

Assessing the Ripple Protocol: Implications of Distributed Networks and Digital Currencies for Retail Payments

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Abstract

High barriers to entry have created fragmented payment systems and a reliance on numerous intermediaries for cross-border and cross-network payments. Antiquated infrastructure has limited connectivity, while non-competitive markets drive up costs and risk.

Increasing globalization and greater demand for faster payments are highlighting the shortcomings of today's payment systems. Many of these inefficiencies can be minimized or resolved by replacing antiquated infrastructure.

Emerging technologies offer a modern alternative for payment infrastructure. This paper assesses the impact of the Ripple protocol, including its distributed network, competitive funding market and digital currency. The Ripple protocol enables real-time 24/7/365 bilateral settlement for same and multi-currency transactions. As neutral infrastructure, Ripple standardizes, distributes and flattens the cost of transactions, enabling new payment products and an improved consumer experience.

Ripple's ability to facilitate direct integration into payment systems and improved transaction economics allows banks to offer (1) greater payment reach at lower costs, (2) real-time cross-border settlement for low-value and micropayments, and (3) 24/7/365 access to settlement with improved transaction monitoring capabilities.

This paper contains a summary of today's payment systems, a description of payments via Ripple's distributed network, and an assessment of this emerging technology on payment networks and retail payments.

Key words: Ripple, distributed network-based payment system, digital currencies, real-time settlement system, cross-border payments, payment system integration, settlement protocol

Introduction

Opportunities to improve payment systems

Despite much innovation, retail payments across borders remain a complex and imperfect experience. Fragmented payment systems limit interoperability, force reliance on numerous intermediaries, and add costs and delays to settlement.

Consumers and businesses that either live near or conduct business across borders are often burdened with the high cost and limited options for payments. Many rely on multiple bank accounts in order to accept and use various currencies.

Some countries have realized the need for improved payments and have taken the initiative to upgrade payment rails. However, these efforts have not yet enabled seamless interoperability or fully minimized costs and structural inefficiencies.

Increasing globalization is emphasizing the shortcomings of today's systems, driving demands for modernization from all players in the payments ecosystem:

- Consumers are seeking a more seamless payments experience with faster settlement and greater geographic reach, particularly for cross-border payments or payments between networks.
- Banks are seeking greater efficiency, lower liquidity costs, new revenue potential, and better compliance capabilities.
- Regulators are seeking reduced fragmentation through greater interoperability, lower systemic and operational risk, and improved transaction visibility.

The source of today's inefficiencies is either the increasingly antiquated infrastructure of existing systems or the complete lack of infrastructure between systems. Modernizing the technology that underpins payment systems can reduce many structural inefficiencies, allowing banks to improve their retail payment products.

Emerging technologies including distributed networks and digital currencies offer new possibilities and benefits for future payment infrastructure. This paper examines the potential of using these technologies through the adoption of the Ripple protocol, a digital settlement standard designed for banks and payment systems. The Ripple protocol creates an efficient infrastructure that empowers incumbents and networks to meet the evolving retail payment needs.

Method of evaluating new technology

The theme of this conference is balancing innovation, trust, and regulation in retail payments. Properly balancing these priorities requires a keen focus on the end goal, which the European Central Bank and the Suomen Pankki describe as the following:

Central banks in the euro area strive to strike the right balance between improving the efficiency of retail payment services, safeguarding trust in payment systems and fostering further market integration in an environment that is still prone to fragmentation.¹

Along this backdrop, this paper presents the Ripple's protocol in the following sections:

1. Understanding the Ripple protocol
2. Assessing Ripple's impact on the end goals of:
 - Improving efficiency in retail payments
 - Increasing resiliency, security, and trust of payment systems
 - Enabling integration and reducing fragmentation
3. Implications for retail payment products and user experience
4. Regulatory considerations for adopting distributed networks and digital currencies

¹ European Central Bank, Call for papers, "Getting the balance right: innovation, trust and regulation in retail payments," http://www.ecb.europa.eu/events/conferences/html/150604_retpaym.en.html.

1. Understanding the Ripple protocol

The state of payments today

Payment networks consist of several layers. Starting at the top, networks have services, which are the applications and consumer-facing interfaces to initiate or edit transactions. In many geographies, payment innovation has been focused on this layer.

The next layer down consists of instruments, or the tools that facilitate transactions. Included in this layer are banks' systems, risk management procedures, and transaction monitoring tools.

