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

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NOTE

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

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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. This decentralized Internet payment protocol could provide a cure to an inefficient cross-border payments system. Although Ripple's technology can reduce significant risks and costs that exist in the international-payments system, regulators should adopt a new regulatory framework that responds to how this technology works. This Note performs two functions to help regulators realize this goal. It first helps regulators and other market participants understand how Ripple operates by explaining what Ripple is and comparing it to current payments systems. Second, it suggests a series of principles that regulators should use to monitor decentralized Internet payment protocols like Ripple. It does this by drawing from and tailoring existing regulatory principles to account for the risks reduced and presented by Ripple.

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INTRODUCTION

Joe lives in a rural town in the United States and has an account with a small bank, AmeriBank. Joe wants to pay $100 to Mary, who lives in a small town 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 the New York bank across national borders to the Delhi bank. Finally, it moves from the Delhi bank through the Reserve Bank of India, and to IndiaBank. The ultimate 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 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.[3]

1. PHILLIP RAPOPORT ET AL., RIPPLE LABS INC., THE RIPPLE PROTOCOL: A DEEP DIVE FOR FINANCE PROFESSIONALS 4, 45 (2014) [hereinafter THE RIPPLE PROTOCOL].

2. *Id.* at 4. "Ripple Labs" has since dropped "Labs" from its name. Alec Liu, *A New Chapter for Ripple*, RIPPLE (Oct. 6, 2015), https://ripple.com/blog/a-new-chapter-for-ripple/ [http://perma.cc/4R8A-9CT6]. To help distinguish between the protocol and the company largely behind it, this Note refers to the company as Ripple Labs.

3. *See* THE RIPPLE PROTOCOL, *supra* note 1 at 4–5, 13.

Today's international-payments system is broken, and Ripple could provide its cure. The international-payments system lacks transparency and remains antiquated, "slow, inconvenient, [and] costly."[4] Thus the Federal Reserve, in proposing reforms to the U.S. 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.[5] 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 $20 billion a year in infrastructure costs related to cross-border payments, securities trading, and compliance.[6] This Note argues that Ripple provides the solution that the Federal Reserve calls for by offering a more efficient and secure way to send money across borders than traditional systems.

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.[7] And although it governs how the users' computers interact with each other, the protocol does not affect the users' legal rights and obligations.[8] Ripple does not propose to replace the current financial infrastructure, but instead intends to become a part of it, much like an app on an iPhone.[9] Ripple provides the rail on which payments move; it does not define any other aspect of the relationships of its users or their legal responsibilities to one another.[10] Because of its decentralized nature and unclear legal status, Ripple—like other distributed ledger-based protocols—does not fit into existing frameworks for regulating payment systems or service providers.

This Note first helps regulators and other market participants understand how Ripple operates. It then suggests principles that regulators might use to monitor these increasingly important decentralized and globalized value transmitters. Part I explains how traditional payment systems work

4. Fed. Reserve Sys., Strategies for Improving the U.S. Payment System 25 n.35 (2015), https://fedpaymentsimprovement.org/wp-content/uploads/strategies-improving-us-payment-system.pdf [http://perma.cc/42U7-EVVS].

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

6. Santander InnoVentures et al., The Fintech 2.0 Paper: Rebooting Financial Services 15 (2015).

7. *See* The Ripple Protocol, *supra* note 1, at 4.

8. *See id.*

9. *See id.* at 4–5.

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

and the particularly significant problems and costs that attend people's ability to send money throughout the world. Part II argues that Ripple provides a better way to make cross-border payments because it makes international payments cheaper, more efficient, and more secure. Part II also explains Ripple's unusual governance structure and analyzes how regulators currently require financial institutions to manage Ripple (rather than regulating Ripple itself). Part III provides substantive suggestions for regulating Ripple and other decentralized Internet-payment protocols (DIPPs). It analyzes domestic and international guidelines and regulations and modifies them to account for the particular risks posed and mitigated by Ripple.

I. Noncash Payments: Moving Money Through Settlement

This Part describes the basic characteristics of traditional centralized payment systems to explain how Ripple works. To do this, it analyzes how money "moves" through financial institutions. It then describes 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,[11] the current international system is inefficient and introduces considerable risks to the global financial system.

A. *Moving Money in the United States*

At the most basic level, payment systems move money from a payer to a payee.[12] While one might think of money as physical banknotes, most payment systems today move money in the form of deposit balances held in banks.[13] A bank customer creates a deposit balance when she deposits cash into her account.[14] 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.[15] A noncash payment from a payer to a payee 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.[16] This process is a "settlement" because it settles a payment obligation by moving a financial asset, a deposit balance, between a payer and a payee.[17]

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11. *See infra* note 47 and accompanying text.

12. Comm. on Payment & Settlement Sys., Bank for Int'l Settlements, A Glossary of Terms Used in Payments and Settlement Systems 38 (rev. ed. 2003) [hereinafter Glossary], http://www.bis.org/cpmi/glossary_030301.pdf [http://perma.cc/KB7G-7VCP] (defining "payment systems").

13. 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], http://www.bis.org/cpmi/publ/d55.pdf [http://perma.cc/B6E9-624T].

14. *Cf. id.* at 2 (describing how deposits at settlement institutions are accepted as money).

15. *Id.*

16. *See id.*

17. *Id.* at 9–10.

Settlement occurs when banks update their ledgers to adjust deposit balances.[18] 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, the banks must also settle the transaction between them. To accomplish this interbranch settlement, the payer's bank must send a corresponding amount of funds to the payee's bank.[19] For every credit there must be a corresponding debit: both banks have to update their ledgers to account for the transfer of funds.[20]

A "payment system" provides the protocol that defines how banks settle these obligations.[21] More specifically, a payment system is a set of instruments, procedures, and rules that govern the transfer of funds from one bank to another to settle their obligations.[22] A payment system, then, defines interbank settlement behavior. It defines the processes through which money moves.

