Analysis of blockchain-based Ripple and SWIFT

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Abstract— Blockchain is one of the modern new edge technologies which is capable of transforming the traditional financial system, especially in the financial industry. Cross-border money transfer is one of the big challenges in terms of security, cost, and other regulatory issues. Presently, the most popular international money transfer system is SWIFT in the financial sector. Ripple is one of the upcoming payment networks for cross-border payment systems based on blockchain technology and uses its own cryptocurrency called XRP. This paper highlights the implementation challenges of SWIFT and Ripple networks. It also underlines the features of whether the blockchain-based application can transform the existing traditional payment system and how the new proposed system works. This paper is also explained how the proposed system has some advantages over the traditional system. Still, SWIFT is the market leader in remitting money for cross-border payments. On the other hand, the Ripple network is an emerging technology that may contribute a lot to cross-border payment in the financial industry in the near future.

Keywords: *Blockchain, SWIFT, Ripple, XRP, Cryptocurrency*

1. INTRODUCTION

Society for Worldwide Interbank Financial Telecommunications (SWIFT) was founded in 1973, where participants were 239 banks in 15 countries. In the year 2021, SWIFT has been processed an average of 42.5 million messages per day [1]. Before implementing the SWIFT service for cross-border payments, the remittance system called Telex was used in the financial industries. SWIFT introduced the standard fixed-size code called SWIFT code, through which the remittance operation has become user-friendly and more authentic [2]. Most of banks are using SWIFT across the globe.

The telex machine is very similar to the typewriter machine that is connected to the printer, where the data is transmitted from the telex machine to another telex machine through a telephonic circuit [3]. The Telex system was used for domestic as well as international money transfer purposes. The free-form message formats were used by the telex machine.

Though SWIFT is very popular, there are still huge liquidity and credit risks that exist in the SWIFT network in financial institutes. Another remarkable drawback is a third-party dependency which may accelerate the fraudulent activity. Clearing settlement or reconciliation unit needs to maintain separately in both ends sender and receiver institute.

On the other hand, the Ripple network has been developed based on blockchain technology which eliminates the intermediator between the sender and receiver banks. The sender bank can make the cross-border payment directly to the beneficiary's bank account without any delay [4]. The blockchain application system maintains the authenticity of the payment by using distributed ledger technology, and the transaction process is completed by using their own digital token or cryptocurrency [5]. Here Ripple is using their own digital currency called XRP.

It works as a digital medium that allows the conversion of the different currencies to XRP [6]. All the transactional data, reconciliation, and settlement are completed instantly in the Ripple network [7]. Transaction in the Ripple network is not possible until synchronizing all the transactional data. Ripple network is very secure and cost-effective, and no additional settlement time is required to complete the whole transactional data in both sender and receiver banks [8].

Though SWIFT is a very renowned cross-border payments platform in the market, the Ripple system has also become an emerging payment network platform due to its reliability, cost-effectiveness, and support for the real-time settlement process, which may replace the traditional SWIFT system. The originality of this paper analyses the core technical functions of SWIFT and Ripple as well as highlights the challenges for the same. This paper also helps the new researcher to work on blockchain-based application systems in the financial sector.

2. SWIFT MONEY TRANSFER SYSTEM

SWIFT system is used to transfer money domestically and internationally among the member institutes of its' network. It is a member-owned cooperative and ensures a safe and secure platform to transfer money. All member institutions are working under a SWIFT network to ensure their identities and all members are holding the unique institution ID number [9]. SWIFT always uses predefined code to send the messages from sender to receiver institute. The SWIFT standard code maintains 4 components called bank code four digits, country code 2 digits, location code 2 digits, and 3 digits for the bank's branch code [10]. For example, the SWIFT code is BCOLBDDHXXX. The first four-digit BCOL is used for bank identification which represents the Bengal Commercial Bank Limited, the next two-digit BD represents the country code for Bangladesh, the third component which consists of 2 digits DH is used to identify the location of Dhaka, and the final three-digit XXX represents the branch code of the bank. The branch code XXX is optional and is used only for the bank's internal purpose of identifying the branch. The other parts of the message body follow the specific SWIFT message format for representing the universal message format. SWIFT can send messages only from one member to another. There are two parts to the SWIFT system: message transfer and payment settlement instruction [11]. The payment settlement instructions are executed at the bank's end. Several standard SWIFT message formats are used to send the message from sender to receiver institution.