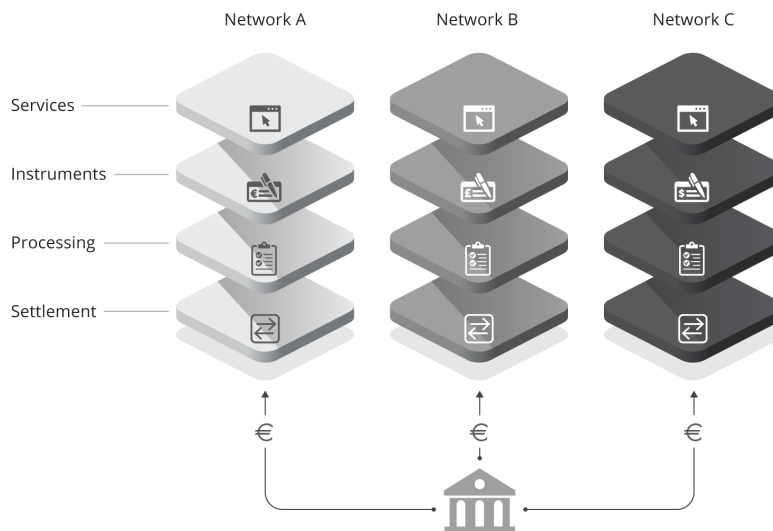
Beneath instruments is processing, which includes the rules, governance, message standards, and clearing and netting of transactions.

Finally, the bottom layer and foundation of a network is the settlement infrastructure. For decades this layer remained unchanged for many payment systems. Some countries have made recent efforts to modernize payment infrastructure, yet others still rely on antiquated technology that is decades old in some cases.

Each network – either in the same payment region or across borders – has a central counterparty with its own unique or proprietary layers, making interoperability between networks challenging or impossible.

To access broad reach in payments, banks must join numerous networks, each of which requires integration costs, reserves and ongoing maintenance. This is an expensive and resource intensive effort.

Figure 1: Payment Networks Today



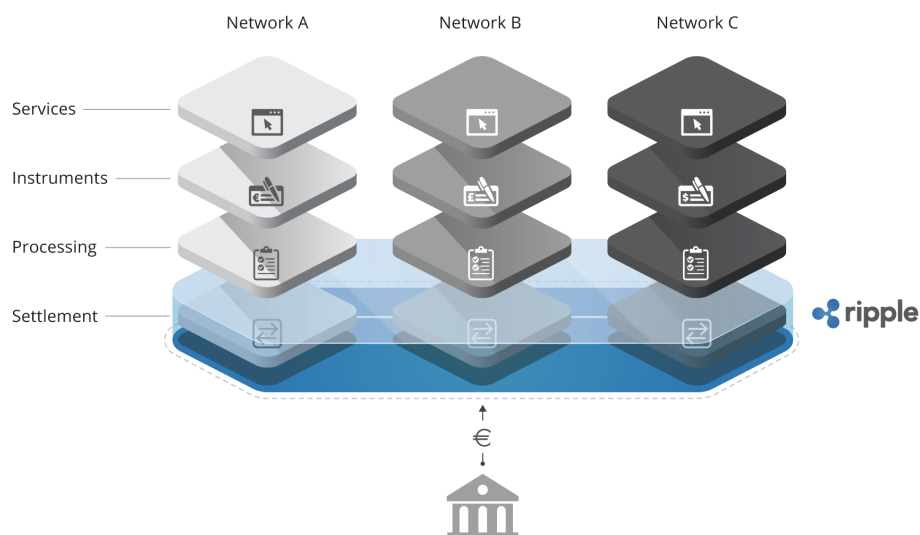
Many banks lack the size, resources, or payment volume to justify direct integration in multiple networks, so they rely on correspondents to access other domestic or cross-border networks. Relying on numerous intermediaries requires reserves or collateral, and introduces additional costs and counterparty risks. If these costs and risks are not feasible, a bank goes without access to the network. These conditions have created high barriers to entry, resulting in a fragmented system with reliance on intermediaries.

The first neutral settlement protocol

Payment networks can minimize or eliminate many of the costs and risks of today's fragmented system by adopting the Ripple protocol, a neutral settlement standard that serves as the foundational layer of a payments system.

As neutral infrastructure, Ripple incorporates the existing messaging standards, governance, and rules of the networks that adopt the protocol. Ripple does not replace or show preference for any existing networks, rather it is used by networks, banks, and clearing houses to enable increased efficiency and interoperability through a common platform.

Figure 2: Connectivity Through the Ripple Protocol



Ripple enables interoperability through the use of an open Internet protocol-based technology called RTXP, or the Ripple Transaction Protocol. RTXP is a common digital standard for payments that can be freely adopted by financial institutions.

Open Internet protocols have been used to solve connectivity issues in other sectors. For instance, in the early days of email, each email domain was a siloed, closed system, much like payment networks today. Users of one email domain were only able to communicate with others on that domain, forcing users to hold accounts with multiple domains to reach a broader number of recipients.

These inefficiencies and structural barriers were eventually resolved when email providers adopted the SMTP Internet protocol, an open standard that underpins the interoperable email system we know and use today. SMTP enables connectivity between all email domains, making email much more efficient.