Most modern payment systems rely on a central "settlement institution," which holds deposits from each bank that is a party to a payment so it can settle obligations between banks.[23] By adjusting the deposit balances of the payer's and payee's respective banks,[24] the settlement institution provides the key mechanism to facilitate a fund transfer.[25] These deposit balances, called "settlement assets," provide the funds necessary to balance out the adjustment of liabilities that arise when a payer pays a payee.[26] Most of the time, the settlement institution is a central bank, such as the Federal Reserve in the United States.[27] And because the Federal Reserve requires every member bank to deposit a minimum reserve balance, it can enable the free flow of settlement between many different banks.[28]

For example, imagine that Joe wants to pay Mary $100. Each holds an account with different banks, Blue Bank and Yellow Bank, which in turn

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18. Glossary, *supra* note 12, at 45. 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, http://www.investopedia.com/terms/g/generalledger.asp [http://perma.cc/J5NT-9DE5].

19. Central Bank Money, *supra* note 13, at 9–10.

20. *See id.*

21. *See* Glossary, *supra* note 12, at 38 (defining a payment system as "a set of instruments, banking procedures and, typically, interbank funds transfer systems that ensure the circulation of money").

22. *Id.*

23. *See* Central Bank Money, *supra* note 13, at 2; Glossary *supra* note 12, at 45 (defining "settlement institution").

24. *See* Glossary, *supra* note 12, at 45 (defining "settlement").

25. *See* Central Bank Money, *supra* note 13, at 9–10.

26. *See* Glossary, *supra* note 12, at 45 (defining "settlement assets").

27. *See id.*; Central Bank Money, *supra* note 13, at 2; Bd. of Governors of the Fed. Reserve Sys., The Federal Reserve System: Purposes & Functions 34–35 (9th ed. 2005) [hereinafter Purposes & Functions], http://www.federalreserve.gov/pf/pdf/pf_complete.pdf [http://perma.cc/D2H3-V66Q].

28. *See* Purposes & Functions, *supra* note 27, at 35.

both hold deposit accounts with the 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 transfers 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), for retail payments,[29] and FedWire, for "large-value, time-critical payments."[30] While FedWire provides near real-time settlement, ACH transactions require one to two days to settle.[31] Although FedWire settles significantly more transactions in dollar amounts than the ACH, the ACH processed 21.7 billion transactions in 2012 compared to FedWire's 287.5 million transactions.[32] The Federal Reserve uses software to update its ledger to process batches of payment orders between two banks and to calculate net balances.[33] Although 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.[34]

It is hard to imagine a more financially stable institution than the Federal Reserve, but any payment system that depends on a central settlement institution creates risks and inefficiencies. Because settlement takes place on

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29. *Id.* at 93–95. ACH is an operational system that facilitates "clearing." *See* 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], http://www.bis.org/cpmi/publ/d105.pdf [http://perma.cc/J5BG-WQPS]. In the ACH system, the Federal Reserve (the settlement institution) serves as an ACH operator and runs a centralized application software that processes interbank payments. *See id.* The Electronics Payment Network (EPN) is a private entity that also operates ACH. *Id.*

30. PURPOSES & FUNCTIONS, *supra* note 27, at 94–95. The Clearing House Payments Company L.L.C., which operates EPN, also operates Clearing House Interbank Payments System (CHIPS). CPSS ON INT'L PAYMENT SYSTEMS, *supra* note 29, at 488. CHIPS provides real-time settlement for large value transfers to approximately fifty American banks that meet detailed requirements in CHIPS's rules. *See id.* at 488–89. To facilitate this real-time settlement, CHIPS relies on central settlement institutions—the Clearing House Payments Company and the Federal Reserve Bank of New York—to hold prefunded balance accounts. *Id.*

31. PURPOSES & FUNCTIONS, *supra* note 27, at 94.

32. FED. RESERVE SYS., THE 2013 FEDERAL RESERVE PAYMENTS STUDY 42–44 (2014), https://www.frbservices.org/files/communications/pdf/general/2013_fed_res_paymt_study_detailed_rpt.pdf [http://perma.cc/S42D-AHDZ].

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

34. *See* PURPOSES & FUNCTIONS, *supra* note 27, at 93–95.

the settlement institution's books, both paying and receiving banks need accounts with that institution.[35] To transfer any funds, then, both banks depend on the settlement institution's operational soundness.[36] This dependence on a central institution to facilitate money transfers magnifies the operational risk of the settlement institution failing to settle funds.[37] And while the U.S. government backs the Federal Reserve, which in turn guarantees payments made on FedWire,[38] the Federal Reserve is not immune from technological and other operational risks,[39] even though the United States' payment system depends on its sound functioning.

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.[40] 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 value of the transferred money.[41] The Federal Reserve does not operate on credit, however, because the U.S. government funds it.[42] 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.[43] 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.[44] Thus most—although by no means all—payment systems settle through central banks, which eliminate credit and liquidity risk at perhaps the payment system's most fragile point, where exposures are "highest and most concentrated."[45] "The widespread use of central bank money as a settlement asset reflects its overall qualities of safety, availability, efficiency, neutrality and finality."[46]

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35. Central Bank Money, *supra* note 13, at 9–10; *see also* Glossary, *supra* note 12, at 45.

36. *See* Central Bank Money, *supra* note 13, at 10.

37. *See id.*

38. *See* Purposes & Functions, *supra* note 27, at 95.

39. *See, e.g.*, Priya Anand, *St. Louis Federal Reserve Confirms Hack*, MarketWatch (May 18, 2015, 6:57 PM), http://www.marketwatch.com/story/st-louis-federal-reserve-confirms-hack-2015-05-18 [http://perma.cc/V2HQ-5C6X].

40. Central Bank Money, *supra* note 13, at 11.

41. *Id.*; *see also* Glossary, *supra* note 12, at 17.

42. *See* Purposes & Functions, *supra* note 27, at 85–86; Central Bank Money, *supra* note 13, at 11–13.

43. *See* Central Bank Money, *supra* note 13, 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.

44. *See* Purposes & Functions, *supra* note 27, at 85; Central Bank Money, *supra* note 13, at 13.

45. Central Bank Money, *supra* note 13, at 11–12.

46. *Id.* at 2.

