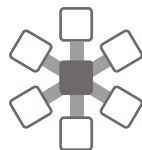


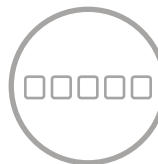
Ripple Market Makers



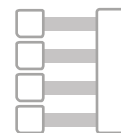
Consumers



Market Makers



Gateways



Merchants

Overview

This document provides a basic introduction to market making on the Ripple network. Any user can manually post bids and offers to buy/sell currencies or other assets on Ripple. Serious firms will develop their own automated trading strategies to effectively compete in the marketplace.

You may wish to start with the [Ripple Primer](#) to get a broad understanding of Ripple before continuing with this document.

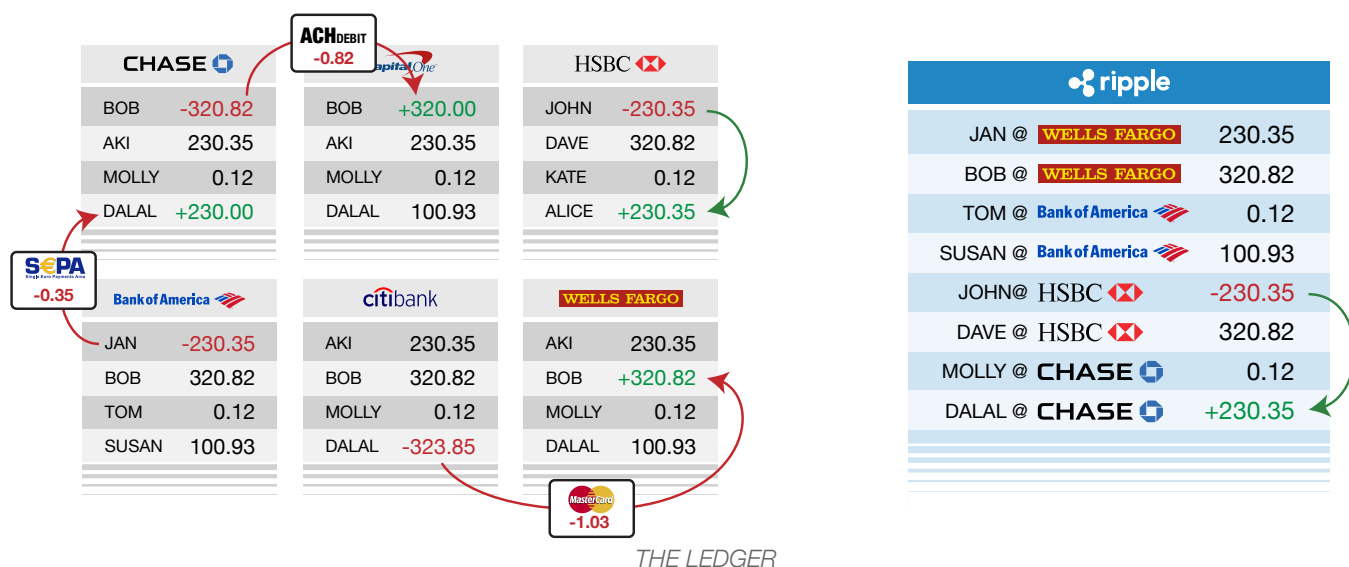
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What is Ripple?

Ripple is a decentralized payment system and distributed currency exchange. Ripple is currency agnostic; it supports any currency (USD, EUR, BTC, etc.) including its own native currency, XRP.

At its core, the Ripple network is a distributed database that contains information about user accounts, balances, and trades. This record within the database is known as the Ripple ledger.

The Ripple ledger is analogous to the database that a bank would typically use to manage accounts and balances. However, instead of a centralized and proprietary bank ledger, Ripple's database is distributed across computers around the globe and shared between all users. It has no central operator and no single point of failure.



A peer-to-peer network of Ripple servers around the world maintain the ledger. These servers run software known as “rippled” (short for Ripple daemon).

Each rippled server keeps its own copy of the current ledger in its entirety. In this way, anyone can view the ledger and see a record of all activity on the Ripple network.