Similarly, the Ripple protocol is an open digital standard that enables payment systems and banks to connect seamlessly, much like SMTP has done for email. Financial institutions would no longer be burdened by separate integrations and reserves for each payment network; rather, they could simply integrate the Ripple protocol once and use the payment networks build on top of the protocol.

As open, neutral infrastructure, Ripple modernizes the foundational layer of payments, bringing efficiencies and benefits to rest of the payment network. In addition to the RTXP settlement standard, there are three crucial components of Ripple:

- A record of balances without a central counterparty
- A competitive market for funds exchange and delivery
- A digital asset ensuring operational efficiency and security

A record of balances without a central counterparty

Ripple features a ledger that bilaterally clears and settles payments between banks and payment systems in real-time. Unlike today's networks which typically rely on a central counterparty for executing and confirming transactions, Ripple transactions are cleared via consensus: a process native to Ripple by which a collection of authorized counterparties validate transactions through a distributed network.

The consensus process settles transactions every 3 to 6 seconds (near real-time) 24/7/365. Having many parties engage in consensus via a distributed network maximizes operational redundancy, thereby minimizing risk of systemic failure.

The distributed network eliminates the single point of failure that exists in networks with a central operator. On a distributed network, a large majority of the independent parties that participate in consensus would each have to be compromised to disrupt Ripple's operations.

Further, financial institutions that use Ripple are no longer restricted to the technical capabilities and settlement hours of the one central counterparty. Consensus enables real-time, low-cost 24/7/365 clearing and settlement without reliance on a central counterparty.

A competitive market for funds exchange and delivery

When making cross-border transactions today, banks are subject to the FX dictated by their correspondent. The reliance on a single FX provider poses several risks. If the provider is temporarily unable to facilitate the transaction, banks are left with few alternatives, as the cost of switching providers is significant. The reliance on one FX provider paired with high switching costs yields limited currency liquidity and inherently uncompetitive FX rates for cross-border transactions.

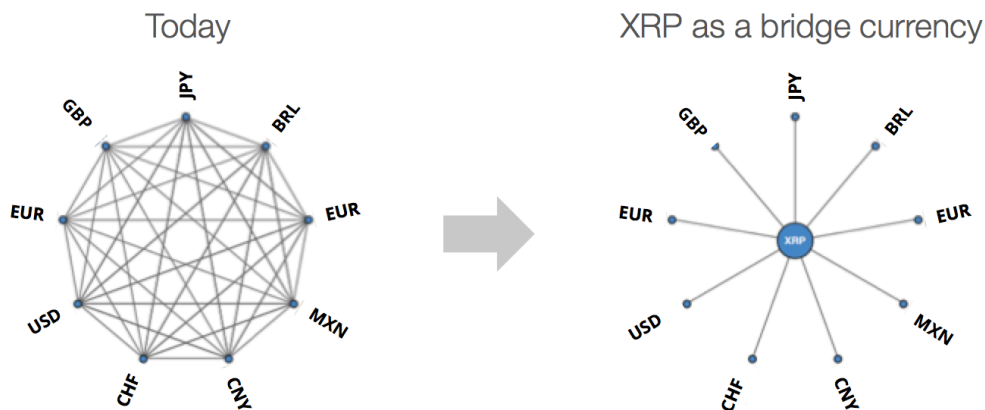
Ripple structurally changes the process by opening FX up to a competitive marketplace. Authorized liquidity providers post bids to facilitate currency exchange. Ripple routes transactions through the lowest FX rate, reducing a material cost and minimizing banks' risk associated with having only one FX provider. This arrangement allows banks to outsource the financing of their payments and frees up working capital.

XRP: Digital asset ensuring operational efficiency and security

The advent and adoption of Bitcoin brought attention to digital currencies; however, most discussions have focused on their use as a means of exchange and a store of value. The Ripple protocol deploys a digital currency as well, called XRP, but in two very different ways: as an optional bridge currency between illiquid markets and as a security mechanism.

XRP is the only native asset on the Ripple protocol; all other funds are IOUs that are backed by deposits in the banks' accounts. This allows XRP to be used as a common denominator between currencies on the network, a helpful attribute in the event that a payment needs to be made between two rarely traded currencies. In this illiquid market, the sending and receiving bank may opt to use XRP as a bridge between the two currencies, creating an efficient transaction path.

Figure 3: XRP Improves Efficiency as a Bridge Currency



In this role XRP ensures operational efficiency in currency exchange. It is important to note that use of XRP as a bridge currency is completely optional. Users can freely opt to transact only in fiat currencies.

XRP's second role is as a security mechanism. All users are required to hold a small reserve of 20 XRPs to use the protocol.² A small fraction of an XRP is destroyed with each

²As of 28 January 2015, 20 XRPs equated to €0.25.

transaction. In this way XRP is similar to a postage stamp for transactions on the protocol. The small portion of the XRP that is destroyed is not a fee collected by anyone, rather a cost of using the protocol.