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, and 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.[47] In other words, there is no global settlement asset that allows banks to transfer funds across borders because there is no process or institution like a global central bank that could update its ledger. This is because cross-border payments require settlement in multiple currencies and thus depend on a foreign-exchange (FX) transaction.[48]

Instead of a central settlement institution, cross-border payment systems rely on an interbank correspondent-banking system.[49] This system processes cross-border payments through international correspondent-banking agreements that link together domestic-payment systems.[50] 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).[51]

Most cross-border payments involve two banks that do not have a correspondent-banking relationship with each other.[52] So, many payments must move through a domestic settlement institution before reaching a correspondent through which it can cross a border.[53] This process is relatively

47. *See id.* at 3, 37–38.

48. *Cf. id.* at 25, 37-38, 43 (describing the ways in which the development of the CLS Bank addresses risks in foreign-exchange transactions).

49. *See id.* at 5, 25.

50. *See id.* at 11.

51. Glossary, *supra* note 12, at 16.

52. *See* Central Bank Money, *supra* note 13, 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 (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).

53. Fin. Crimes Enf't Network, Feasibility of a Cross-Border Electronic Funds 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."); *see* White, *supra* note 52, at 9–11, 20 (explaining that while most payment systems follow a

more expensive than using a domestic-payment system, for at each point in 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.[54]

The lack of a central settlement institution leads to a highly complex international payment system, which creates risks because processing transactions involves a series of separate settlement processes. The Federal Reserve's role as central settlor in the U.S. payment system mitigates almost all credit and liquidity risk, but these risks become very real in the international-payments system.[55] Because there is no single global-payments rail that connects the payer to the payee to effect final settlement, a payment must travel on one domestic-payment rail in one country, then cross national borders through correspondent banks, before jumping to a domestic-payment rail in another country.[56] This inefficient system results in increased transaction costs and creates risk that the payment will get stuck (for example, if a bank in the chain fails or cannot process a transaction) as it travels between different rails.[57] Ripple, however, provides a 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 moves money through an alternative settlement mechanism called "distributed settlement."[58] Distributed settlement functions without a central settlement institution; rather than relying on a central bank to update its ledger to settle transactions and facilitate fund transfers, Ripple processes transactions through a public ledger that Ripple users update through algorithmic settling.[59]

This Part explains what Ripple is, how it works, and how it is governed and managed. This Part 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 Ripple fails to account for Ripple's unusual governance and management structure, resulting in inefficient and flawed supervision of this modern payment system.

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form of this "typical" interbank payment system model, the degree of tiers varies in different countries and markets).

54. The Ripple Protocol, *supra* note 1, at 35.

55. *See* Central Bank Money, *supra* note 13, at 10–12, 16–22.

56. *See id.* at 9–11, 20.

57. *See id.* at 12–13.

58. *See* The Ripple Protocol, *supra* note 1, at 11.

59. *See id.*

A. *Ripple Balances and Distributed Settlement*

Ripple facilitates the movement of money through distributed settlement, 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.[60] This is a public—as opposed to a private or central bank—ledger because every Ripple user can see and update the ledger.[61] The public ledger records every single transaction processed through the Ripple protocol and keeps track of all Ripple users' balances.[62] It is a publicly maintained record-keeping mechanism. While 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 collection of fund transfers immediately.[63] Ripple's public ledger facilitates a move from a model that depends on centralized actors to update their individual ledgers to a system in which decentralized actors update a single, public ledger. In essence, it flips the correspondent-banking model on its head.[64]

Distributed settlement is a significant innovation because it solves two problems that parties do not encounter when they settle a transaction through a central settlement institution: the double-spending problem and Denial of Service 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 same time even if that user only had enough money to make a payment to one counterparty.[65] To prevent this double-spending problem, distributed-settlement systems must ensure the accurate ordering of transactions.[66] Ripple does this through a process called "consensus."[67]

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60. *Id.* In contrast, only the Federal Reserve or Goldman Sachs can update their respective ledgers. *See id.* at 4–5.

61. *Id.* at 11.

62. *Id.*

63. *See id.*

64. Ripple's rejection of a central settlement institution also means it uses a different type of settlement asset. *Id.* at 4. Gateways, which are where "fiat money enters and exits the Ripple protocol," turn cash deposited by their customers into balances that they can transfer across the Ripple network. Bryant Gehring, *How Ripple Works*, Ripple (Oct. 16, 2014), https://ripple.com/knowledge_center/how-ripple-works/ [http://perma.cc/UM6B-4EPU]. These "Ripple balances," which reflect the balance type (dollars or Euros) and the party that issues them (that is, Yellow Bank), are settlement assets that users trade across the Ripple network. The Ripple Protocol, *supra* note 1, at 11, 32. "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.* at 15.

65. Pedro Franco, Understanding Bitcoin: Cryptography, Engineering, and Economics 12 (2015).

66. *See id.*

67. The Ripple Protocol, *supra* note 1, at 11.

Consensus involves validating nodes, Ripple users who vote to verify the authenticity of a transaction, agreeing to reject or approve a transaction as valid.[68] If a supermajority of validating nodes approve a transaction, the validating nodes update the public ledger.[69] This process enables secure and real-time settlement without using a central institution.[70]

The second problem that Ripple solved is the problem of Denial of Service attacks.[71] A Denial of Service attack refers to a malicious act in which someone "creates many identities in a peer-to-peer network to exert a disproportionately large influence."[72] For instance, an attacker could create a large number of accounts (or public keys) and flood the network with fake or otherwise illegitimate transactions.[73] 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, which would paralyze the network.[74]

Ripple's innovative solution to Denial of Service attacks is a virtual currency called the XRP.[75] Like other digital currencies such as Bitcoin, XRP is a "math-based currency" or a "cryptocurrency."[76] XRP is the native currency of the Ripple ledger, just like Bitcoin is the native currency of the

68. David Schwartz et al., Ripple Labs Inc., The Ripple Protocol Consensus Algorithm 2–3 (2014), http://www.naation.com/ripple-consensus-whitepaper.pdf [http://perma.cc/4JPA-78YK]. Ripple signs every transaction that parties submit to the network with a digital signature, which relies on public/private key cryptography. The Ripple Protocol, *supra* note 1, at 11. Each user then selects a list, called a "unique node list," comprising other users that it trusts as validating nodes. Schwartz et al., *supra*, at 3; *Unique Node List*, Ripple Wiki, https://wiki.ripple.com/Unique_Node_List [http://perma.cc/L6PU-CETV] (last modified Oct. 10, 2014, 7:00 PM). Each validating node independently verifies every proposed transaction within its network to determine if it is valid. A transaction is valid 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. The Ripple Protocol, *supra* note 1, at 11; *see* Schwartz et al., *supra*, at 1–3. 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 and it is not reflected in the next updated ledger. *See* Schwartz et al., *supra*, at 1–4.

