Solution Overview

A comprehensive business overview for financial institutions on RippleNet

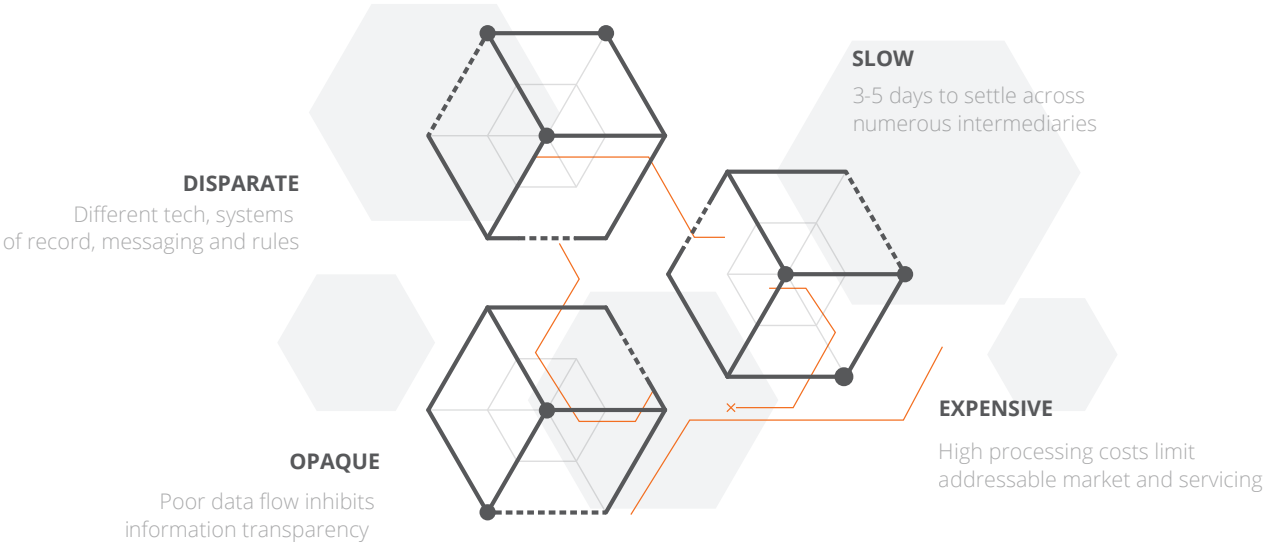
October 2017

ripple

One frictionless experience to send money globally

Across a connected network of financial institutions

Payments Networks Today



A Fragmented System Of Siloed Networks

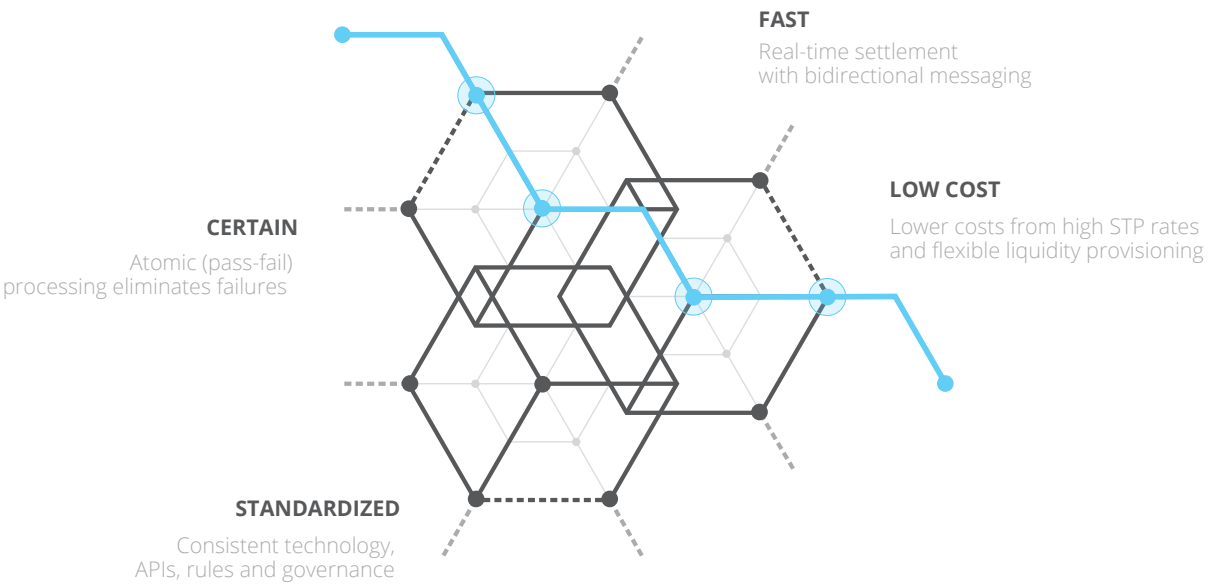
Today's global payments system is neither global or a system. A system, defined as a set of connected things forming a complex whole, does not describe the currently siloed payments networks that lack effective inter-connectivity to deliver on the demands of today's customers. As for its global reach, due to the high costs and inefficiencies of cross-border payments, many banks, businesses and consumers are shut out of the current system.

The litany of pain points – delays, limited transparency and high costs – from the current system stem from the lack of a single, global payments network. The fragmentation of existing networks has significant downstream impact; primarily, it results in a marginal experience for all parties involved in cross-border payments.

Without direct connectivity between transacting parties, factors such as traceability and timing are a black box to sending and receiving banks, businesses and consumers.

