 77% of live enterprise blockchain networks have little in common with multi-party consensus systems apart from incorporating some of the same technology components (e.g. cryptography, peer-to-peer networking) and using similar nomenclature. These are classified as "blockchain meme" systems.

Blockchain types

- Blockchain meme
- Potential multi-party consensus system
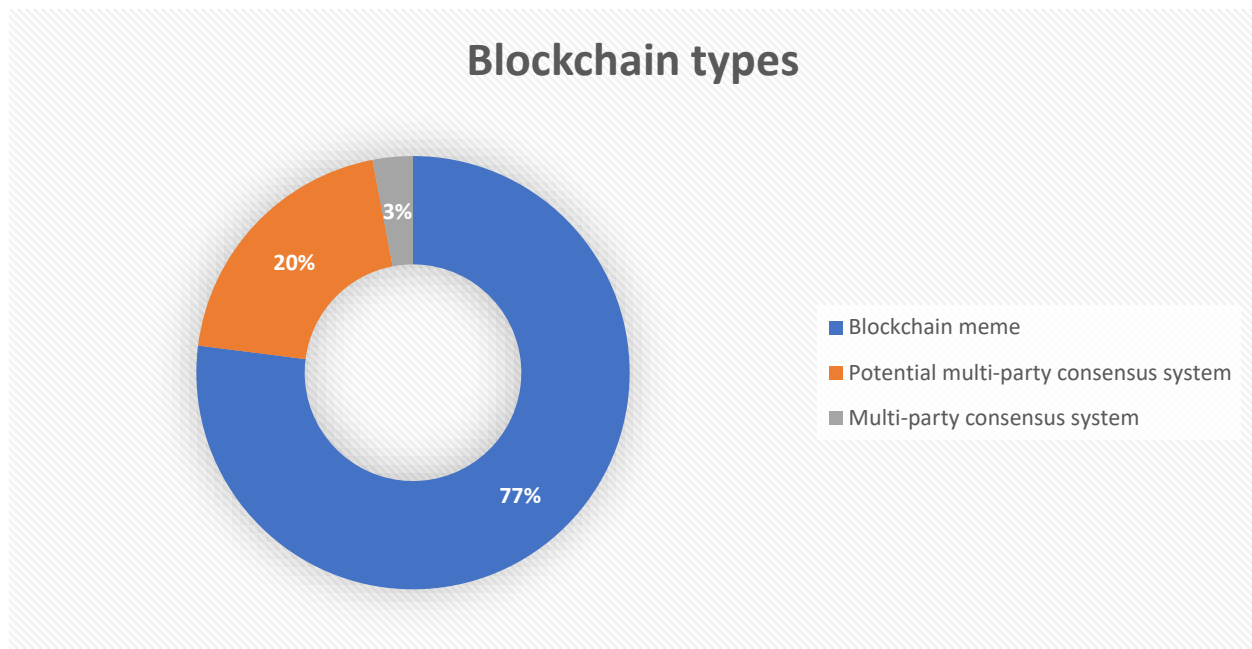- Multi-party consensus system

77%
20%
3%

Figure 1: Enterprise blockchain classification based on the Cambridge Centre for Alternative Finance (CCAF) dataset of 67 live enterprise blockchain network (Rauchs, 2019)

However, the blockchain meme does not necessarily mean a bad thing. Using several technology components of a conventional blockchain system, these projects promote connection among entities, sharing data in standardized formats and reducing the number of steps in reconciling ledgers among all participants. Thus, stakeholders have a *base* system to rethink how their internal business process should work and eventually move towards a new model that involves multi-parties with share infrastructure that is operated by distinct industry partners.

