Exhibit 115

Message

From: [redacted]@ripple.com]
Sent: 6/26/2017 9:17:07 AM
To: Dinuka Samarasinghe[redacted]@ripple.com]
Subject: bootstrapping XRP as a bridge currency
Attachments: Bridge Currency Incentive.pdf; Untitled attachment 00011.htm; XRP as Universal Bridge.pdf; Untitled attachment 00014.htm

This is some stuff I wrote in bootstrapping XRP into a bridge currency.
There was no real audience for the papers except as discussion with [redacted] who proposed the incentive concept.
I tried put some execution parameters around his concept.

A few people have read these within Ripple but the ideas didn't get much traction. But we did file a patent on them.

Bridge Currency Incentive

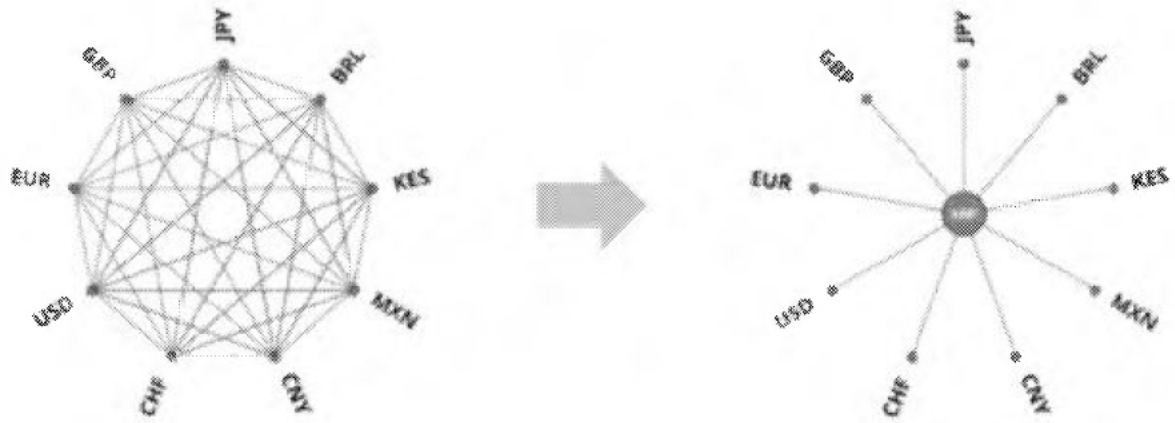
[redacted]

Ripple, Inc.

Confidential

Introduction

The key requirement for bootstrapping XRP as a bridge currency is to assure that the currency conversion path through XRP is always cheaper than the direct conversion path.



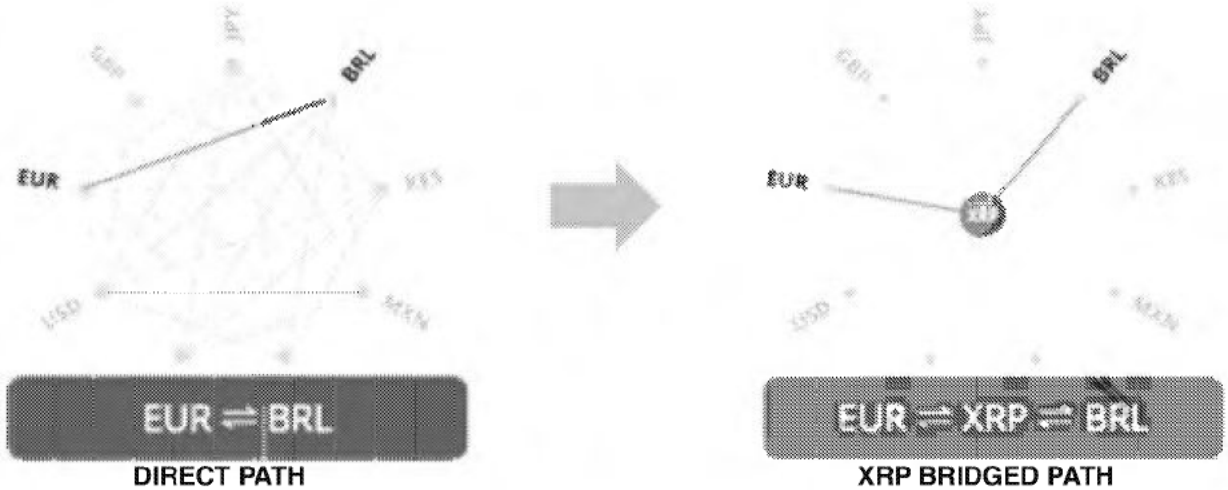
DIRECT PATHS **XRP BRIDGED PATHS**

Direct and bridged payment transactions can be compared as follows:

Path Type		Path Cost
Direct Path		X EUR * BRL/EUR = Z BRL
XRP Bridge Path		Y EUR * XRP/EUR * BRL/XRP = Z BRL
	where	Y < X

Because pathfinding's job is to find the lowest cost, XRP will only serve as a bridge when Y is less than X. That means the sum of the XRP/EUR and BRL/XRP component costs must be less than the direct BRL/EUR cost.

If that holds in both directions, then XRP's spread cost against both EUR and BRL must average **less than half** of the direct spread between the two. (Measured as a percentage of the exchange rate.)



DIRECT PATH **XRP BRIDGED PATH**

XRP Incentive

The most direct way to narrow XRP market spreads is to incentivize traders who provide the best XRP bids and offers. The incentive would always be paid in XRP, never in the counter currency.

This paper compares and contrasts two proposed approaches to creating an incentive policy. The first is to incentivize narrowing specific XRP markets individually. The second is to incentivize XRP orders for contributing to low cost bridge pathways.

The remainder of this introduction discusses issues common to an XRP incentive in general. Details of the specific approaches follows in the next section.

Sustainability

The goal of the incentive program is to establish XRP as a universal bridge currency and to have XRP maintain that status in perpetuity. Using an incentive to do so is only sustainable if we can show that the necessary XRP incentive amount remains constant (or declines) as total origination volume increases unbounded.

Constraint: Fixed XRP incentive, as volume increases

XRP Capital Cost

Providing bridge markets through XRP requires additional capital (XRP) beyond that required to make the same direct market. At all times, the value of the XRP incentive must exceed this additional capital cost.

- If a fixed XRP incentive's value is not sufficient to offset the additional capital costs of bridging at high volume, then XRP paths will lose their lower cost status.
- If the XRP incentive amount must scale with volume, then we will exhaust our XRP pool.
- If XRP value trends down over time, the XRP incentive must increase over time to cover cost

So to prove XRP can be a sustainable bridge currency we must show that, as origination volume increases, XRP's incentive value will increase faster than bridge capital costs increase.

Guideline: Increase XRP value, as volume increases

Guideline: Reduce capital requirements, as volume increases

Prove: XRP's value will increase faster than bridge capital costs will increase

Incentive Amount

XRP incentive payments put a downward pressure on XRP price. This is because market makers must sell their incentive to realize the revenue needed to cover their capital costs. This downward pressure MUST be offset by a matching demand to buy the incentive's XRP. Otherwise, as discussed above, the XRP bridge is not sustainable.