69. Ripple requires a supermajority (80 percent) of nodes to vote for the transaction before it is reflected in the next ledger update. *See* Schwartz et al., *supra* note 68, at 4. 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.

70. The Ripple Protocol, *supra* note 1, at 11.

71. *See id.* at 14. People also often refer to Denial of Service attacks as Sybil attacks. *See id.*

72. Franco, *supra* note 65, at 165 n.3.

73. *See* The Ripple Protocol, *supra* note 1, at 14.

74. *Id.*

75. *See id.* at 14–15.

76. *Id.* at 14. 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.

blockchain,[77] the publicly distributed ledger used and maintained by Bitcoin users.[78] 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.[79] 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.[80] The twenty XRP (or about $0.16)[81] 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.[82] As a second line of defense, with each transaction that Ripple processes, it destroys 0.00001 XRP (roughly $0.00000008).[83] 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 Denial of Service attack—the fee rises rapidly.[84] This makes Denial of Service attacks extremely expensive for attackers.

B. *Changing the International-Payments System: Atomic and Straight Through Settlement*

In addition to offering an alternative settlement mechanism, Ripple's other significant innovation is offering atomic (all or nothing), real-time settlement for cross-border payments. Ripple does this by relying on third-party intermediaries called "market makers."[85] By providing liquidity, market makers provide an end-to-end payment rail between a payer and a payee.[86] 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.[87] 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.[88] The Ripple protocol then routes every transaction to the cheapest available

77. *Id.* at 14.

78. Franco, *supra* note 65, at 15–16.

79. The Ripple Protocol, *supra* note 1, at 14–16.

80. *Id.* at 14.

81. *Ripple/US Dollar (XRP/USD) Price Chart*, CoinGecko, https://www.coingecko.com/en/price_charts/ripple/usd [http://perma.cc/K8LX-D85T].

82. The Ripple Protocol, *supra* note 1, at 14.

83. *Id.*

84. *Id.*

85. *See* Bryant Gehring, *What Are Market Makers?*, Ripple (Oct. 16, 2014), https://ripple.com/knowledge_center/market-makers-2/ [http://perma.cc/XC57-9A6K?]

86. The Ripple Protocol, *supra* note 1, at 12–13.

87. *See id.* at 12.

88. *See id.* at 12–13. For example, consider the example in which 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

price.[89] But the Ripple protocol looks not only for the cheapest offer, but the cheapest *path*, causing market makers to not only provide liquidity, but to actively compete for spreads.[90]

In addition, because Ripple's transactions are atomic, Ripple eliminates the risk that payments will not reach the targeted payee once the payer initiates the transaction.[91] For example, if a party wants to complete a transaction, it may have to pass through multiple market makers 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 steps happen at all.[92] Thus, the atomic nature of a Ripple transaction means that it cannot get stuck at a single market maker, eliminating counterparty risk.[93] 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.[94]

Because these transactions happen in real time, the Ripple protocol increases cost savings[95] and allows parties to better manage their risks.[96] While international correspondent-banking model transactions can take up to four days to process,[97] creating uncertainty for the payer and payee, under Ripple, parties know their positions immediately.[98] Real-time settlement also reduces the transaction costs of each discrete settlement process associated with traditional cross-border payments.[99]

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by simultaneously buying Euros from the European gateway and selling dollars to the U.S. gateway. *Id.*

89. *Id.* 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.

90. *Id.* at 12–13.

91. *Id.* at 13.

92. *Id.*

93. *Id.*; *see also* Gehring, *supra* note 85. 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. *See* The Ripple Protocol, *supra* note 1, at 13.

94. *See* The Ripple Protocol, *supra* note 1, at 13.

95. *Id.* at 2. Ripple typically processes transactions in three to six seconds. *Id.*

96. *See id.* at 11 (explaining the process of consensus used by Ripple to create fast and secure settlement on the Ripple Network).

97. Houman Shadab, *How Bitcoin Will Change International Bank Payments*, Coin Center (Mar. 9, 2015), https://coincenter.org/2015/03/bitcoin-will-change-international-bank-payments/ [http://perma.cc/LCM2-EBLV].

98. *See* The Ripple Protocol, *supra* note 1, at 13 & n.3.

99. *Id.* at 11. Through real-time settlement, parties access 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. *See id.* at 2, 22.

Ripple not only creates a faster settlement system, but it also allows parties to make foreign-exchange trades with fewer transaction costs. Although "[t]he average bank . . . charge[s] [a] 5.88%" foreign-exchange transaction fee[100] in addition to the FX spread, Ripple users pay only the FX spread (and a negligible amount of XRP).[101] Although manual control over trading makes FX transactions expensive,[102] 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.[103] 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.[104]

Ripple provides a way to settle international payments speedily and reliably in the absence of a global central bank. Ripple provides the essential central settlement function that the current international-financial system lacks. Perhaps it comes as little surprise, then, that financial institutions have begun to adopt distributed ledger technology systems, such as Ripple, to tap into the estimated $15–20 billion a year in savings by improving their settlement systems.[105] Ripple has partnerships with financial institutions across the world, including Germany-based bank Fidor, Kansas-based CBW Bank, New Jersey-based Cross River Bank,[106] and three of Australia's "big four

100. Alina Comoreanu, *Currency Exchange Study: How to Save on International Spending*, CardHub (May 12, 2015), http://www.cardhub.com/edu/currency-exchange-study/ [http://perma.cc/AT7M-EQK4].