Because of the high processing costs from one network to the next that are passed down to end users, it limits banks' addressable market and impacts their servicing capabilities. The lack of standardization across networks impacts functionalities such as data transfer – making it unreliable for end users to send critical information with their transaction. The result is driving businesses and consumers from banks to FinTech providers that can more adequately meet their needs.

RippleNet



One Connected Global Payments Network

RippleNet delivers a single, frictionless experience for global payments. Rather than a constellation of disparate technologies, unstandardized communications and centralized networks, RippleNet is a decentralized, global network of banks that send and receive payments via Ripple's distributed financial technology – providing real-time messaging and settlement of transactions.

RippleNet is based on an agreement between Ripple and network participants – all of which utilize the same technology and adhere to a consistent set of payment rules and standards.

RippleNet banks benefit from the robust connectivity, standardized technology and rich data attachments with each payment. Ripple's distributed financial technology outperforms today's infrastructure by driving down costs, increasing processing speeds and delivering end-to-end visibility into payment fees, timing and delivery.

RippleNet Participants

The ecosystem of RippleNet includes network members, participants that process payments, and network users, participants that originate payments.

Network Members

Banks looking to process payments for corporates and consumers. Some would also process payments for and provide liquidity to other banks. These banks would leverage RippleNet to enhance their servicing to existing customers and drive acquisition.

Payment providers looking to supply liquidity and expand payout reach for banks to increase their payment volumes.

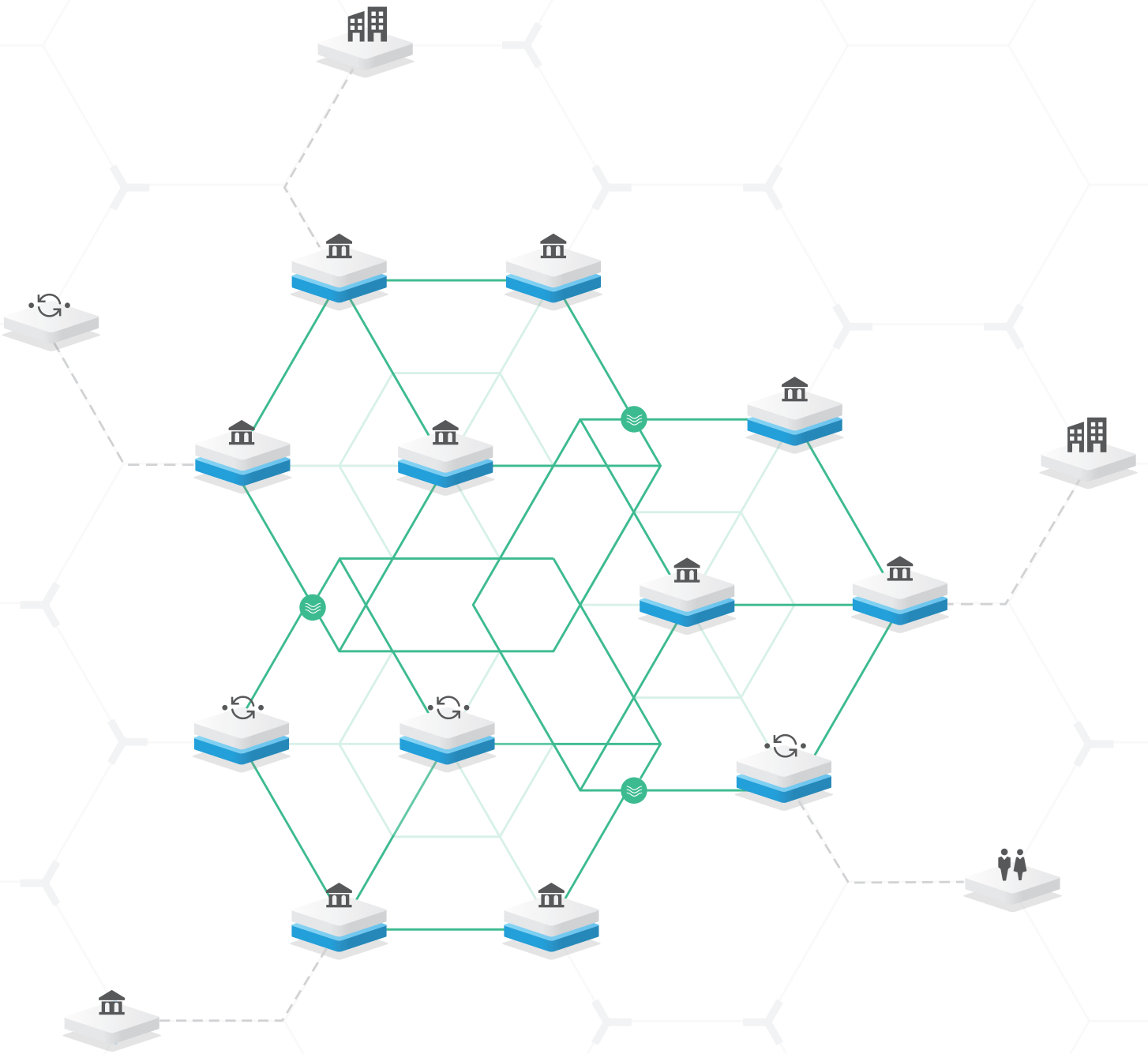
Network Users

Corporates looking to send large disbursements across their global supply chain to gain greater capital efficiency, visibility and control.

Platform businesses looking to send disbursements of high volume and low value to a global base of suppliers, merchants and employees.