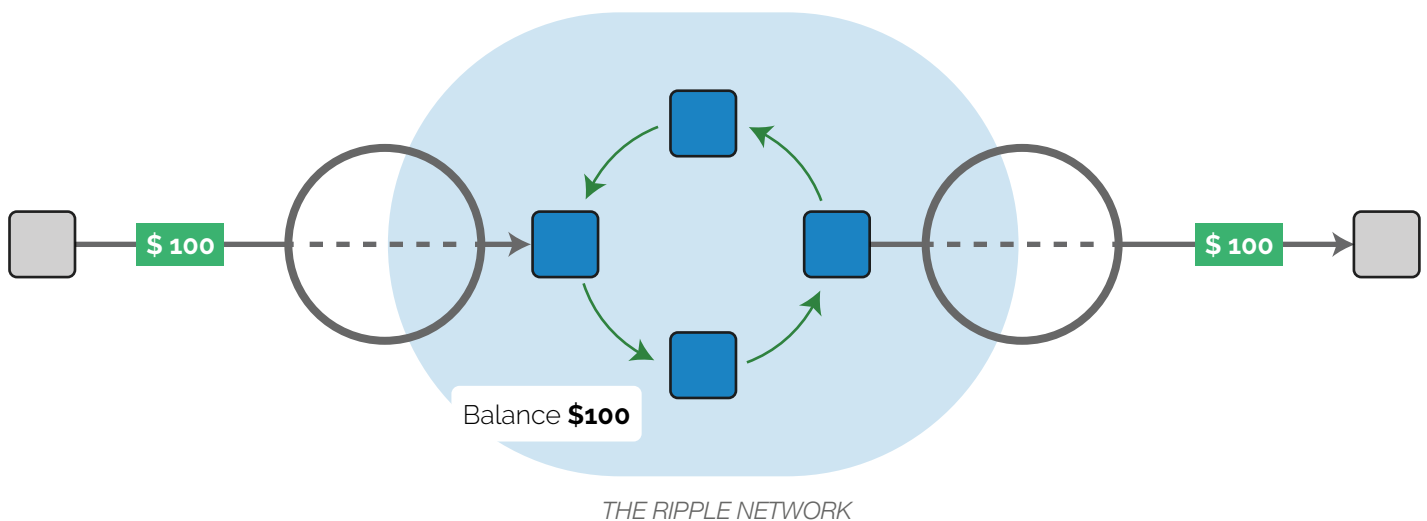
Just like on a traditional bank's network, a trade or a payment is executed on Ripple by making a valid change to the ledger. Instead of relying on a centralized network operator, servers around the world mutually arrive at consensus about changes to the ledger and then update their local copies of the database, so everyone stays on the same page at all times.

Ripple is fully open source, so anyone can audit the code, develop improvements to the code, and use it for any purpose without obtaining prior approval from any entity (though users should obey applicable laws and regulations in their region).

Gateways and Balances on the Ripple Network

Currency enters and exits the Ripple network via gateways. “Gateway” is Ripple’s term for currency entry and exit points to the network.

Gateways are businesses that accept currency deposits from customers and issue them balances on the Ripple network in return. This is very similar to the role of traditional banks (accepting deposits and issuing balances).

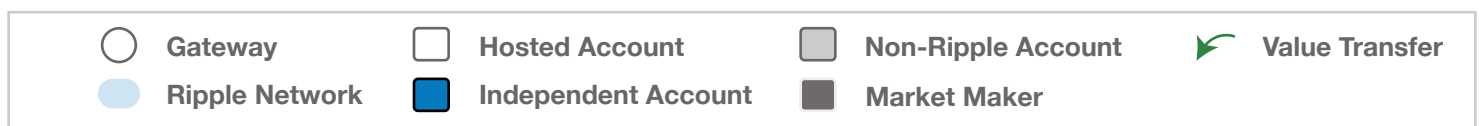


Every currency on Ripple has a specific issuing gateway: USDsnapswap, EURbitstamp, BTCbitstamp, etc. XRP is the exception to this, which we will explain below.

When a user wants to withdraw money from the Ripple network by redeeming a balance for cash, the gateway that originally issued the balance is responsible for redeeming it against the deposits it holds.

In practice, many Ripple gateways may look very similar to traditional banks; but a gateway can be any business that provides access to the Ripple network. Gateways can be banks, money service businesses, marketplaces, or any financial institution.

For more information on gateways: [Ripple Gateway Whitepaper](#)



Gateway Counterparty Risk

Holding an institution's balances exposes you to counterparty risk. This is true both in Ripple and in the traditional financial system.

As we learned during the financial crisis, dollar balances at Chase are not always equivalent to dollar balances at the Bank of Cyprus. A balance is effectively just the bank's or gateway's promise to repay its depositors -- a bank owes its customers their money back. This often gets glossed over, but bank balances (and gateway balances on Ripple) are technically debt instruments.

Users should only hold the balances of creditworthy gateways, because a balance is nothing more than a gateway's promise to repay its liability.

Users must manually "extend trust" to a specific gateway in order to hold its balances. Extending a trust line lets the Ripple network know that you are accepting the gateway's counterparty risk and are willing to hold its balances.