2.1 Driving technology

What are those technology components that drive the adaptation of blockchain technology in an enterprise context? From our experience, there are three most important ones:

- **Immutable Distributed Ledger**: The immutable data structure of the blockchain, in conjunction with a distributed software architect, fits a lot of general purposes in enterprise context as enterprise systems tend to favor security and availability (by having multiple instances).
- **Smart Contract**: is a way to *execute the same code* with the *same input* and produce the *same output* in all nodes in the network. This creates high confidence in the *correctness*, *consistency, and authenticity* of transactions going through the system. This is also a very appealing characteristic of financial applications.
- **Off-the-shelf software**: There is a lot of ready-mades, open-source applications, and libraries that can be used right away to build production-level applications. Hyperledger Fabric, R3 Corda, etc. are mature open-source platforms that work just out of the box. Thus, it is straightforward for businesses to pick up one, build PoC, MVE systems and later scale-out to production.

2.2   Landscape

From the platform development, the enterprise blockchain platform landscape is quite diverse. We modified the framework proposed by Colin Platt (Platt, 2017) to add the Blockchain as a Service (BaaS) section. Figure 2 shows the complete landscape model with several notable examples in each layer. Overall, the landscape is divided into four main layers:

1. Protocol: framework and software platforms
2. Network: business networks that are managed by multiple parties
3. Application: business applications and templates deployed on existing networks.
4. BaaS: software as a service solution that helps operate and manage blockchain network on cloud or virtual private servers.

Figure 2: Four layers model of the enterprise blockchain landscape

2.2.1   Protocol

Hyperledger Fabric, R3 Corda, MultiChain and Quorum are the most successful blockchain platform with their protocols, architecture, and design. The clear winner in 2019 is Hyperledger Fabric, managed by The Linux Foundation and IBM. Hyperledger Fabric offers a modular platform that supports multiple consensus types and plugin. IBM also has a reputation for its enterprise platforms. Our observation is that Hyperledger Fabric is clearly among the most mature blockchain platforms and is suitable for enterprise context.
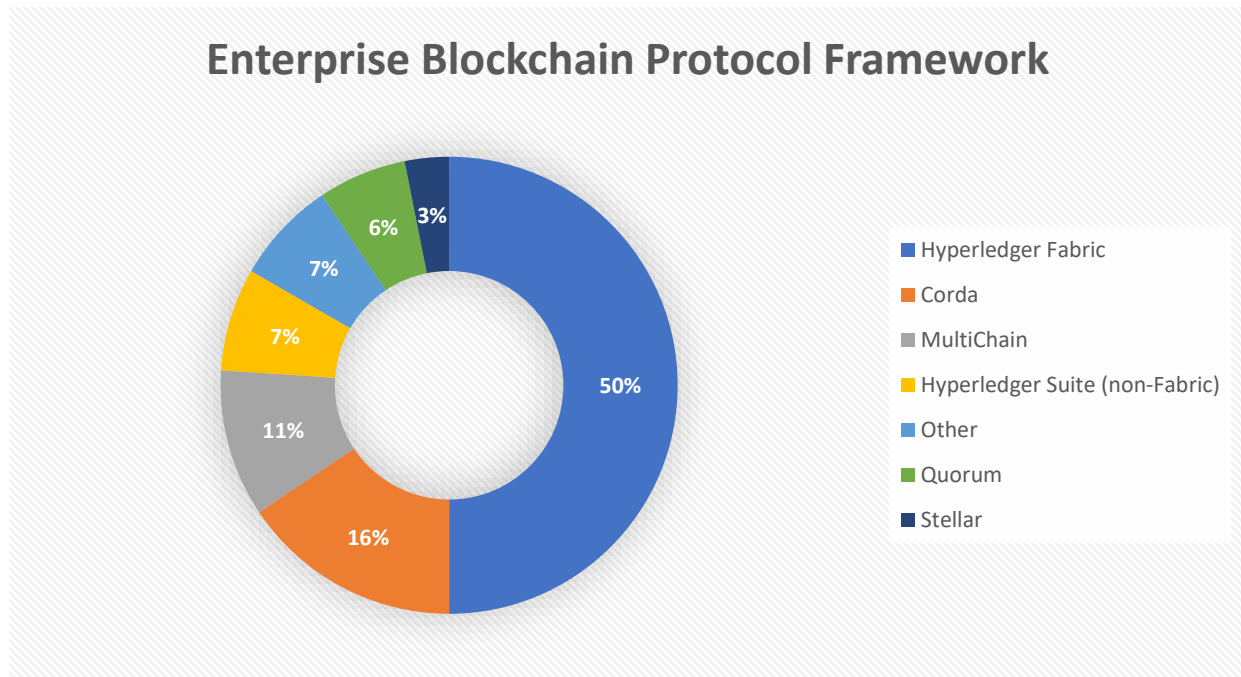
Enterprise Blockchain Protocol Framework