101. The Ripple Protocol, *supra* note 1, at 5, 9.

102. 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], http://www.bis.org/cpmi/publ/d76.pdf [http://perma.cc/47LB-9T76]. Manual control has also enabled bankers to manipulate FX spreads at 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: Citigroup Paid $2.5BN in Fines for Rigging Currency Rates as Bank Made Just $1M from Misconduct*, Int'l Bus. Times (June 11, 2015, 2:47 AM), http://www.ibtimes.co.uk/fx-fixing-scandal-citigroup-paid-2-5bn-fines-rigging-currency-rates-bank-made-just-1m-1505515 [http://perma.cc/EQ3Q-RADE].

103. *See* The Ripple Protocol, *supra* note 1, at 9.

104. 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., Migration and Remittances, Migration & Development Brief 24, at 1 (2015), http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1288990760745/MigrationandDevelopmentBrief24.pdf [http://perma.cc/DR2K-SUJM]. 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 percent* to send money abroad, with the highest average cost reaching 12 percent in sub-Saharan Africa. CPSS on Int'l Remittances, *supra* note 102, at 15; Dilip Ratha et al., *supra*, at 1.

105. *See* Santander InnoVentures et al., *supra* note 6, at 15 (suggesting that "distributed ledger technology could reduce banks' infrastructure costs attributable to cross-border payments, securities trading and regulatory compliance by between $15-20 billion per annum by 2022").

106. James Schneider & S.K. Prasad Borra, Goldman Sachs, The Future of Finance, Part 2: Redefining "The Way We Pay" in the Next Decade 56 (2015), http://www

banks"—the Commonwealth Bank of Australia, Westpac Banking Corp, and the Australia and New Zealand Banking Group.[107] Perhaps surprisingly, Western Union (which charges $40 to send $500 overseas), is also considering a partnership with Ripple.[108]

C. *Decentralized Governance*

Ripple presents innovations at the operational level that will reduce many risks presented by current payment systems, but its unusually 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 some sort of central operator. Although Ripple Labs is developing and promoting the Ripple protocol, it does not actually control or maintain the protocol.[109] Development of the protocol depends on the system's users adopting proposed changes to the protocol.[110] In contrast, centralized legal entities own or operate the existing major payment systems.[111]

Ripple's development is unusual because changes to the Ripple protocol occur only through the validating nodes.[112] Just as validating nodes must update Ripple's ledger and vote to approve a transaction, a majority of nodes must approve a proposed change to the protocol.[113] Any entity can

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.slideshare.net/jqvcru/gs-the-future-of-finance-redefining-the-way-we-pay-in-the-next-decade-150310 [http://perma.cc/XDW4-5UD7].

107. Paul Smith, *Westpac, ANZ Trial Ripple Payments, but Big Four Reluctant on Bitcoin*, Australian Fin. Rev. (June 9, 2015, 4:12 AM), http://www.afr.com/business/banking-and-finance/financial-services/westpac-anz-trial-ripple-payments-but-big-four-reluctant-on-bitcoin-20150608-ghhmsq [http://perma.cc/4KFY-2FR8].

108. 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/ [http://perma.cc/UQC8-K33X].

109. If Ripple Labs were to disappear, "[t]he Ripple network would then operate independently of Ripple Labs." *FAQ*, Ripple Wiki, https://wiki.ripple.com/FAQ [http://perma.cc/9HYS-MYF6] (last modified May 27, 2015, 1:13 AM).

110. *See Understanding: Forking the Ripple Protocol*, Ripple Wiki, https://wiki.ripple.com/understanding:_Forking_the_Ripple_Protocol [http://perma.cc/3565-TWCB?type=source] (last modified Apr. 17, 2014, 6:08 AM).

111. 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 29, at 488, 493.

112. Email from Ryan Zagone, Dir. of Regulatory Relations, Ripple Labs, Inc., to authors (Aug. 6, 2015, 12:09 AM) (on file with authors); *see also* Schwartz et al., *supra* note 68, at 4.

113. Email from Ryan Zagone to authors, *supra* note 112. As Zagone explains,

> "[i]n 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 110. Forking refers to a situation in which a segment of the protocol's users split off into

propose a change to the Ripple protocol.[114] 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.[115] But a change to the protocol would only occur if at least a majority of validators accept a proposal.[116]

Also, Ripple does not replace existing relationships, but instead "plugs in" to existing structures.[117] 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.[118] For example, financial institutions that use Ripple must continue to rely on the bilateral agreements they had in place before joining Ripple.[119] Ripple provides only the *rail* on which payments move, it does not define any other aspect of financial institutions' relationships or legal responsibilities.[120] 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."[121]

D. *Current Regulatory Status of Ripple*

Because Ripple plugs in to existing structures and serves only as payment rails, regulators logically treat Ripple as an entity that financial institutions install, like software. Ripple's discussions with regulators have centered on Ripple's status as a "third-party vendor" to financial institutions.[122] 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

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their own group and use a modified version of the software. Linus Nyman & Juho Lindman, *Code Forking, Governance, and Sustainability in Open Source Software*, TECH. INNOVATION MGMT. REV., Jan. 2013, at 7, 7–8. This means that two different versions of the protocol would operate independently of one another. *Id.* at 7. "The right to fork code is built into the very definition of what it means to be an open source program." *Id.* at 8.

114. Email from Ryan Zagone, Dir. of Regulatory Relations, Ripple Labs, Inc., to authors (Aug. 9, 2015, 3:39 PM) (on file with authors).

115. *See id.*; *Understanding: Forking the Ripple Protocol*, *supra* note 110.

116. Email from Ryan Zagone to authors, *supra* note 112. *See generally* Nyman & Lindman, *supra* note 113 (explaining the role of code forking in the governance and sustainability of open source software).