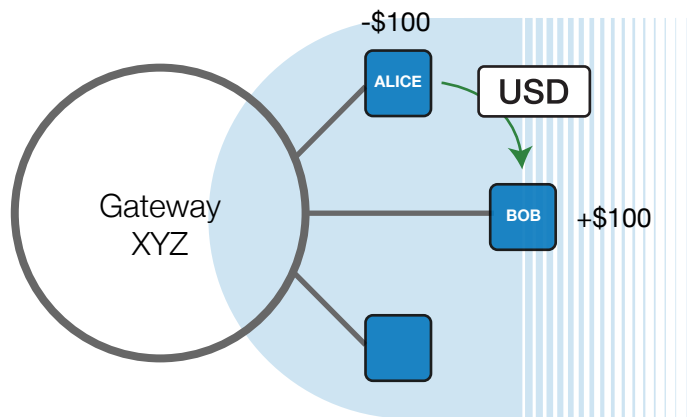
Name / Address	Currency	Balance	Trust Limit	Add trust
<div style="border: 1px solid #ccc; padding: 5px; display: inline-block;"> Bitstamp <small>rvYAfWj5gh67oV6fW32ZzP3Aw4Eubs59B</small> </div>				Add trust
Amount				
<input style="width: 100%;" type="text" value="1000"/>	<input style="width: 100%;" type="text" value="EUR - Euro"/>			
<input type="checkbox"/> Allow Rippling				
<input type="button" value="Cancel"/>	<input type="button" value="Grant trust"/>			

OPENING A TRUST LINE

Trust is not unbounded; it is extended for a specific amount. You might be willing to hold up to \$250,000 in USD at Bank ABC but only willing to hold €10,000 with Bank XYZ.

Transacting with Balances

Ripple users can pay each other by transferring gateway balances. This does not require that users directly trust each other. It only requires that users mutually trust a shared gateway to hold their deposits. For example, two people who both trust GatewayXYZ for USD can send payments to one another in USD without any direct trust or counterparty risk between the users themselves.



If you have arranged direct deposit with your employer, you are familiar with this system of payment. You effectively have a trust line open to your bank, meaning that your employer can pay you \$100 by making your bank owe you \$100.

XRP: The Native Currency of the Ripple Network

XRP (sometimes pronounced “ripples”) is the native currency of the Ripple network. Unlike dollars or euros, XRP is a *natively digital* asset, and it exists only within Ripple. 100 billion units of XRP were programmed into the Ripple ledger, and no more can ever be created according to the Ripple protocol’s rules.

XRP is the only currency within Ripple that is an asset. Every other currency within Ripple exists as a balance, which means it is some gateway’s *liability*. **This asset versus liability distinction is one of the revolutionary characteristics of math based currency.**

Because XRP is an asset and not a liability, users can exchange value in XRP without agreeing to take a third party’s counterparty risk, as they must do in order to transfer USD balances.

XRP trades freely against other currencies within the network, just like EUR trades freely against USD. There is a fluctuating market price for XRP in dollars, euros, pounds, bitcoins, etc. Prices are driven by supply and demand.

Like gold or paper dollars, XRP has no intrinsic value — it is only worth what someone else is willing to pay for it.

There is no requirement that users of Ripple adopt XRP as a store of value or a medium of exchange. In fact, we expect that most users will continue to transact in USD, EUR, JPY, and other traditional currencies, without holding any XRP.

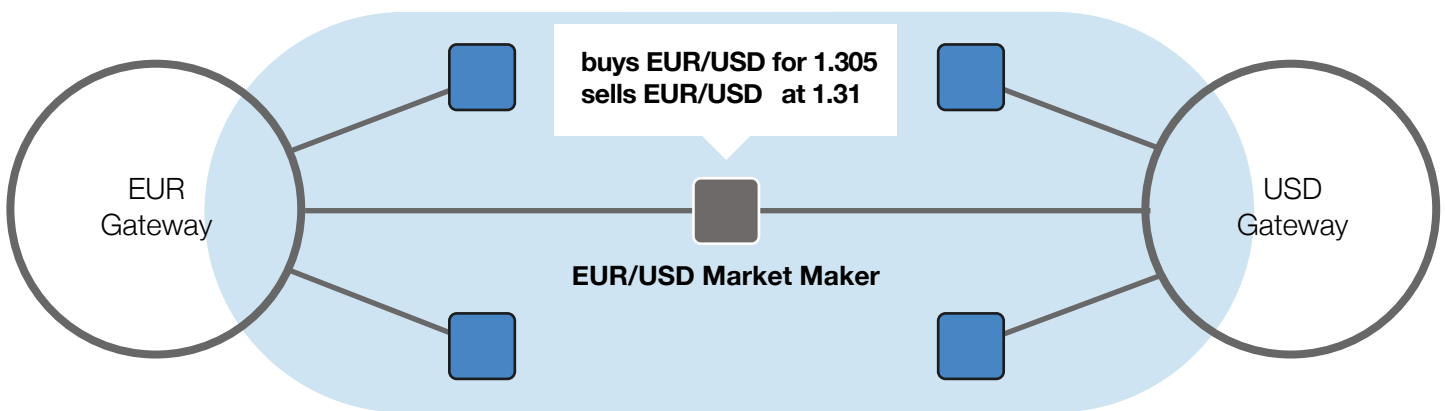
So why create XRP at all? XRP is a tool to support the network’s functionality. It exists to perform two specific network functions — it plays a role in network security and acts as a bridge currency. We will discuss each of these functions in Sections 8 and 9.