Banks and payment providers looking to only send payments, rather than process them, to overcome the high costs and inefficiencies of correspondent banking.

Consumers looking to send global payments through their bank or payment provider for a cost-efficient, real-time and traceable option.



xCurrent
A standardized technology enabling the ability to message and settle transactions between banks with increased speed, transparency and efficiency.

Ripple For Banks

State Of Banking Payments
Inefficient, Batch Infrastructure

The needs of today's corporate and retail transaction banking customers have evolved significantly. In addition to sending high value payments, they require the ability to send international low value payments on demand and in real time – not only across banking networks but also emerging financial networks (e.g., mobile wallets). The limitations of today's infrastructure force banks to process payments in batch, resulting in high processing costs, lengthy settlement times and a poor customer experience. These inefficiencies not only result in an enormous cost (an estimated $1.6T* per year for all participants in the ecosystem), but also fail to meet the needs of today's banking customer.

With Ripple
Efficient, On-demand Payments Infrastructure

Ripple's software connects these siloed networks through an open, neutral protocol – Interledger Protocol (ILP) – that brings new efficiency to financial settlement by enabling real-time settlement, ensuring transaction certainty and removing settlement risk. Ripple's software also includes data-rich messaging between all transacting parties – delivering a real-time payments experience to end users.

* Ripple analysis across: World Trade Organization, International Trade Statistics 2014; Institute of International Finance, Aggregate Capital Flows 2014; Federal Reserve Financial Services, Cross Border Payments, 2015

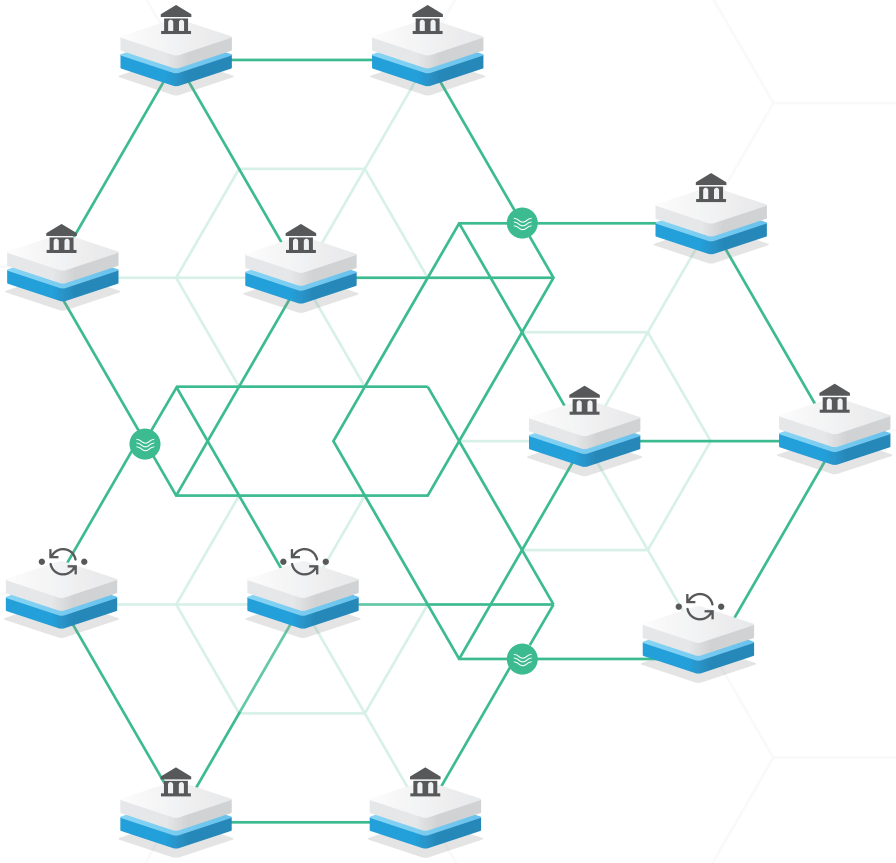
xCurrent

Process real-time payments

Ripple's software, xCurrent, enables banks to differentiate themselves by offering new cross-border payments services while lowering their total cost of settlement. The solution is specifically designed to meet the needs of banks by fitting within their existing risk, compliance and information security frameworks. Ripple's software is installed within the bank's infrastructure and is built to interface with the bank's systems using an API interface or through a translation layer that can consume traditional payment message formats to compress the integration time frame into weeks.

All members of RippleNet are connected through Ripple's standardized technology, xCurrent. xCurrent is the first, global real-time gross settlement (RTGS) system that enables banks to message and settle their transactions with increased speed, transparency and efficiency across RippleNet's global footprint of banks and payment providers.

The solution is built around ILP, an open, neutral protocol, that enables interoperation between different ledgers and payments networks. The solution offers a cryptographically secure, end-to-end payment flow with transaction immutability and information redundancy. It is designed to comply with each bank's risk, privacy and compliance requirements. The software is architected to fit within banks' existing infrastructure – minimizing integration overhead and business disruption.



Solution Components

Messenger

Messenger is an API-based messaging module that enables bidirectional communication between connected RippleNet banks. It connects to the beneficiary bank's instance of Messenger to exchange KYC and risk information, fees, FX rates (if applicable), payment details and expected time of funds delivery. It packages this information and presents the entire cost structure to the originating bank, providing unprecedented visibility into the total cost of the transaction. If information is incorrect or missing, transacting parties will find out before initiating the transaction, drastically increasing straight-through processing (STP) rates. Once the sender approves the transaction, Messenger employs ILP to settle funds and notifies all parties of the transaction confirmation.

