

Understanding & Regulating Twenty-First Century Payment Systems: The Ripple Case Study

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INTRODUCTION

Joe lives in rural United States and has an account with a small bank, Ameribank. Joe wants to pay \$100 to Mary, who lives in India and has an account with another small bank, IndiaBank. How does that \$100 get to Mary, and what will it cost Joe? First, it moves from AmeriBank, through the Federal Reserve to a large New York bank that has a contractual relationship with a large Delhi-based bank. Then, it moves from that New York bank across

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national borders to the Delhi bank. Finally, it moves from that Delhi bank through the Reserve Bank of India, and finally to IndiaBank. In this case, the final transaction between Joe and Mary occurred through three separate settlements, and at each point in the transmission of the transaction and at each settlement point, the bank earns a fee. But what if instead Joe and Mary could complete the transaction in a single step?

Ripple is an open-source Internet software that enables users to conduct payments across national boundaries in multiple currencies as seamlessly as sending an email.¹ Created by Ripple Labs, Inc. (“Ripple Labs”) in 2012, this software is embedded with a protocol that dictates how Ripple-connected computers interact with each other.² This protocol uses a distributed ledger – a collection of financial accounts updated by numerous and dispersed entities – through which Ripple users can conduct cross-border payments in a way that is faster, less costly, and more efficient than traditional means.

Today’s international payments system is broken, and Ripple could provide its cure. The international payment system lacks transparency and remains antiquated, “slow, inconvenient, [and] costly.”³ Thus the Federal Reserve, in proposing reforms to the United States payment system listed the ability of “United States consumers and businesses to send and receive convenient, cost-effective and timely cross-border payments” as one of five desired outcomes to improve the modern payment system infrastructure.⁴ And while the Federal Reserve has identified the problem, private banks believe that distributed ledger technology could provide the solution. Santander Bank estimates that distributed ledger technologies could save banks up to

¹ RIPPLE LABS, INC., *THE RIPPLE PROTOCOL: A DEEP DIVE FOR FINANCE PROFESSIONALS* 4, 45–46 (2014) [hereinafter *THE RIPPLE PROTOCOL*].

² *Id.* at 4.

³ FED. RES. SYSTEM, *STRATEGIES FOR IMPROVING THE U.S. PAYMENT SYSTEM* 25 n.35 (2015).

⁴ *Id.* at 2. The other improvements focus on speed, efficiency, and security improvements. *Id.*

\$20 billion a year in infrastructure costs related to cross-border payments, securities trading, and compliance.⁵ This Note argues that Ripple provides the solutions that the Federal Reserve calls for by offering a more efficient, speedy, and secure solution for international payments than what traditional systems can provide.

This Note suggests that Ripple should and will become widely adopted, serving as at least one major international payments protocol. But if Ripple is widely adopted in the global payments ecosystem, regulators must figure out the best way to oversee its use. This poses challenges because unlike traditional payment systems, Ripple is an open-source Internet protocol: it is not owned or operated by any entity, but it facilitates operational processes between its members.⁶ And although it governs how the users' computers interact with each other, the protocol does not affect the users' legal rights and obligations.⁷ Ripple does not propose to replace the current financial infrastructure, but instead intends to become a part of it, to plug into it, much like an app on an iPhone.⁸ Ripple provides only the *rail* on which payments move, and it does not define any other aspect of the relationships of its users or their legal responsibilities to one another.⁹ Because of its unique decentralized nature and unclear legal status, Ripple – like other distributed ledger-based protocols – does not seem to fit into existing frameworks for regulating payment systems or service providers.

Along with explaining what Ripple is, does, and how it relates to the existing payments system, this Note suggests a comprehensive approach to regulating Ripple. Part I of this Note explains how today's traditional payment systems work and the particularly significant problems

⁵ SANTANDER BANK, THE FINTECH 2.0 PAPER: REBOOTING FINANCIAL SERVICES 15 (2015).

⁶ THE RIPPLE PROTOCOL, *supra* note 1, at 4.

⁷ *See id.*

⁸ *Id.* at 4–5.

⁹ Telephone Interview with Ryan Zagone, Dir. of Regulatory Relations, Ripple Labs, Inc. (Apr. 20, 2015).

and costs that attend people's ability to send money throughout the world. Part II of this Note argues that Ripple provides a better way to conduct cross-border payments because it represents an alternative infrastructure mechanism that makes international payments cheaper, more efficient, and more secure. Part II also explains Ripple's unique governance structure and how regulators currently require financial institutions to manage Ripple for risks (rather than actually regulating Ripple). Part III provides substantive suggestions for regulating Ripple and other decentralized internet payment protocols ("DIPPs"). It will propose a new set of principles for regulating Ripple by analyzing domestic and international guidelines and regulations and modifying them to account for the particular risks posed and mitigated by Ripple.

Thus this Note serves two general functions. It will first help regulators and other market participants understand *how* Ripple operates. And secondly, it will suggest principles that regulators might use to monitor these increasingly important decentralized and globalized value-transmitters.

I. NON-CASH PAYMENTS: MOVING MONEY THROUGH SETTLEMENT

This Section will describe the basic characteristics of traditional centralized payment systems in order to explain how Ripple works. To do this, it will first analyze how money "moves" through financial institutions. It will then describe how modern domestic payment systems rely on central institutions to facilitate this movement of money between institutions. Because no central institution provides global settlement functions, the current international system is inefficient and introduces considerable risks to the global financial system.

A. *Moving Money in the United States*

Because the structure of payment system regulation depends on the underlying logic of the payment system, one must know how the system works in order to understand the rationale

for its regulation. (And to justify any potential regulatory reform, one must understand how changes in the underlying payment system affect the ability to achieve regulatory goals.) At the most basic level, payment systems move money from a payer to a payee. While one might think of money as banknotes that people can hold in their hand, most payment systems today move money in the form of deposit balances held in banks.¹⁰ A bank customer creates a deposit balance when she deposits cash into her account. This deposit balance is a financial asset and a form of money because it reflects a depositor's claim on the bank that the depositor can redeem from that bank.¹¹ A non-cash payment from a payer to a payee – for example, through an inter-bank wire transfer – uses these deposits to “move” money from the payer's bank account to the payee's bank account by decreasing the payer's deposit balance account and increasing the payee's deposit balance account. This process is a “settlement” because it settles a payment obligation by moving a financial asset, a deposit balance, between a payer and payee.¹²

Settlement occurs when banks update their ledgers to adjust deposit balances.¹³ But because settling an obligation between a payer and a payee necessarily creates a new obligation between the payer's bank and the payee's bank that the banks must also settle, the payer's bank must send a corresponding amount of funds to the payee's banks to settle the obligations. For every credit there must be a corresponding debit: both banks have to update their ledger, to account for the transfer of funds.

¹⁰ COMM. ON PAYMENT & SETTLEMENT SYS., BANK FOR INT'L SETTLEMENTS, THE ROLE OF CENTRAL BANK MONEY IN PAYMENT SYSTEMS 1–2 (2003) [hereinafter CENTRAL BANK MONEY].

¹¹ *Id.* at 4.

¹² *Id.* at 6.

¹³ A “general ledger,” which most banks maintain for accounting purposes, provides a record of every financial transaction into which the institution enters. *General Ledger*, INVESTOPEDIA.COM, <http://www.investopedia.com/terms/g/generalledger.asp> (last visited Aug. 9, 2015).

A “payment system” provides the protocol that defines how banks settle these obligations.¹⁴ More specifically, a payment system is a set of instruments, procedures, and rules for the transfer of funds from one bank to another in order to settle their obligations.¹⁵ A payment system, then, defines inter-bank settlement behavior. It defines the processes through which parties move money.

Most modern payment systems rely on a “settlement institution,” which holds deposits from each bank that is party to the payment transaction, in order to settle obligations between banks that arise when their customers make payments.¹⁶ By adjusting the deposit balances of the payer’s and payee’s respective bank, it provides the key mechanism to facilitate a fund transfer.¹⁷ These deposit balances, called “settlement assets,” provide the funds necessary to balance out the adjustment of liabilities that arise from the payment from a payer to a payee.¹⁸ Most of the time, the settlement institution is a central bank, such as the Federal Reserve in the United States.¹⁹ And because the Federal Reserve requires every member-bank to hold minimum reserve balances with the Federal Reserve, the Federal Reserve holds the balances of many banks and thus can enable the free flow settlement assets from many different banks.²⁰

For example, imagine that Joe wants to pay Mary \$100. Each holds an account with different banks, Blue Bank and Yellow Bank, who in turn both hold deposit accounts with the

¹⁴ COMM. ON PAYMENT & SETTLEMENT SYS., BANK FOR INT’L SETTLEMENTS, A GLOSSARY OF TERMS USED IN PAYMENTS AND SETTLEMENT SYSTEMS 38 (2003) [hereinafter GLOSSARY] (defining a payment system as “a payment system consists of a set of instruments, banking procedures and, typically, interbank funds transfer systems that ensure the circulation of money”).

¹⁵ *Id.*

¹⁶ *Id.* at 45.

¹⁷ *Id.*

¹⁸ *Id.*

¹⁹ *Id.*; see BD. OF GOVERNORS OF THE FED. RES. SYS., THE FEDERAL RESERVE SYSTEM PURPOSES & FUNCTIONS 35 (9th ed. 2005) [hereinafter PURPOSES & FUNCTIONS]

²⁰ *Id.*

Federal Reserve. When Joe initiates the payment, Blue Bank debits \$100 from his account, which decreases the liability it owes Joe by \$100. Blue Bank then instructs the Federal Reserve to decrease its deposit balance by \$100 and increase Yellow Bank's balance by \$100, which requires both Blue Bank and the Federal Reserve to update their own ledgers. Through this process, Blue Bank transferred a \$100 settlement asset, in the form of Federal Reserve deposit balance, to Yellow Bank. Because its assets increased by \$100, Yellow Bank can credit Mary's account by \$100, increasing its liability to Mary and thus balancing its ledger.