Under normal network volumes, this XRP cost remains very small. However, in the event that a participant tries to overwhelm the network with illicit activity – for instance with a denial of service attack – the Ripple protocol will exponentially increase the cost of each transaction. This feature quickly bankrupts the bad actor of its XRP reserve, prohibiting any additional traffic from its account.

In this role, XRP ensures the security and stability of the Ripple protocol at a minimal cost to users.

2. Assessing Ripple's impact

Ripple's open protocol, shared ledger, FX marketplace, and digital currency offer a modern foundation for payment systems. This section assesses the ability of Ripple's unique qualities to meet the objectives of the European Central Bank and the Suomen Pankki:

- Improving efficiency in retail payments,
- Increasing resiliency, security, and trust of payment systems, and
- Enabling integration and reducing fragmentation.

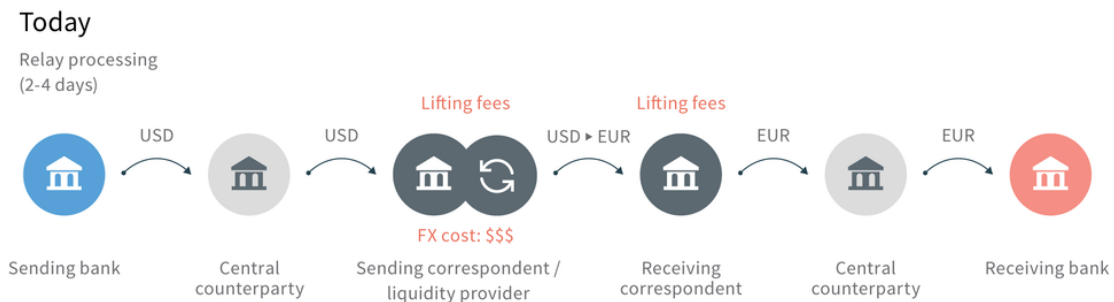
Objective 1:

Improving efficiency in retail payments

For cross-border transactions today, banks send payment messages through a global network provider (e.g. SWIFT) but must rely on a complex patchwork of correspondents and intermediaries for settlement.

A sending bank and its correspondent connect via a central counterparty. The sending correspondent charges a lifting fee and an FX fee for the transaction, then passes the payment to a receiving correspondent. The receiving correspondent charges a lifting fee and connects to the receiving bank through a central counterparty. This process can take between two to four days given the institutions and currencies involved.

Figure 4: Today's relay processing (2-4 days)



This fragmented settlement process adds costs, delays, and risks for cross-border (and cross-network) payments:

- Principal risk (also called *Herstatt risk*) is the outright loss of a payment when an intermediary or counterparty receives the funds but fails to provide the corresponding currency or extend the payment to the next intermediary.
- Replacement cost risk is the cost of replacing a failed payment with a new counterparty at a new market price.

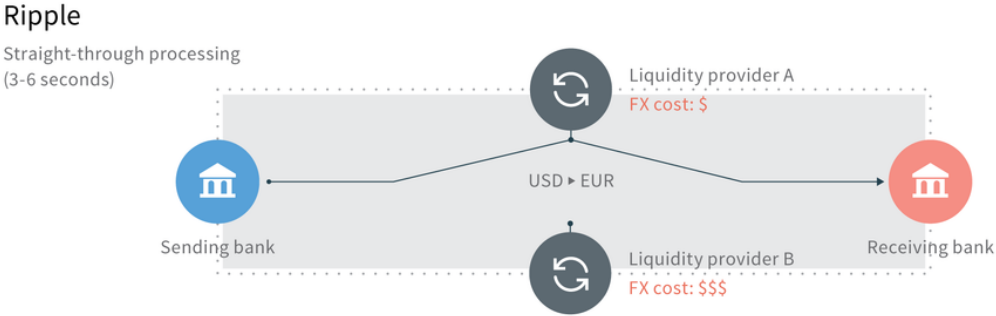
- FX risk is the risk of a change in exchange rates during the timing gap between the agreement of the rate and the actual conversion of currency. Since settlement occurring through intermediaries can take up to four days, FX risk can be substantial with some currencies.
- Operational risk is the cost and time of manual error resolution. Since banks must rely on intervention from their correspondent to resolve errors, the process can take several days and often involves fees assessed by the correspondent.

These risks and related costs create a system that is only feasible for high-value payments.

Minimizes costs and risks through real-time bilateral payments

The Ripple protocol enables bilateral payments – direct from sending to receiving banks – in real-time. This straight-through processing circumvents the chain of intermediaries along with their costs, delays, and risks.