FX Ticker

FX Ticker is the component of xCurrent that facilitates the exchange between ledgers by enabling liquidity providers to post FX rates. This component provides the exchange rate between any pair of ledgers that it is configured with. Additionally, it keeps track of the account, currency and authentication credentials for each configured ILP Ledger. During the transaction, it coordinates transfers on ILP Ledgers for settlement, ensures the validity of an FX quote and transfers the payment amount to the beneficiary bank's ILP Ledger.

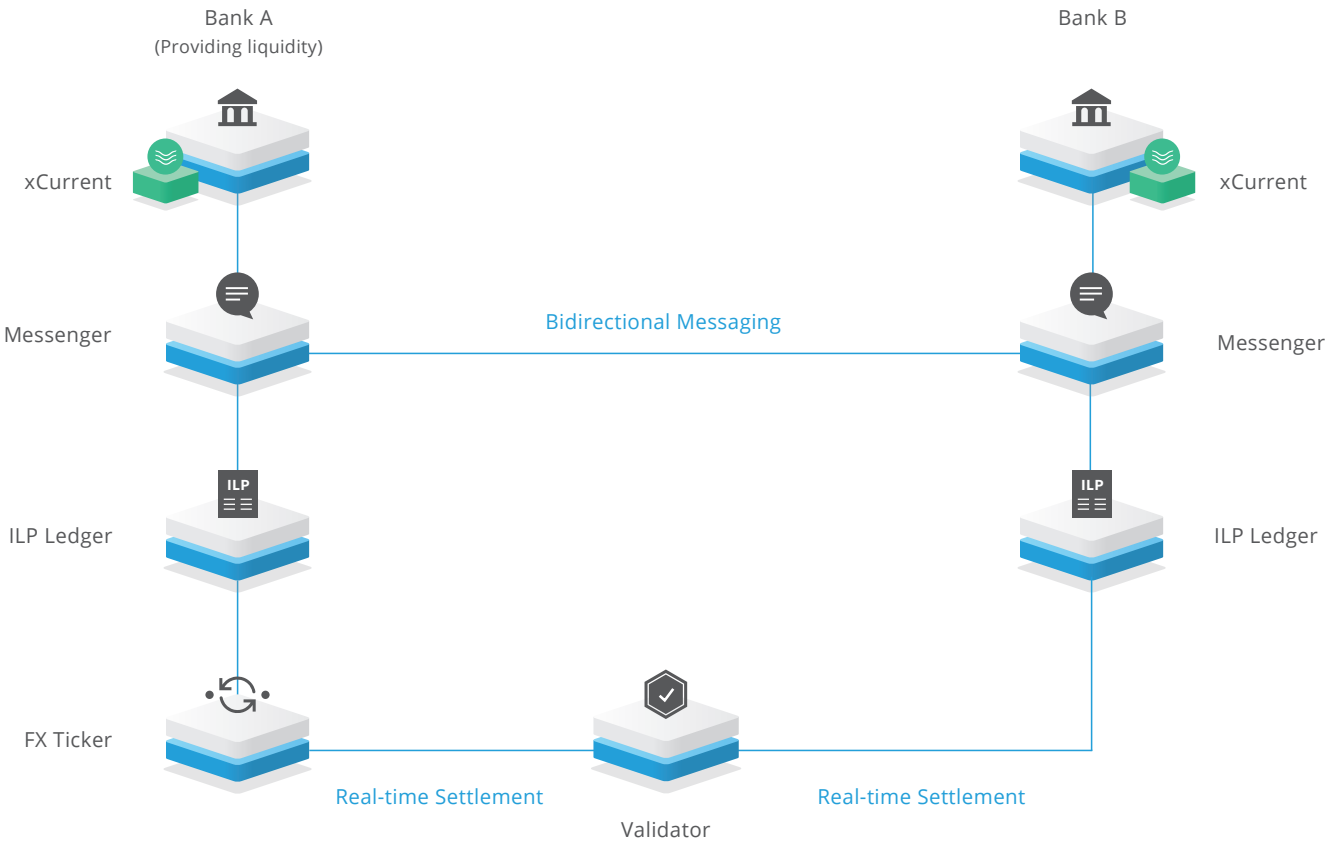
Validator

Validator is a component that cryptographically confirms the success or failure of a payment. It coordinates the funds movement across the ledgers of transacting parties in a way that removes all settlement risk and minimizes delays in settlement. Validator provides the single source of truth for the transacting parties regarding the success or failure of a payment.

ILP Ledger

ILP Ledger is a subledger of each transacting bank's general ledger. This component of xCurrent is utilized to the track the credits, debits and liquidity across the transacting parties. ILP Ledger enables transacting parties to settle funds atomically, which means the entire transaction settles instantly or not at all – no matter how many parties are involved.

The ability to atomically settle enables new, low-value offerings through the ability to send real-time payments as the settlement of funds happens in milliseconds. Further, the settlement risk is eliminated because the payment processes entirely or fails upfront. ILP Ledger is designed to provide transacting banks with 24/7, on-demand availability. The combination of these capabilities allows banks to profitably offer low-value, on-demand international payments products and services.