In the United States, the Federal Reserve operates two systems to facilitate settlement: the Automated Clearing House ("ACH"),²¹ for retail payments, and FedWire, for large-value and time sensitive payments.²² Although FedWire provides near real-time settlement, ACH transactions require one to two days to settle.²³ While FedWire settles significantly more transactions in dollar amounts than the ACH, the ACH processed 21.7 billion transactions in 2013 compared to FedWire's 287.5 million transactions.²⁴ The Federal Reserve uses software to update its ledger to process batches of payment orders between two banks and to calculate net

²¹ *Id.* at 93–95. ACH is an operational system that facilitates "clearing." 2 COMM. ON PAYMENT & SETTLEMENT SYS. BANK FOR INT'L SETTLEMENTS, PAYMENT, CLEARING & SETTLEMENT SYSTEMS IN THE CPSS COUNTRIES 493 (2012) [hereinafter CPSS ON INT'L PAYMENT SYSTEMS]. In the ACH system, the Federal Reserve (the settlement institution) serves as an ACH operator and runs a centralized application software that process inter-bank payments. *Id.* The Electronics Payment Network ("EPN") is a private entity that also operates ACH. *Id.*

²² PURPOSES & FUNCTIONS, *supra* note 17, at 93–95. The Clearing House Payments Company L.L.C., which operates EPN, also operates Clearing House Interbank Payments System ("CHIPS"). *Id.* CHIPS provides real-time settlement for large value transfers to fifty American banks that meet detailed requirements in CHIPS' rules. *Id.* at 489. To facilitate this real-time settlement, CHIPS relies on central settlement institutions – Clearing House Payments Company and the Federal Reserve Bank of New York – to hold prefunded balance accounts. *Id.*

²³ *Id.*

²⁴ FEDERAL RES. SYS., THE 2013 FEDERAL RESERVE PAYMENTS STUDY 42–44 (2014).

balances.²⁵ While processing payments in batches and netting final balances is more efficient than updating the ledger after each transaction, the one- to two-day settlement process is slow.²⁶

While it is hard to imagine a more financially stable institution than the Federal Reserve, a payment system that depends on a central settlement institution creates risks and inefficiencies. Because settlement takes place on the settlement institution's books, both paying and receiving banks need accounts with that institution.²⁷ To transfer any funds, then, both banks depend on the settlement institution's operational soundness.²⁸ This extensive dependence on a central institution to facilitate money transfers magnifies the operational risk that the settlement institution can fail to function to settle funds.²⁹ And while the United States government backs the Federal Reserve, which in turn guarantees payments made on FedWire, the Federal Reserve is not immune from technological and other operational risk even though the United States' payment system depends on its sound functioning.³⁰

The Federal Reserve also plays a central role in American payment systems because it helps reduce many risks associated with the use of settlement institutions. Ordinary settlement institutions may present credit risks, which exist if the settlement institution relies on credit to facilitate transactions.³¹ If the settlement institution cannot settle an obligation, it may expose a payer's bank to the risk that its transaction will not process, potentially causing it to lose the

²⁵ *Id.* For example, if Blue Bank and Yellow Bank conducted another payment, in addition to Joe and Mary's, where Yellow Bank transferred \$150 in funds to Blue Bank, the ACH operator would net the two transactions and figure out that the net transfer should be \$50 to Blue Bank.

²⁶ See PURPOSES & FUNCTIONS, *supra* note 17, at 93–95.

²⁷ See GLOSSARY, *supra* note 12, at 45.

²⁸ *Id.* at 36.

²⁹ *Id.*

³⁰ See PURPOSES & FUNCTIONS, *supra* note 17, at 95; Priya Anand, *St. Louis Federal Reserve Confirms Hack*, MKT. WATCH (May 18, 2015), <http://www.marketwatch.com/story/st-louis-federal-reserve-confirms-hack-2015-05-18>.

³¹ CENTRAL BANK MONEY, *supra* note 9, at 11.

value of the transferred money.³² However, the Federal Reserve does not operate on credit because the United States government funds it.³³ A settlement institution may also face liquidity risk, or the risk that it lacks funds to make immediate payments to meet the claims of depositors.³⁴ But liquidity problems are not a real risk for a central bank, like the Federal Reserve, which prints the currency in which it operates and through which it facilitates fund transfers.³⁵ Thus most – although by no means all – payment systems settle through central banks, which eliminate credit and liquidity risk at the payment system’s perhaps most fragile point, where exposures are highest and most concentrated.³⁶ The widespread use of central bank money as a settlement asset reflects its general availability, efficiency, neutrality, and finality.³⁷

On an operational level, domestic settlements between banks involve nothing more than an adjustment of deposit balances by the settlement institution. While each bank must ultimately update its own ledger, the Federal Reserve’s updating and maintaining a central ledger greatly enhances efficiency and mitigates risk. As the next Section details, cross-border payment systems do not have a central settlement institution and thus are more inefficient and risky.

B. The Complexity, Risk & Expense of the Current Cross-Border Payments System

Cross-border payments are more complicated to process and present more risks than domestic payments because there is no global central settlement institution that holds the accounts of banks across national borders. There is no global settlement asset that allows banks

³² *Id.*; GLOSSARY, *supra* note 12, at 17.

³³ See PURPOSES & FUNCTIONS, *supra* note 17, at 85–86; CENTRAL BANK MONEY, *supra* note 9, at 11–13.

³⁴ CENTRAL BANK MONEY, *supra* note 9, at 11–13. Thus the Federal Reserve is immune from the most significant risk that a settlement institution can face because it can create its own liquidity.

³⁵ PURPOSES & FUNCTIONS, *supra* note 17, at 85; CENTRAL BANK MONEY, *supra* note 9, at 13.

³⁶ CENTRAL BANK MONEY, *supra* note 9, at 11–12.

³⁷ *Id.*

to transfer funds across borders because there is no process or institution like a global central bank that could update its ledger.³⁸ This is because cross-border payments require settlement in multiple currencies and thus depend on a foreign exchange (“FX”) transaction.³⁹

Instead of a central settlement institution, cross-border payment systems rely on an interbank correspondent banking system.⁴⁰ This system processes cross-border payments through international correspondent banking agreements that link together domestic payment systems.⁴¹ An international correspondent banking relationship is a contractual arrangement under which a bank in one jurisdiction (a correspondent) holds deposits, denominated in its native currency, but owned by a bank in another jurisdiction (a respondent).⁴²

Most cross-border payments involve two banks that do not have a correspondent banking relationship with each other.⁴³ So most payments must move through a domestic settlement institution before reaching a correspondent through which it can cross a border.⁴⁴ This process is relatively more expensive than using a domestic payment system, for at each point in the

³⁸ See CENTRAL BANK MONEY, *supra* note 9, at 3, 37–38 (explaining that central banks do not accept other central banks’ currency as collateral).

³⁹ See *id.*

⁴⁰ *Id.* at 4–5.

⁴¹ *Id.*

⁴² GLOSSARY, *supra* note 12, at 16.

⁴³ See CENTRAL BANK MONEY, *supra* note 9, at 11. Negotiating individual contracts with international banks that *may* be that bank’s counterparty involves high transaction costs that may not be justifiable to smaller financial institutions. See William R. White, *International Agreements In The Area Of Banking And Finance: Accomplishments And Outstanding Issues* 8–10, 28 (Bank for Int’l Settlements, Working Paper No. 38, 1996) (explaining that these agreements are driven by private sector agents and that accounting for changes via contract can be expensive).

⁴⁴ *Id.* at 9–11, 20 (explaining that while most payment systems follow a form of this “typical” interbank payment system model, the degree of tiers varies in different countries and markets); FIN. CRIMES ENFORCEMENT NETWORK, FEASIBILITY OF A CROSS-BORDER ELECTRONIC FUND TRANSFER REPORTING SYSTEM UNDER THE BANK SECRECY ACT 56 n.41 (2006) (“Most community banks use a correspondent bank to provide cross-border transactions. As a result, most community banks do not deal directly with institutions located outside the United States.”).

transmission of the transaction, the parties must not only absorb the cost of the foreign exchange spread, but must also pay the bank – functionally a broker – a fee.⁴⁵

The lack of a central settlement institution leads to highly complex international payment system, which creates risks because processing transactions involves a series of separate and discrete settlement processes. Where the Federal Reserve’s role as central settlor in the United States payment system mitigates almost all credit and liquidity risk, these risks become very real in the international payments system.⁴⁶ Because there is no single global payments rail that connects the payer to the payee to effect final settlement, a payment must travel through one domestic payment rail in one country, then cross national borders through correspondent banks before going through the other domestic payment rail in another country.⁴⁷ This inefficient system results in increased transaction costs and creates risk that the payment will get stuck (i.e. if a bank in the chain fails or cannot process a transaction) as it travels between different rails.⁴⁸ Ripple, however, provides a new technology that provides that single rail, which could reduce the inefficiencies and risks associated with the current international payments system.

II. RIPPLE: POWERING THE MOVEMENT OF MONEY THROUGH DISTRIBUTED SETTLEMENT

Ripple powers the movement of money through an alternative settlement mechanism called “distributed settlement.”⁴⁹ Distributed settlement settles transactions without a central settlement institution: rather than relying on a central bank to update its ledger to settle

⁴⁵ *Id.* at 15.

⁴⁶ *See* CENTRAL BANK MONEY, *supra* note 9, at 10–12, 16–22.

⁴⁷ *Id.* at 9–11, 20.

⁴⁸ *Id.* at 12–13.

⁴⁹ THE RIPPLE PROTOCOL, *supra* note 1, at 11.

transactions and facilitate fund transfers, Ripple processes transactions through a public ledger that the users of the Ripple network update through algorithmic settling.⁵⁰

This Section will explain in more detail what Ripple is, how it works, and how it is governed and managed. This Section argues that Ripple's distributed settlement process provides a novel way of accounting for the movement of money that is more efficient than current models. It then argues that regulators' current approach to regulating Ripple fails to account for its unique governance and management structure, making it an inefficient and flawed way to supervise this modern payment system.

A. Ripple Balances and Distributed Settlement

Because Ripple facilitates the movement of money through distributed settlement, it provides a way of transmitting money that is fundamentally different from existing systems. In distributed settlement, a ledger is distributed among, and algorithmically updated by, the collective actions of Ripple users rather than a central party.⁵¹ This is a public – as opposed to a private or central bank – ledger because every Ripple user can see the ledger and can update it.⁵² The public ledger records every single transaction processed through the Ripple protocol and keeps track of all Ripple users' balances.⁵³ It is a publicly maintained and updated record keeping mechanism. Where the correspondent banking system requires each financial institution in the payment chain to update its individual ledger, the collective users of Ripple update a single, public ledger that represents every user's balance, which enables the system to process a

⁵⁰ *Id.*

⁵¹ *Id.* In contrast, only the Federal Reserve or Goldman Sachs can update their respective ledgers.

⁵² *Id.*

⁵³ THE RIPPLE PROTOCOL, *supra* note 1, at 11.

collection of funds transfers immediately.⁵⁴ Ripple’s public ledger facilitates a move from a model that depends on decentralized actors to update their individual ledgers to a system where decentralized actors – that are not party to the transaction – update a single, public ledger. In essence, it flips the correspondent-banking model on its head.⁵⁵

Ripple’s process of distributed settlement is a significant innovation because it solves two unique problems that parties do not encounter when they settle a transaction through a central settlement institution: the double spending problem and Sybil attacks. The double spending problem refers to the risk that a user could instruct the system to make a payment to multiple counterparties at the exact same time even if that user only had enough money to make a payment to one counterparty.⁵⁶ To prevent this double-spending problem, distributed settlement systems must ensure the accurate ordering of transactions.⁵⁷ Ripple does this through a process called “consensus.”⁵⁸ Consensus is a process through which “validating nodes,” which are Ripple users who vote to verify the authenticity of a transaction, agree to reject or approve a transaction as valid.⁵⁹ If a supermajority of validating nodes approve a transaction, the validating nodes

⁵⁴ *Id.*

⁵⁵ Ripple’s rejection of a central settlement institution also means they use a different type of settlement asset. *Id.* at 4. Like banks (which they may be), gateways turn cash deposited by their customers into balances that they can transfer across the Ripple network. *Id.* These “Ripple balances,” which reflect the balance type (i.e. dollars or Euros) and the party that issues them (i.e. Yellow Bank), are settlement assets that users trade across the Ripple network.⁵⁵ *Id.* at 11. “This is important because USD balances issued by two different banks are technically liabilities of different institutions and have different counterparty risk profiles. From the perspective of the protocol, they are different financial instruments.” *Id.*

⁵⁶ PEDRO FRANCO, UNDERSTANDING BITCOIN: CRYPTOGRAPHY, ENGINEERING, AND ECONOMICS 12 (2015).