The Role of Market Makers

Any user can post bids and offers to trade currencies on Ripple's distributed exchange. Market makers post both buy and sell orders, providing liquidity to the market in order to earn bid/ask spread.

Market makers play the critical role of facilitating payments between users where no shared trust exists. The market maker below is advertising a price to exchange USD balances from GatewayABC and EUR balances at GatewayXYZ.

Market Maker in EUR/USD

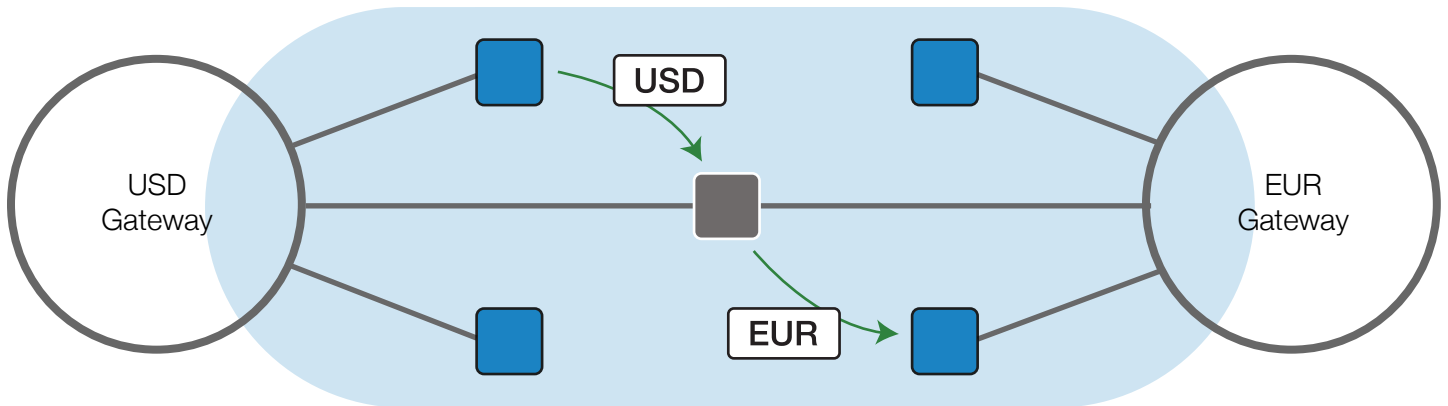


The market maker must have trust lines in place and hold balances with both gateways in order to fulfill this function.

The Role of Market Makers

USD Holder Sending a Payment in EUR

By routing a payment through a market maker, Ripple users can pay each other in currencies that they do not hold. In our example, the market maker allows a user with USD balances to send a payment in EUR. The market maker buys USD and sells EUR in order to make this happen.