Bank A
(Providing liquidity)
Bank B
xCurrent
xCurrent
Messenger
Bidirectional Messaging
Messenger
ILP
ILP
ILP Ledger
ILP Ledger
FX Ticker
Real-time Settlement
Validator
Real-time Settlement

Key Benefits

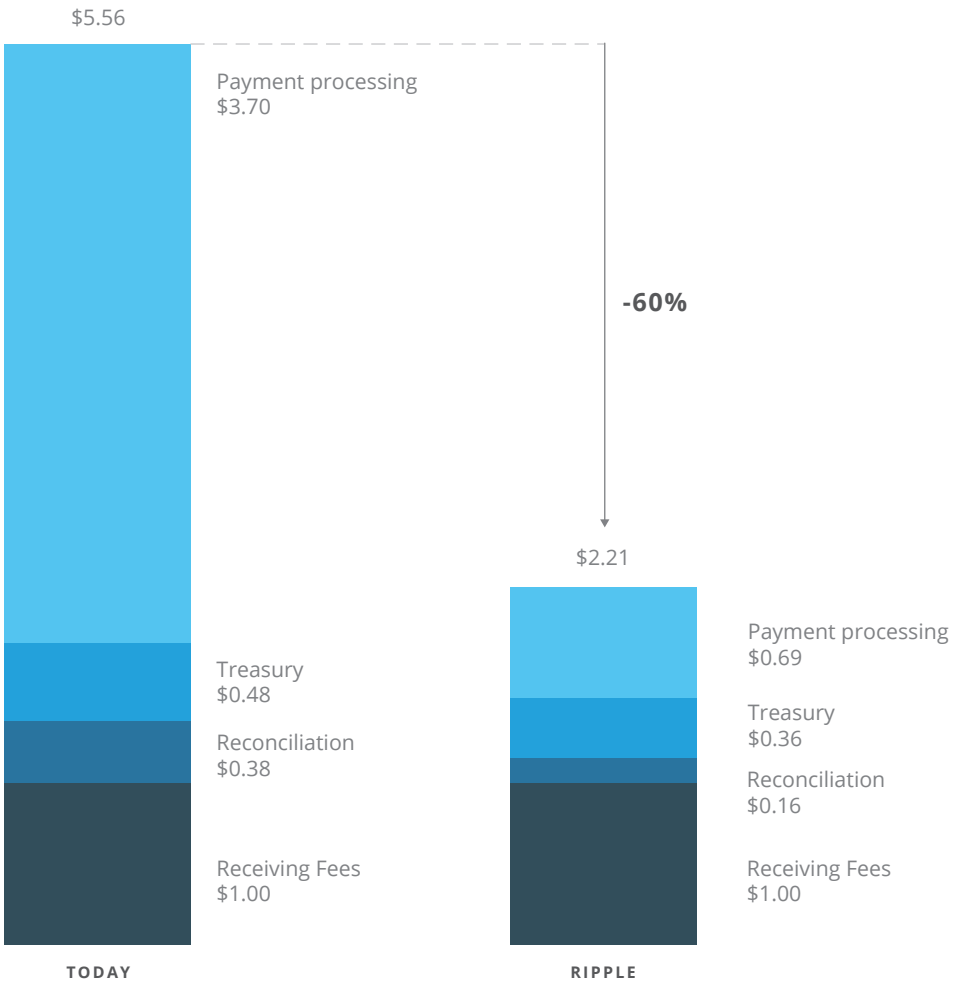
Enhance Customer Acquisition And Retention

By delivering new products and services to retail and corporate customers – featuring high-speed, on-demand, cost-effective and traceable global payments – in both assisted and unassisted channels, it provides an opportunity re-engage and retain existing customers. xCurrent's frictionless payments experience mitigates disintermediation from online, non-bank payment providers. The solution is a key competitive advantage and promotion-worthy offering to drive customer acquisition.

Lower Operational Costs

With xCurrent's bidirectional messaging, banks can more efficiently exchange information regarding the sender, receiver, fees, rates, delivery estimate and payment status to lower their operational cost of processing international payments. Payment processing costs are significantly reduced through xCurrent's ability to increase STP rates and eliminate SWIFT fees. Treasury operations costs are decreased by lowering in-flight capital requirements, liquidity costs, counterparty risk and compliance costs. Reconciliation costs are reduced due to xCurrent's ability to provide instant confirmation and real-time liquidity monitoring.

Estimated Total Cost Per Payment



Note: Modeled use-case: Annual Payment Volume: $100M; Number of Annual Payments: 200K; Average Payment Size: $500; Corridor: CAD/USD

Liquidity Provisioning on Ripple

RippleNet offers banks the ultimate flexibility to optimize the provisioning of liquidity for transaction banking. RippleNet provides broad support for a spectrum of current liquidity arrangements and enables the combination of multiple arrangements in a single transaction. Connections between banks on RippleNet consist of two components:

Technical Connectivity

xCurrent provides the technical connectivity between the banks, allowing them to send and receive sender/beneficiary information, fees, rates, payment status and confirmation of payment. xCurrent also coordinates the settlement between the private ledgers of the two transacting banks using ILP.

Liquidity Relationships

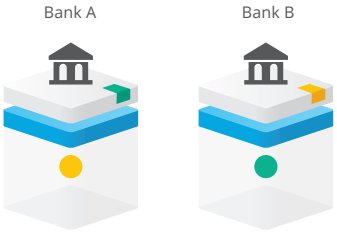
Banks also require liquidity relationships with other counterparties on RippleNet. Today, these relationships consist of bilateral nostro/vostro relationships between banks. Scaling these relationships to extend reach for banks is a significant challenge as it becomes increasingly capital intensive.

Liquidity Arrangements & Pathfinding

RippleNet is designed to support three different liquidity arrangements between financial institutions. At the network level, RippleNet is designed to interoperate across different liquidity arrangements through the pathfinding functionality.