2.1 Message Transfer Process

SWIFT message transfer instruction is explained in Fig. 1 below. All the messages are prepared as per SWIFT standard format by the sender. It is sent to the SWIFT network for making the payments to the receiver and other related information as well. For all the messages sent from one country to another country for cross-border payment, SWIFT convert all the message as per their valid standard message format. SWIFT networks not only check the standard format, but they also do the message through a sanction screening software for authentication of the sender and receiver. The message sends by the SWIFT network to the receiver end and one copy is sent back to the sender end for checking the delivery authenticity. Finally, the receiver checks all the payment's instruction validity and contacts the beneficiary of the payment, but the sender gets the latest report on the entire process.

2.2 Payment Settlement Process

The payment settlement process is conducted at the respective bank end and this process is dependent on their procedure. SWIFT payment follows a few numbers of steps. First, the payment originator conducted with his/her bank which is called the originating bank. The originating bank then conducts with the corresponding bank for transferring the cross-border payment to the beneficiary's bank account. The originating bank communicates with the central bank for currency conversion or currency exchange. The central bank then helps to transfer the money from the central bank to the corresponding bank. Finally, the money transferred to the beneficiary's bank account number of the beneficiary's bank account. The corresponding banks for sender and receiver deduct the charges for the transactions. All the corresponding payment instructions follow the standard SWIFT message format, and all the messages are stored in all the above entities, which are verified by sanctioned screening and other international and domestic regulatory requirements. The sender has also updated the entire process.
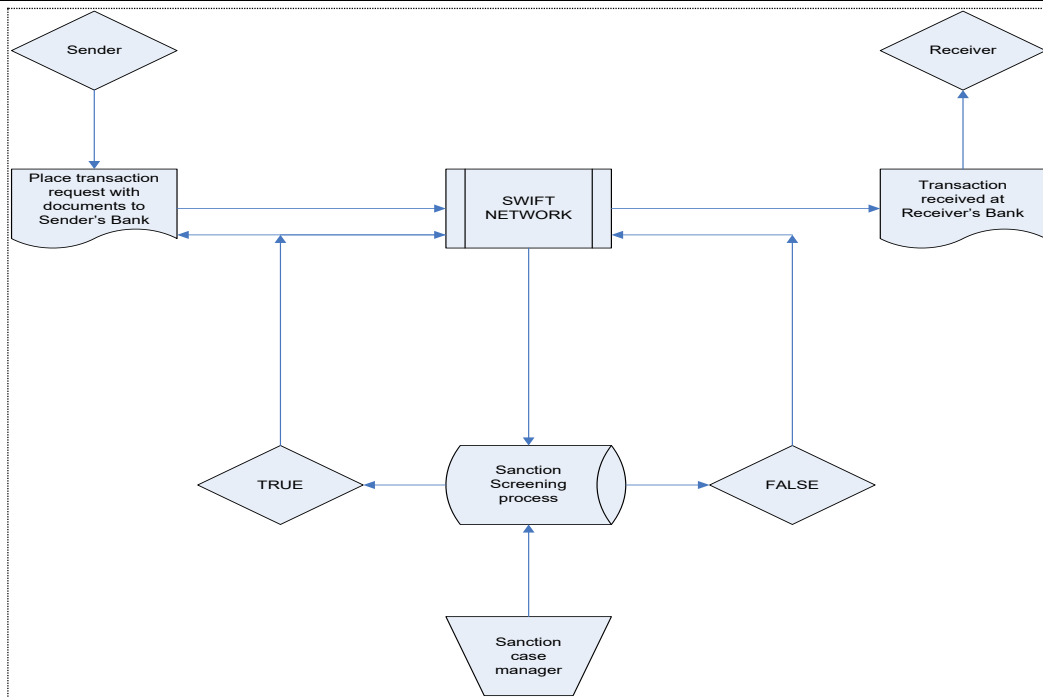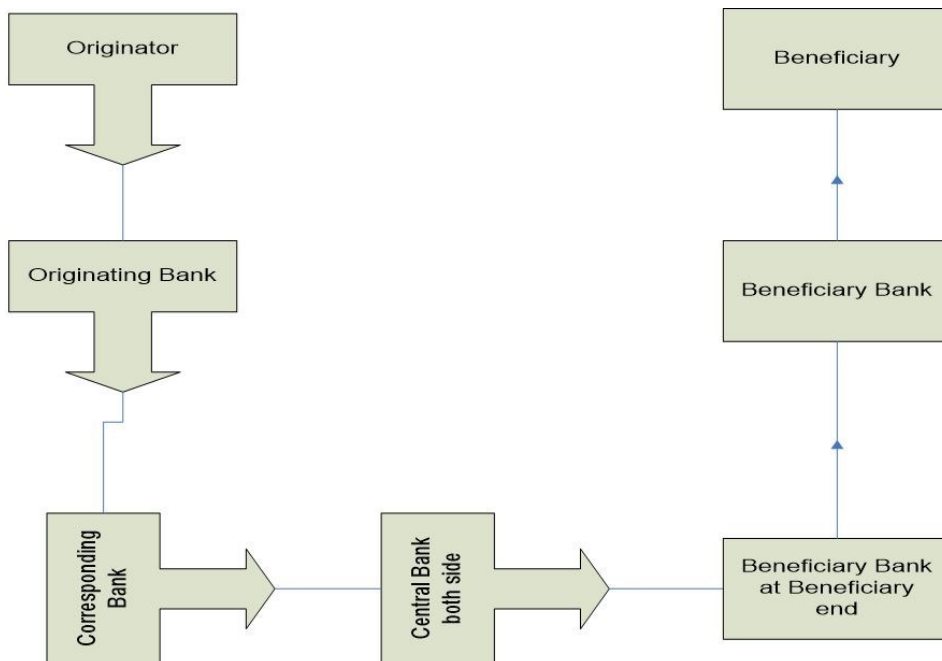
Fig. 1: SWIFT Message Process Flowchart