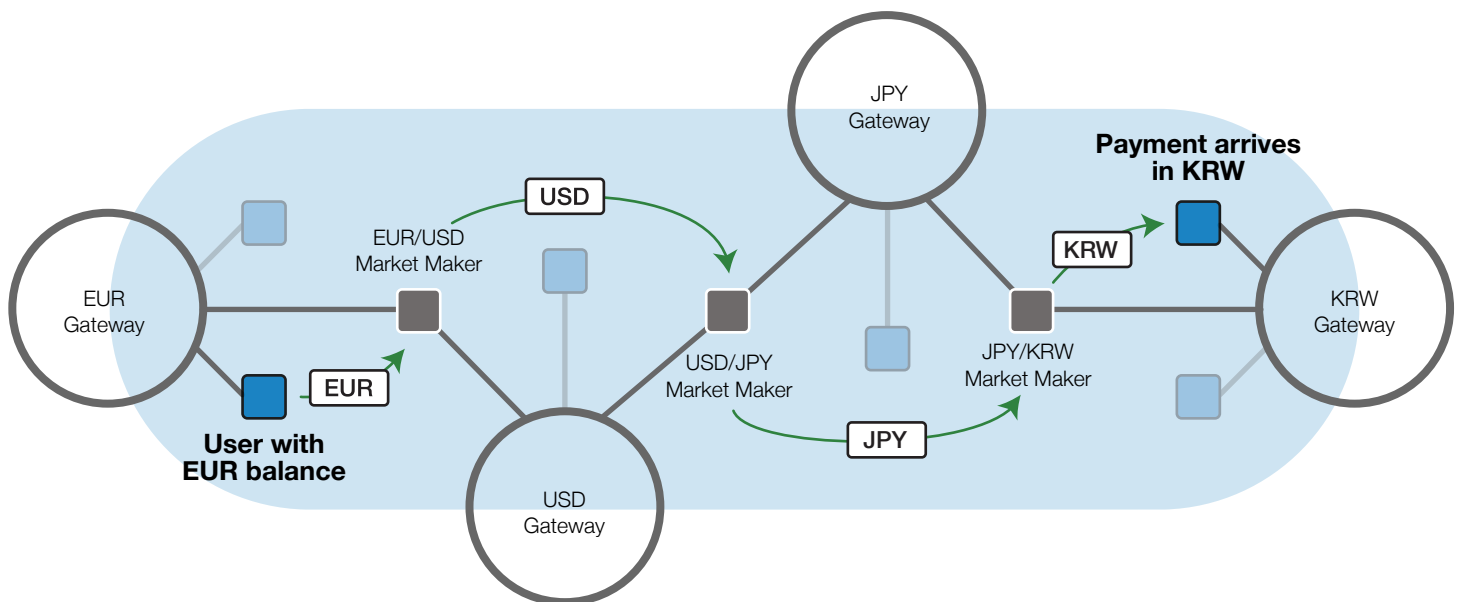


With Ripple, no one is exposed to risk they don't want. Market makers price take risk, counterparty risk, and bear the costs of rebalancing funds between gateways so other users don't have to.

Path Finding Algorithm

Ripple's Path Finding Algorithm looks for the cheapest path for payments to move across the network. In this context, "cheapest" means the path that incurs the least bid/ask cost for the sender of a payment.

Pathfinding: EUR to KRW



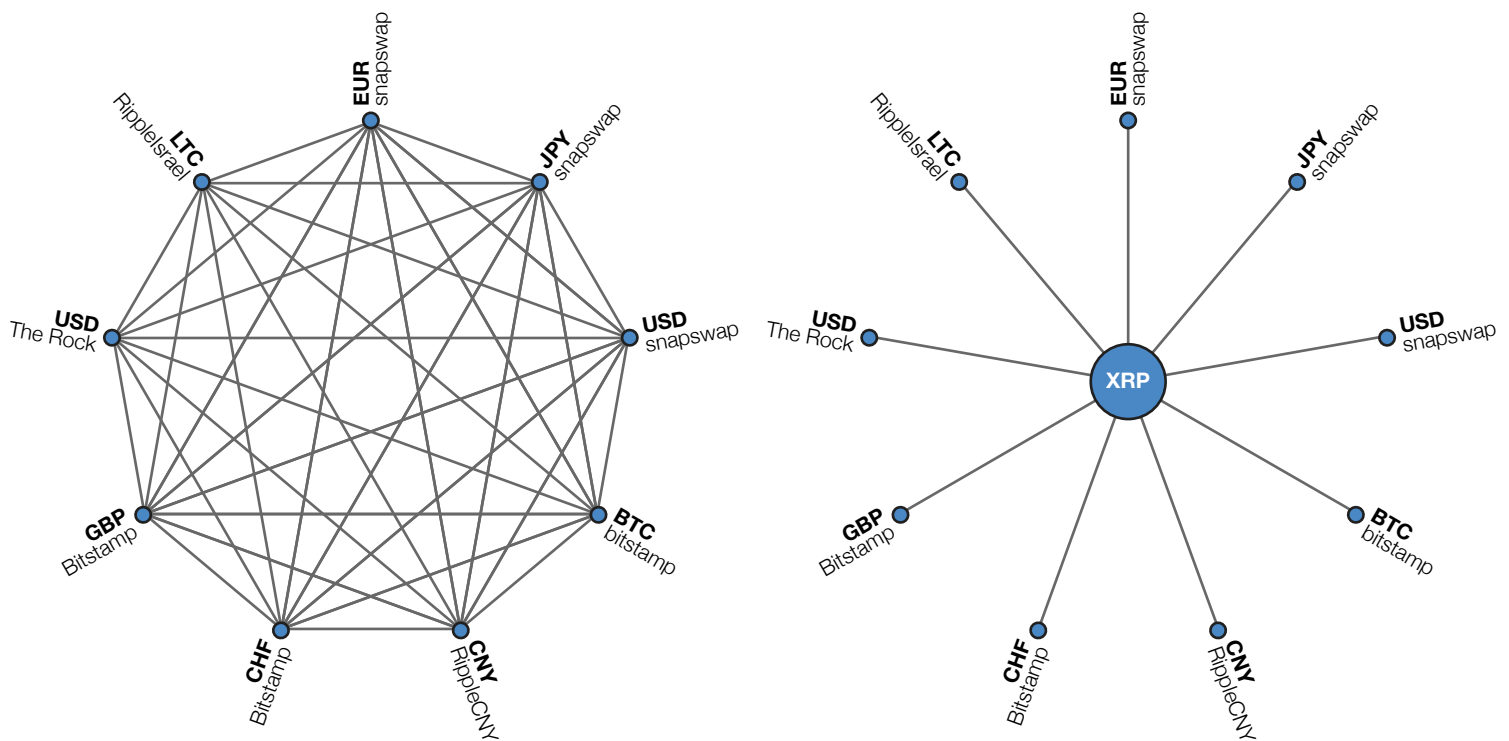
In liquid currency crosses, the cheapest path will often be a direct "one hop" path, through one market maker. However, the Ripple's pathfinding feature will seek the cheapest path even if it is a more complex route through several intermediary currencies.