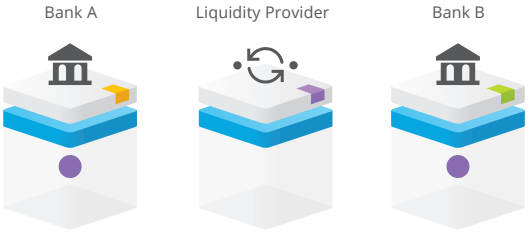
Bank-to-bank Fiat Currency Relationship

A fiat currency relationship involves one bank holding a liquidity position with another bank and using that liquidity position to facilitate payments between the two. This makes one of the banks the asset-holder (a nostro account holder) and the other bank a liability-issuer (a vostro account issuer). This arrangement can be used with either pre-funded positive balances or credit positions. This liquidity arrangement enables one of the banks (the holder of the nostro account) to earn FX revenues, making it ideal to be used for high-volume corridors.



Third-party Liquidity Provisioning

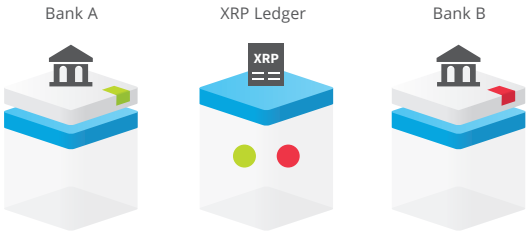
A third-party liquidity arrangement allows both transacting banks to authorize a third-party institution to provide the FX liquidity for delivery of payments. This third-party institution can be a payment provider that holds accounts with both transacting banks and provides the FX for the transaction. This liquidity arrangement gives banks instant reach into multiple corridors through the third-party liquidity provider without the need for direct nostro relationships. This makes it ideal for corridors where banks do not have existing correspondent banking relationships.



Settlement Through Digital Assets (XRP)

Future Release

This arrangement allows for the transacting banks to settle payments using XRP as a digital asset. XRP's reach into exotic corridors and average daily trading volume higher than most exotic currencies, makes it an ideal bridge asset for settling transactions between banks. In this arrangement, each bank holds XRP as a fungible liquidity pool that can be used for payments within a number of exotic corridors without the need to hold nostro accounts in those currencies. With XRP eliminating the need for banks to have nostro accounts or foreign currency exposure, this arrangement is ideal to be used for exotic corridors.

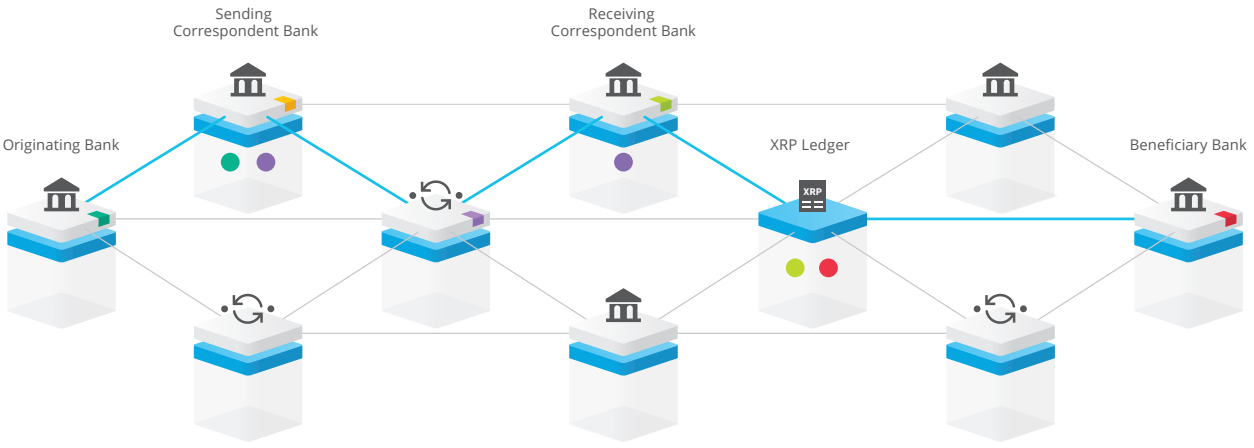


Pathfinding

Future Release

Ultimately, the goal for each transaction over RippleNet is to find the best liquidity route between the originator and the beneficiary. RippleNet's pathfinding functionality is designed to traverse a payment through any number of participants utilizing any of the above-mentioned liquidity arrangements.

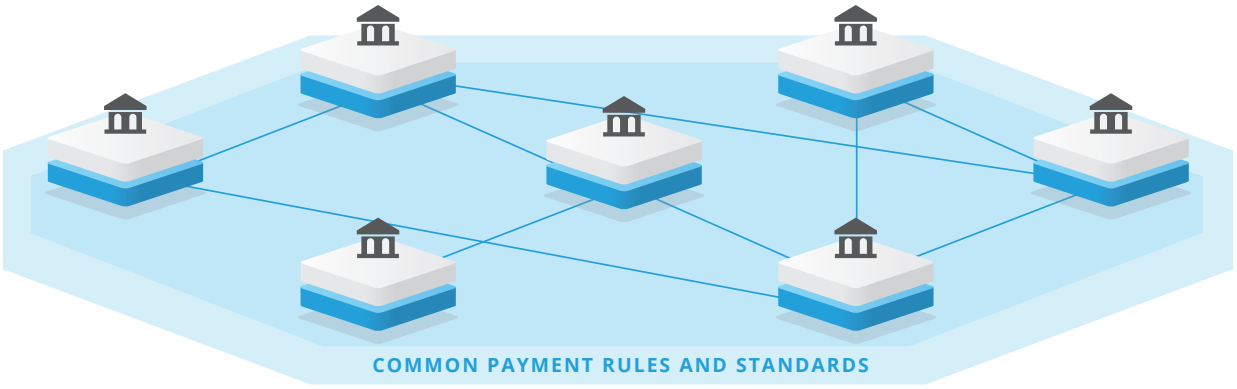
RippleNet's ability to closely integrate information flow (through bidirectional communication) with the settlement of funds allows banks to leverage maximum flexibility in terms of their liquidity provisioning to best suit their business needs. Depending on the corridor (volume flows, cost of FX) and the use case (low-value or high-value payments), banks can choose between a number of liquidity arrangements to optimize for costs, risks and capital efficiency.