Figure 3: Market share of blockchain protocols for enterprise based on CCAF dataset

2.2.2   Network

The CCAF survey (Rauchs, 2019) has been conducted on more than 160 companies with 67 live networks between April and June 2019. It shows a healthy picture of how the blockchain technology makes its way to be adopted in enterprises. Though most of those networks are founder-lead and do not have a clear way of using multi-party consensus, it is noted that many have utilized *some* features that a blockchain brings and has the potential to become a full multi-party consensus when the network expands. This is far more different in comparison to a "Blockchain-as-an-Excuse (BaaE)" situation where the general idea is to have marketing materials for the enterprise. These BaaE projects normally do not make it into production networks and if yes, have a very short life span.

2.2.3   Application

Since the introduction of Bitcoin, people have tried to apply the blockchain technology to many applications rather than just cryptocurrency. In an enterprise context, this correlates with business workflows that need some of the characteristics offered by the technology: multi-party consensus, transparency, encryption, immutable storage, smart contract, etc. The once described "Do you need a blockchain" model by (Karl Wüst, 2018) is not necessary to be true anymore as any application now can be redesigned to have some of the listed characteristics. The model is gradually shifting from *"whether we **need** a blockchain"* to *"do we **want** a blockchain"* or can the current blockchain technology satisfy requirements on performance, scalability, etc. that a traditional centralized system can provide.

From the surveyed live network in CCAF data, Finance and Insurance are taking the lead. The reason is quite easy to explain as this is directly related to the original use case of Bitcoin where people have years to run, polish and developing best practices.

2.2.4 Blockchain as a Service

BaaS is a different take of technology giants on the blockchain trend. Microsoft Azure Blockchain, Hyperledger Composer, Hyperledger Cello, Amazon Blockchain and later, Oracle Blockchain, all those systems offer a way for enterprises to quickly create and manage their blockchain platform of choice to a specific cloud service (Azure, AWS, Oracle) or on any infrastructure (Akachain, Cello, Composer). At a glance, those services do not change how underlying blockchain components work. Instead, they provide a more refined API wrapper or better user interface for engineers who are not experts in blockchain can still interact with the system effectively.

2.3 Discussion

The observed trends of the enterprise blockchain landscape offer valuable insight and affect our decision making a lot. Taking on the Blockchain-as-a-Service approach, we believe that none of the existing solutions provide adequate functionalities that a multi-enterprise blockchain network desires. We believe that cloud-vendor lock-in is not appealing to general customers.

An ideal platform should be **(1) portable (with containers) to different clouds or on-premise systems**. If we only consider blockchain meme inside one organization or master-slave relationship between a closed group of enterprises, there would be no concern as the group leader can freely choose his vendor. Yet, in the context of a multi-party consensus network, each organization will have different preferences in terms of strategic business or physical infrastructure to choose their cloud provider or local data center. The ideal BaaS platform should be able to work transparently among different kinds of infrastructure so that it is straightforward for independent enterprise organizations to collaborate and expand their network into a true multi-consensus network.

Inside one organization, an enterprise blockchain system must have **(2) flexible architecture that can be easily integrated with the existing enterprise infrastructure of each organization**. This is a mandatory requirement even for current BaaS service and to some extent, the protocol platform layer as well. We have seen that most networks are founder focused or meme. In those cases, the blockchain component must be considered as a part of the enterprise software ecosystem and able to integrate seamlessly with other enterprise components. This means having standardized API, following industrial standards in authentication, authorization and device compatibility that ease the adaptation process in an enterprise context. Enterprise blockchain applications inside one organization also must be scalable, cost utilized, secure, highly available and crash fault-tolerant.