Figure 5: Ripple’s straight-through processing (3-6 seconds)



Unlike today’s systems, which operate with delayed settlement and sequential processing, payments in Ripple are either fully and simultaneously settled in real-time or they do not occur at all -- a process called atomic payments. This eliminates or reduces many of the risks that plague today’s reliance on intermediaries for cross-border payments, including:

- Principal risk - since payments settle bilaterally in real-time, Ripple eliminates the risk of failure along the chain of intermediaries. Atomic payments enable two-way simultaneous settlement, either fully settling or not settling at all. This makes it impossible for a transaction to fail during the payment path.
- Replacement cost risk - since payments fully settle in real-time, there is no possibility that a payment will fail several days after being initiated. Therefore, sending institutions do not have to account for the risk and cost of replacing a failed transaction with a new intermediary and a new market price several days later. If for some reason a payment cannot be completed on Ripple, the sending bank knows immediately and can make adjustments accordingly.

- FX risk - with the FX conversion and settlement occurring in real-time, Ripple minimizes the foreign currency risk arising from the timing gap between the agreement of the rate and the actual conversion of currency.
- Operational risk – the direct connection between the sending and receiving institutions provides real-time transaction confirmation and enables them to immediately resolve errors without reliance on intermediaries.

Ripple's straight through processing and bilateral settlement minimize many of the costs and risks of cross-border payments, resulting in a faster, more efficient payment systems.

Maximizes payment reach while minimizing reserve requirements

Today, a bank must place reserves or collateral at its correspondent to minimize counterparty risk. As each correspondent typically only serves select markets or networks, a bank must maintain multiple correspondent relationships to maximize payment reach. This ties up significant amounts of working capital.

Ripple provides a more capital efficient solution while simultaneously enabling greater payment reach. Bilateral settlement obviates the need for correspondents and eliminates multiple reserve requirements. Instead of posting reserves at each correspondent, banks only have to allot one reserve to Ripple, which enables access to all the currencies, market makers, and payment networks on the protocol.

Enables 24/7/365 settlement in real-time

Today, banks are bound by the technological limitations and operating hours of the network's central counterparty. This may limit transaction speed and the restrict settlement to specified times.

Ripple replaces the central counterparty with a distributed network and consensus process discussed in the previous section. This enables low-cost, real-time settlement 24 hours a day, seven days a week, 365 days a year. The increased settlement speed and continuous access to payment services vastly improves the efficiency of networks.

Reduces FX costs through a competitive marketplace

Today, banks have to fund their own transactions and typically have to rely on their correspondent for currency conversion. This non-competitive arrangement results in high transaction, capital and FX costs.

Given that only a handful of institutions have the size and international presence to serve as a correspondent, settlement of cross-border payments is largely concentrated in a small group of global money center banks, leaving most banks with few alternatives if their correspondent ceases operations.

Ripple reduces these costs through hosting a competitive market of FX liquidity and cash accounts to fund payments. Liquidity providers bid on currency conversion and offer excess

cash liquidity for others to leverage in funding their transactions. This allows Ripple to offer pre-funded and credit models as well as support hybrid systems.

Ripple routes transactions through the most reliable, lowest-cost liquidity provider. By offering outsourced funding and hosting FX conversion in competitive market, Ripple minimizes FX costs, maximizes currency liquidity, reduces transaction costs and eliminates the risk of relying on one FX provider.

Objective 2:

Increasing resiliency, security, and trust of payment systems

Enables complete fund traceability and transaction visibility

Today's system provides little transaction visibility for sending and receiving banks. Transaction paths are typically opaque at best, complicating balance confirmations, audits and AML compliance. Banks have little to no insight into the transaction path, lifting fees and counterparties as funds move across borders.

Figure 6: Limited Transaction Visibility in Correspondent Banking



Bilateral connectivity and Ripple's shared ledger enables full funds traceability between sender and receiver. Further, banks can exchange more payment information (e.g. fee pre-disclosure; balance validation; confirmation) before and after settlement.

The transparency offered by Ripple's ledger has the potential to greatly improve the industry's AML efforts. Through enhanced AML capabilities, Ripple enables more-complex transactions while lowering banks' cost of compliance. Importantly, personally identifiable information like account numbers or customers' unique identifiers are not stored on the ledger.

Reduces systemic risk: no single point of failure

The distributed network created by the Ripple protocol maximizes redundancy across the parties on Ripple. Through this approach, systemic operation does not rely on any single party, rather it is shared across the participants. While the failure of a central processor would disrupt the operation of one of today's networks, on Ripple a large majority of independent participants would need to fail for the system to cease operating.

Unlike networks that use a central processor and other technologies that require "mining", it is impossible for control or power within Ripple to become concentrated in any one or few parties. Ripple's distribution minimizes systemic risk and improves operational resiliency - essential aspects of a trusted payment system.

Improves information security and reduces cyber threats

While cyber security is a top priority for the financial services industry, sending payments through numerous intermediaries increases the opportunities for information to be breached.

Further, banks using correspondents do not have control over or visibility into the payment path. Payments could be sent through institutions in jurisdictions that require disclosure to regulators and government agencies.

Ripple's bilateral payments – direct from sender to receiver – eliminate the intermediaries and many opportunities for data breach. Ripple helps safeguard information, improve information security, and ensure payment data is not unnecessarily shared with outside parties.