Fig. 2: SWIFT Payment Settlement Process

As per the above diagram (fig.1 and Fig.2), the SWIFT message transfer flow and settlement process are involved in several steps. But the fund transfer process can be conducted among the several banks in the SWIFT network. The fund transfer or payment can be stopped at any stage if there is any liquidity problem with the bank. In that case, it will take a significant amount of time to complete the settlement process. It means that the transaction process through SWIFT is not synchronized or real-time. On the other hand, the settlement process is taking longer and is less cost-effective.

2.3 SWIFT Implementation Challenges

i) Technology adaptation

Before implementing the SWIFT application in the financial institute, the implementation team should have a full understanding of the business need and must have a clear understanding of SWIFT operational process flows. Selecting the SWIFT implementation partner is another challenge than hiring talents from the industries.

ii) Secure Network setup

Secured Network setup is a very big challenge which is one of the mandatory requirements by the SWIFT organization. SWIFT network should be installed as per their guideline which is challenging and costly as well. This network should be isolated from the other network of the bank, must have deployed the two-factor authentication system, and must follow the SWIFT message formats and other instructions.

iii) Maintenance

SWIFT changes its requirements from time to time which needs to implement promptly to comply with them. They also provide the patches regularly that must have to upload in the SWIFT application. All these changes should be uploaded before doing any transaction in the network.

iv) Anti-Money Laundering (AML)

Nowadays, the AML issue is one of the biggest concerns for financial institutions and regulatory bodies as well. They have strictly followed the regulatory compliance to protect the criminal financing and illegal cross-border money transfer. Before making any payment, the financial institute should sanction the Transaction for cross-border payment and should verify the Know Your Customer (KYC).