Finally, an enterprise blockchain platform should **(3) provide inter-organization communication capability**. Even if the current landscape does not see much application of it, the communication, consensus process among multiple parties are defining characteristics of a blockchain system.

3 Akachain Solution

With the target of solving three challenges in the discussion above, we introduce **Akachain**, **a full-stack blockchain-as-a-service solution** that brings the power of the blockchain to modern businesses. Akachain simplifies the development and management of a private blockchain system by providing automatic deployment solutions on different cloud infrastructure, ready-made business application templates and professional support services. In general, our targets customers are enterprises that seek to build production level blockchain-based applications with great flexibility as mentioned in the previous section.

We choose Hyperledger Fabric as the core of Akachain and build everything on top of Hyperledger Fabric. Figure 4 shows services that Akachain offers that map to the enterprise landscape framework defined in section 2.2. Akachain provides services from 2 layers: BaaS and Application.
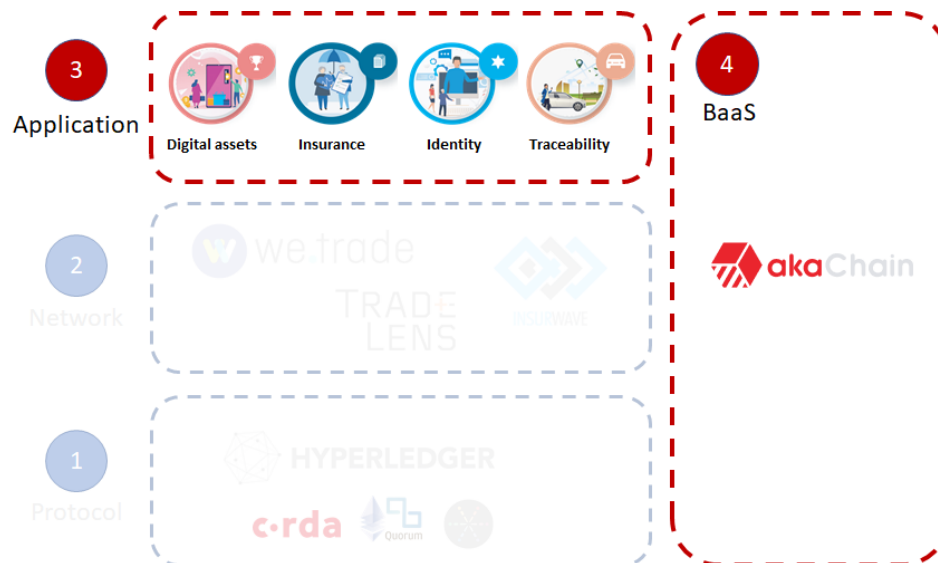

Figure 4: Akachain service offerings

There are multiple *Layers* in the platform that target different user types: Infrastructure, Application Development Support, Administration Toolkit, and Industrial Template.

3.1 Infrastructure

Target: System Administrators, DevOps engineers.