Eliminates conflicts of interest as neutral infrastructure

Ripple is designed to be a neutral payments infrastructure, meaning it is currency agnostic and, like email and other standards, shows no preference to any country, jurisdiction, or system.

Ripple leverages the governance and messaging standards of the payment networks that adopt the protocol, making it flexible infrastructure without conflicting interests.

Objective 3:

Enabling integration and reducing fragmentation

Drives greater access to payment systems

As common settlement infrastructure, Ripple standardizes, minimizes and distributes its costs across all parties that adopt the protocol, enabling it to lower the barriers for direct participation in payment networks.

As a neutral infrastructure, Ripple supports the rules, governance and standards of existing networks, allowing banks to adopt the protocol without disrupting their existing business practices.

Being an open protocol allows banks to freely adopt the Ripple, replacing multiple integrations and access fees for proprietary products. Ripple eliminates the need to post reserves or capital for each network, allowing banks to post one common reserve that can be leveraged for all networks using the Ripple protocol. This improves banks' liquidity and enables more efficient capital allocation.

The removal of intermediaries eliminates or minimizes many of the associated costs, delays and risks. (See Objective 1 for a detailed discussion of risks.) Additionally, Ripple replaces one FX provider with a competitive marketplace offering improved currency liquidity at lower prices.

Ripple flattens the cost of payments, lowering the marginal transaction cost to as close to zero as possible. These attributes enable participation in networks for financial institutions that previously lacked the size or payment volume to justify direct integration.

Enables interoperability without sacrificing autonomy

Many regions seek the efficiency and cost savings of seamless payment interoperability. Yet few are willing or able to sacrifice their own autonomy and adopt a common settlement currency. This is particularly true for tightly linked economies, such as the countries in the Nordic region (Denmark, Finland, Norway, and Sweden) and for regions that may one day wish to connect their multiple payments systems, such as in Africa. While sharing a common settlement currency increases the likelihood of successful regional payments integration, this is not feasible in all circumstances.³

While central banks in the Nordic region may consider building separate interlinked systems for settling multiple currencies, this effort, while valiant, only provides reach to the currencies directly involved.

Ripple offers a single infrastructure for multi-currency clearing and settlement, enabling regions to retain their own currency and autonomy while benefiting from more seamless cross-border payments with less costly FX. Integrating the Ripple protocol in the Nordic

³ Dr. Leo Lipis, "SWIFT Institute Working Paper No. 2014-005: Cross-Border Low Value Payments and Regional Integration: Enables and Disablers," SWIFT Institute, 26 November 2014.

region enables interoperability between Denmark, Finland, Norway and Sweden, and simultaneously enables access to other global regions, currencies, and networks.

Aligning data and messaging standards is a crucial part of regional payments integration. Ripple being neutral infrastructure supports existing rules, standards and governance. Adopting Ripple does not disrupt the ongoing work to harmonize standards, rather supports the existing progress and future outcome.

Altogether, Ripple offers a low-cost solution for seamless multi-currency settlement with broader reach than many existing or emerging options.

3. Implications for retail payments and user experience

Ripple's improved access to and economics of payments enables many benefits for end-users. Consumers can enjoy greater payment reach at lower costs, access to low-value and micropayments, and 24/7/365 real-time settlement.

Greater payment reach at lower costs

Today, the high cost of establishing a new correspondent relationship to facilitate payments to a new region deters banks from offering greater geographic reach for cross-border payments. Modernizing settlement infrastructure with the Ripple protocol allows banks to offer greater payment reach at a lower cost than possible today.

Removing the risk of relying on intermediaries and the costs of holding relationships with multiple correspondents, Ripple lowers the barriers for banks' direct participation in payments. Replacing one provider for FX with a fully competitive market for funding and currency conversion, Ripple standardizes and flattens transaction costs to as close to zero as possible.

Banks gain access to the networks, market makers, and currencies on Ripple from their one reserve, replacing today's capital-intensive market structure that requires multiple reserves and collateral.

Through enhanced access and competitive pricing, Ripple enables banks to offer their customers greater geographic reach at lower costs. More direct integration into payment networks drives banks to compete on services and costs – resulting in improved retail payment experiences at lower costs for consumers.

Access to low-value and micropayments for the first time

The high cost structure and risks of today's system makes cross-border payments (and in some areas real time gross settlement) only feasible for high-value transactions. However, Ripple's ability to minimize costs and risks make real-time settlement of low-value and micropayments feasible for the first time.

Ripple makes it economical for a bank to introduce low-value cross-border payment products that are not possible today. Consumers can enjoy greater payment reach without the monetary and efficiency costs of managing multiple accounts across geographic borders.

Improved payment experience via 24/7/365 real-time settlement

Today, settlement (and in some cases access to payments) is limited by the technology of the central counterparty. Ripple replaces the central counterparty with a distributed network that facilitates real-time payments 24/7/365.