v) Intermediator

SWIFT works as an intermediator for making cross-border payments from one country to another. Payment initiators or remitters cannot make payments directly to the beneficiary's account. So, it takes time, and the remitter needs to pay SWIFT transaction fees and other fees to the bank. Security is another big concern in this payment method.

vi) Reconciliation

SWIFT operation is not synchronized. As a result, real-time reconciliation is not possible with this network. IT is a time-consuming and hard job for the banks to run the settlement process due to the huge amount of data. Sometimes banks cannot complete the reconciliation process on time and the Cash flow management becomes very difficult with unreconciled data in the financial institutes.

3. RIPPLE NETWORK

Blockchain is one of the modern technologies which can be used to develop blockchain-based applications for cross-border payment. Ripple is one of the blockchain-supported networks for international cross-border payment. Two features of blockchain technology called Distributed Ledger (DL) and Cryptocurrency are used in Ripple [12]. All the transactions in the Ripple network are real-time, so it transfers the message and fund transfer instructions together [13]. But in the SWIFT operation, the message transfer process and fund transfer process are not synchronized. Ripple uses cryptocurrency tokens that support converting all other currencies to a single currency called XRP. Ripple also uses blockchain distributed ledger technology to pass the Transaction on the Peer-to-Peer (P2P) network [14]. All transactional information and settlement in the Ripple network would be completed immediately once the payment transaction initiates by the sender. Both the messaging and settlement features are exit the Ripple network. Transaction for cross-border payment through the Ripple network is faster than SWIFT. Within a few seconds, payment can be credited to the beneficiary's account and at the same time, settlement is also real-time. So, the cost to transfer the money through Ripple is much cheaper than SWIFT.

The blockchain concept was first introduced by a pseudonymous person or a group of persons called Satoshi Nakamoto in 2009 [15]. Blockchain is a technology that represents the data as a chain of blocks that gather the data in the blocks. It is a list-type data structure, immutable data structure, and cryptographically chains block in chronological order [16]. Each block contains data, the previous block hash value (The first block of a blockchain

contains the initial value, which is '0000'), timestamp, and the transaction data. The previous block hash is the initial hash of the current block. Cryptographic hashing algorithm and digital signature have ensured the consistency of data. Once the data send by the sender, it is not possible to alter the data in the blockchain network. Always blockchain network generates new blocks by solving the mathematical puzzle, and at the same time, all the connected nodes in the network will be updated accordingly. All the consensus protocols in the P2P blockchain network update and validate the newly generated blocks.

Ripple is always maintaining the currency conversion rate among the consortium or member banks. The Ripple network is very transparent to provide the liquidity status of the sender bank; on the other hand, SWIFT can provide the minimum liquidity information of the sender bank.

All corporate and retail customers look for a low-cost solution for making their cross-border payments as well as demand for real-time payment. Still, there are some limitations on the bank's infrastructure and banks are bound to process the payment in batch, with high processing costs and lengthy settlement time.