Akachain provides a built-in tool to facilitate the deployment of Hyperledger Fabric on cloud service of choice (Azure, AWS or GCP). It also supports the deployment over on-premise systems traditional bare metal server or vSphere. Figure 5 shows the applicable infrastructure of Akachain.
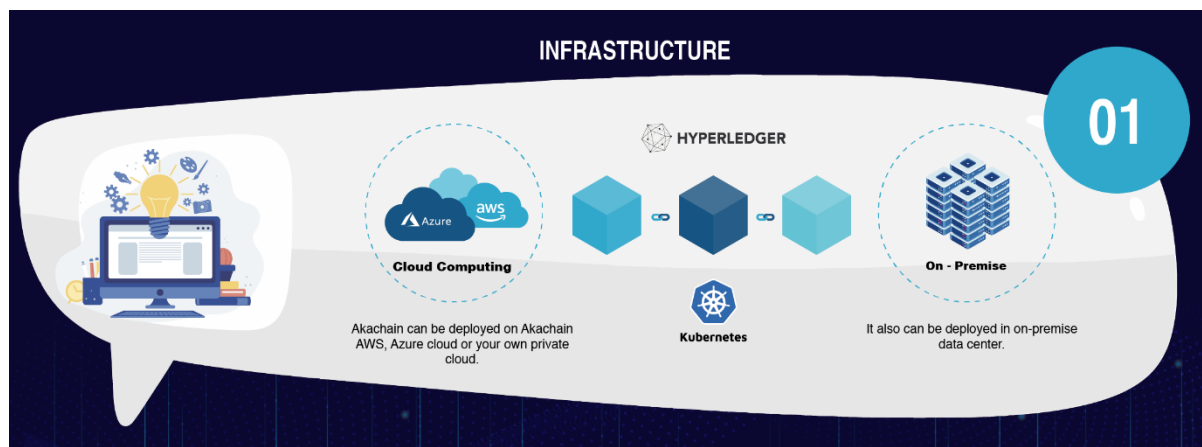

Figure 5: akaChain infrastructure on clouds and on-premise systems

The Akachain infrastructure tool is a collection of scripts and Kubernetes templates with to quickly a Hyperledger Fabric network with configurable parameters such as the number of nodes, consensus types, network configurations, etc. Originally, Akachain was designed to work exclusively with Amazon Web Service, so the tool has been working exclusively with Amazon Managed Kubernetes Service and other related services, e.g. EFS, NLB, etc. Lately, we have succeeded to migrate the AWS dependent scripts into using KubeSpray to deploy a Kubernetes Cluster. Thus, the current Akachain infrastructure tool now can be deployed on any platform that supports native Kubernetes.

In the deployment model, there are multiple ways an enterprise can make use of Akachain infrastructure tool:

- Build it yourself: A very straight forward way to use Akachain is just to subscribe to Akachain's license and just build the network yourself with the help of the Akachain Infrastructure Tool. It is pre-configured, documented and well tested so that you can have a blockchain network on private infrastructure in less than 1 hour.
- Shared Akachain Core: In a multi-organization setup, Akachain offers a working model as a service provider that provides essential Hyperledger Fabric components such as the Ordering Service or the Certificate Authority Service. This way, enterprises can just focus on maintaining their peers and Application without worrying about maintaining the availability and security of those core services.

3.2 Application Development Support

Target: Developers

A normal application on Akachain has 2 main parts, the Decentralized Application (DAPP) and the Smart Contract (Hyperledger Fabric Chaincode). Figure 6 shows the interaction among those components. We are all familiar with the concept of smart contract/chaincode in a blockchain system. The DAPP is a unique application in each organization that interacts with the blockchain network. One can understand a DAPP provides an application interface for all blockchain-related transactions.
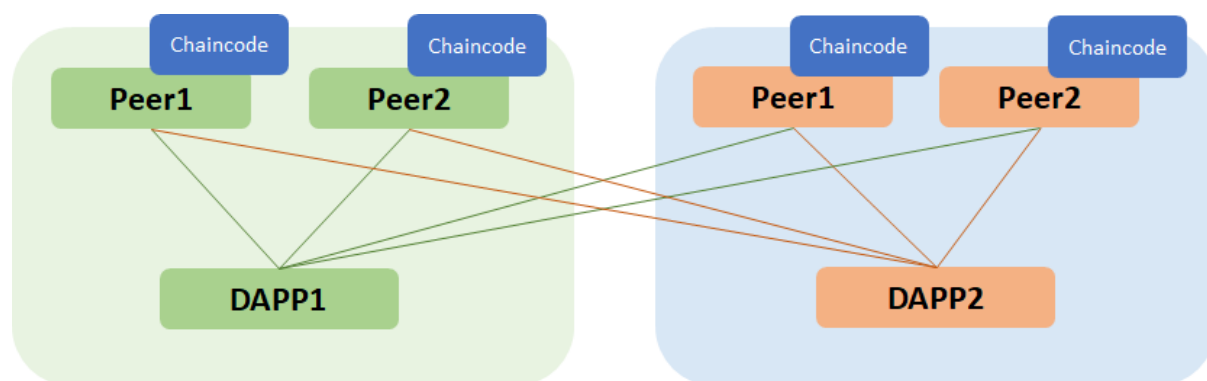