⁵⁷ This problem is also referred to as the “Byzantine Generals Problem.” *Id.*

⁵⁸ THE RIPPLE PROTOCOL, *supra* note 1, at 11.

⁵⁹ SCHWARTZ, YOUNGS & BRITTO, *supra* note 61, at 2. Ripple signs every transaction that parties submit to the network with a unique digital signature, which relies on public/private key cryptography. *Id.* Each user then selects a list, called a “unique node list,” comprising other users that it trusts (called “validating nodes”). DAVID SCHWARTZ, NOAH YOUNGS, & ARTHUR BRITTO,

update the public ledger. This is the process that enables secure and real-time settlement without using a central institution.

The second problem that Ripple solved is the problem of Sybil attacks.⁶⁰ A Sybil attack refers to a malicious act where someone creates many identities in a peer-to-peer network to exert a disproportionately large influence.⁶¹ For instance, an attacker could create a large number of accounts (or public keys) and flood the network with fake or otherwise illegitimate transactions.⁶² Enough requests would compromise the consensus process and significantly disrupt settlement, or they could so overwhelm a server that the server could not respond to legitimate requests, paralyzing the network.⁶³

Ripple's innovative solution to Sybil attacks is a virtual currency called the XRP, which also adds value to the protocol in important ways.⁶⁴ Like other digital currencies such as Bitcoin,

RIPPLE LABS, INC., THE RIPPLE PROTOCOL CONSENSUS ALGORITHM 2 (2014); *Unique Node List*, WIKI.RIPPLE (Oct. 10, 2014), <https://wiki.ripple.com/>. Each validating node independently verifies every proposed transaction within the network to determine if it is valid, that is, if the correct signature appears on the transaction, which is the signature of the funds' owner, and whether the parties have enough funds to make the transaction. SCHWARTZ, YOUNGS & BRITTO, *supra* note 61, at 1–3; THE RIPPLE PROTOCOL, *supra* note 1, at 11. If it believes that the transaction is valid, it “votes” for it to be included in the updated ledger. If a supermajority of nodes do not vote for the transaction, the system rejects the transaction for the time being and it is not reflected in the next updated ledger. SCHWARTZ, YOUNGS & BRITTO, *supra* note 61, at 1–3. But if a supermajority (80%) of nodes votes for the transaction, it will be reflected in the next ledger update. *Id.* After several rounds of voting, the current public ledger will close and become the “last-closed ledger.” *Id.* Because all the nodes will maintain the same last-closed ledger, the last-closed ledger reflects the correct Ripple balances of all the users in the network at a particular moment in time. *Id.* at 2.

⁶⁰ THE RIPPLE PROTOCOL, *supra* note 1, at 14. People also often call Sybil attacks Denial of Service attacks. *Id.*

⁶¹ FRANCO, *supra* note 57, at 165.

⁶² See THE RIPPLE PROTOCOL, *supra* note 1, at 14.

⁶³ *Id.*

⁶⁴ *Id.*

XRP is a “math-based currency” or a “cryptocurrency.”⁶⁵ XRP is the “native” currency of the Ripple ledger, just like Bitcoin is the native currency of the blockchain, the publicly distributed ledger used and maintained by Bitcoin users.⁶⁶ But unlike the Bitcoin protocol, Ripple is currency agnostic: users can choose *not* to use XRP as a medium of exchange and can instead use other currencies.⁶⁷ This allows Ripple to settle, for example, foreign exchange transactions.

The Ripple protocol requires each account to hold a small reserve of XRP in order to create ledger entries.⁶⁸ The 20 XRP (or about \$0.16)⁶⁹ reserve requirement is a negligible transaction fee for normal users, but it would be a significant cost for attackers who wish to flood the network with many false transactions.⁷⁰ As a second line of defense, with each transaction that Ripple processes, it destroys 0.00001 XRP (roughly \$0.00000008).⁷¹ While this fee is worth virtually nothing, when the system must process many transactions – such as when someone attempts to overload the server through a Sybil attack – the fee rises rapidly.⁷² This makes Sybil attacks extremely expensive for attackers.

B. Changing the International Payments System: Atomic & Straight Through Settlement

In addition to offering an alternative settlement mechanism, Ripple’s other significant innovation is offering atomic, real-time, settlement for cross-border payments. Ripple does this

⁶⁵ *Id.* A cryptocurrency is a type of digital asset that entities transfer within a network and whose creation and distribution is verifiable using mathematical properties. *Id.* at 12.

⁶⁶ *Id.*; FRANCO, *supra* note 57, at 12.

⁶⁷ *Id.*

⁶⁸ *Id.*

⁶⁹ *Ripple Price Chart*, COINGECKO https://www.coingecko.com/en/price_charts/ripple/usd (last visited June 9, 2015).

⁷⁰ THE RIPPLE PROTOCOL, *supra* note 1, at 14.

⁷¹ *Id.*

⁷² *Id.* at 14–15.

by relying on third-party intermediaries called “market makers.”⁷³ By providing liquidity, market makers provide an end-to-end payment rail between a payer and a payee.⁷⁴ In the case of cross-border payments, a market maker would be a foreign exchange trader who posts bids and offers to trade currencies on Ripple’s exchange.⁷⁵ Market makers in the Ripple network provide a function typical of market makers in other markets: they match buyers and sellers and profit off spreads at the price they buy and sell a particular asset (here, currency).⁷⁶ The Ripple protocol then routes every transaction to the cheapest available price.⁷⁷ But the Ripple protocol not only looks for the cheapest offer, but the cheapest *path*, causing market makers to not only provide liquidity, but to actively compete for spreads.⁷⁸

In addition, because Ripple’s transactions are atomic, Ripple eliminates the risks that payments will not reach the targeted payee once the payor initiates the transaction.⁷⁹ For example, if a party wants to complete a transaction, it may have to pass through multiple market makers in order to reach the payee. But even if a transaction must pass through multiple market makers who operate in different currencies, either the *entire* transaction happens or none of the

⁷³ Bryant Gehring, *What are Market Makers?*, RIPPLE LABS, INC. (Oct. 26, 2014), https://ripple.com/knowledge_center/market-makers-2/

⁷⁴ THE RIPPLE PROTOCOL, *supra* note 1, at 12–13.

⁷⁵ *Id.* at 12.

⁷⁶ *Id.* For example, consider the example where a Ripple user in Europe wishes to pay a Ripple user in the United States. The gateways of the payer and the payee do not hold balances with each other. The market maker establishes “trust lines” with both gateways by setting up accounts with each of them. *Id.* The market maker facilitates the transaction by simultaneously buying Euros from the European gateway and selling dollars to the United States gateway. *Id.*

⁷⁷ *Id.* at 12–13. Even for a more complicated transaction involving multiple currencies, there is one path that runs from a payer to a payee. This is because the distributed settlement process allows a one step, end-to-end settlement between the payer and the payee. *Id.* For example, imagine that a European wants to pay somebody in South Korean Won. There might not be a liquid market for Euro/Won exchanges. However, the Ripple protocol finds a path – the cheapest path – to facilitate that transaction, which may involve swapping Won for Dollars, and then swapping Dollars for Euros. *Id.* at 13.

⁷⁸ *Id.*

⁷⁹ *Id.*

steps happen at all.⁸⁰ Thus, the atomic nature of a Ripple transaction means that it cannot get stuck at a single market maker, eliminating counterparty risk.⁸¹ If a market maker cannot facilitate the transaction, for example, because of a lack of liquidity, either the Ripple protocol will bypass that market maker and find another, or the transaction will not occur at all.⁸²

Because these transactions happen in real time, the Ripple protocol reduces risks and increases cost-savings.⁸³ Because transactions are in real time, parties can better manage their risks: where in the international correspondent banking model transactions can take up to four days to process,⁸⁴ creating uncertainty for the payor and payee, under Ripple, parties know their positions immediately. Real-time settlement also reduces the transaction costs associated with each discrete settlement process associated with traditional cross-border payments.⁸⁵

Ripple creates not only a faster settlement system, but also allows parties to make foreign exchange trades with fewer transaction costs. Where “the average bank . . . charge[s] [a] 5.88%” foreign exchange transaction fee in addition to the FX spread,⁸⁶ Ripple users pay only one fee: the FX spread.⁸⁷ Where manual control over trading makes these transactions expensive,⁸⁸

⁸⁰ *Id.*

⁸¹ Gehring, *supra* note 79. For example, in the absence of real time settlement, a transaction may get stuck if a bank in the payment chain fails while it holds the payment that is in transit.

⁸² THE RIPPLE PROTOCOL, *supra* note 1, at 13.

⁸³ Ripple typically processes transactions in three to six seconds. *Id.*

⁸⁴ Houman Shadab, *How Bitcoin Will Change International Bank Payments*, COINCENTER (Mar. 9, 2015), <https://coincenter.org/2015/03/bitcoin-will-change-international-bank-payments/>.

⁸⁵ THE RIPPLE PROTOCOL, *supra* note 1, at 11. Through real-time settlement, parties get access to their funds more quickly, allowing them to allocate their resources to more productive uses instead of having their money tied up in a delayed foreign exchange transaction.

⁸⁶ Alina Comoreanu, *Currency Exchange Study: How to Save on International Spending*, CARDHUB <http://www.cardhub.com/edu/currency-exchange-study/> (last visited June 13, 2015).

⁸⁷ THE RIPPLE PROTOCOL, *supra* note 1, at 9.

⁸⁸ COMM. ON PAYMENT & SETTLEMENT SYS., BANK FOR INT’L SETTLEMENTS & WORLD BANK, GENERAL PRINCIPLES FOR INTERNATIONAL REMITTANCE SERVICES 15 (2007) [hereinafter CPSS ON INT’L REMITTANCES]. Manual control has also enabled bankers to manipulate FX spreads at

Ripple's best path algorithm ensures users get the lowest spread available on the network and takes the control of trades out of brokers' hands. The Ripple protocol thus enables cheaper FX trades, allowing users to direct their capital to more productive uses. Ripple may be particularly significant for reducing costs in the massive and expensive global remittance market.⁸⁹

With the ability to speedily and reliably settle transactions, Ripple provides a way to settle international payments in the absence of a global central bank. As a payment system that provides the essential central settlement function that the current international financial system lacks, Ripple makes significant progress in fixing the international payments system. Perhaps it comes as little surprise, then, that financial institutions have begun to adopt Ripple to tap into the estimated \$20 billion a year in savings by improving their settlement systems.⁹⁰ Ripple has partnerships with financial institutions across the world, including Germany-based bank Fidor, Kansas-based CBW Bank, New Jersey-based Cross River Bank,⁹¹ three of Australia's "big four banks" – the Commonwealth Bank of Australia, Westpac Banking Corp, and the Australia and

their clients' expense in a series of recent high profile scandals that have led to over \$5.7 billion in fines. Jerin Mathew, *FX Fixing Scandal*, INT'L BUS. TIMES (June 11, 2015),

⁸⁹ The World Bank estimates that almost 250 million migrant workers sent approximately \$440 billion to their homes in developing countries in 2014. DILIP RATHA ET AL., *THE WORLD BANK, MIGRATION & REMITTANCES 1* (2015). But because the foreign exchange market depends on manual processing, the low value of remittance transactions makes them relatively more expensive than commercial foreign exchange transactions: on average, global migrants pay 8% to send money abroad, with the highest average cost reaching 12% in sub-Saharan Africa. CPSS ON INT'L REMITTANCES, *supra* note 95, at 15; DILIP RATHA ET AL., *supra* note 97, at 1.