To address the above, the Ripple application provides an open-ended, neutral protocol called Inter Ledger Protocol (ILP) which brings an efficient, faster, real-time settlement process that removes the settlement risks. Four components help to complete the entire Transaction between sender and receiver for cross-border payment.
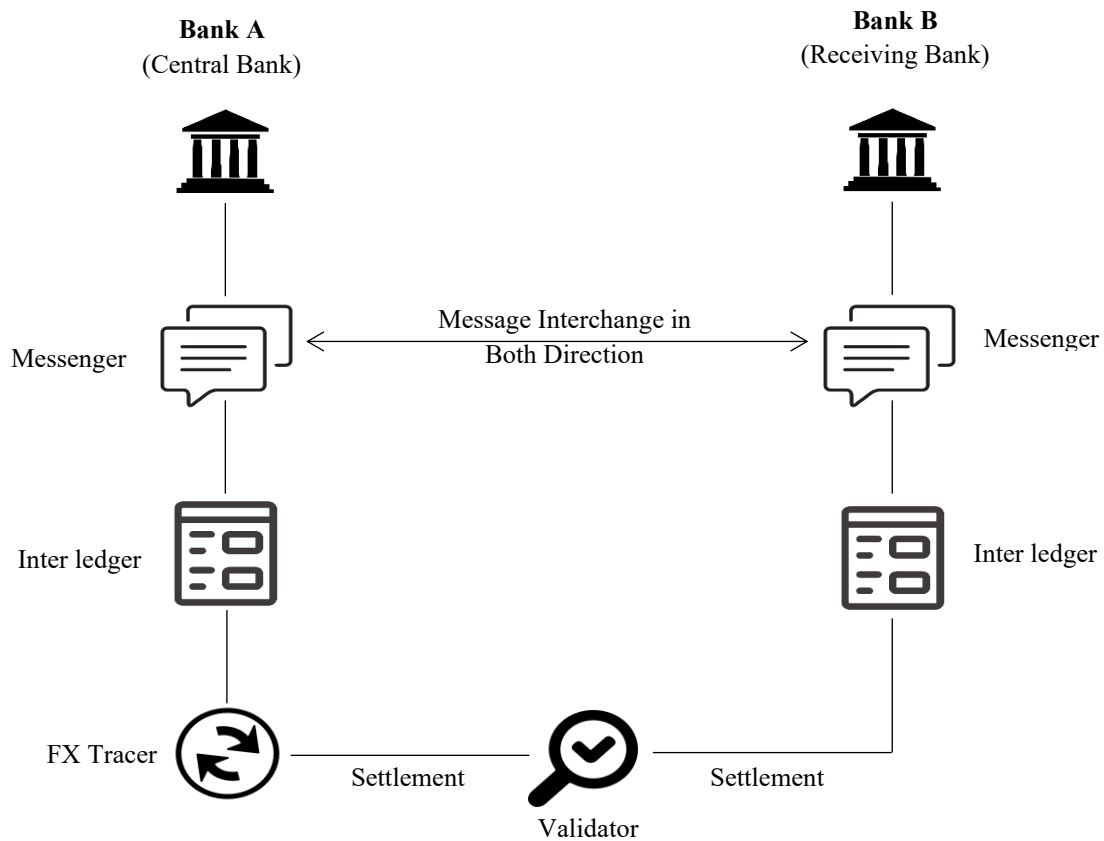

Fig. 3: Ripple Network Transaction Process Flow.

i) Messenger

Messenger establishes the connection between sender and receiver bank through Ripple network. Using this connection, both parties exchange the KYC, foreign exchange rate, charges, mode of payment, and expected time frame. After collecting this information, they send it to the originating bank as well as provide the total transactional cost. Before initiating the Transaction, the transacting party needs to check all the above-mentioned information. The sender then approves the Transaction, and the messenger sends the notification to all the related parties through ILP to settle the fund.

ii) Inter ledger

It is a sub-ledger that records general ledger information of the transacting bank. Inter ledger kept the track records of the transacting parties' debit, credit, and liquidity information. It also helps to do all the settlement processes automatically on a real-time basis. This feature is completely a new feature to the traditional SWIFT system.

iii) FX Ticker

It is one of the components of the Ripple network that provide an exchange rate between the sender and receiver ends' ledger and update accordingly. It also keeps the information of the transacting account, transacting currency, and authenticity of the ILP Ledger. When the sender bank makes the payment, the Fx Ticker sends the information to the ILP Ledger to conduct the settlement process, ensure the validity of the Fx quote and ensure the payment transfer process to the beneficiary's bank Inter ledger. The sender bank converts the local currency to XRP and this XRP cryptocurrency send to the receiver's bank through the Ripple network.

iv) Validator

Validator validates the Transaction cryptographically to the receiving bank whether the Transaction is a failure or a success. It also minimizes the additional settlement time and reduces the transactional cost as well.