Users are not exposed to legging risk. There is no way for a payment to get "stuck" in one of the intermediate steps illustrated above. Ripple executes multi-hop paths as a single atomic transaction. Since Ripple transactions are just updates to a distributed ledger, multiple legs can be executed at the same instant as they are all included in the same ledger update.

XRP as a Vehicle Currency

Because each gateway's balances trade as distinct assets within Ripple, the number of currency pairs can quickly become unmanageable for a market maker. Each gateway has its own flavor of USD, EUR, etc., so the number of potential crosses can become quite large.

Instead of quoting every possible currency/gateway combination, XRP can serve as a useful bridging tool for market makers. If every currency is liquid to XRP, it is also liquid to every other currency.



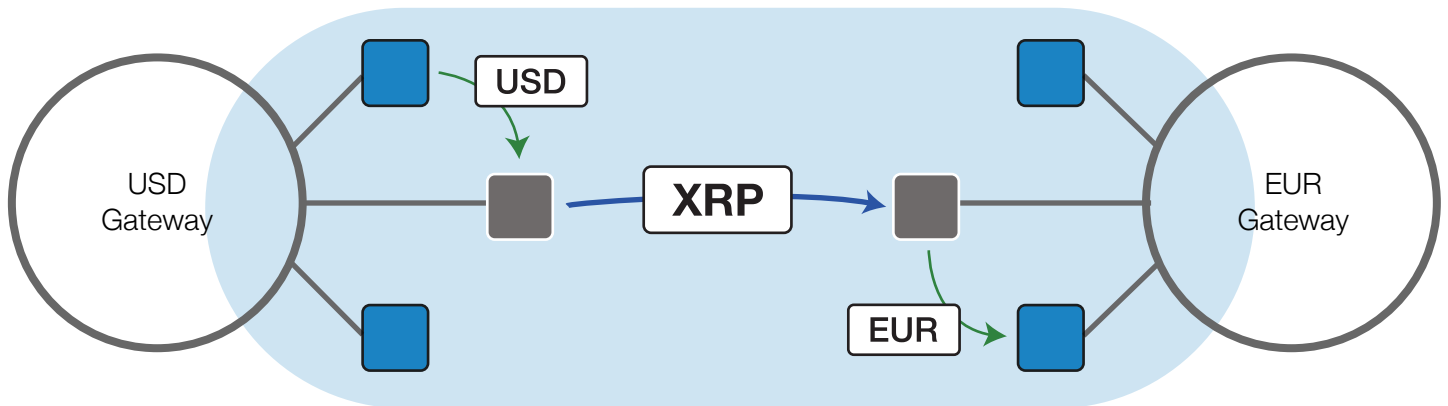
Bridging quotes with XRP is not a requirement; it is just a useful feature. Market makers can directly quote EURbitstamp / USDsnapswap if they prefer.

This role of a “bridge currency” or “vehicle currency” is traditionally played by USD in financial markets. Within the Ripple network, there is a functional reason to prefer XRP. Because XRP is a natively digital asset (as opposed to a balance/liability), it is the only asset within Ripple that does not require counterparty trust, so it can be exchanged between market makers with no friction. Also because it has no counterparty, XRP never has third party fees attached to it.

XRP as a Vehicle Currency

XRP as a Vehicle Currency

XRP in Ripple is like gold in your hand. It is an asset without counterparty and plays the role of a bridge currency between exotic gateways. This is similar to the role of USD in exotic forex markets.



XRP is native to Ripple which means it is native to the Internet. Like the internet, it is global and borderless. Sending XRP around the world does not require cross-border currency exchange and does not incur the associated costs.

XRP Secures the Network

In addition to providing utility as a bridge currency, XRP plays a vital role in securing the network.