⁹⁰ SANTANDER BANK, *supra* note 5, at 15.

⁹¹ JAMES SCHNEIDER & S.K. PRASAD BORRA, *The GOLDMAN SACHS GRP., FUTURE OF FINANCE: REDEFINING "THE WAY WE PAY" IN THE NEXT DECADE, PART 2* 56 (2015).

New Zealand Banking Group⁹² – and perhaps surprisingly, Western Union (who charges between \$50 and \$400 to send money overseas).⁹³

C. *Unique Governance*

The innovations Ripple presents at the operational level will reduce many risks that current payment systems pose, but its uniquely decentralized governance structure may pose new challenges and risks to entities interested in regulating Ripple. Current regulatory regimes for payment systems, and institutions within payment systems, have depended on the concept of some sort of central operator. Although Ripple Labs is developing and promoting the Ripple protocol, it does not actually control or maintain the protocol.⁹⁴ Instead, development of the protocol depends on the system's users adopting proposed changes to the protocol.⁹⁵ In contrast, some centralized legal entity owns or operates the existing major payment systems.⁹⁶

Ripple's development is unique because changes to the Ripple protocol occur only through the entities that update Ripple's ledger and validate transactions: the validating nodes.⁹⁷ Just as validating nodes must vote to approve a transaction, a majority of nodes must approve a

⁹² Paul Smith, *Westpac, ANZ Trial Ripple Payments, But Big Four Reluctant on Bitcoin*, AUSTR. FIN. REV. (June 9, 2015), <http://www.afr.com/business/banking-and-finance/financial-services/westpac-anz-trial-ripple-payments-but-big-four-reluctant-on-bitcoin-20150608-ghhmsq>.

⁹³ Philip Ryan, *Western Union Will Give Ripple a Chance*, BANK INNOVATION (Apr. 29, 2015), <http://bankinnovation.net/2015/04/western-union-will-give-ripple-a-chance/>.

⁹⁴ If Ripple Labs were to disappear, "the Ripple network would then operate independently of Ripple Labs." *FAQ*, WIKI.RIPPLE (May 27, 2015), <https://wiki.ripple.com/>.

⁹⁵ See *Understanding: Forking the Ripple Protocol*, WIKI.RIPPLE (Apr. 17, 2014), <https://wiki.ripple.com/>.

⁹⁶ For example, the Clearing House Payments Company L.L.C. operates EPN and operates Clearing House Interbank Payments System ("CHIPS"). CPSS ON INT'L PAYMENT SYSTEMS, *supra* note 19, at 493.

⁹⁷ E-mail from Ryan Zagone, Dir. of Regulatory Relations, Ripple Labs, Inc., to Marcel Rosner & Andrew Kang (Aug. 6, 2015, 12:09 EST) (on file with author). See *supra* note 61.

proposed change to the protocol.⁹⁸ Any entity can propose a change to the Ripple protocol.⁹⁹ Because Ripple is an open-source protocol controlled by no single entity, the only way that Ripple Labs, as a developer, can introduce new features into the protocol is by *proposing* a change.¹⁰⁰ However, only if the participating users – at least a majority – accept a proposal would any changes to the protocol occur.¹⁰¹

Another important concept to understand is that Ripple does not replace existing relationships, but instead “plugs in” to existing structures.¹⁰² In other words, while Ripple improves the underlying settlement infrastructure of global payment systems, it does not affect the existing legal relationships between the participants of such systems.¹⁰³ For example, financial institutions that use Ripple must continue to rely on the bilateral agreements they had in

⁹⁸ E-mail from Ryan Zagone, Dir. of Regulatory Relations, Ripple Labs, Inc., to Marcel Rosner & Andrew Kang (Aug. 6, 2015, 12:09 EST) (on file with author). As Mr. Zagone explains, “in order for a change to the protocol to be made, a majority (at least) of validators must support the proposed change. Once a threshold of validators review and accept a change to the protocol, a two-week countdown begins before the change goes live. The two weeks allows time for others to analyze the change and make a case for or against it. The change has to hold a majority for two weeks to get implemented.” *Id.* In addition, the protocol could “fork.” *Understanding: Forking the Ripple Protocol*, *supra* note 104. Forking refers to a situation in which a segment of the protocol’s users split off into their own group and use a modified version of the software. Linus Nyman & Juho Lindman, *Code Forking, Governance, and Sustainability in Open Source Software*, 2013 TECH. INNOVATION MGMT. REV. 7, 7. This means that two different versions of the protocol would operate independently of one another. *Id.* This right to fork code is built into the very definition of what it means to be an open source program. *Id.*

⁹⁹ E-mail from Ryan Zagone, Dir. of Regulatory Relations, Ripple Labs, Inc., to Marcel Rosner & Andrew Kang (Aug. 9, 2015, 15:39 EST) (on file with author).

¹⁰⁰ *Id.*; *Understanding: Forking the Ripple Protocol*, *supra* note 104.

¹⁰¹ E-mail from Ryan Zagone, Dir. of Regulatory Relations, Ripple Labs, Inc., to Marcel Rosner & Andrew Kang (Aug. 6, 2015, 12:09 EST) (on file with author); *Understanding: Forking the Ripple Protocol*, *supra* note 104; Nyman & Lindman, *supra* note 107, at 7.

¹⁰² Telephone Interview with Ryan Zagone, Dir. of Regulatory Relations, Ripple Labs, Inc. (Apr. 20, 2015).

¹⁰³ *Id.*

place before joining Ripple.¹⁰⁴ Ripple provides only the *rail* on which payments move, it does not define any other aspect of financial institutions’ relationships or legal responsibilities.¹⁰⁵ Rather than displace current institutions, Ripple plugs into an already vibrant and regulated payment ecosystem: to succeed, it depends on “partnerships [with] banks, payment processors, money transmitters, and other financial services institutions.”¹⁰⁶

D. Current Regulatory Status of Ripple

Because Ripple in fact plugs in to existing structures and serves only as the rails, regulators logically treat Ripple as an entity that financial institutions install, like a software. Ripple’s discussions with regulators have centered on Ripple’s status as a “third party vendor” to financial institutions.¹⁰⁷ A collection of federal agencies – the Office of the Comptroller of the Currency (“OCC”), the Consumer Financial Protection Bureau, the Federal Deposit Insurance Corporation, and the Federal Financial Institutions Examination Council – regulates financial institutions’ relationships with third-party vendors.¹⁰⁸ These regulations would put the burden on financial institutions to engage in “effective risk management” practices that attend their relationship with Ripple.¹⁰⁹

¹⁰⁴ *Id.* So, for example, if no bilateral agreements are in place, the financial institutions that use Ripple *must make* those agreements before transactions on Ripple rails can occur. *Id.*

¹⁰⁵ *Id.*

¹⁰⁶ THE RIPPLE Protocol, *supra* note 1, at i; *see Ripple Labs Joins NACHA Alliance*, RIPPLE LABS, INC. (June 9, 2014), <https://ripple.com/blog/ripple-labs-joins-nacha-alliance/>.

¹⁰⁷ Telephone Interview with Ryan Zagone, *supra* note 111.

¹⁰⁸ *New OCC Standards Require Stricter Oversight of Third-Party Relationships*, BAKER TILLY (Feb. 17, 2015), <http://www.bakertilly.com/insights/new-occ-standards-require-stricter-oversight-of-third-party-relationships/>.

¹⁰⁹ *See Risk Management Guidance*, OFFICE OF THE COMPTROLLER OF THE CURRENCY, OCC BULLETIN 2013-29 (Oct. 30, 2013), <http://www.occ.gov/news-issuances/bulletins/2013/bulletin-2013-29.html>. The OCC, which is the primary prudential regulator for national banks, for example, would require banks to: (1) create plans that identify the inherent risks of using Ripple, including details about how the bank selects, assesses, and oversees it; (2) conduct “proper due

This approach is weak because many of these rules simply do not make sense as they apply to Ripple. For example, the OCC suggests an effective risk management process would include “written contracts that outline the rights and responsibilities of all parties.”¹¹⁰ And at least one commentator suggests the “key” to effective risk management of third-party vendors “is the contract.”¹¹¹ But because Ripple is a *protocol*, and Ripple Labs has no effective control over the development of that protocol, any contract with Ripple Labs would be meaningless; a contract with the Ripple protocol would be impossible. And similarly, because no single entity controls Ripple, there would be no way to actually manage the risks Ripple poses: its development depends on the decisions of its users. Recognizing the structural reality of Ripple, then, demands that the “key” to managing Ripple would involve monitoring and putting processes in place that could mitigate the consequences that could attend negative developments in Ripple’s protocol.

Not only do the rules make little sense as they apply to Ripple, they also do not meet international standards of quality financial regulation. By supervising financial institutions’ relationships with Ripple, instead of focusing on Ripple itself, regulators would not create regulatory structure that would: enable transparency and communication between regulators and Ripple (leaving Ripple without the ability to effectively represent itself)¹¹²; develop the protocol

diligence” before adopting Ripple; (3) monitor Ripple once implemented; (4) establish contingency plans for terminating the relationship in an effective manner; (5) establish clear roles and responsibilities for overseeing and managing Ripple; (6) establish documentation and reporting that facilitates oversight, accountability, monitoring, and risk management of Ripple; and (7) conduct independent reviews that allow bank management to determine whether the bank’s process aligns with Ripple’s strategy. *Id.*

¹¹⁰ *Id.*

¹¹¹ *New OCC Standards Require Stricter Oversight of Third-Party Relationships*, *supra* note 118.

¹¹² DEP’T OF THE TREASURY; FINANCIAL REGULATORY REFORM: A NEW FOUNDATION 3 (2009); Julia Black & Stéphanie Jacobzone, *Tools for Regulatory Quality and Financial Sector*

in socially-beneficial ways¹¹³; assess the burden of rules on banks or other institutions that use Ripple¹¹⁴; comprehensively regulate payment systems¹¹⁵; provide the government the ability to manage a potential crisis involving Ripple¹¹⁶; and, finally, create international coordination mechanisms.¹¹⁷ While the current approach fails to meet these goals, the next Part suggests comprehensive principles that not only meet these basic standards of quality financial regulation, but do so in a realistic way that accounts for Ripple’s unique governance and management structure, and which considers the particular risks Ripple mitigates and poses to the global financial system.