117. Telephone Interview with Ryan Zagone, *supra* note 10.

118. *See id.*

119. *See 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. *See id.*

120. *See id.*

121. THE RIPPLE PROTOCOL, *supra* note 1, at i; *see* Alec Liu, *Ripple Labs Joins NACHA Alliance*, RIPPLE (June 9, 2014), https://ripple.com/blog/ripple-labs-joins-nacha-alliance/ [http://perma.cc/WBK8-YZE2].

122. *See* Telephone Interview with Ryan Zagone, *supra* note 10.

Examination Council—regulates financial institutions' relationships with third-party vendors.[123] These regulations would put the burden on financial institutions to engage in "effective risk management" practices in their relationships with Ripple.[124]

This approach is weak because many of these rules simply do not make sense when applied 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."[125] And at least one commentator suggests the "key" to effective risk management of third-party vendors "is the contract."[126] 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. Similarly, because no single entity controls Ripple, there would be no way to manage the risks Ripple poses: its development depends on its users. The structural reality of Ripple demands that the "key" to managing Ripple would involve monitoring and putting processes in place that could mitigate the consequences of 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 fail to create a regulatory structure that would enable transparency and communication between regulators and Ripple (leaving Ripple without the ability to effectively represent itself);[127] develop

123. *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/ [http://perma.cc/MRN6-326G].

124. Office of the Comptroller of the Currency, U.S. Dep't of the Treasury, OCC Bull. 2013-29, Risk Management Guidance (2013), http://www.occ.gov/news-issuances/bulletins/2013/bulletin-2013-29.html [http://perma.cc/7C76-YK3G]. 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 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.*

125. *Id.*

126. *New OCC Standards Require Stricter Oversight of Third-Party Relationships*, *supra* note 123.

127. *See generally* Dep't of the Treasury, Financial Regulatory Reform: A New Foundation 3, http://www.treasury.gov/initiatives/Documents/FinalReport_web.pdf [http://perma.cc/ZR3X-597X] (noting that financial regulation oversight should "promote transparency, simplicity, fairness, accountability, and access"); Julia Black & Stéphane Jacobzone, *Tools for Regulatory Quality and Financial Sector Regulation: A Cross-Country Perspective* (OECD Working Papers on Public Governance No. 16, 2009), http://dx.doi.org/10.1787/

the protocol in socially beneficial ways;[128] assess the burden of rules on banks or other institutions that use Ripple;[129] comprehensively regulate payment systems;[130] provide the government the ability to manage a potential crisis involving Ripple;[131] and create international coordination mechanisms.[132] While the current approach cannot 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 is, the proposed principles account for Ripple's unusual governance and management structure and reflect the particular risks Ripple mitigates and poses to the global financial system.

III. A Principles-Based Approach to Regulating Ripple

The main challenge in formulating a regulatory approach for Ripple is that it is a decentralized Internet payment protocol (DIPP), making it different from other payment systems. Regulators must account for Ripple's nuances 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 unowned protocols present different risks but also mitigate others. And because Ripple has an international focus, regulators must coordinate and communicate with stakeholders in other jurisdictions. At the same time, Ripple has an interest in avoiding duplicitous 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.[133] In 2012, the CPMI, along with the Technical Committee

218772641848 [http://perma.cc/8BMG-3KWT] (analyzing principles of "quality regulation" systems of financial regulators in five countries).

128. *See generally* Economic Crisis Summit, *Report of the Commission of Experts of the President of the United Nations General Assembly on Reforms of the International Monetary and Financial System* (Sept. 21, 2009), http://www.un.org/ga/econcrisissummit/docs/FinalReport_CoE.pdf [http://perma.cc/R7WR-FZD8].

129. Black & Jacobzone, *supra* note 127, at 49–50.

130. *See* Dep't of the Treasury, *supra* note 127, at 3.

131. *See id.* at 8.

132. *See id.* at 8–9; Black & Jacobzone, *supra* note 127, at 9–10.

133. It also sets standards for settling and clearing systems. Comm. on Payments & Mkt. Infrastructures, Bank for Int'l Settlements, Charter 1 (2014), http://www.bis.org/cpmi/charter.pdf [http://perma.cc/L6SR-DMSS]. It is a member of the Financial Stability

of the International Committee of Securities Commissioners, released a set of standards known as the Principles for Financial Market Infrastructures (PFMIs).[134] 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.[135]

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 all relevant jurisdictions."[136] But this does not yet exist for Ripple. And because it likely qualifies as a financial market utility[137] and the United States and Europe have largely adopted the PFMIs,[138] 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 for how to improve these PFMIs to account for the different risks Ripple and other DIPPs pose.

A. *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

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Board and also coordinates with other international standard setters, such as the International Organization of Securities Commissions and the Basel Committee on Banking Supervision. *Id.* These international standard-setting bodies sit 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).

134. Comm. on Payment & Settlement Sys. & Tech. Comm. Int'l Org. Secs. Comm'ns, Bank for Int'l Settlements, Principles for Financial Market Infrastructures (2012) [hereinafter The PFMIs], http://www.bis.org/cpmi/publ/d101a.pdf [http://perma.cc/F8N9-DMVA].

135. *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 7. 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.

136. *Id.* at 21.

137. *See supra* note 135.

138. Not only has the Federal Reserve issued regulations for payment systems consistent with these principles, *Payment System Risk*, Board Governors Fed. Res. Sys., http://www.federalreserve.gov/paymentsystems/psr_about.htm [http://perma.cc/9LJ5-M66E] (last updated July 23, 2015), but the Governing Council of the European Central Bank incorporated the PFMIs in June 2013. European Cent. Bank, Eurosystem Oversight Report 2014, at 6 (2015), https://www.ecb.europa.eu/pub/pdf/other/eurosystemoversightreport2014.en.pdf [http://perma.cc/CR8R-S7KP].

systemic level.[139] The PFMIs look to the rights and obligations of parties to payments transactions in addition to the system itself.[140] If risk management is to be sound and efficient, the rights and obligations relating to payment system operations require a high degree of certainty.[141]