Ripple replaces the delays from daylight and batch settlement, allowing banks to offer consumers continuous access to payments that settle in real time. Further, bilateral payments on Ripple – direct for sending to receiving institutions – enable greater customer experience through improved tracking, immediate payment confirmation, and real-time error resolution.

4. Implications for regulators and governments

Benefits for regulators and governments

The benefits for banks and end users are matched with those for regulators and governments.

The increased interoperability, reduced transaction costs, and improved network access allow central banks to build more seamlessly connected payment systems without having to select a common settlement currency. Ripple's ability to enable low-cost multi-currency settlement empowers central banks to retain their autonomy while improving their global connectivity.

Ripple removes material costs to cross-border transactions, supporting countries' efforts to improve global trade and economic growth.

Importantly, central banks, regulators and governments can enable greater connectivity without the tradeoff to security and control. As a neutral protocol, Ripple allows users to retain their transaction threshold and improves transaction monitoring. The reduction in fragmentation and elimination of a single point of failure reduces the systemic risks and improves resiliency and stability.

Altogether, Ripple enables connectivity and interoperability with less risk and greater transaction visibility, producing a more efficient and safer global payments system.

Balancing innovation and regulation

To ensure payment systems can take advantage of these benefits, there are regulatory considerations for governments and central banks.

Ensure regulations account for the new technologies that will be necessary for creating a more competitive, inclusive, and efficient payment system

Emerging technologies should rightfully be subject to regulators' safety and security standards and be held to the regulatory requirements of other enabling technologies. However, regulators must consider how their rules and oversight should be applied to new technology solutions.

For instance, regulatory requirements for payments reflect the existing systems, which generally assume a centralized operator. Yet, this assumption is not applicable to distributed networks, which do not rely on a central controller.

As an alternative governance model, distributed networks offer many benefits to payment systems: the elimination of systemic risk that stems from a single point of failure; maximized operational redundancy to improve system resiliency; and the distribution of trust across parties to eliminate the concentration of control in one entity.

For payment networks to leverage these benefits, regulators should ensure their rules are applicable to and inclusive of emerging technologies. The application of some rules may need to be revisited to reflect the alternative governance models of emerging technologies.

Recognize the various use cases of digital currencies

Most market and regulatory discussions of digital currencies focus on their use as a medium of exchange and a store of value. These use cases are applicable to the majority of digital currencies, but when writing regulations, it is crucial that regulators understand and reflect the other use cases of digital currencies.

Ripple includes a native digital currency (XRP) but deploys this tool in a very different way than other digital currencies. XRP serves operational efficiency and security roles within the Ripple protocol.

Within Ripple, XRP acts as a common denominator between all currencies. In the event of an illiquid market, especially between two rarely traded currencies, participants can opt to use XRP as a bridge currency to create an efficient transaction path. XRP maximizes liquidity between currencies and ensures efficiency of the system.

Further XRP acts as a postage stamp for transactions sent across the Ripple protocol. With each transaction, a small portion of a participant's XRP reserve is destroyed. In normal, proper use of Ripple, the amount destroyed is a small fraction that is inconsequential to a user.

However, if a bad actor tries to overwhelm the network with illicit traffic (for instance issuing a denial of service attack), Ripple exponentially increases the cost of transacting, bankrupting the user of its XRP reserve. This prohibits the bad actor from sending any additional transaction across the protocol, ensuring security and resiliency of Ripple.

To ensure payment systems can take advantage of these benefits, regulators should ensure their rules and guidance accommodate these alternative use cases of digital currencies.

Enable startups and smaller companies to contribute to payment system innovation

One of a regulator's primary responsibilities is to ensure the safety and soundness of the system. To fulfill this role, regulators issue requirements for industry participants, service providers, and third-party vendors. These requirements help minimize systemic risk and ensure a resilient ecosystem.

In crafting and applying these rules, regulators can support innovation by issuing a flexible framework rather than proscriptive guidance. Putting forth inflexible or one-size-fits-all regulation will exclude startups and smaller companies – typically the drivers of innovation – from participating in the payments system.

To create a more competitive and innovative system, regulators can create a tiered, risk-based regulatory scheme that considers the size and unique circumstances of each participant. Holding startups and smaller companies to the same expectations as large companies may prohibit them from participating and undermine the efforts to foster an innovation and competitive system.

A tiered approach would grant greater flexibility to startups and then increase expectations as they mature or begin to serve crucial functions within the system. Ensuring rules enable firms of all sizes to participate helps foster a diverse and vibrant ecosystem necessary to create a leading payment system.

Encouragingly, the UK's new Payment System Regulator (PSR) has shown intentions of balancing safety and security with the need to create a competitive, innovative payment system. To do so, the PSR proposed taking a flexible governance approach that considers the size and circumstances of each participant. This approach will help ensure the UK payment system can benefit from the contributions of startups and smaller companies.