III. A PRINCIPLE-BASED APPROACH TO REGULATING RIPPLE

The main challenge in formulating a regulatory approach for Ripple is that its unique properties as a decentralized Internet payment protocol (“DIPP”) make it different from many other traditional payment systems. Regulators need to account for Ripple’s nuances in order to preserve its efficiency, but they must also ensure its users do not impose negative externalities on other market participants and the real economy. Principles that regulate financial market utilities based on the assumption that they use a central settlement institution owned by somebody will not lead to this optimal degree of regulation. These decentralized and un-owned protocols present different risks, but also mitigate others. And because Ripple has a very international focus, regulators must confront the need to coordinate and communicate with other jurisdictions

Regulation: A Cross-Country Perspective 9–10 (OECD Working Papers on Public Governance, No. 16).

¹¹³ See generally Report of the Commission of Experts of the President of the United Nations General Assembly on Reforms of the International Monetary and Financial System, *Economic Crisis Summit* U.N. Doc. A/CONF. 214/9 (Sept. 21, 2009).

¹¹⁴ Black & Jacobzone, *supra* note 123, at 9–10.

¹¹⁵ See DEP’T OF THE TREASURY, *supra* note 123, at 3–4.

¹¹⁶ *Id.*

¹¹⁷ *Id.*; Black & Jacobzone, *supra* note 123, at 9–10.

while Ripple has an interest in avoiding duplicious and possibly conflicting regulations from different jurisdictions. Thus this Part proposes six principles based on existing internationally produced principles but amended to account for the particular risks posed and mitigated by Ripple. Ultimately, this Part hopes to construct a new set of guiding principles for Internet protocols based on the Ripple model.

The principles upon which this Part rely come from the Committee on Payments and Market Infrastructure (“CPMI”), a committee of twenty-five central banks that sets global standards for the international regulation of payment systems.¹¹⁸ In 2012, the CPMI along with the Technical Committee of the International Committee of Securities Commissioners released a set of standards known as the Principles for Financial Market Infrastructures (“PFMIs”).¹¹⁹ The main public policy objectives of the PFMIs are to enhance safety and efficiency in payment, clearing, settlement, and recording arrangements, and more broadly, to limit systemic risk and foster transparency and financial stability.¹²⁰

With respect to Ripple, the United States and international regulators are failing the PFMIs. Principle I, as explained below, states that a financial market utility “should have a well-founded, clear, transparent, and enforceable legal basis for each material aspect of its activities in

¹¹⁸ It also sets standards for settling and clearing systems. *About the CPMI*, BANK FOR INT’L SETTLEMENTS (Sept. 1, 2014), <http://www.bis.org/cpmi/info.htm?m=3%7C16%7C29>. It is a member of the Financial Stability Board and also coordinates with other international standard setters, such as IOSCO and the Basel Committee on Banking Supervision. *Id.* It sits at the heart of the modern global financial architecture. Michael S. Barr, *Who’s in Charge of Global Finance?* 45 GEO. J. INT’L L. 971 (2014).

¹¹⁹ COMM. ON PAYMENT & SETTLEMENT SYS & TECH. COMM. INT’L ORG. SECS. COMM’NS, PRINCIPLES FOR FINANCIAL MARKET INFRASTRUCTURES 6 (2012) [hereinafter THE PFMIs].

¹²⁰ *Id.* at 5–7. The PFMIs define a financial market infrastructure as a multilateral system among participating institutions, including the operator of the system, used for the purposes of clearing, settling, or recording payments, securities, derivatives, or other financial transactions. *Id.* at 5. The CPMI notes that financial market utilities can differ in organization, function, and design, and can be legally organized in a variety of forms. *Id.* Because Ripple settles payment transactions, it likely qualifies as a financial market utility.

all relevant jurisdictions.”¹²¹ But this does not yet exist for Ripple. And because it is a financial market utility¹²² and the United States and Europe have largely adopted the PFMI, ¹²³ they are neglecting their legal duty to ensure a legitimate legal regime supports Ripple. Part of this Note’s goal is to help U.S. regulators and international bodies begin the process of providing a “well-founded” legal basis for Ripple. This Note’s second goal is to provide substantive suggestions on how to improve these PFMI to account for the different risks Ripple and other DIPP pose.

Principle I – Comprehensive Legal Frameworks for the Institutions that Use Ripple

The legal basis for a payment system is critical to its overall soundness, and it consists of framework legislation as well as specific laws, regulations, and agreements governing payments on the transactional level as well as the systemic level. ¹²⁴ The PFMI look to the rights and obligations of parties to payments transactions in addition to the system itself. ¹²⁵ And if risk management is to be sound and efficient, the rights and obligations relating to payment system operations require a high degree of certainty. ¹²⁶

¹²¹ THE PFMI, *supra* note 130, at 21.

¹²² The PFMI define a financial market infrastructure as a multilateral system among participating institutions, including the operator of the system, used for the purposes of clearing, settling, or recording payments, securities, derivatives, or other financial transactions. *Id.* at 5. The CPMI notes that financial market utilities can differ in organization, function, and design, and can be legally organized in a variety of forms. *Id.* Because Ripple settles payment transactions, it likely qualifies as a financial market utility.

¹²³ In a shining example of the potential for global administrative law, the world’s major financial market regulators have largely adopted the PFMI. *See generally* Michael S. Barr & Geoffrey P. Miller, *Global Administrative Law: The View from Basel*, 17 EUR. J. INT’L L. 16 (2006). Not only has the Federal Reserve issued regulations for payment systems consistent with these principles, *Payment System Risk*, BD. OF GOVERNORS OF THE FED. RES. SYS. (May 15, 2015), http://www.federalreserve.gov/paymentsystems/psr_about.htm, but the Governing Council of the European Central Bank incorporated the PFMI in June 2013. EUROPEAN CENTRAL BANK, EUROSYSTEM OVERSIGHT REPORT 6 (2015).

¹²⁴ THE PFMI, *supra* note 130, at 21–25.

¹²⁵ *Id.* at 21.

¹²⁶ *See id.*

Because no single entity can change the Ripple protocol, there is no centralized institution that regulators can require to make positive changes to the protocol. In contrast, a central institution – the Federal Reserve and the National Automated Clearing House Association (“NACHA”), a self-regulatory organization representing ACH users – has *actual* control over the development of the clearing and settlement system of ACH.¹²⁷ There is no institution with any real control over Ripple: Ripple Labs or any other institution can *propose* changes, but the protocol changes only if a majority of users accept a given proposal.¹²⁸ The lack of effective control presents significant legal problems because regulators cannot impose standards over any central body that controls the development of the Ripple protocol. Where the Federal Reserve can monitor the ACH system’s developments, the Federal Reserve could not justifiably require Ripple Labs to make changes to the protocol, or punish them for failing to do so.

Regulators could continue to supervise users’ relationships with Ripple on the individual level like the OCC does now. But that does not solve the problems presented by the current third-party vendor approach analyzed above.¹²⁹ Still, regulators must recognize that the Ripple protocol and other DIPPs do not define any legal rights or obligations of its members.¹³⁰ Ripple instead plugs into the existing legal framework of the institutions that use Ripple: it merely sits at the bottom of payment ecosystem that already experiences (at least in the U.S.) comprehensive regulation.¹³¹ For example, UCC regulations at the transactional level would apply to any

¹²⁷ Stephanie Heller, *Contracting Out of The Uniform Commercial Code: An Endangered Species: The Increasing Irrelevance Of Article 4 Of The UCC In An Electronics-Based Payments System*, 40 LOY. L.A. L. REV. 513, 516 n.18 (2006).

¹²⁸ See *supra* note 100–04 and accompanying text.

¹²⁹ See *supra* Section II.D.

¹³⁰ See *supra* Section II.C.

¹³¹ See *supra* notes 105–10 and accompanying text.

transaction that users performed using Ripple.¹³² And correspondent relationships would continue to have to define the *legal* connections between banks even if Ripple provided those banks the technology – the Ripple protocol – to settle monetary obligations with one another.¹³³

Since regulators did not design these frameworks for institutions that used a settlement infrastructure powered by a DIPP, these frameworks would not do an optimal job in accounting for the settlement risks that Ripple poses and mitigates. It is more likely that the unique features of the Ripple protocol would actually reduce many risks that current regulations seek to mitigate. For example, because Ripple dramatically reduces settlement and counterparty risk through its real-time settlement of atomic transactions, detailed requirements for who could use Ripple would reduce very little risk while increasing inefficiencies by reducing access to financial market utilities.¹³⁴ By recognizing Ripple’s ability to mitigate counterparty and settlement risk, more market participants will have access to real-time settlement institutions.¹³⁵

In addition to challenging the logical basis for certain payment system regulations, Ripple may test the legal relevancy of other domestic rules. For example, increased access to Ripple would increase pressure on its operations, making its operational soundness, settlement systems,

¹³² See UCC § 4A (governing wholesale fund transfers).

¹³³ See *supra* notes 115–121 and accompanying text.

¹³⁴ Limiting access to a financial market utility to only large and safe institutions is a way to reduce counterparty and settlement risks. *Cf. supra* note 20 (explaining the Clearing House Interbank Payments System access limitations to only fifty financial institutions). In addition, Ripple reduces another risk that even central settlement institutions cannot mitigate: principal risk. Because the Federal Reserve does not provide real-time settlement for the vast majority of payments, its role as central operator introduces another risk into the United States payments system: “principal risk.” See *supra* notes 21–24 and accompanying text; GLOSSARY, *supra* note 12, at 40. Principal risk is the risk that a party will lose the value involved in the transaction because of a lag between the final settlement of the various legs of a transaction. GLOSSARY, *supra* note 12, at 40. This risk becomes particularly acute in the case of foreign payments

¹³⁵ Recall that ACH, which has delayed settlement, facilitated 21.7 billion transactions in 2013 compared to FedWire’s 287.5 million transactions, and that only fifty American banks have access to CHIPS. See notes 19–24 and accompanying text.

and the finality of its transactions more important. To clearly establish finality, it is important for the legal framework to define when a payment has occurred. For example, in the United States, UCC 4A provides the framework legislation that defines when a payment has legally occurred.¹³⁶ Determining *when* a payment has legally occurred is crucial to establishing the final positions of its members in multilateral netting systems.¹³⁷ That is, determining the order of payments is important for central institution, like the Federal Reserve with ACH, who has to net a batch of transactions at once.¹³⁸ But because Ripple is a real-time gross settlement system, positions between two parties are final when the transaction occurs. Simply, the legal definition becomes obsolete in the face of this new technology. These regulatory reference points thus seem irrelevant, potentially imposing additional undue burdens and inefficiencies on Ripple users.

Furthermore, Ripple's international appeal means that reviewing the relevant legal framework will not only depend on domestic laws, but also on international laws. This will require regulators to assess the complex issues arising from possible conflicts between relevant laws of different jurisdictions.¹³⁹ In assessing whether a comprehensive legal framework exists for Ripple and its users, regulators must have flexible solutions to these potential problems. As Ripple expands into other jurisdictions, including those with less developed legal institutions, this issue may become increasingly significant.¹⁴⁰

¹³⁶ UCC § 4A

¹³⁷ See *e.g.*, CPSS ON INT'L PAYMENT SYSTEMS, *supra* note 19, at 442–43 (explaining the importance of determining the timing of payments in ACH and FedWire).

¹³⁸ See *supra* notes 25–26.

¹³⁹ See COMM. ON PAYMENT & SETTLEMENT SYS & TECH. COMM. INT'L ORG. SECS. COMM'NS, CORE PRINCIPLES FOR SYSTEMICALLY IMPORTANT PAYMENT SYSTEMS 5 (2001) [hereinafter CPSIPS].