Because no single entity can change the Ripple protocol, there is no centralized institution that regulators can force to make positive changes to the protocol. Ripple Labs or any other institution can propose changes, but the protocol changes only if a majority of users accept a given proposal.[142] 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.[143] Although the Federal Reserve can monitor the ACH system's developments, the Federal Reserve could not justifiably require Ripple Labs to change the protocol, or punish it 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.[144] Still, regulators must recognize that the Ripple protocol and other DIPPs do not define any legal rights or obligations of its members.[145] Ripple instead plugs into the existing legal framework of the institutions that use Ripple: it sits at the bottom of a payment ecosystem that already experiences (at least in the United States) comprehensive regulation.[146] For example, UCC regulations at the transactional level would apply to any transaction that users performed using Ripple.[147] And correspondent relationships would continue to have to define the legal connections between banks even if Ripple gave those banks the technology—the Ripple protocol—to settle monetary obligations with one another.[148]

Since regulators did not design these frameworks for institutions that used a settlement infrastructure powered by a DIPP, these frameworks cannot efficiently account for the settlement risks that Ripple poses and mitigates. It is more likely that the Ripple protocol would actually reduce many

139. The PFMIs, *supra* note 134, at 21–25.

140. *Id.* at 21.

141. *Id.*

142. *See supra* notes 112–116 and accompanying text.

143. *See* Stephanie Heller, *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, 517 n.20 (2006).

144. *See supra* Section II.D.

145. *See supra* Section II.C.

146. *See supra* notes 117–124 and accompanying text.

147. *See* U.C.C. § 4A (Am. Law Inst. & Nat'l Conference of Comm'rs on Unif. State Laws 2012) (governing wholesale fund transfers).

148. *See supra* notes 117–120 and accompanying text (explaining that Ripple does not affect the existing legal relationships—including correspondent relations—between participants in global-payment systems).

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.[149] By recognizing Ripple's ability to mitigate counterparty and settlement risk, more market participants will have access to real-time settlement institutions.[150]

In addition to challenging the logical basis for existing 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, 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 defines when a payment has legally occurred.[151] Determining when a payment has legally occurred is crucial to establishing the final positions of members in multilateral netting systems.[152] That is, determining the order of payments is important for a central institution, like the Federal Reserve, with ACH, which has to net a batch of transactions at once.[153] 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

149. 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 30 (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 27, 32 and accompanying text; *see also* 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. *See* Gabriele Galati, *Settlement Risk in Foreign Exchange Markets and CLS Bank*, BIS Q. Rev., Dec. 2002, at 55, 55–58.

150. Recall that ACH, which has delayed settlement, facilitated 21.7 billion transactions in 2012 compared to FedWire's 287.5 million transactions, and that only approximately fifty American banks have access to CHIPS. *See supra* notes 29, 32 and accompanying text.

151. U.C.C. § 4A.

152. *See* Comm. on Payment & Settlement Sys., Bank for Int'l Settlements, Core Principles for Systemically Important Payment Systems 20 (2001) [hereinafter CPSIPS], http://www.bis.org/cpmi/publ/d43.pdf [http://perma.cc/F9V2-RTEF] (explaining how obligations of senders in a multilateral netting system are satisfied under UCC 4A).

153. *See* Purposes & Functions, *supra* note 27, at 93–94.

arising from possible conflicts between relevant laws of different jurisdictions.[154] 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.[155]

B. *Principle II: Stakeholder Buy-In: International Forums of Regulators and 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 work with Ripple users and international bodies to effectively regulate the protocol. As Principle X of the PFMIs explains, financial market utilities must have "effective, accountable and transparent governance" that promotes the safety and efficiency of Ripple and support the stability of the broader financial system.[156] That same Principle, however, dictates that effective governance would also consider the interests of relevant stakeholders.[157] Because Ripple's stakeholders are widespread and diverse, the biggest challenge to regulating 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 users manage the system's developments, an effective discourse between these users and regulators is the most effective way to ensure efficiency and accountability. A trade group that represents Ripple's users could ensure the stakeholders who control Ripple have a voice in its regulation.

NACHA, a self-regulatory organization that governs ACH with the Federal Reserve, provides an excellent model for ensuring broad stakeholder

154. *Cf.* CPSIPS, *supra* note 152, at 5. ("Although the Core Principles are expressed in terms of payment systems in a single country, they are equally applicable where the payment system arrangements extend over a broader economic area, such as where a single payment system or a collection of interconnected payment systems cover a region broader than a country.").

155. For example, which insolvency laws to follow in case a gateway becomes insolvent may prove a significant question. Clear guidelines would be necessary to solve this problem. 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 correspondent agreements which insolvency laws to follow. 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 to properly address such uncertainty.

156. CPSIPS, *supra* note 152, at 53.

157. *Id.* at 54.

involvement.[158] 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 Network participant."[159] NACHA's rules apply to the financial institutions that initiate payments on ACH.[160] While NACHA's rules do not directly reach merchants and other nonfinancial institutions that use the ACH, NACHA's rules govern financial institutions' relationships with these entities, requiring them to meet certain requirements.[161] And when institutions use the Federal Reserve to transmit payments, the Federal Reserve incorporates the NACHA rules by reference.[162] 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, Ripple could be integrated with (or modeled after) a self-regulatory organization like NACHA; the NACHA rules would continue to define the financial institutions that use ACH and Ripple.[163] 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.[164] Ripple users must accept (by at least a majority) any changes to the protocol.[165] 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

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

159. *NACHA Operating Rules*, NACHA, https://www.nacha.org/rules [http://perma.cc/59F9-JZW4].

160. *See* Robert G. Ballen & Thomas A. Fox, *The Role of Private Sector Payment Rules and a Proposed Approach for Evaluating Future Changes to Payments Law*, 83 Chi.-Kent L. Rev. 937, 941–42 (2008).

161. *Id.*

162. *Id.* at 941.

163. Ripple Labs is a member of NACHA. Liu, *supra* note 121.

164. Something like a trade group for Ripple has already emerged: the "International Ripple Business Association is a 501(c)(3) not-for-profit whose focus is on providing support to businesses being built on the Ripple Protocol." *About*, Int'l Ripple Bus. Ass'n, http://www.ripplebusiness.org/about/ [http://perma.cc/3V6K-N9JJ]. Although 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. *See id.* 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.*

165. *See Understanding: Forking the Ripple Protocol*, *supra* note 110.