Guideline: Award as small an XRP incentive as necessary to maintain an XRP bridge.

XRP Spreads

Offsetting demand can come from NEW third-party market makers wishing to enter the system. Or it can come from NEW first parties wishing to make their own un-incentivized markets. Market makers who are currently incentivized can't both sell their incentive and buy it back. (This paper ignores "store of value" demand unrelated to bridge payments.)

New third-party market maker demand requires a revenue pool which grows with origination volume. This means that market maker revenue can't come from a fixed XRP incentive alone. Additional revenue must come from market spread costs paid by originators.

Guideline: Higher XRP spreads support XRP's value. Zeros spreads are infeasible.
Guideline: Higher origination volume supports XRP's value.
Guideline: Encouraging market makers to pay costs from spread revenue. Keep incentive revenue as XRP. Both encourage price appreciation.

Flow Balance

Offsetting flows don't move the market price. These consume equal liquidity from both sides of the book. This temporarily widens the spread without shifting the mid-market price. If the consumed orders belong to the same market maker, they can be immediately replaced without cost. This is optimal for a market maker.

All mid-market price changes derive from market flow imbalances. These flows widen one side of the book while leaving the other side alone. This has the net effect of shifting the mid-market price toward the consumed side of the book.

Flow imbalances also exhaust capital at the destination making funds rebalancing a necessity. Rebalancing costs add to the market maker's capital costs of providing liquidity. In addition, as flows become balanced, the capital requirements of providing liquidity tend toward zero. As capital costs go to zero, a market maker's profit tends toward infinity!

Guideline: Balancing payment flows, increases MM profit, which motivates XRP demand

XRP Flows

XRP market flows become especially difficult to rebalance. For example, if the XRP/MXN flow tends to deliver more MXN than it originates, all MXN will eventually be exhausted.

It is never in a market maker's interest to cross the spread, so funds can't be rebalanced in the same market. An incentivized XRP market is by intention narrower than every other comparable non-incentivized XRP market. So, there exists no cheaper external XRP/Fiat market that can be used to rebalance funds lost to imbalanced flows.

To rebalance XRP a market maker must:

1. Sell XRP for a third currency. (ex. USD)
2. Use the USD to purchase MXN in an external market.
3. Wire that MXN back to the original ripple bank for re-issuance
4. Replace the XRP/MXN ripple offer

Guideline: Balancing XRP flows minimizes rebalancing cost, which motivates XRP demand

Market Aggregation, good

Rebalancing problems are maximized if each bank currency is individually issued and non-fungible. The multitude of markets: reduces competition, increases required capital, and maximizes the number of necessary rebalancing events.

Unifying each XRP/fiat market through a fiat hub minimizes the flow imbalances. This minimizes capital cost, minimizes rebalancing costs and maximizes the revenue/capital ratio for market makers.

Guideline: Fiat hubs balance XRP flows, minimize cost, increase profit, which motivates XRP demand

A fiat hub simplifies connecting new banks to the Ripple liquidity network. A single trust line connects a new bank and the fiat hub. This gives a new bank immediate access to the best spreads.

A managed fiat hub can also leverage local rails for rebalancing funds among same currency banks. Local rail transfers use a "sending more is cheaper" pricing model, rather than a market place's "sending more is more expensive" model. This further reduces rebalancing costs and additionally provides for cheap, fast same currency bank transfers between banks.

Guideline: Fiat hubs simplify integration and provide the best interbank rates. This simplifies increasing originator volume, which motivates XRP demand.

Bi-Lateral Netting, Bad

We want to discourage bi-lateral netting. Net settling balanced flows removes that profit from the market and converts the market to one way flow. The market makers' capital cost will need to be payed for whether or not the cost is split across balanced volume or not.

Netting the balanced flows between parties shifts all liquidity cost to the party originating more volume. Every payment from the lesser originator nets out at zero cost, so the party originating more has to pay the entire cost of rebalancing.

Rebalancing is normally done in a single large market transaction at the end of a defined period. This MAXIMIZES the capital cost required to provide the rebalancing liquidity. Since market makers don't know the size or direction of the rebalancing payment, they need to invest enough capital to cover any possibility. This entire capital cost must be recovered in a single transaction, so it has the effect of MAXIMIZING the offered spread between those two parties.

Guideline: Payment originator should be encouraged to trade through the liquidity network on every transaction. This results in the lowest total cost being paid to liquidity providers.

XRP Volatility

When acting only as a bridge currency, XRP's value should be quite stable. Bridge payments neither produce nor consume XRP. They only shift it from one market maker to another. The closer we balance the flows through XRP the narrower the spread and more stable XRP value becomes

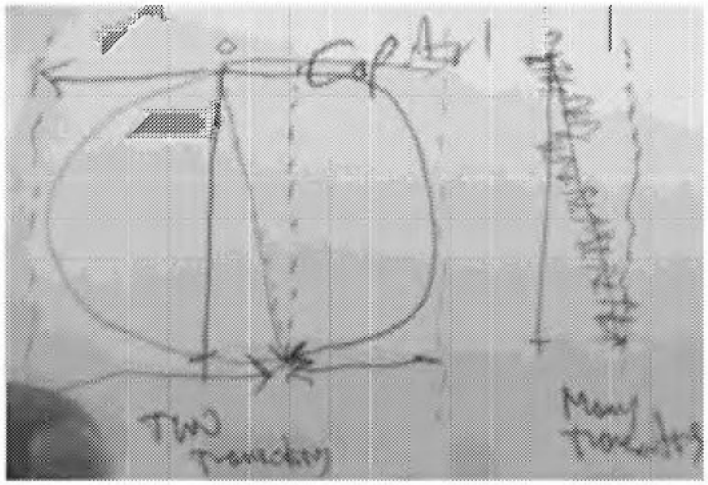
All price volatility is related to unpredictability of demand. In the bridge currency use case this means unpredictability of imbalanced flows. As discussed above balanced flows don't move the mid-market price.

Guideline: Increase predictability to reduce volatility costs and spreads

Transaction Size

It turns out that predicability and its related volatility are directly related to the average transaction size. For a given market origination volume, volatility decreases as the number of payments increases.

The best way to visualize this is to think of a market where the total volume happens as a single payment. The worst case is if we don't know how much that payment will be, or which direction the flow will be. In this case, market makers have to provide enough capital to cover both direction's worst cases. (Half the capital will go completely unused). They also have to recoup all the capital and rebalancing costs in a single payment. This maximizes the required spread.



The optimal case is steady flow of small payments in alternating directions. This assures that the net flow balance doesn't deviate from zero more than a small amount. The capital required is the maximum deviation in each direction. As the number of payments increase, this deviation is minimized.

Guideline: A lot of individual payment transactions requires less capital than a few large rebalancing transactions.

Incentive Directionality

Imbalance markets require different amounts of capital in each direction. In fact, if a market is very directional, the reverse flow may require no initial capital at all. For example, if the dominant flow is from USD to MXN, a market maker may need to provision a million dollars worth of MXN, but zero USD. The market maker will accumulate USD as payments happen. If a reverse flow MXN to USD transaction happens, the market maker simply sells back the USD he has accumulated. This unexpected balanced flow represents free revenue to the market maker.