Rulebook & Advisory Board

The value of RippleNet derives from its combination of key elements: standardized and powerful technology; a global network of banks and payment providers; a consistent set of rules and standards and a governance structure comprised of an advisory board of industry leaders.

To join RippleNet, both members and users sign a Network Service Agreement and implement the rules and standards as outlined in the Rulebook, which eliminates the need to create inefficient bilateral agreements.



RippleNet Bank — Liquidity Relationship

Rulebook

The objective of the Rulebook is to create a legal framework that ensures optimal working relationships with all network participants and a seamless experience for the end user. The Rulebook provides detailed information regarding the rights and obligations of network participants, business and operational rules and the process for changes to the Rulebook. It also offers in-depth technical standards regarding the end-to-end transaction flow and defines the service-level agreement between transacting parties. In essence, the Rulebook creates consistency across RippleNet by providing operational certainty and legal clarity for every transaction.

RippleNet Advisory Board

Ripple actively consults its advisory board which includes industry leaders from Transaction Banking, Digital Services and Cash Management. Regarding the Rulebook, the advisory board provides governance to consistently ensure that the rules and standards are in close alignment with the exact needs of today's banks and their customers.

Compliance

Ripple As A Software Provider

Ripple provides licensed software and integration services that enable clients to facilitate real-time payments. A bank's use of xCurrent may be subject to a regulator's oversight, approval and examination, depending on the rules of each country.

The regulatory treatment of xCurrent is dependent on several factors, such as:

- The type client being serviced (including its type of license, charter and designation)
- Country of integration and geographic scope of operations
- Volume and scope of activity enabled through the software provided
- Level of dependency on the software provided
- Other factors determined by the bank or regulator

Ripple has engaged with central banks and regulators globally to educate them on distributed networks as well as Ripple and xCurrent's role in the ecosystem. As business engagements are formalized, Ripple works with each bank to identify and assist them with meeting all relevant regulatory requirements ahead of integration.

Data Privacy And Protection

xCurrent creates a direct, secure connection between the banks. All payment data is sent directly between the institutions that are parties to the payment; neither Ripple (the company) nor any third party have access to this data. This design ensures that the banks have control over access to their customer data and how it is stored.

Data in flight: Data sent using xCurrent is transferred securely using HTTPS and is protected by SSL encryption. Additionally, Ripple uses a combination of OAuth and client SSL certificate authentication to protect connections and endpoints. Data is only accessible to the banks that are part of the transaction.

Data at rest: As only the banks related to the payment have access to the data, those banks maintain control over their customer data and transaction records, storing this information per their IT, cyber security and data protection standards.

KYC And AML Compliance Processes

Use of xCurrent for payments does not impact a bank's compliance responsibilities. Recognizing this, Ripple's products are designed to complement a bank's existing customer onboarding, due diligence and transaction monitoring programs.

When using xCurrent, a bank's customer onboarding and know your customer (KYC) obligations remain unchanged. The bank maintains full responsibility for ongoing compliance with Anti-Money Laundering (AML) and Office of Foreign Assets Control (OFAC or, more broadly, "sanctions") legislation and regulations. Banks are also responsible for ongoing monitoring of transactions conducted through xCurrent in accordance with their existing transaction monitoring program requirements. U.S. banks also maintain responsibility for compliance with foreign correspondent account recordkeeping and due diligence requirements specified under Section 312 of the USA PATRIOT Act. Use of Ripple does not alter these obligations of the bank.

Ripple has designed its software to assist its bank customers in complying with other related regulations. The messaging capability of Messenger enables banks to comply with U.S. Travel Rule requirements. It also provides upfront fee negotiation capabilities to assist with Regulation E pre-payment disclosure obligations (Section 1073 of the Dodd Frank Act). The direct, bidirectional messaging between originating and beneficiary banks allows for the secure transfer of additional data about the payment, its sender and its recipient.

While the bank's compliance with AML and sanctions obligations remains unchanged, the timing of its sanctions screening activities may need to be altered given the real-time nature of xCurrent transactions. To capitalize on the speed at which transactions are conducted using xCurrent, banks may wish to augment their sanctions screening processes to pass this benefit on to their customers. This consideration is institution-specific, dependent on the capabilities, speed and compliance policy of the bank.

Fee Pre-Disclosure

xCurrent enables banks to have complete clarity into the fees and FX cost of the payment before initiating the transaction. This transparency allows the bank to accurately quote the total cost of sending the payment to the consumer before sending the funds.