Figure 6: Decentralized Application on Akachain

Akachain provides several Software Development Kit (SDK) to accelerate Chaincode and Decentralized Application (DAPP) development process. Akachain SDK and other application support libraries are open sources. Our Github repository is located at https://github.com/Akachain.

3.3 Administration Toolkit

Target: System Administrator, Executive officers

Akachain provides a layer of built-in tools that support managing Akachain service inside the organization. This includes monitoring tools, advance dashboard, continuous integration process, and network management tools.

Figure 7: Akachain Administration Toolkit

There are four categories of tools:

- Monitoring Tools: a collection of independent tools providing real-time information on system throughput, transaction details, logs, resource utilization, etc.
- Dashboard: An information management tool providing at glance information of the whole network.
- CI/CD: Continuous integration and deployment processes using Gitlab or Github.
- Network Management: a collection of tools that help to manage the blockchain network programmatically.

3.4 Industrial Templates

The above 3 sections cover the BaaS layer of Akachain. For the application layer, Akachain provides different **solution templates,** which are complete software solution packages that have been developed, tested and deployed on production networks. Akachain provides 3 main industrial templates: Loyalty and Rewards Network (LRN), electronic Know Your Customer (eKYC) and Asset traceability. Each template is

a complete package of its own and is not the focus of this paper. Please contact us at http://akachain.io for more details of those templates.

4 Case Study: Loyalty and Rewards Network.

In this section, we give a brief introduction to one of our industrial templates: The Loyalty and Rewards Network to give readers a better understanding of enterprise blockchain use case

The loyalty & Rewards Network (LRN) is Akachain's very first production-ready industrial software package. It is also our most successful, mature template that we have developed. Currently, LRN has been adopted, customized and run on live networks in Vietnam and Southeast Asia countries. The current biggest LRN is in Vietnam with nearly 100,000 users and average 6000 transactions per day.