Since the Ripple network is based around a shared ledger of accounts, and a malicious attacker could create large amounts of “ledger spam” (i.e. fake accounts) and transaction spam (i.e. fake transactions) in an attempt to overload the network. This could cause the size of the ledger to become unmanageable and interfere with the network’s ability to quickly settle legitimate transactions.

To protect the network from abusive creation of excess ledger entries, each Ripple account is required to have a small reserve of XRP to create ledger entries. This reserve requirement is currently 20 XRP, which is roughly equivalent to \$0.50 (as of December 2013). This requirement is intended to be a negligible amount for normal users while preventing a potential attacker from amassing a large number of fraudulent accounts to “spam” the network.

With each transaction that is processed, 0.00001 XRP is destroyed (roughly one one-hundred-thousandth of a penny in USD terms). This is not a fee that is collected by anyone – the XRP is destroyed and ceases to exist. This transaction fee is also designed to be negligible for users. But when the network is under heavy load, such as during a denial of service attack, this fee rapidly rises.

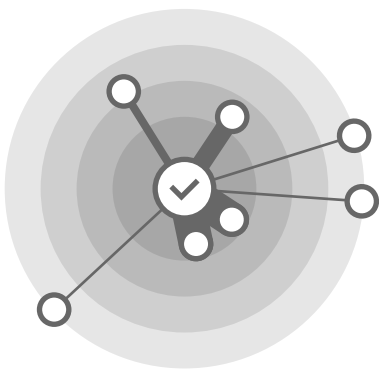
The goal of this design is to quickly bankrupt attackers and keep the network functioning smoothly. Attacking the Ripple network can get very expensive, very quickly, but for regular users, the cost effectively remains “free”.

Demand for XRP will naturally result as a byproduct of this design. To access the network, users will need some, albeit a tiny amount, of XRP. As the network grows, this demand will have to grow with it.

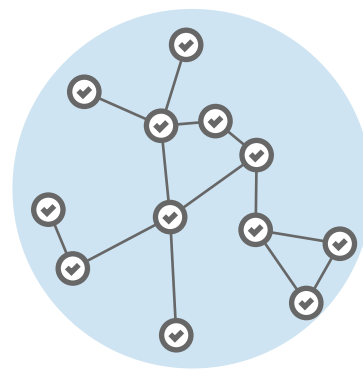
Execution Speed

Transactions in Ripple are both executed and fully settled at the instant that they are included in a closed ledger. A new ledger generally closes every 2 – 20 seconds. We expect that ledgers will likely close every 3 seconds in an active market. In the absence of transactions, a ledger will still close every 20 seconds to demonstrate that the network is functioning properly and that balances are still valid.

Ripple is clearly not a high frequency platform. Transaction latency is a function of the time required for servers around the world to communicate and reach consensus about trades and payments.



*CENTRALIZED EXCHANGE
PHYSICAL DISTANCE MATTERS*



*DISTRIBUTED EXCHANGE
ALL SERVERS AGREE TO UPDATE THE
ORDERBOOK IN TANDEM*

While seconds of latency may seem like an eternity for traders accustomed to ultra low latency financial markets, this architecture actually provides a more level playing field to all market participants regardless of their physical location. Because the Ripple exchange is distributed globally, no one can gain an unfair speed advantage by co-locating nearer to some centralized exchange. There is simply no central point near which traders would co-locate.

So while Ripple may be slower than other exchange platforms, it is arguably a more fair system than existing exchanges.

Order Queue

Every order on Ripple receives a timestamp. If two orders have the same limit price, the earlier timestamp gets execution priority over the later timestamp.

If multiple orders with the same limit price are included in the same ledger, they are timestamped in a deterministic but unpredictable order for fairness. This is necessary because it is difficult to accurately ascertain which order was “first” in a distributed exchange system. There is no centralized location towards which orders would otherwise race, as with traditional centralized exchanges.

Integration Process

Manual Trading

We recommend that new users interested in market making start with manual trading to get a practical understanding of Ripple's trading flow.

1. [Create](#) an account and [fund it](#) with XRP.
2. Extend trust to a Ripple gateway.
3. From the Trade tab within the client, post a bid/offer to an order book.