In the United States, the New York Department of Financial Services (DFS) has also shown intent of balancing regulation with innovation. In crafting requirements for a digital currency license, the DFS included a 2-year transitional license for startups. Without this provision, startups would not have been able to meet the expectations for mature companies and would be excluded from contributing innovation and competition. This is a great example of a tiered approach to regulation that balances oversight and safety with innovation.

Take a holistic view of risk

New technologies present new risks and deserve careful consideration before implementation. However, many of these risks are known and can be mitigated.

Regulators should take a holistic view, also considering the risks from reliance on antiquated infrastructure. As these risks are not always as apparent as the risks that come with a new

technology, they are often underappreciated, yet can pose serious threats to a system's operational resiliency.

Balancing the risks of the current systems with those of emerging technology ensures a prudent approach to innovation and safety.

Understand the role of open protocols in banking

Open protocols are prominent tools used to enable connectivity and interoperability. Section 1 of this paper discussed the use of SMTP to seamlessly connect email domains. The Ripple protocol facilitates connectivity in payments, but it is not the first application of an open protocol in finance.

One primary example is the development and adoption of the Advanced Message Queuing Protocol (AMQP), a standard used to order, translate and route payment messages across diverse programming languages that were not previously interoperable.

AMQP was started and developed by the banking industry as an alternative to proprietary standards that did not allow connectivity across systems. J.P. Morgan Chase led the development of AMQP in 2003, organizing a working group of international banks including Bank of America, Credit Suisse, Deutsche Bank, Barclays, and Goldman Sachs.

AMQP has been adopted globally to enable connectivity in banking. J.P. Morgan Chase sends one billion messages using AMQP each day.⁴ The Deutsche Borse was the first financial exchange to adopt AMQP, enabling users to better monitor positions and risks.

Being an open standard has allowed non-banking sectors to adopt and benefit from the protocol as well. AMQP is currently being used by the defense, telecommunication, and manufacturing sectors at organizations including Google, NASA, the Government of India, AT&T, and the U.S. National Science Foundation.

Another widely used open protocol in banking is the Financial Information eXchange (FIX) protocol. FIX is an open standard used by buy and sell-side firms, trading platforms and regulators to facilitate securities transactions.

FIX was developed in 1992 to allow Fidelity Investments and Salomon Brothers to share trading information electronically, instead of verbally over the phone. FIX has evolved to become the de facto standard used by virtually every exchange, investment bank and financial firm.⁵ The use of the FIX open standard has enabled connectivity and interoperability with firms globally.

Open protocols underpin connectivity in banking and many other sectors. When assessing open standards for payments, it is crucial for regulators to understand their value, existing use cases, and potential applications.

⁴ Source: Advanced Message Queuing Protocol. <http://www.amqp.org/product/realworld>

⁵ Source: "Who Uses FIX?" FIX Trading Community, <http://www.fixtradingcommunity.org/pg/main/who-uses-fix/fix-version>

Conclusion

High barriers to direct participation in payment networks have created a fragmented system ripe with costs and risks. Many of the inefficiencies in today's systems result from antiquated infrastructure that prohibits interoperability.

Ripple offers a modern, neutral infrastructure that reduces inefficiencies, eliminates the reliance on intermediaries, and supports broader integration and connectivity.

Ripple's distributed network reduces the systemic risk posed by a single point of failure. Ripple replaces today's non-competitive FX with a fully competitive currency and funding market. Real-time bilateral settlement reduces or eliminates many of the operational costs and risks of payments.

Ripple enables central banks and regulators to seamlessly connect payment systems without forfeiting their autonomy or selecting a single settlement currency. Further, end-to-end transaction monitoring vastly improves AML capabilities and reduces the cost of compliance.

These benefits accrue to the end users of retail payments in three key ways. First, Ripple's reduced reserve requirements and competitive funding market allow banks to offer greater payment reach at lower costs.

Second, improved transaction economics enables banks to offer real-time settlement of low-value and micropayments for the first time.

Third, Ripple improves customer experience through faster payments, access to 24/7/365 settlement, and real-time transaction confirmation.

To leverage these benefits and meet today's payment demands, regulators must ensure existing and future rules accommodate emerging technologies and alternative governance structures. Regulators must take a holistic view of risk and ensure startups and smaller companies have the opportunity to participate in payment system innovation.

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About Ripple Labs

Named one of the 50 Smartest Companies by MIT Technology Review, Ripple Labs is the technology company that conceived of and developed the Ripple protocol.

The company has experience with financial services, payment networks, security, technology, and policy. Employees come from E-Loan, Goldman Sachs, Fiserv, Visa, Jumio, NSA, Apple, Google, Federal Reserve, and Promontory Financial Group.

Ripple Labs is backed by prominent investors including Google Ventures, Andreessen Horowitz, Lightspeed Venture Partners and IDG Capital Partners.

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