In this situation, if we invest our incentive equally in both directions, we are incentivizing the reverse flow for no reason. Likewise, if we require a market maker to provision an equal amount of liquidity in both directions, then we are incentivizing creating capital cost where none is necessary.

Guideline: The incentive should vary with to each market direction's capital requirements.

Bridge Currency Bootstrapping Process

1. Create tradable currencies (ILP) and/or issuers (RCL)
2. Decide where to hold the assets backing the above accounts. (Bank, FXAll, etc.)
3. Ripple Inc. trades fully hedged (cross exchange) direct markets between all currencies to set baseline spread and provide backstop liquidity.
4. We then incentivize others to create XRP bridge markets narrower than our backstops.
    1. Initialize: Assign XRP incentive percentages to currency markets by best guess.
    2. Adjust Up: If backstop orders execute, then increase related market incentive
    3. Adjust Down: If some incentivized orders don't execute, decrease related incentive.

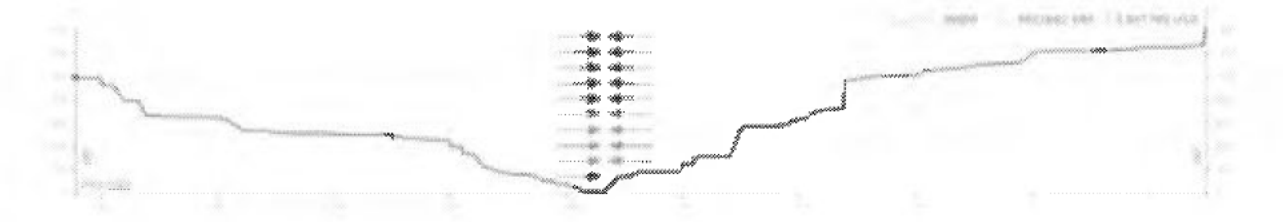
Incentive Approaches

Decisions	XRP Spread	Bridge Value
Which currencies do we incentivize?	manually chosen	manually chosen
Incentivized markets	XRP/Fiat (n books)	Fiat/XRP/Fiat (n*n-1 paths)
Reward points based on	spread as percentage of rate	better than direct rate
How much XRP do we give out system wide per incentive increment?	fixed amount according to long term distribution function	fixed **maximum** amount according to long term distribution function
Does the overall incentive depend on market volume?	no, it's fixed dependent on time	no, constrained by effectiveness up to the fixed max.
What percentage of total XRP incentive goes to each market?	manually adjusted by XRP book	automatically adjusted by bridge path according to effectiveness
Does the incentive percentage depend on market volume?	not directly. volume may be considered in manual adjustment	no. effectiveness will depend more on market flow balance

1) XRP Spread Approach

Market makers “bid” to buy currency at a low price then “offer" to sell it back at a higher price. If both orders execute then the “spread” (difference) between the two prices represents the market maker's profit.

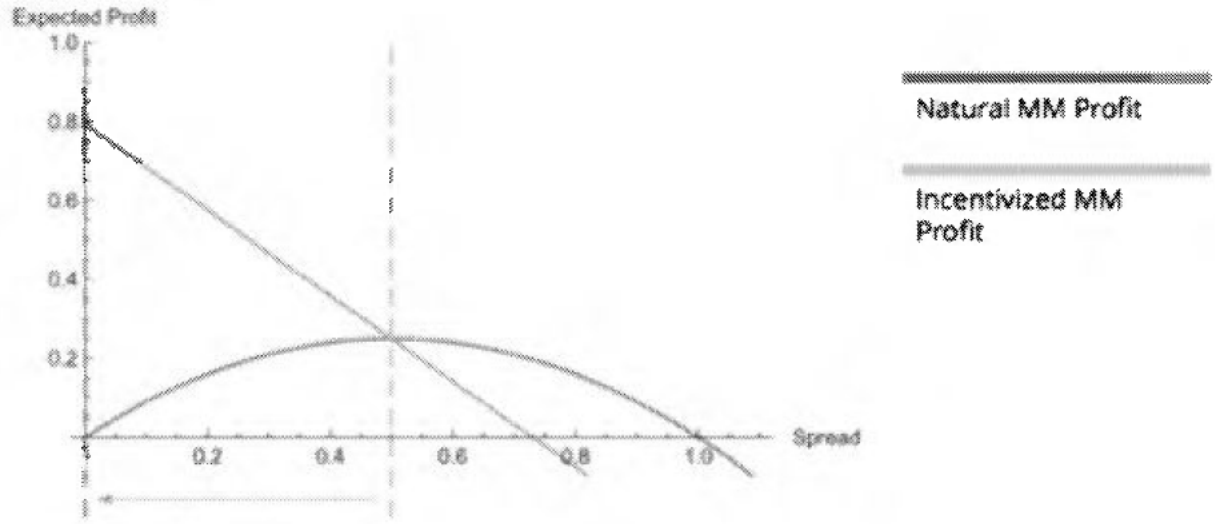
The basic idea of the market making approach is that we would pay for funded bid/offer pairs between XRP and another currency. Specifically, we would pay for them sitting on the books over time.



Another important aspect is that the payout for a given time interval would be fixed. And that people would get a share of it. That creates an environment where market makers will increase their capital to maximize their share of the incentive pool. So you end up with a competitive profit rather than a “game-able" giveaway.

The goal is to have as much low cost liquidity available as possible. Even if this liquidity is not currently trading. This liquidity is then available to provide low cost quotes to originators and others who can increase bridge payment volume.

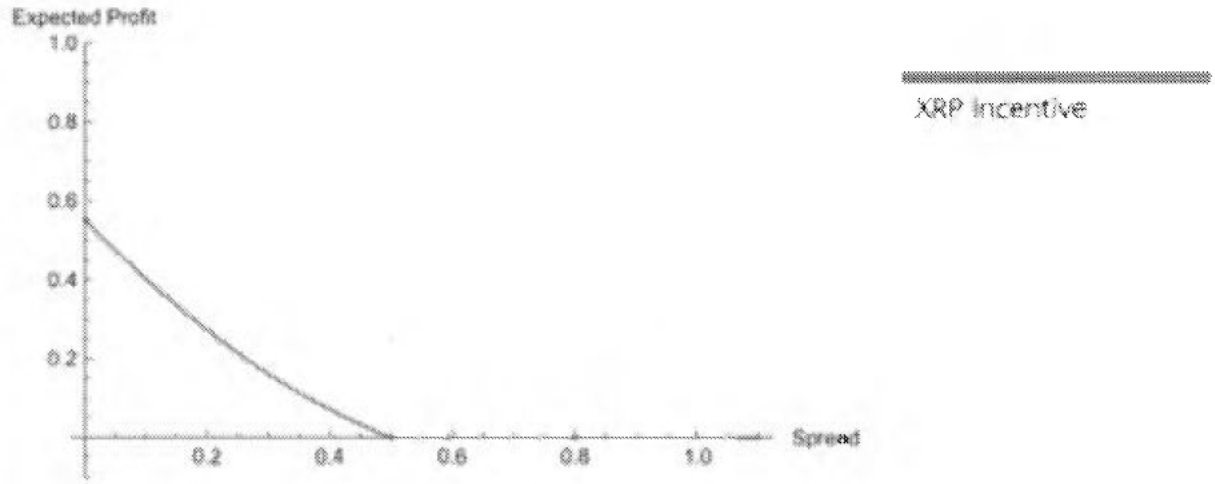
From a market maker’s perspective, if your orders do get taken you 1) profit from your spread and 2) put the orders back in the market so you also profit from the time incentive. The (yellow) incentivized profit should always exceed the market maker’s natural profit.