Fee transparency in xCurrent is a significant advantage over payment systems today, which do not provide visibility into the total cost before sending the payment. xCurrent's ability to pre-disclose all fees prior to sending the payment not only improves the customer experience, but also enables compliance with laws in some countries, specifically the United States.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Security

Payment Data Separation

Implementing a payments system on xCurrent provides a layer of separation and security between payment data and settlement data for financial transactions that are executed over ILP. Validator only sees the cryptographic cases that it uses to mathematically verify that the each institution has fulfilled the conditions required to execute the payment and does not require payment data. This limits the number of times data needs to be transmitted between the two banks. The actual payment data is encrypted and shared only between the two institutions making payments to each other when necessary.

The following types of payment data are stored and maintained in internal databases that are only accessible by each bank:

- Identifiers for originators and beneficiaries
- Required PII/CIP information for originators and beneficiaries
- Additional payment information such as invoice numbers
- Additional metadata

Secure Communication

Banks' internal systems communicate with xCurrent over secure HTTPS connections and use OAuth 2.0 for authentication. ILP components of xCurrent use HTTPS for secure communication with each other and Messenger, using CA certificates for authentication.

HTTPS is also used for:

- Pre-transaction communication between Messenger instances at corresponding partner institutions
- Communication between Messenger, Validator, ILP Ledger and FX Ticker

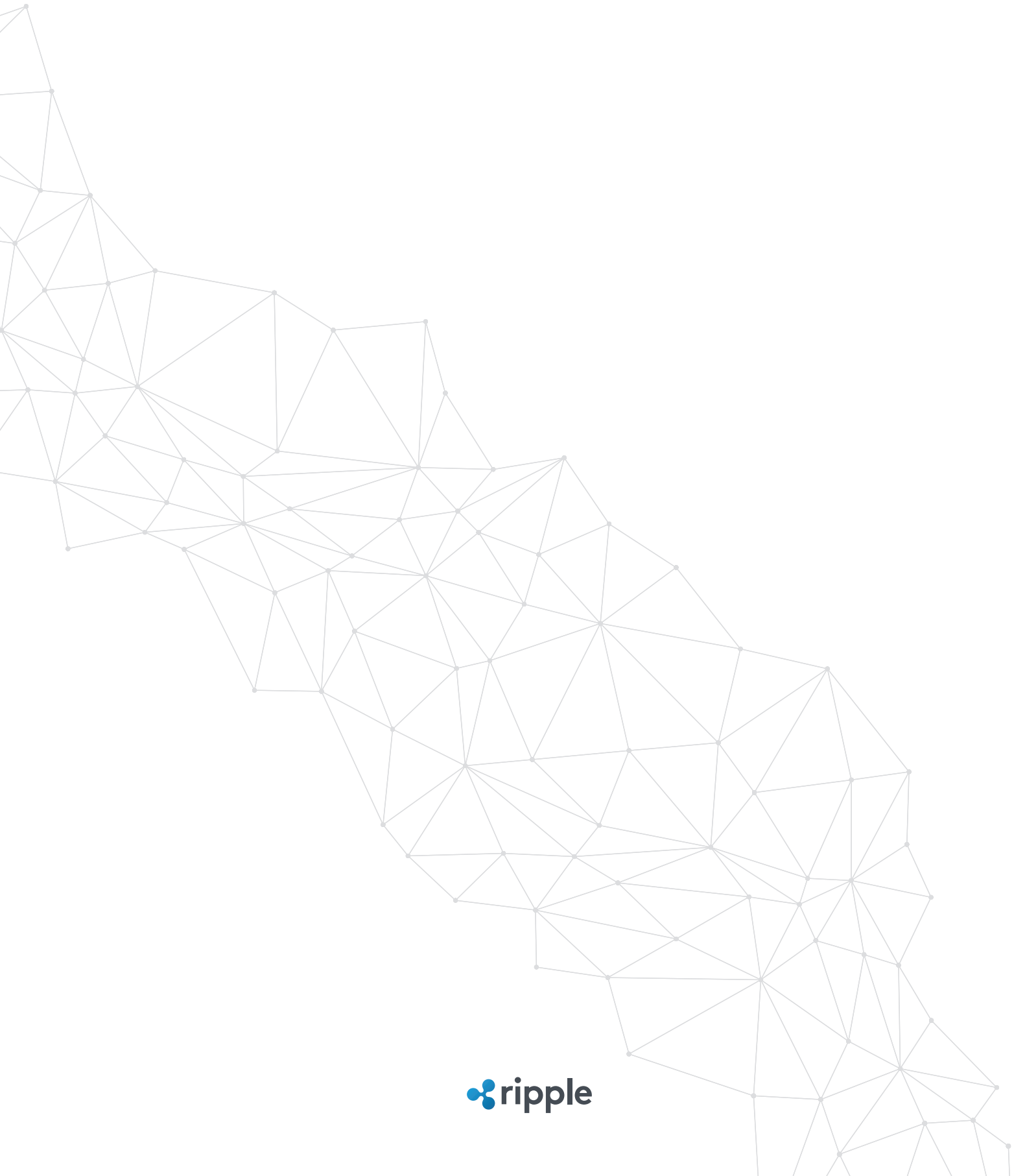
About Ripple

Ripple provides one frictionless experience to send money globally using the power of blockchain. By joining Ripple's growing, global network, financial institutions can process their customers' payments anywhere in the world instantly, reliably and cost-effectively. Banks and payment providers can use the digital asset XRP to further reduce their costs and access new markets.

With offices in San Francisco, New York, London, Sydney, Mumbai and Luxembourg, Ripple has more than 90 customers around the world.

Contact Us

To learn about joining RippleNet and leveraging xCurrent for cross-border payments, please contact us at ripple.com/contact.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