¹⁴⁰ For example, which insolvency laws to follow in case a gateway becomes insolvent may prove a significant question. To solve this problem, clear guidelines of which insolvency laws to follow would be necessary. Regulators could do this between themselves through memorandums of understanding. Or they could turn to Ripple's users and have the gateways delineate in their

Principle II – Stakeholder Buy-In: International Forums of Regulators & A Ripple-SRO

Ripple’s decentralized development structure and international presence means that its effective governance will depend on regulators’ changing their regulatory paradigm. Rather than impose regulations *on* the protocol, regulators need to ensure they work *with* Ripple users and international bodies to ensure its effective regulation. That Ripple’s development depends on dispersed and decentralized users’ acceptance of a proposed change may prove the biggest challenge to regulators. As Principle II of the PFMI explains, financial market utilities must have effective, accountable and transparent governance that would promote the safety and efficiency of Ripple and support the stability of the broader financial system.¹⁴¹ However, that same Principle dictates that effective governance would also consider the interests of relevant stakeholders.¹⁴² Ripple’s stakeholders are widespread and diverse: because Ripple is not owned by any single entity, its users manage its development, and because it has no physical limitations, these users operate throughout the world. Thus the biggest challenge to formulating effective governance arrangements for Ripple is defining the entities that should be accountable as leaders for pursuing the objectives and policy considerations of its stakeholders.

To effectively respond to this need, an international forum of regulators, chaired by the Federal Reserve and a self-regulatory organization representing Ripple users, should govern Ripple. Because Ripple’s unique structure means that users manage the system’s developments, an effective discourse between these users and regulators is the most effective way to ensure efficiency and accountability. DIPP by their nature depend on a significant number of dispersed

correspondent agreements as to which insolvency laws the gateways should follow in the case of insolvency. In any event, when uncertainty exists regarding the enforceability of Ripple’s choice of law in relevant jurisdictions, the relevant regulatory body should obtain reasoned and independent legal opinions and analysis in order to properly address such uncertainty.

¹⁴¹ *Id.* at 26.

¹⁴² *Id.*

users. Thus, a trade-group that represents Ripple’s users provides the most realistic means of ensuring the stakeholders that control Ripple have a voice in its regulation.

NACHA, a self-regulatory organization that, alongside the Federal Reserve, governs ACH, provides an excellent model for ensuring broad stakeholder involvement.¹⁴³ NACHA’s Operating Rules form the legal foundation for every ACH payment by defining the “roles and responsibilities of financial institutions and establishing clear guidelines for each participant.”¹⁴⁴ NACHA’s rules apply to the financial institutions that initiate payments on ACH.¹⁴⁵ While NACHA’s rules do not directly reach merchants and other non-financial institutions that use the ACH, NACHA’s rules govern financial institutions’ relationships with these entities, requiring them to meet certain requirements.¹⁴⁶ And when institutions use the Federal Reserve to transmit payments, the Federal Reserve incorporates the NACHA rules by reference.¹⁴⁷ So a self-regulatory organization *regulates* a payment system operated by private and public bodies.

This sort of self-regulatory model could work for a DIPP like Ripple. Although Ripple’s development depends on dispersed and decentralized users, many of its proposed users will be the same financial institutions that NACHA represents. In fact, one could see how Ripple could be integrated with (or modeled after) a self-regulatory organization like NACHA: the NACHA

¹⁴³ NACHA, which is a non-profit trade association organization that represents 11,000 financial institutions, is responsible for developing comprehensive rules and business practices for members of the ACH network. Heller, *supra* note 141, at 516 n.18.

¹⁴⁴ *NACHA Operating Rules*, NACHA, <https://www.nacha.org/rules> (last visited June 9, 2015).

¹⁴⁵ Robert G. Ballen & Thomas A. Fox, *The Role of Private Sector Payment Rules & A Proposed Approach For Evaluating Future Changes to Payments Law*, 83 CHI. KENT L. REV. 937, 941–42 (2008).

¹⁴⁶ *Id.*

¹⁴⁷ *Id.*

rules would continue to define the financial institutions that use ACH and Ripple.¹⁴⁸ In these cases, the existing legal rights and obligations set forth by the payment system will not change.

In addition, not only does the very foundation of the Ripple protocol mirror a self-regulatory organization in many ways, but it provides the best means to ensure users develop the protocol in the most socially beneficial way.¹⁴⁹ Ripple users must accept (by at least a majority) any changes to the protocol. The development of the protocol, in its very essence, is self-regulatory (although it is a *de facto* and not a *de jure* sort of self-representation). This sort of organization could help motivate user buy-in because it would give users a forum to communicate *their views* with regulators in a constructive way. That is, if regulators gave Ripple users the actual opportunity to represent themselves – and potentially regulate themselves like NACHA –they may have more of an incentive to constructively engage with regulators. And regulators also have an interest in developing this sort of relationship, for Ripple users are the entities ultimately responsible for, and the only ones capable of, developing Ripple in socially beneficial ways.

Just as there is precedent for regulators to recognize a self-regulatory organization's rule-making capacities, models exist for coordinating international regulation of payment systems.

¹⁴⁸ Ripple Labs is a member of NACHA. *Ripple Labs Joins NACHA Alliance*, *supra* note 116.

¹⁴⁹ Something like a trade group for Ripple has already emerged: the International Ripple Business Association is a 501(c)(3) not-for-profit that focuses on providing support to businesses being built on the Ripple protocol. While this association is not so much a governance arrangement as it is a support group with voluntary membership, its existence suggests that Ripple users can coordinate to develop something akin to NACHA. *About, INT'L RIPPLE BUS. ASS'N* <http://www.ripplebusiness.org/about/> (last visited June 12, 2015). The International Ripple Business Association offers disclosure standards, best practices, educational tools, publications, events, and networking opportunities to its members, which includes gateways and individual users. *Id.*

Ripple Labs is specifically marketing Ripple as a solution to the FX markets.¹⁵⁰ Because users can operate it from anywhere in the world, regulators from across the world will have interest in the safety and soundness of Ripple, in addition to ensuring Ripple's users comply with other local laws.

The forums of international regulators that regulate CLS Bank and Society for Worldwide Interbank Financial Telecommunication ("SWIFT") present an ideal approach to regulating DIPPs like Ripple. CLS Bank settles foreign exchange transactions, facilitating the conversion of the world's currencies.¹⁵¹ This gives CLS a particularly significant international dimension. Considering CLS Bank's importance in processing transactions in myriad countries' currencies, regulators across the globe have a vested interest in the safety, soundness, and efficiency of an institution responsible for providing liquidity to local and global currency markets.¹⁵² Because of CLS Bank's tremendous role in the international financial infrastructure, the Federal Reserve and other central banks have entered into the Protocol for the Cooperative Oversight Arrangement of CLS.¹⁵³ The Federal Reserve, the primary prudential regulator of the U.S. bank, serves as the Chair of the CLS Oversight Committee, organizing and administering the forum.¹⁵⁴ This forum attempts to reconcile international regulators' interest in the comprehensive regulation of CLS with concerns for efficiency by minimizing duplicative and

¹⁵⁰ See e.g., Ryan Young, *Using Ripple for Cross-Currency Payments*, RIPPLE LABS, INC. (Apr. 29, 2015), https://ripple.com/knowledge_center/using-ripple-for-cross-currency-payments/.

¹⁵¹ CPSS ON INT'L PAYMENT SYSTEMS, *supra* note 19, at 103.

¹⁵² See *id.*

¹⁵³ The Cooperative Oversight Arrangement is a cooperative international oversight arrangement for CLS. *Protocol for the Cooperative Oversight Arrangement of CLS*, BD. OF GOVS. OF THE FED. RES. SYS. (Sept. 9, 2009), http://www.federalreserve.gov/paymentsystems/cls_about.htm.

¹⁵⁴ The Financial Stability Oversight Council designated CLS Bank as systemically important for its role in clearing FX transactions. *Designated Financial Market Utilities*, *supra* note 19.

burdensome regulations of the Bank.¹⁵⁵ The members of the forum also designed it to enhance transparency in communications between the member-regulators in developing rules and in communications with CLS.¹⁵⁶ Like CLS Bank, a college of regulators chaired by the National Bank of Belgium supervise the Belgium-based SWIFT.¹⁵⁷

It is in both international regulators' and Ripple's best interest to create an international forum that supervises the protocol. For international regulators, a cooperative forum would provide all regulators with a voice, and would help to prevent potential races to the bottom and regulatory arbitrage that could attend inconsistent regulations.¹⁵⁸ By preventing races to the bottom and regulatory arbitrage, regulators could ensure high-quality laws governed Ripple that mitigate the externalities it may pose, and that Ripple's users did not just flock to favorable (more weakly regulated) jurisdictions. Furthermore, it will reduce systemic risk by providing a forum through which regulators from any country could view Ripple's operations on an international basis.¹⁵⁹

An international forum would reduce the regulatory burden on Ripple users by minimizing the likelihood they would have to comply with duplicative, or inconsistent regulations.¹⁶⁰ Most significantly, it would give Ripple users an opportunity to represent their interests to global regulators and provide them the ability to start a dialogue with the bodies that supervise them. The Federal Reserve, as evidenced by its relationship with NACHA, is open to

¹⁵⁵ *Id.*

¹⁵⁶ *Id.*

¹⁵⁷ *Private Sector Systems*, BD. OF GOVERNORS OF THE FED. RES. SYS. (Jan. 29, 2015), http://www.federalreserve.gov/paymentsystems/over_pssystems.htm.

¹⁵⁸ *See Barr, supra* note 129, at 1005, 1010.

¹⁵⁹ Erik Heitfield, *Using Trade Repository Data For Systemic Risk Monitoring*, 37 IFC BULL. 190, 190–91 (2014)

¹⁶⁰ *Cf.* note 123 and accompanying text (explaining the importance of analyzing the burden on a regulated entity in developing “quality” financial regulation).

coordinating regulation of payment systems with self-regulatory organizations; and as reflected by its regulation of CLS (and participation in the SWIFT forum), it is willing to work with international bodies in supervising American institutions. Perhaps the Federal Reserve would even consider co-chairing the forum with a Ripple-self-regulatory organization.

Ultimately, an international forum that involves Ripple users is the only way to ensure that Ripple's diverse stakeholders can participate in its regulation; conversely, the only way to ensure effective regulatory involvement in Ripple's development is through these users' buy-in. To encourage Ripple users to promote socially beneficial uses of its platform, such as making Ripple more accessible to the global remittance market, Ripple user buy-in is even more important because the only way to incentivize positive change is through user acceptance of proposed changes. Ripple (and other DIPP) presents a truly rare regulatory challenge in that its development and operation exists on the Internet and outside the control of a single entity. This means that Ripple user buy-in is more important to successful reform than what regulators may be accustomed to. Successful regulation may require re-conceptualizing what it means to regulate an entity.