With the consideration of technological advantages, transactional efficiency, operational cost, transaction time, and settlement time, more than 100 banks are worldwide are using the Ripple network [17]. On the other hand, SWIFT is a lengthy process that might take additional time to complete the entire process.

3.1 Implementation challenges of Ripple Network

Though Ripple has become a success to use the Ripple network for cross-border payment by using a cryptocurrency called XRP, there are still a significant number of challenges that need to address before going live across the globe. A few numbers of challenges are highlighted below:

i) Technology

Ripple is a used blockchain-based payment platform that is new for most users in the financial industry. The payment method supports its' cryptocurrency called XRP. Ripple uses a consensus mechanism and connects all the member banks in their network. It is entirely vendor-dependent, and technical experts are very rear, especially in financial institutes.

ii) Centralization

The 'Trusted vendor' concept is used to verify the Transaction in the Ripple network to maintain transactional integrity. Users are not entitled to get the incentive to validate the Transaction. So, fewer users are interested in validating the transactions, which leads to high-security risks.

iii) Pre-Mining

The pre-mining protocol is used to release a certain amount of XRP on a regular interval basis. Investors may think that Ripple may generate a huge amount of XRP, and the value of cryptocurrency may be fallen drastically.

iv) Legal Issue

All financial institutes are controlled, supervised, and monitored by the central bank of their respective country. Economic Affairs Committee forum is working on the central bank digital currency issue but not regulated yet. XRP is a cryptocurrency like other cryptocurrencies. Before initiating cross-border payment worldwide, the central bank needs to publish authorized policy guidelines for cryptocurrency or digital currency. To date, central bank policy is not available for XRP or any other cryptocurrency.

v)XRP volatility

XRP is a type of cryptocurrency like other cryptocurrencies. The price of this currency fluctuates like others,

so the investors are worried before investing the money in XRP. Properly addressing cybersecurity is another notable concern of this currency.

4. COMPARISON BETWEEN SWIFT AND RIPPLE NETWORK

Table 1: SWFT vs Ripple

Particulars	SWIFT	Ripple
Mode of operation	Exchange of data.	Exchange of value.
Transaction capability	SWIFT can handle up to 1,000 transactions per second.	Ripple network is capable of handling up to 1,500 transactions per second.
Members	More than 11,000 member institutions.	More than 100 member banks.
Intermediator	SWIFT works like an intermediator between sender and receiver institutes.	Intermediator is not required. The sender bank can pay directly to the beneficiary's bank account
Currency handle	All types of currencies are supported by SWIFT.	Support only own cryptocurrency called XRP.
Controlling authority	Controlled by regulators and central banks of the respective country.	Controlled by the vendor itself. Not controlled by central banks and regulators.
Consensus protocol	No consensus protocol is used in SWIFT	The consensus protocol is a mandatory requirement to initiate any transaction.
Platform size	biggest payment platform for Cross-border payment in the financial industry.	At the initial stage.
Payment settlement process	The payment settlement process is complicated and lengthy.	Ripple network supports the real-time payment settlement process.
Network Speed	Transaction completion time from sender to receiver is comparatively slow than Ripple network.	Due to the real-time nature of payment, the Transaction can complete within a few seconds.

5. CONCLUSION

The traditional method for cross-border payment SWIFT network is much slower than the blockchain-based Ripple network. The payment settlement process is a very complicated and high risks bearing system in SWIFT. On the other hand, the transaction and payment settlement process is completed together on a real-time basis. Though. SWIFT is the leader of the remittance market in financial sectors, especially for cross-border payments. Ripple will dominate the payment industry within a short period. Ripple networks support the cryptocurrency, distributed ledger, using cryptographic digital signature, and highly secure technological platform which supports pay directly from sender to beneficiary's bank account. But SWFIT does not support the distributed ledger and cryptocurrency which leads to slow the payment process. Transaction turns around time support 24X7 with low transactional cost in Ripple network. The Ripple network is developed based on the new technology that will bring a new dimension, especially for the cross-border payment in financial industries.

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