In brief, LRN is a unique enterprise software package that allows multiple enterprise organizations to construct a blockchain network. They can use this network to send transactions that convert their loyalty points to others or to accumulate points to redeem gifts. The high-level workflow of an LRN system is depicted in Figure 8. Before going deeper, there are a few notes that we must understand.
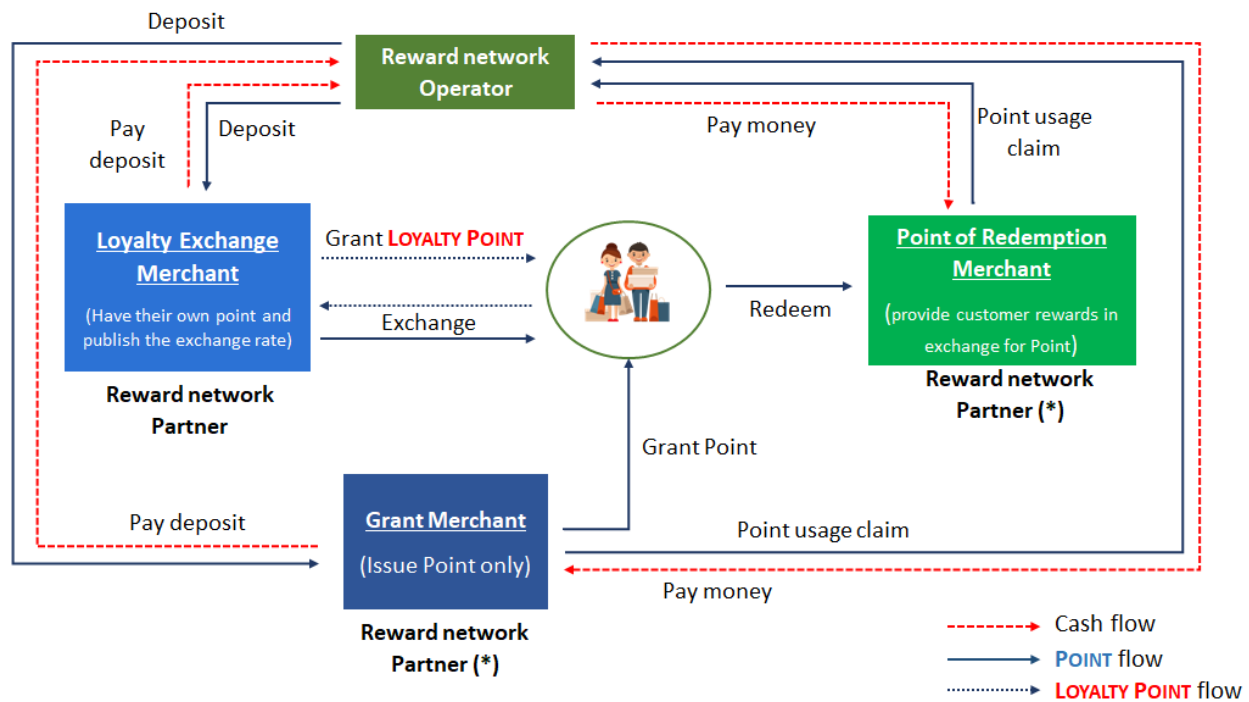
Figure 8: Workflow of a Loyalty and Rewards Network

4.1 Point

An LRN system aims to orchestrate the flow of POINTS among different actors in the network. A POINT is a currency unit that everyone agrees on when they join the network. In the public blockchain landscape, one can imagine POINT is like BTC, ETH and so on. In our enterprise context, a POINT is just an intermediate currency that every partner in the network agrees to use. Normally, 1 POINT unit is equivalent to the currency of the country that the system is deployed (VND, USD, EUR, etc.). Since our system is a Loyalty

based system, the POINT here is also referring to the idea of loyalty point that consumers earn when they use the services of an organization.

4.2   Reward Network Operator

The founder of the LRN system. The operator provides essential facilities for a blockchain to work. In the network, the Operator acts as a central bank that issue POINT and deposit to other partners in exchange for cash. Other partners can later use their accumulated POINT to claim back cash from the operator.

4.3   Merchant

Besides the Network Operator, other partner organizations in the network are called **merchant**, merchants are categorized based on their capabilities in the network.

Loyalty Exchange Merchant: partner organization that has its own loyalty point that is coming from their existing loyalty system. For example, a Loyalty Exchange Merchant **A** has his LOYALTY POINT to gives to his customers. In this case, the LRN system allows a way for **A** to *exchange* LOYALTY POINT to POINT (not the other way around) with a pre-defined rate that is agreed with other partners.

A Loyalty Exchange Merchant must *buy* POINT from the Reward Network Operator with cash through a Deposit process. Then, a customer can use their LOYALTY POINT from **A** to join the exchange process where the customer returns LOYALTY POINT to **A** to receive POINT to use in the LRN system. The rate of exchange is defined by **A**. This is because **A** can only allow customers to exchange LOYALTY POINT to the amount of POINT that has been deposited by Network Operator before. To encourage customers to use POINT, **A** can set the exchange rate to favor POINT. Meanwhile, A can always set the exchange rate to favor its LOYALTY POINT to encourage customers to earn and keep their LOYALTY POINT.

Grant Merchant: partner organization that uses POINT to reward their customer. Customer use services from this type of merchant and received loyalty point in the form of POINT that has been deposited by the network operator before. This type of merchant is suitable for a partner who does not have his loyalty system before or just want to switch to use POINT.