Principle III – Managing Financial Risks

In addition to the buy-in from Ripple users, international regulators should use their inherent powers to implement substantive regulations on DIPP to mitigate potential risks it may pose. Credit and liquidity risks are among the most important areas of risk in payment systems, and the key way to control them is through a system's rules and procedures.¹⁶¹ Risk management

¹⁶¹ THE PFMIs, *supra* note 130, at 22–24.

should cover both normal situations and abnormal events, such as a participant's inability to meet its obligations.¹⁶²

Payment systems traditionally face credit risk from their participants, their payment and settlement processes, or both.¹⁶³ The PFMI's explain that credit risk mainly derives from extending credit to participants pre-settlement so participants can make transactions and the central settlement institution can wait until the end of the day to net transactions.¹⁶⁴ The methods to reduce credit risks introduce significant transaction costs: the PFMI's require participants to post collateral for each trade in addition to always holding a balance at the settlement institution.¹⁶⁵

However, Ripple does not face credit risk because Ripple is not a central settlement institution and because it *cannot* extend intraday credit to its participants. Settlement is both atomic (all or nothing) and immediate because the Ripple system trades on real assets, not credit, and it facilitates the trades in real time.¹⁶⁶ Because Ripple payments involve the transfers of claims on the gateways in the form of Ripple balances, no market participant (aside from users) has to hold a balance in any institution.¹⁶⁷ Not only is this more efficient because users can put their money to productive uses instead of leaving them unused as reserve funds, but it is actually safer because the users' funds are not subject to the health of the institution that holds the

¹⁶² See *id.* at 33, 96.

¹⁶³ *Id.* at 38.

¹⁶⁴ For example, a settlement institution could face credit risk if the value of collateral posted by a member to cover intraday credit fell below the amount of credit the settlement institution provided the member. *Id.* (explaining that credit risk derives from "current exposures from extending intraday credit to participants").

¹⁶⁵ *Id.* at 39; Gabriele Galati, *Settlement Risk in Foreign Exchange Markets & CLS Bank*, BIS Q. REV., Dec. 2002, at 62–63.

¹⁶⁶ See THE RIPPLE PROTOCOL, *supra* note 1, at 11–13.

¹⁶⁷ See *id.* at 9, 13–15.

funds.¹⁶⁸ The PFMI's reflect regulators' concerns with the safety and soundness of a settlement institution, whose failure could be disruptive by disabling access to the market.¹⁶⁹ With Ripple, there is no central settlement institution that could fail. These two credit risks, then, largely disappear in the move to a DIPP settlement mechanism.

Payment systems also present special liquidity risks.¹⁷⁰ Whether a participant making a payment has sufficient funds on its account with the settlement institution so that the system can accept the payment for settlement is a particularly significant concern for regulators.¹⁷¹ If that institution lacks sufficient liquidity to make its transactions, or if the central settlement institution similarly lacks sufficient liquidity to process the transactions, the system may come to a halt.¹⁷² Frequent gridlock can lead to a loss of confidence in the payment.¹⁷³

Ripple, however, presents different liquidity risks than traditional payment systems. Payments made on Ripple are not likely to lead to liquidity risks because a bank will not run out of central bank deposits.¹⁷⁴ A gateway need not hold deposits in any third-party institution.¹⁷⁵ On the other hand, cross-border payments on Ripple do generate liquidity risk in the sense that there

¹⁶⁸ CENTRAL BANK MONEY, *supra* note 9, at 11–12.

¹⁶⁹ THE PFMI'S, *supra* note 130, at 78–87 (explaining Principle 13, requiring financial market utilities to have default management processes in place).

¹⁷⁰ Liquidity risk is the risk that a party will not have sufficient funds to meet its financial obligations to another party as and when expected (even if it may have the funds to make that obligation later). *Id.* at 19. Liquidity risks are a particularly significant concern for regulators because they have the potential to pose systemic risks, especially if an asset becomes illiquid, when markets close, or if it creates questions about an entity's solvency. *See* FIN. CRISIS INQUIRY COMM'N, THE FINANCIAL CRISIS INQUIRY REPORT: FINAL REPORT OF THE NATIONAL COMMISSION ON THE CAUSES OF THE FINANCIAL AND ECONOMIC CRISIS IN THE UNITED STATES 341, 345–46. (2011). Indeed, the Financial Crisis Inquiry Commission suggests liquidity problems – not general insolvency problems – caused Lehman Brother's collapse and AIG's bailout during the 2007-08 financial crisis. *Id.*

¹⁷¹ CPSIPS, *supra* note 149, at 24.

¹⁷² *See* THE PFMI'S, *supra* note 130, at 57–61.

¹⁷³ *Id.*

¹⁷⁴ THE RIPPLE PROTOCOL, *supra* note 1, at 4.

¹⁷⁵ *Id.*

must be sufficient currency on the buy side for the market maker to facilitate the payment.¹⁷⁶

However, the fact that each Ripple payment involves an atomic transaction and straight through path from a payer to a payee minimizes the risk of gridlock. If there is not enough liquidity of the currency on the buy-side, the payment does not occur at all.¹⁷⁷ But a lack of liquidity in the underlying assets – i.e. a particular currency – could create risks because it would prevent the processing of transactions.¹⁷⁸ Ripple does mitigate this risk, however, because XRP can bridge otherwise illiquid currency pairs: if every currency is liquid with respect to XRP, every currency becomes liquid to every other currency.¹⁷⁹

The use of Ripple balances instead of central bank money presents another unusual liquidity risk. Recall that Ripple balances reflect the claims on gateways rather than a central bank. These claims obviously create more credit risk than a settlement asset in the form of central bank money, which is freely redeemable and always liquid.¹⁸⁰ A gateway might not be able to honor its obligation to repay a user the amount in her deposit balance, if, for example the gateway became insolvent. However, the trust lines help users manage the credit risk between them and their gateway.¹⁸¹ Imprudent use of these trust lines to unstable gateways may lead to large exposures.¹⁸² Regulators should make sure that users fully understand the use of trust lines and encourage them to be vigilant in minimizing credit risk.

¹⁷⁶ *Id.* at 12–13.

¹⁷⁷ *Id.* at 11–13.

¹⁷⁸ THE RIPPLE PROTOCOL, *supra* note 1, at 15.

¹⁷⁹ *Id.* For example, while there might not be a market to exchange Euros for Won, if there is a market for XRP to Euros and XRP to Won, then XRP can serve as a bridge currency that makes the currencies liquid with respect to one another.

¹⁸⁰ *See* CENTRAL BANK MONEY, *supra* note 9, at 2, 11–13.

¹⁸¹ Bryant Gehring, *Understanding Connecting To A Gateway (Trust Lines)*, RIPPLE LABS, INC. (Sept. 18, 2014), https://ripple.com/knowledge_center/understanding-connecting-to-a-gateway-trust-lines/.

¹⁸² *See id.*

In conclusion, it is important for regulators to ensure that Ripple users acknowledge that the source of Ripple’s liquidity and credit risks are different from traditional payment systems’ credit and liquidity risks. While most of the procedures the CPMI proposes to mitigate these risks relate to the use of collateral, deposit accounts, and limits on exposures and borrowings from the central bank and/or settlement institution, these tactics would do little to account for Ripple’s risks.¹⁸³ However, it might be useful for the Federal Reserve to impose procedures with respect to cross-border liquidity risks. For instance, it might request data from Ripple users to note when and how often a payment fails because of a lack of liquidity. Doing so could help Ripple users and the Federal Reserve determine which gateways do not hold enough cash to cover the cross-border payment needs of its depositors, and XRP’s viability as a liquidity provider. But this sort of socially beneficial behavior from Ripple users may not otherwise be available without their buy-in.

***Principle IV – Transparency: Ensure Regulators & Market Participants Understand the
Ripple Protocol***

The PFMI’s emphasize the importance of ensuring that regulators and participants have enough information about payment systems to make sound decisions and have confidence in the system.¹⁸⁴ In particular, the PFMI’s explain that payment systems facilitate parties’ understanding of the risks they pose by providing clear and comprehensive rules, procedures, market data, and

¹⁸³ See e.g., THE PFMI’S, *supra* note 130, at 36–53 (explaining the standard use of collection of collateral, margin and position limits to minimize credit and liquidity risks).

¹⁸⁴ *Id.* at 121.

fees.¹⁸⁵ The parties need to understand the basic design of the system so that they can determine their rights, obligations, and the potential risks they may face.¹⁸⁶

The Ripple protocol exemplifies transparency at the most basic level because it is a free, open protocol.¹⁸⁷ By definition, the Ripple protocol is “freely available”; anyone can view the specific code of the protocol and the public ledger at anytime.¹⁸⁸ However, regulators should ensure that resources exist that communicate to Ripple users how it works (in digestible ways, like through the learning resources Ripple Labs currently provides), in addition to any relevant changes to the protocol that may occur. Even if Ripple does not impose any legal rules on its members, the protocol does govern the way that the Ripple-connected computers interact with each other.¹⁸⁹

Traditional regulations do not account for the reality of Ripple ownership. Most rules dictate that the system operator bears the primary responsibility for the provision of this information.¹⁹⁰ Because Ripple is not owned by anyone, transparency depends again on buy-in from Ripple users. Relying on Principle I, regulators must coordinate with the relevant Ripple-self-regulatory organization to ensure the free flow of information continues. The relevant Ripple-self-regulatory organization would be the most knowledgeable about the system’s design and regulators should thus encourage it to write detailed guides that not only provide a how-to

¹⁸⁵ *Id.*

¹⁸⁶ *Id.*

¹⁸⁷ THE RIPPLE PROTOCOL, *supra* note 1, at 4.

¹⁸⁸ *Open-source*, NEW OXFORD AMERICAN DICTIONARY (2013); Bryant Gehring, *How Ripple Works*, RIPPLE LABS, INC. (Oct. 16, 2014), https://ripple.com/knowledge_center/how-ripple-works/.

¹⁸⁹ *See* THE RIPPLE PROTOCOL, *supra* note 1, at 4 (explaining that Ripple is a protocol); *supra* note 2 and accompanying text.

¹⁹⁰ *See e.g.*, CPSIPS, *supra* note 149, at 21.

guide to its use. But it should also explain, as this Note has done, the theoretical design principles behind the protocol and any subsequent changes.

Principle V – Operational Risk Management of Vital Participants: Focusing on Nodes, the Consensus Algorithm, & the Ripple Protocol

A payment system should be designed and operated with a high degree of security and operational reliability.¹⁹¹ The security of any system is “only as strong as its weakest link.”¹⁹² Thus, regulating bodies must concern themselves not just with the security and operational reliability of the components of the central system, but also with components of the system’s participants.¹⁹³ This extends beyond the system’s interface and includes operations by participants that could adversely affect the payment system. This Principle is especially important for payments conducted through Ripple, which relies on a new Internet technology for its core operations.

The validating nodes and the consensus process present the most serious security and operational risks to Ripple users. Remember that each participant in the Ripple network chooses a list of validators that settle transactions based not on a detailed review of the merits of the transaction, but simply on the fact that they agree the transaction is authentic.¹⁹⁴ The integrity of the process depends on the trustworthiness of the validating nodes, which are not subject to any review.¹⁹⁵ Although every honest node’s goal is to verify good transactions and vote against bad transactions, it is possible that users trust the wrong, “bad” nodes such that they could

¹⁹¹ *Id.* at 37.

¹⁹² *Id.*

¹⁹³ *Id.* at 37–38.