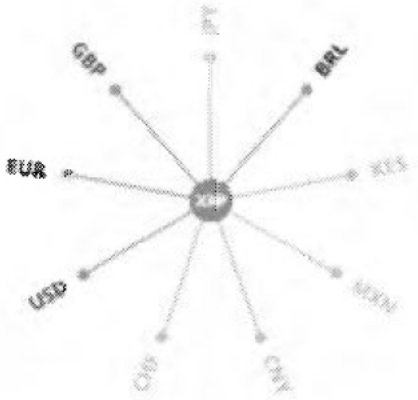
Spread Incentive Function

The way the incentive is calculated is that for each market maker you calculate "reward points" and their incentive will be proportional to their share of the total reward points pool. Reward points are proportional to the **liquidity** (size of orders) - this relationship is strictly linear.

The relationship between reward points and spread is more complex - this is a non-linear relationship. But it would be some relationship where the higher the **spread**, the fewer reward points. Finding the optimum shape of that **curve** is still an open question at this point.



The other knob that we have to find is the optimum setting for is the **incentive size** over time for each given **order book**.



- Strategic order books are incentivized
  ⇒ e.g. USD ⇌ XRP ⇌ EUR
  ⇒ Zero spread to be competitive
- Others purchase XRP to access liquidity
  ⇒ e.g. INR (BOI) ⇌ XRP ⇌ USD
  ⇒ Instead of buying USD *and* EUR *and* ...

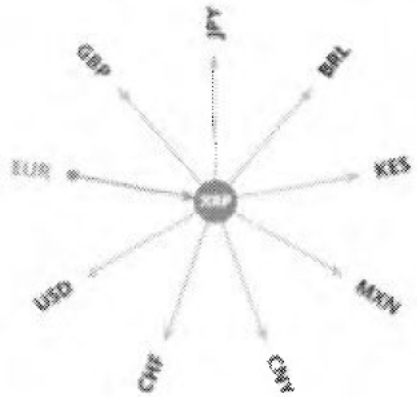
Approach Risks

Incentivizing individual XRP markets should alway narrow that market's spread. However, it does not guarantee that the spread is narrowed far enough to facilitate bridge payments. In the above diagram, it is possible that we incentivize both EUR/XRP and XRP/BRL markets individually but only reduce each spread to 60% of the natural direct market spread. In that case the direct EUR/BRL path would still be cheaper than the incentivized XRP bridge alternative.

2) Bridge Value Approach

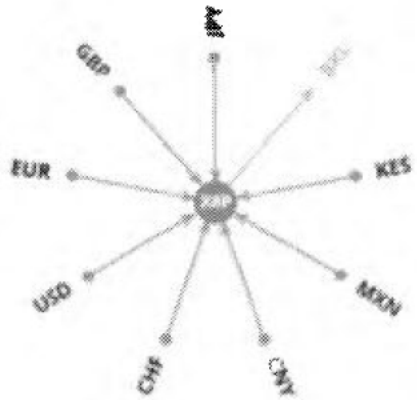
An alternative incentive approach is to look at each XRP "bid" and "ask" as a contributor to multiple bridge paths. For example, given (n) non-XRP currencies:

An EUR/XRP "bid" (green) can be paired with (n-1) other XRP "asks" thus defining (n-1) bridge paths.



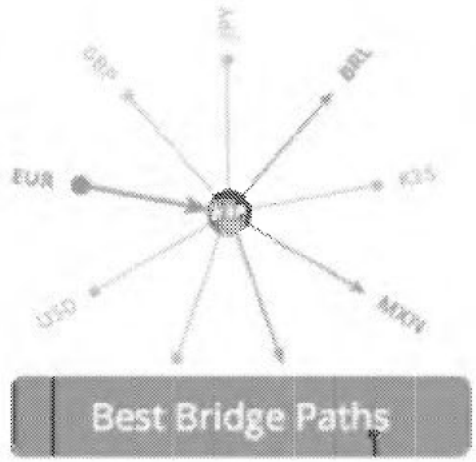
- Each XRP "bid" enables (n-1) possible paths
  ⇒ e.g. placing EUR ⇌ XRP enables:
  EUR ⇌ XRP ⇌ BRL
  EUR ⇌ XRP ⇌ GBP
  EUR ⇌ XRP ⇌ JPY
  ...
  EUR ⇌ XRP ⇌ USD

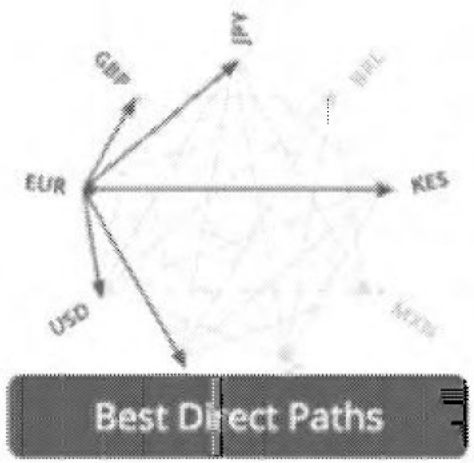
Likewise, an XRP/BRL "ask" (yellow) can be paired with (n-1) other XRP "bids" also defining (n-1) bridge paths.



- Each XRP "ask" enables (n-1) possible paths
  ⇒ e.g. placing XRP ⇌ BRL enables:
  EUR ⇌ XRP ⇌ BRL
  GBP ⇌ XRP ⇌ BRL
  JPY ⇌ XRP ⇌ BRL
  ...
  USD ⇌ XRP ⇌ BRL

So depending each order's pricing, each XRP bid or ask can create up to (n-1) cheaper than direct paths. The EUR/XRP bid below is good enough to create 3 bridge paths, but not good enough to undercut the other 5 direct paths.