Point of Redemption Merchant (PoR): partner organization that provides *Rewards* which can be *redeemed* by customers with POINT. Later, they can use accumulated POINT to *claim* for cash from the Network Operator.

Mix: a real-life merchant type can be mixed between both Grant and PoR at the same time.

4.4   Action

There are different types of actions in the system performed by different actors. Here is a list of main actions:

Action	Description
Deposit	The Network Operator gives POINT to a Merchant
Pay Deposit	A Merchant pays cash to the Network Operator
Grant POINT	A Grant Merchant gives POINT to a customer

Grant **LOYALTY POINT**	A Loyalty Exchange Merchant gives **LOYALTY POINT** to a customer
Exchange	A customer gives back **LOYALTY POINT** to a merchant in exchange for **POINT**
Redeem	A customer spends **POINT** at a PoR Merchant to get rewards (gifts, voucher, etc.)
Point Usage Claim	A PoR Merchant gives back **POINT** to the Network Operator
Pay Money	The Network Operator pays a PoR Merchant for the claimed **POINT**

4.5   Just Meme or potential Multi-Consensus system?

So far, we haven't touched on the concept of the blockchain on the LRN yet. Is a blockchain necessary in this situation? The answer will depend on how our stakeholders want to control their actions. Assuming that there are 4 independent organizations in the network as in Figure 8: the Network Operator, a Loyalty Exchange Merchant, a Grant Merchant and a PoR Merchant.

A Meme blockchain system will therefore only have 1 set of peers that handle all types of action. There will be no multi-party consensus and we can only use the blockchain as a method of storing data and process transactions in sequence. **This is, in fact, not bad as it retains all workflows of a transaction ledger**. Transactions are processed in sequence and are stored in the blockchain data structure. Though, the system is over-complicated and produces a lower throughput in comparison to a system with a traditional database.

In the second step, we can assume that the Loyalty Exchange Merchant wants to run his own set of peers to join the LRN system. **The Merchant control and maintain these peers so that no other organization can have access to them**. Now, all transactions that start from this Merchant will be invoked by these Merchant peers and are accepted in the network through the consensus among the Merchant peers and the Network Operator ones. The Merchant also has a trusted view of all transactions in the network through its peers to make sure that there are no malicious intent or mistake from the Network Operator.

Lastly, in a real live network, **it does not mean that all organizations must have their own peer**. The LRN template is flexible in a way that different merchants can use the same set of peers if they don't have the requirements or the resources to run their own. This way, they will have to put trust in the organization that maintains the peer, but it is an acceptable way for the network to function in the founder-lead model that is very common in the wild. When the network is opened for more organizations to join, it is up to those organizations to decide whether they want to be a node in the network or to delegate their transactions to others. Thus, we can conclude that **LRN is designed to be a potential Multi-Consensus System**.

5   Conclusion

We have presented Akachain, an enterprise blockchain platform based on Hyperledger Fabric. Akachain provides Blockchain as a Service and ready-made application packages in different domains. The Akachain BaaS is a flexible solution that can run on any cloud or on-premise servers. It offers various middleware tools to accelerate the development, operation, maintenance and scale-out process of enterprise blockchain applications. These tools also follow industrial standards on security and provide a

standardized application interface to ease the integration process of blockchain applications with enterprise ecosystems.

Akachain industrial templates are complete software packages that are developed and deployed on multiple live blockchain networks. These templates can be tailored to fit new business requirements and design upon request. They are great bootstrapping components that a business should always choose to start an enterprise blockchain network as we have developed best practices, optimized and tested thoroughly.

In this paper, we also give a case study for one of the Akachain industrial templates: The Loyalty and Rewards Network (LRN). LRN is a novel solution that shows how enterprise blockchain can help to generate new values for services in a very saturated domain. It also shows best practices on how to design an effective (potential) multi-party consensus blockchain network that serves real-life use cases.

For more information on Akachain or enterprise blockchain consultancy in general, please contact us at https://akachain.io

6   Bibliography

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