¹⁹⁴ *Id.*

¹⁹⁵ *Id.*

compromise the consensus process.¹⁹⁶ While this risk may be small, there should be systems in place, in the form of consumer protection rules, to ensure that new users – especially retail users – know how to avoid making bad node selections.¹⁹⁷

In addition to screening for nodes' honesty, regulators should run periodic stress tests.¹⁹⁸ Stress tests would help identify and eliminate dishonest nodes, helping regulators – and honest users – to determine critical points of failure before the consensus process could fail. The consensus algorithm itself should also be subject to repeated stress tests.¹⁹⁹ If the algorithm is somehow faulty or presents greater risk than expected, the network users and regulators need to adjust their risk management procedures. And while this does require the expenditure of public funds and energy, in the post-Dodd-Frank regulatory world, stress tests are becoming an increasingly important and commonly used regulatory tool.²⁰⁰ As discussed in conjunction with

¹⁹⁶ *Id.* According to Ripple Labs, the properties of the consensus algorithm make it difficult for bad nodes to take over the network. *Id.* Ripple Labs designed the protocol so that someone could control the network only if enough validating nodes are not only untrustworthy, but collude with each other; because the person who proposes the transaction chooses her unique node list, the ability to screen nodes provides an additional layer of security. *Consensus*, WIKI.RIPPLE (Jan. 6, 2015), <https://wiki.ripple.com/>.

¹⁹⁷ *Id.*

¹⁹⁸ Stress tests are simulations in which regulators test the stability of an institution in adverse market conditions. *See* GLOSSARY, *supra* note 12, at 47 (“Stress Testing [is] the estimation of credit and liquidity exposures that would result from the realisation of extreme price changes.”) These stress tests should also focus on things like whether Ripple’s defense to Sybil attacks – in the form of its XRP transaction fees – would be sufficient to withstand attacks from well-financed malicious users. *See supra* notes 60–72 and accompanying text.

¹⁹⁹ Although Ripple Labs provided a mathematical proof that the consensus process is completely secure, SCHWARTZ, YOUNGS & BRITTO, *supra* note 61, at 1–4, regulators should not depend entirely on that analysis and should actually test the system.

²⁰⁰ *See e.g.*, *Stress Tests and Capital Planning*, BD. OF GOVERNORS OF THE FED. RES. SYS (June 2, 2015), <http://www.federalreserve.gov/bankinforeg/dfa-stress-tests.htm>; Peter Eavis, *What to Know About Bank Stress Tests*, N.Y. TIMES (Mar. 4, 2015), http://www.nytimes.com/interactive/2015/03/04/business/dealbook/05db-stress.html?_r=0 (explaining that stress tests are a common regulatory device in the post-Dodd Frank world).

Principle II, the Federal Reserve should take the lead in administering these stress tests with the assistance of other international regulators and the Ripple-self-regulatory organization.

In addition to managing the risks nodes pose and the consensus algorithm, regulators need to monitor the risk of forks in the Ripple protocol.²⁰¹ The first risk is that the Ripple protocol develops in unanticipated ways that could alter the risks it poses (including changes to the consensus algorithm or settlement process).²⁰² This sort of change could compromise the safety and soundness of the payment operations conducted through it, potentially destabilizing the system and risking the safe and secure flow of money through the global financial system.

The second risk is that users could leave Ripple entirely and use a “forked” version of the protocol.²⁰³ There already have been several fork attempts during Ripple’s lifetime.²⁰⁴ Some of these, like Stellar, could become direct competitors to the Ripple protocol.²⁰⁵ While competition might lead to the development of useful features, it would detract from the network effect that bolsters the soundness of the system. For example, if potential users leave Ripple to join a fork, there will be fewer potential validating nodes, which could weaken the consensus process. In addition, fewer users in the system would decrease liquidity for currency transactions.

In both instances, regulators need to monitor developments in the protocol, consistent with Principle IV’s focus on transparency. Regulators should also impose contingency plans in case Ripple forks into an undesirable version or if too many users leave the network. The PFMI

²⁰¹ See discussion *supra* Section III.A.

²⁰² See discussion *supra* Section II.C.

²⁰³ See *supra* notes 101–02.

²⁰⁴ These include: NetPay on September 26, 2013, Splash on December 15, 2013, Radix on March 4, 2014, Vpal on March 12, 2014, Stellar on July 31, 2014, and the TRUST Framework in February 2015. *Fork Attempts*, WIKI.RIPPLE (May 10, 2015), <https://wiki.ripple.com/>.

²⁰⁵ Michael J. Casey & Paul Vigna, *Mt. Gox, Ripple Founder Unveils Stellar, a New Digital Currency Project*, WALL ST. J. (July 31, 2014), <http://blogs.wsj.com/moneybeat/2014/07/31/mt-gox-ripple-founder-unveils-stellar-a-new-digital-currency-project/>.

suggest parties should use business continuity arrangements to ensure that the agreed service levels are met even in the event of one or more components of the system failing.²⁰⁶

Most importantly, regulators should continue to pursue principles-based approaches to regulating Ripple (and other DIPPs), such as the approach promoted by this Note. Using a principles-based approach focused on the buy-in of all stakeholders would ensure that regulators have flexibility to account for unforeseeable changes. Where traditional payment systems exist in physical institutions, like CHIPS in the Clearing House Corporation, or FedWire in the Federal Reserve, DIPPs like Ripple rely on far more flexible and easy to change code-based protocols. Regulatory approaches must recognize the inherent flexibility of DIPPs in order to try to effectively keep up with their development.

Principle VI – Risk Management of Ripple Users: Systemic Risk & AML / KYC

This Note has emphasized a common theme: that Ripple largely plugs into existing legal frameworks instead of displacing them. Ensuring the safety and soundness of Ripple, then, requires regulators to ensure the safety and soundness of the financial institutions and other entities that use Ripple. While Ripple may significantly reduce many risks, the entities that use Ripple still face traditional risks. This Note advocates for the continued regulation of gateways, both for their safety and soundness and their Anti-Money Laundering (“AML”) and Know Your Customer (“KYC”) risks.²⁰⁷ Regulating gateways for their safety and soundness and their

²⁰⁶ THE PFMIS, *supra* note 130, at 21. For example, regulators could come up with plans to ensure that payments that the protocol would have settled but for a fork occur despite that fork.

²⁰⁷ *See e.g., id.* at 10–11, 11 n.16. In the United States, there are two major anti-money laundering statutes. 5 PROTIVITI, GUIDE TO U.S. ANTI-MONEY LAUNDERING REQUIREMENTS 11 (2012). The Bank Secrecy Act of 1970 establishes reporting and recordkeeping requirements to prevent the use of secret foreign bank accounts. *Id.* The Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act of 2001 (the USA PATRIOT Act), which enhances the Bank Secrecy Act’s scope, and, most significantly,

AML/KYC risks will ultimately promote the safety and soundness of the Ripple protocol and encourage its adoption.

Cryptocurrencies receive tremendous attention for their anonymity features.²⁰⁸ Like Bitcoin, if users do not tell others that the address they use on Ripple belongs to them, they reveal no personally identifiable information.²⁰⁹ This includes when users make trades through gateways; unless the sender, receiver, or gateway reveals their identity, Ripple transactions are not traceable.²¹⁰ “This allows people to mask their total payments and disassociate their spending from the general public.”²¹¹ Perhaps it is unsurprising, then, that Ripple and other DIPPs present significant KYC and AML risks.

Regulators are cracking down on DIPPs’ (non-)compliance with AML/KYC laws.²¹² In fact, the Financial Crimes Enforcement Network assessed a \$700,000 civil money penalty against Ripple Labs for violating the Bank Secrecy Act’s AML statute.²¹³ It fined Ripple Labs for “selling its virtual currency [XRP] . . . without registering [it], and by failing to implement an adequate [AML] program designed to protect its products from use by money launderers or terrorist financiers.”²¹⁴

extends AML compliance to nonbank financial institutions. *Id.* KYC requirements in the United States refer to the processes financial institutions must comply with to establish the identity of their customers. *Id.* at 171. These processes are focused on due diligence and involve compliance with AML rules. *Id.*

²⁰⁸ Peter J. Henning, *More Bitcoin Regulation Is Inevitable*, N.Y. TIMES (Feb. 3, 2014), http://dealbook.nytimes.com/2014/02/03/more-bitcoin-regulation-is-inevitable/?_r=0 (explaining the debate attending Bitcoin’s anonymity and scandals involving its use in online criminal enterprises).

²⁰⁹ *FAQ*, WIKI.RIPPLE (May 27, 2015), <https://wiki.ripple.com/>.

²¹⁰ *Id.*

²¹¹ *Id.*

²¹² Henning, *supra* note 222.

²¹³ *FinCEN Fines Ripple Labs Inc. in First Civil Enforcement Action Against a Virtual Currency Exchanger*, FINCEN (May 5, 2015), http://www.fincen.gov/news_room/nr/html/20150505.html.

²¹⁴ *Id.*

Although this Note argues that Ripple Labs does not *own* XRP, it nonetheless demonstrates that regulators will ensure that AML/KYC compliance processes exist. However, consistent with the fact that Ripple Labs does not own the Ripple protocol and that Ripple “plugs in” to existing legal frameworks, regulators should focus on whether *gateways* have adequate KYC/AML procedures in place. A gateway is where “fiat money enters and exits” the Ripple protocol: it is at the gateway, not the protocol itself, where AML/KYC issues exist.²¹⁵ But the gateways themselves may be non-traditional and require regulatory attention they may not have otherwise received. For example, SnapSwap, Inc., is a popular, non-bank gateway that may not otherwise deserve regulatory attention but for the AML/KYC risks it poses.²¹⁶ Regardless, this Principle maintains that regulators should continue to focus on the regulation of Ripple users – especially gateways – for both their systemic and AML/KYC risks. And above all, the overarching rule remains that regulators should use a *principles-based* approach so they can account for unforeseen risks, such as a change in the source of AML/KYC risks.

CONCLUSION

Ripple reflects a major innovation in payments technology. Unlike other innovations in recent years that affected operational components on the customer interface level, the Ripple protocol has introduced a new distributed method of settlement that is significantly different from the traditional model that relies on central institutions. The Ripple protocol offers many advantages compared to traditional payment systems in terms of safety, efficiency, and cost,

²¹⁵ Gehring, *supra* note 203.

²¹⁶ See Julian Martinez, *Popular Gateways*, RIPPLe LABS, INC. (Apr. 25, 2015), https://ripple.com/knowledge_center/gateway-information/; *About*, SNAPSWAP <https://snapswap.us/#/about> (last visited June 13, 2015). Other DIPPs, however, may pose different AML/KYC risks of which regulators must be aware. This explains why a flexible approach to DIPPs is important: changes to these protocols are relatively easy (compared to changing a physical institution), and so the sources of risk could quickly change.

especially with respect to the costly and inefficient cross-border payment system. Because its properties as a DIPP distinguish it from traditional payment systems and service providers, sound regulation of Ripple requires a flexible and principle-based approach that amends current regulatory frameworks to account for modern technological realities. Ripple's advantages suggest that users will increasingly utilize the system in place of traditional payment processes. But this successful growth, and its implications for the safety of the global financial system, also depends on understanding, support, and flexibility from international regulators.