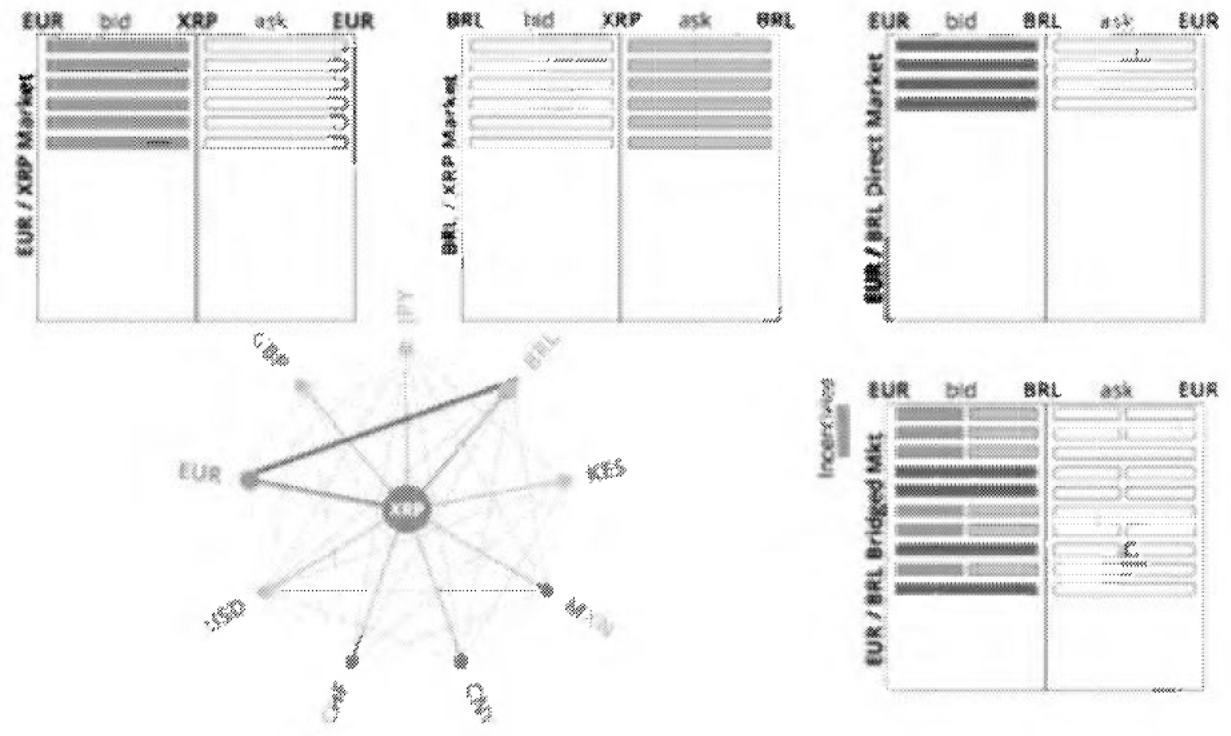


Bridge Incentive Function

The incentive system used in this approach is similar to above. Reward points are still proportional to the **liquidity** created by each order. But rather than incentivizing XRP books, we instead incentivize each bridge path individually.

Each market maker receives reward points for each **cheaper-than-direct** bridge path an XRP bid or ask contributes to. They are encouraged to place better orders in order to benefit from participating in multiple path incentive pools.

The below diagram shows how XRP orders are combined with direct market orders to create a combined direct+bridged book. This book allows us compare orders to determine reward points.



CREATING A COMBINED BOOK

As with the other approach, we still need to decide which currency **order books** are worth incentivizing. This is because in Ripple anyone can create a new currency (with associated order books). Spreading the incentives across insignificant currencies could open the system to gaming.

The system as a whole needs to choose an **incentive size** by time period. However, rather than predetermining this amount and its market split as with the previous system, we can adjust the incentive amounts dynamically. This allows us to evaluate and meet our bridging goals while minimizing the total XRP incentive.

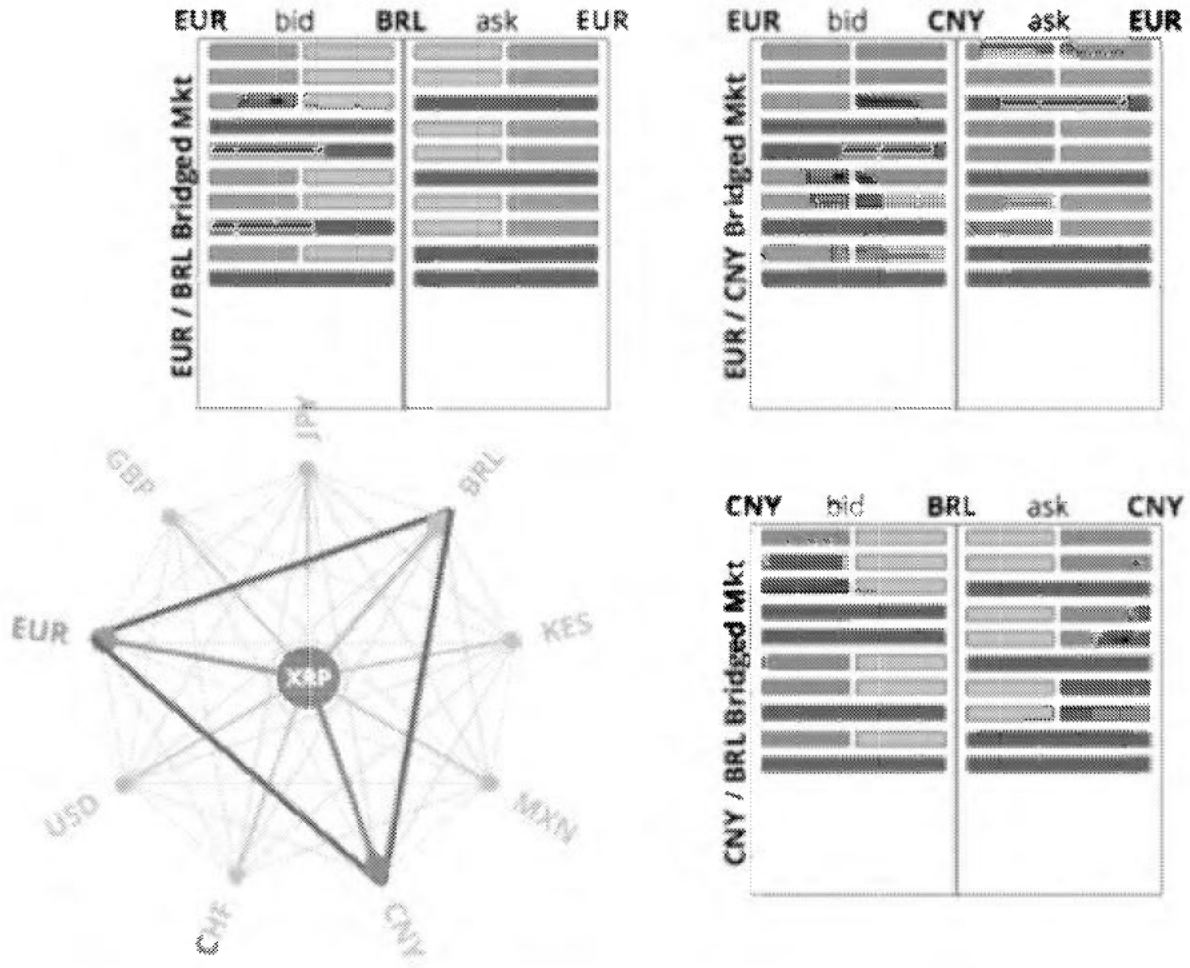
Approach Risks

Automated incentive scaling risks gaming, but if payment originators can be monitored separately from traders the risks might be mitigated.

Monitoring Effectiveness

With either incentive strategy it is pretty straightforward to judge its effectiveness. For (n) incentivized currencies there are (n)*(n-1) bridge paths. If an XRP bridge path is lowest cost in each case, then our incentive is sufficient and has been 100% effective.