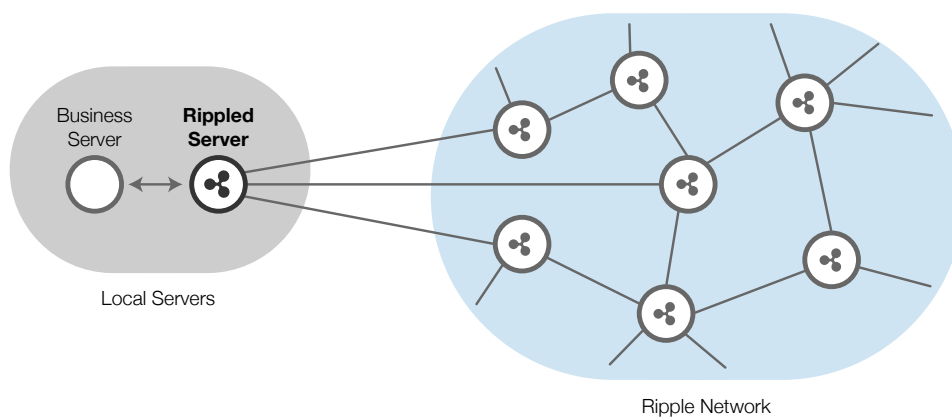
Competitive market making firms will likely use automated strategies. We discuss the integration steps below.

Running a Ripple Server

Most market makers will choose to run their own locally hosted rippled server. Running a Ripple server gives your business fast, dependable, and secure access to the complete Ripple network. If you do not run your own server, you will be relying on a third party server for access to the ledger.

You can find step by step instructions for setting up rippled at [Ripple's Github repository](#).

Market makers send commands to the server in JSON format. The rippled server itself handles all necessary communication with the rest of the peer to peer network.



Unlike a Bitcoin server, which can potentially produce bitcoin, running a Ripple server is not directly profitable. Running a Ripple server will not directly produce XRP. Ripple servers are run by those who want secure access to the network, as well as those who want to help improve the security and performance of the network.

The Rippled Server API

You will use JSON messages to interact with the server. There are two broad categories of messages:

1. Queries which return information about the current state of the server or the ledger.
2. Transactions which change the state of the server or ledger.

All JSON messages are documented here: https://ripple.com/wiki/JSON_Messages

JSON data formatting rules are specified here: https://ripple.com/wiki/JSON_format

Transaction types and formats are listed here: <https://ripple.com/wiki/Transactions>

Ripple's API tool provides an example of rippled commands and the associated server responses, in real time: <https://ripple.com/tools/api>

Websockets vs RPC

Messages can be passed to the server either by making individual RPC calls or by opening a persistent websocket connection. The individual JSON requests and responses use the same data format for both communication channels.

The choice of websockets or RPC is up to the market maker. The choice often depends on the language the existing business server is written in and the skills of the development team. Websockets is a more modern interface and is more suitable to high volume businesses. It also allows user interfaces to update dynamically. RPC's synchronous nature makes it easy for quick experimentation.

Higher Level Interfaces

ripple-lib

Ripple Labs provides a javascript library called ripple-lib which abstracts the low level message sending details. This library is helpful for browser based user interfaces that interact with Ripple. It is also useful to those writing their business server in node.js.

If you are developing in a language other than javascript, ripple-lib can serve as a helpful reference implementation on which to base your implementation. <https://github.com/ripple/ripple-lib>.

command line

The rippled executable also provides a [command line interface](#) that simplifies sending RPC requests to your server. Sending commands using the "verbose" option provides a simple way to learn the JSON request syntax.

The Rippled Server API

Ripple RESTful API

The ripple-rest API makes it easy to access the Ripple system via a RESTful web interface. Most market professionals will find the ripple-rest syntax to be more intuitive than accessing the rippled server directly via a websocket as described in the previous section.

API Documentation is provided here: <https://dev.ripple.com/> and <https://github.com/ripple/ripple-rest>

To utilize ripple-rest, you will need to either run or access a server running the ripple-rest API. The ripple-rest API conforms to the following general behavior for a web interface:

- The HTTP method identifies what you are trying to do. Generally, HTTP GET requests are used to retrieve information, while HTTP POST requests are used to make changes or submit information.
- You make HTTP (or HTTPS) requests to the API endpoint, including the desired resources within the URL itself.
- If more complicated information needs to be sent, it will be included as JSON-formatted data within the body of the HTTP POST request.
- Upon completion, the server will return an HTTP status code of 200 (OK), and aContent-Type value of application/json. The body of the response will be a JSON-formatted object containing the information returned by the endpoint.
- The returned JSON object will include a success field indicating whether the request was successful or not.

Resources

Ripple Homepage - <https://ripple.com>

Ripple Primer - https://ripple.com/ripple_primer.pdf

Ripple API Tool - <https://ripple.com/tools/api/>

Ripple GitHub Repository - <https://github.com/ripple/>

Rippled server code - <https://github.com/ripple/rippled>

Ripple Wiki - <https://ripple.com/wiki/>

Rippled JSON messages - https://ripple.com/wiki/JSON_Messages

JSON data formatting rules - https://ripple.com/wiki/JSON_format

Consensus - <https://ripple.com/wiki/Consensus>

International Ripple Business Association - <http://www.xrpga.org/>

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