It is pretty easy to visualize by displaying all the combined order books in one table. If bridge paths are at the top of each book then our incentive has been effective.



SIX BRIDGED PATHS AS THREE COMBINED ORDER BOOKS

Any payment system that supports a bridge currency must be able to make these calculations in order to support finding the lowest cost path. Rippled does these calculations on demand during pathfinding. Michael's ILP pathfinding service plans to keep the above combined books up-to-date at all times.

For either system (RCL or ILP) we should be able to compute combined books retrospectively. This lets us calculate and award the incentive at the end of a pre-defined period.

Adjusting the Incentives

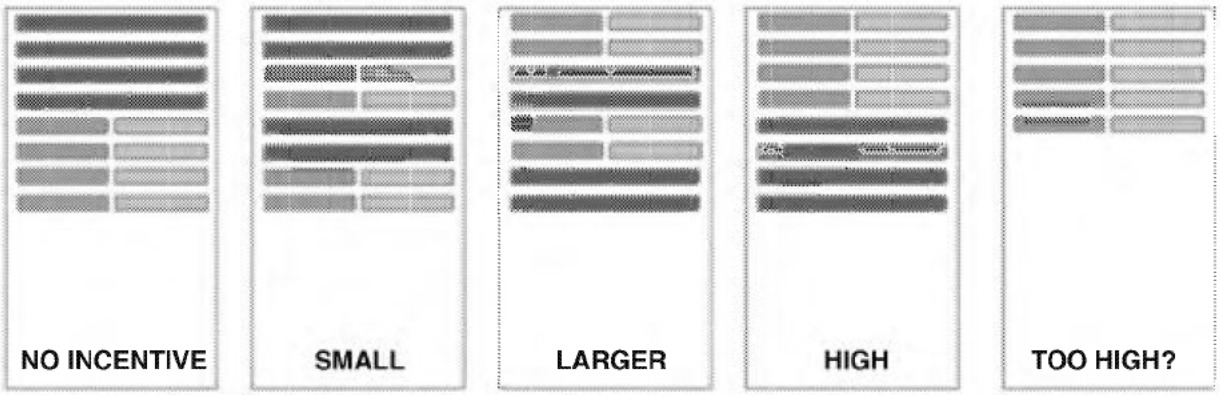
As shown in the introduction, an optimal incentive varies with market volume and balance. As the network volume grows each market's volume and balance will change. This necessitates rebalancing the incentives to assure that XRP remains a viable bridge.

While these adjustments could be done manually, an algorithmic process is preferable of we wish to approach optimality.

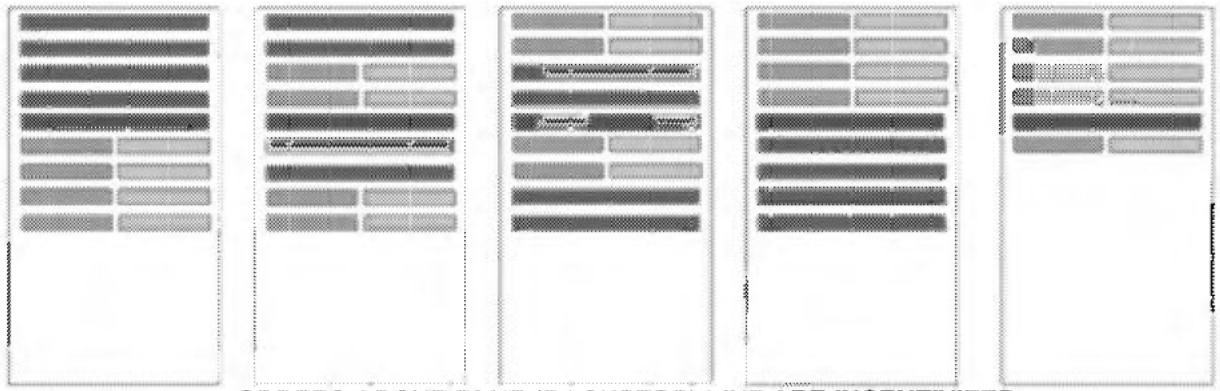
Backstop Liquidity

The first step in any incentive is to figure out what not to incentivize. An initial guideline is to look at the existing direct markets. This provides a reference point for incentivizing bridge order which are less than the best direct orders.

However, as our incentive becomes effective it will make the direct markets less profitable. This will lead to a reduction in capital as the cost of funds exceeds profit. Also it will lead to a widening spread as transactional volume decreases and rates need to be increased to price to profit on the remaining funds. Eventually, there will be no offers left in the direct market. Once this happens, we will have no reference to judge which bridge orders to incentivize.

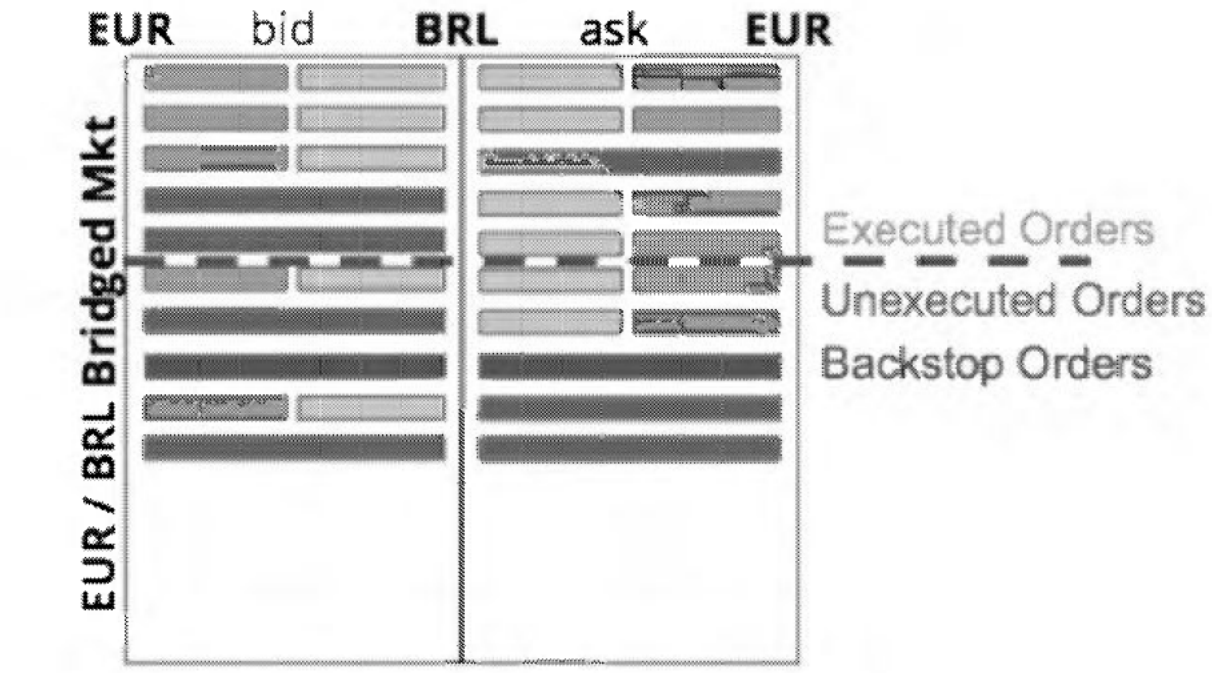


Backstop liquidly is an order placed by Ripple Inc. at a price too high to be worth incentivizing. This price can be determined by taking an external market price and raising it slightly. These orders provide a simple reference for our algorithm to use in adjusting the incentive.



Unexecuted Liquidity (decrease the incentive)

The next question to ask is, "Are we over incentivizing?" For any period of time some order will execute, others will not. If incentivized order are not executing, then they only serve to increase the market maker's capital cost. This cost will need to be paid by selling the XRP incentive thus driving down XRP's price without any real benefit.



Executing Backstop Orders (increase the incentive)

Finally we have to ask, "Are we incentivizing enough?" If our backstop orders execute, that represents our originators getting a worse than (external) market rate. When this happens, we should increase the incentive to draw more XRP bridge capital to this market.

There may be direct market orders that are better than our backstop. These are never incentivized. But, if these direct orders are regularly executing, it is also a signal that we need to increase the incentive.

Optimality

The above algorithm results in an optimal incentive strategy that meets the guidelines in the introduction. Run-time results are easy to evaluate. For all market directions, the executed order line should hover just above the backstop liquidity orders.

Details

This section is a bit geeky but will be a good reference for me when we decide to code an implementation.

Market Capital Requirements

We can calculate the maximum capital needed in both directions for each market based on the originator flow for a given incentive period. This tells us what our incentive actually bought.

- For the EUR/USD market:
  - start with a zero EUR and a zero USD balance
  - For each payment, in order:
    - If the payment delivers USD, add EUR origination amount, subtract USD delivery
    - If the payment delivers EUR, subtract EUR delivery amount, add USD origination
- USD capital requirement is: ABS(the minimum USD balance) if <= zero or zero
- EUR capital requirement is: ABS(the minimum EUR balance) if <= zero or zero

We can compare that to the available (below backstop) capital in both directions at the end of the current period. This gives us a reference to use in adjusting the incentive.

Incentive Algorithm

- Incentive is awarded in XRP based on a period of time. (Incentive Period)
- The total XRP for each incentive period is divided across (n*n-1) currency pair paths.

- Reward points are based on a shorter period than the incentive period. (Reward period)
- The reward period may be a small as a single Ripple ledger increment.
- XRP/Fiat liquidity provided by market makers is measured by the XRP side of the order. This normalizes liquidity comparisons.
- Each [thousand] XRP of liquidity on a path gets one reward point per reward period, if-and-only-if it contributes to a better than backstop priced path.
- Each XRP/fiat order can receive reward points for multiple paths..

- At the end of the incentive period, each market maker gets a share of the incentive for every path to which they hold reward points.
- The share equals (market maker's reward points)/(total issued reward points) for each path.
- The XRP award equals (path's XRP incentive)*(MM's path share).

Initialize Incentive

- Calculate the maximum capital requirements for each Fiat/Fiat path.
- Normalize the directional amounts to XRP using the mid-market rate.
- Total up the capital requirements in XRP.
- The XRP incentive for each path is initialized to that path's required percentage of total capital.

Increment Incentive

- If backstop orders execute, it means that our incentive didn't provision enough bridge capital.
- Calculate the path's current available liquidity (better than backstop)
- Calculate the path's previous capital requirement for the incentive period.
- Increase the incentive by the same percentage that the capital requirement exceeds liquidity.

Decrement Incentive

- We want to avoid incentivizing orders that don't execute. (Provisioning too much bridge capital.)
- Calculate the path's current available liquidity (better than backstop)
- Calculate the path's previous capital requirement for the incentive period.
- Decrease the incentive by the same percentage that liquidity exceeds the capital requirements

Market Maker Pricing Guide

We can calculate an anticipated reward curve based on how many bridge markets a given order (price + amount) would participate in.

- For a proposed XRP/USD order:
  - For each of the (n-1) other incentivized currencies:
    - Given XRP/(fiat) best current price, and USD/(fiat) backstop,
    - Then XRP/USD's worst reward price can be calculated.
  - Rank the calculated worst reward prices
  - then sum the XRP reward from each path into each price range
  - the results in the XRP/USD path's reward curve compared against order price.

This creates a stepped reward curve that approached the curve Stefan drew as the number of incentivized currencies increases.

Conclusions

Several things surprised me with this analysis.

1. A zero or near zero spread is not a viable goal.
    1. It decouples demand for XRP from originator volume. This means growing volume does not increase market maker profits or increase competitive demand.
    2. It assures that market makers must sell their incentive immediately to cover costs. This acts to drive down XRP's price.
2. Reducing the XRP spread below the minimum required for a bridge is counter productive.
    1. The spread is a key part of the market maker's revenue. Maximizing it drives higher profit and brings competition from new market makers who need to buy XRP.
    2. Incentivizing excess capital that doesn't trade has results equivalent to 1.2 above.
3. Balancing payment flows as volume grows is required to sustain a bridge currency.
    1. Balancing flows reduces capital costs, increasing revenues exponentially.
    2. Growing imbalanced flows increases revenue linearly with capital cost.
4. Fiat hubs are required to bootstrap XRP as a bridge currency.
    1. ILP proposes the same solution via Peter's central exchange.
    2. ILP incentive algorithms need access to funded fiat balances.
    3. They provide an optimal solution to balance XRP flows and drive price competition.
    4. Having banks hold their own XRP actually requires someone else to re-invent the hub concept in order to facilitate banks rebalancing their XRP.
5. Originators with many smaller payments our preferable to those wanting to make large (pre-funding or rebalancing) payments.

XRP as Universal Bridge

This document describes the forces that could lead to XRP becoming a universal bridge currency. It also documents the forces that work against XRP as a bridge. It presents things Ripple Labs can do to encourage XRP bridging and why we should do so.

Liquidity

XRP is a purely virtual currency. As such, XRP's value is tied directly to its liquidity. Meaning at any given moment your XRP position is worth exactly what someone else is offering to give you for it. No buyers means no value. Conversely, your XRP becomes more valuable as its liquidity increases. (i.e. instantaneous demand)

XRP's absolute maximum liquidity arises when the cheapest conversion path between every other pair of currencies trades through XRP as a bridge currency. This is fairly easy to prove, but less easy to achieve.

XRP as a Bridge Currency

Direct and bridged payment transactions can be compared as follows:

Path Type		Path Cost
Direct Path		X USD * EUR/USD = Z EUR
XRP Bridge Path		Y USD * XRP/USD * EUR/XRP = Z EUR
	where	Y < X

Because pathfinding's job is to find the lowest cost, XRP will only serve as a bridge when Y is less than X. That means the sum of the XRP/USD and EUR/XRP component costs must be less than the direct EUR/USD cost. If that holds in both directions, then XRP's spread cost against both USD and EUR must average less than half of the direct spread between the two.

Universal Bridge Currency

If we position XRP as a universal bridge currency then by definition the "half spread" relationship must hold against every currency. As a universal bridge, XRP guarantees you (as XRP holder) the following liquidity benefits:

1. Someone paying you in XRP incurs half the conversion cost when making a cross currency payment.
2. You incur half the conversion cost when making cross currency payments to others.
3. You get the best "market" price when sending payments.
4. If you want a better than market price, your "limit" orders go into the highest velocity market.

Value #1: Liquidity benefits alone may entice end-users to purchase (store value in) XRP.

However, it is useful to note that each XRP bridge transaction is intrinsically neutral toward XRP demand. The best way to visualize this is to think of paths where the same trader has the best

price on both ends of the bridge. In this situation, the trader ends up buying XRP from himself. His net liquid XRP at the end of the transaction is exactly the same as at the beginning of the transaction. The same is true with two market makers. The same amount of XRP stays liquid. It just made available by a different trader.

XRP Bridging Supports XRP Price

Nonetheless it is possible to show that, when XRP is acting as a universal bridge, XRP's market price becomes tied to the total cross currency conversion volume of the Ripple network. Increases in volume directly support increases in XRP price. The logic is as follows:

1. An increase in conversion volume necessitates an increase in XRP trading velocity.
2. The increase in velocity, increases every trader's return rate on the same working capital.
3. Increased profit drives competition from new players who must purchase an XRP trading stake.
4. Additional XRP demand against a fixed market based supply increases XRP's relative price.
5. The new competition re-closes the market spread around the higher price.

Value #2: Demand for XRP as a medium-of-exchange augments but is completely independent of the demand for holding XRP as a store-of-value. This use case brings an independent baseline for XRP value even absent consumer demand.

Hurdles to XRP as a Universal Bridge Currency

Unfortunately, while it is possible for XRP to become a universal bridge currency, it absolutely CAN NOT happen without Ripple Lab's assistance. The key reasons are:

1. Market makers require more working capital to provide the same amount of liquidity.
2. XRP volatility adds additional market making risk

Those factors naturally increase XRP bridged spreads over their direct equivalents. Thus disabling the bridge itself. Adding to the odds,

3. It's much more likely that USD becomes established as the bridge currency long before XRP does.

Outside Ripple, USD and the five other majors act as bridge currencies to the exotics. Inside Ripple, USD actually makes a more natural bridge currency than XRP. USD tends to be more liquid and less volatile than XRP.

Self Imposed Hurdles

Worse yet, our FI partners are hesitant to even consider XRP. The friction is so high that business development avoids discussing XRP at all. Without the FI's volume there is little reason for traders to make tight XRP markets. Absent tight markets XRP has no ability to bridge.

Continuity: XRP bridging gives RL a concrete pitch for continuing to wholesale XRP. It also fits into our BD messaging even if we choose never to promote consumer use of XRP.

Required enablers for an XRP Universal Bridge Currency

Fortunately, while existing markets are small, RL has the ability to overcome these hurdles.

1. Market maker XRP subsidies can reduce the additional working capital requirement.
2. Ripple Labs can underwrite the volatility risk to narrow XRP bridge spreads.
3. Over the longer term additional XRP capital costs will be more than offset by bridging's benefits:
   a. More balanced trading flows
   b. Additional market volume

Timing

Ripple pathfinding always works to reinforce the lowest costs paths. As such, establishing XRP as bridge early becomes self reinforcing. However, that same natural reenforcement applies to any established bridge currency including USD. So unseating USD a bridge will be much harder than establishing XRP early.

Note that if USD becomes Ripple's de facto bridge currency, XRP loses the additional medium-of-exchange value described above. It will still be valued by those looking for the best cryptocurrency asset in which to store value. But as these types of value are cumulative, XRP's total value will always be lower when not used as a bridge.

The Dirty Details

Working Capital

Suppose Mark wants to provide a million dollars worth of liquidity in both directions between USD and EUR. Then Mark will need two million dollars worth of working capital. One million dollars worth of dollars to offer for euros. Another million dollars worth of euros with which to bid on dollars.

If Mark wants do the same trading through XRP, he will need to hold a third million dollars worth of XRP as well. This represents a 50% increase in the working capital requirements.

This is not linear of course. If Mark is already holding ten currencies then the adding XRP amounts to 10%. But, for any given conversation volume between EUR and USD, Mark's XRP bridge path trades will always be both lower profit per conversion (user's cost == Mark's profit) and require more working capital.

Remedy: Subsidize important market maker's initial XRP trading stake.

Bring more FI partner conversion volume through the XRP bridge.

Volatility

In addition, because Mark now holds three standing positions, he is exposed to additional XRP currency risk.

EUR/USD and EUR/XRP/USD both have the same EUR/USD currency risk. As such, I'll ignore the common risk to concentrate on the additional XRP risk. So given the above scenario, let's presume that EUR/USD maintains the same ratio, while XRP varies against both.

Given that Mark wants to maintain a million dollars worth of each currency and withdraw his profits as he goes. If flows were balanced from EUR->USD and USD->EUR then in a direct market with static rates, Mark would have to do nothing but withdraw the excess balances from his accounts each day.

But even given balance flows and static EUR/USD rates, bridging through XRP adds volatility risk. Mark benefits on days when XRP's value moves up against EUR/USD. Because the previous day's XRP are worth more than a million dollars, Mark can cash out the excess in addition to his trading profits. However, XRP moves down can eat into the trading profits or even require Mark to deposit additional funds in order to purchase supplemental XRP.

Remedy: Underwrite important market maker's exposure to XRP price volatility

Underwriting

While the market is still small and new, it may be in Ripple Lab's favor to underwrite our important market making partners against large downward movements in the price of XRP. The goal is to give market makers the risk comfort to narrow spreads far enough for XRP to act as a bridge.

Notice that the underwriting cost should be minimal. Underwriting is costless while the value of XRP is increasing. As discussed above, once XRP is established as a universal bridge currency, maintaining it as such binds the value of XRP to the total currency conversion volume through the system. If trading through Ripple continues to increase then the cost of underwriting XRP declines is effectively zero.

Sustaining XRP as a Bridge Currency

There will always be force working against XRP as a "universal" bridge. Acting as a bridge requires XRP markets to have the narrowest spread. However, even when that is the case, there are still ways to create cheaper paths than the XRP bridge. The most common "cheapest" case is bilateral net settlement. If two parties decide to net settle their bi-directional flows, then the balanced transaction volume comes at zero cost. The smaller unbalanced amount can then be gross settled through the XRP bridge at the best market rate.

The key to keeping XRP valuable as a bridge currency is to assure there is sufficient positive value to overcome the bridge currency's additional overhead.

Bridge Currency Velocity

Direct markets require you to hold working capital in both currencies in order to make one (whole fee) market. Making two XRP markets instead gives you (half fee) access between two currencies and every other currency. Bridging adds additional cost free benefits as the number of currencies and/or counter-parties being bridged increases.

Balanced Flows

Where there are unbalanced flows, someone has to bare the external overhead of rebalancing the flows. This is normally accomplished by traders withdrawing the less demanded funds from Ripple, trading them for funds in demand funds through another market, redepositing these funds into Ripple, than marking up those costs in their Ripple marketplace orders. Trading through XRP has the effect of consolidating the total number of markets therefore increasing depth and balance.