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 engage constructively with regulators. Regulators also have an interest in developing this sort of relationship because 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 rulemaking capacities, models exist for coordinating international regulation of payment systems.[166] Ripple Labs is specifically marketing Ripple as a solution to the FX markets.[167] Because users can operate it from anywhere, 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.[168] 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.[169] Because of CLS Bank's important 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.[170] The Federal Reserve, the primary prudential regulator of the U.S. bank, serves as the Chair of the CLS Oversight Committee and organizes and administers the forum.[171] This forum attempts to reconcile international regulators' interest in the comprehensive regulation of CLS with concerns for efficiency by minimizing duplicative and burdensome regulations of the bank.[172] The members of the forum also

166. *See, e.g.*, DEP'T OF THE TREASURY, *supra* note 127, at 80–88.

167. *See, e.g.*, Ryan Young, *Using Ripple for Cross-Currency Payments*, RIPPLE (Apr. 29, 2015), https://ripple.com/knowledge_center/using-ripple-for-cross-currency-payments/ [http://perma.cc/VN5T-88X5].

168. CPSS ON INT'L PAYMENT SYSTEMS, *supra* note 29, at 67, 103.

169. *See id.*

170. *Protocol for the Cooperative Oversight Arrangement of CLS: About*, BOARD GOVERNORS FED. RES. SYS., http://www.federalreserve.gov/paymentsystems/cls_about.htm [http://perma.cc/2ATC-6C5K] (last updated Sept. 9, 2009).

171. The Financial Stability Oversight Council designated CLS Bank as systemically important for its role in clearing FX transactions. *Designated Financial Market Utilities: About*, BOARD GOVERNORS FED. RES. SYS., http://www.federalreserve.gov/paymentsystems/designated_fmu_about.htm [http://perma.cc/9W58-SAWH] (last updated Jan. 29, 2015).

172. *Protocol for the Cooperative Oversight Arrangement of CLS*, BOARD GOVERNORS FED. RES. SYS., http://www.federalreserve.gov/paymentsystems/cls_protocol.htm [http://perma.cc/RZ6M-YMV5] (last updated May 29, 2009).

designed it to enhance transparency in communications between the member-regulators in developing rules and in communications with CLS.[173] Like with CLS Bank, the National Bank of Belgium oversees a college of regulators that supervises the Belgium-based SWIFT.[174]

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.[175] Regulators could thus 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.[176]

An international forum would reduce the regulatory burden on Ripple users by minimizing the likelihood that they would have to comply with duplicative or inconsistent regulations.[177] Most significantly, it would allow Ripple users to represent their interests to global regulators and start a dialogue with the bodies that supervise them. The Federal Reserve, as evidenced by its relationship with NACHA, is open to 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 cochairing 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 participate in its regulation. Conversely, the only way to ensure effective regulatory involvement in Ripple's development is through these users' buy-in. Ripple user buy-in is important because the only way to promote socially beneficial uses of Ripple's platform, such as making it more accessible to the global remittance market, is through user acceptance of proposed changes. Ripple (and other DIPPs) presents a truly rare regulatory challenge in that its development and operation exist on the Internet and outside the control of a single entity. Ripple user buy-in is more important to successful reform than what regulators may be accustomed to. Successful regulation may require reconceptualizing what it means to regulate an entity.

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173. *Id.*

174. *Supervision and Oversight of Financial Market Infrastructures: Private Sector Systems*, Board Governors Fed. Res. Sys., http://www.federalreserve.gov/paymentsystems/over_pssystems.htm [http://perma.cc/56XU-8YGT] (last updated Jan. 29, 2015).

175. *See* Barr, *supra* note 133, at 1005, 1010.

176. *See* Erik Heitfield, *Using Trade Repository Data for Systemic Risk Monitoring*, 37 IFC Bull. (Irving Fisher Comm. on Cent. Bank Statistics), Jan. 2014, at 190–91.

177. *See supra* note 172 and accompanying text (explaining the importance of analyzing the burden on a regulated entity in developing "quality" financial regulation).

C. *Principle III: Managing Financial Risks*

In addition to the buy-in from users, international regulators should implement substantive regulations on DIPPs to mitigate potential risks they 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.[178] Risk management should cover both normal situations and abnormal events, such as a participant's inability to meet its obligations.[179]

Payment systems traditionally face credit risk from their participants, their payment and settlement processes, or both.[180] The PFMIs 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.[181] The methods to reduce credit risks introduce significant transaction costs: the PFMIs require participants to post collateral for each trade in addition to always holding a balance at the settlement institution.[182]

Ripple does not face credit risk, however, because Ripple is not a central settlement institution and because it cannot extend intraday credit to its participants. Settlement is both atomic and immediate because the Ripple system trades on real assets, not credit, and it facilitates the trades in real time.[183] 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.[184] Not only is this more efficient because users can put their money to productive uses instead of leaving it unused as reserve funds, but it is actually safer because the users' funds are not subject to the health of the institution that holds them.[185] The PFMIs reflect regulators' concerns with the safety and soundness of a settlement institution, whose failure could be disruptive by disabling access to the market.[186] 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.

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178. *See* THE PFMIs, *supra* note 134, at 21–24.

179. *See id.* at 33, 96.

180. *Id.* at 38.

181. 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").

182. *Id.* at 39; Galati, *supra*, note 150, at 55, 62–63.

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

184. *See id.* at 9, 13–15.

185. *See* CENTRAL BANK MONEY, *supra* note 13, at 11–12.

186. *See* THE PFMIs, *supra* note 134, at 78–87 (explaining Principle 13, requiring financial market infrastructures to have default management processes in place).

Payment systems also present special liquidity risks.[187] Whether a participant making a payment has sufficient funds in its account with the settlement institution so that the system can accept the payment for settlement is a particularly significant concern for regulators.[188] 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.[189] Frequent gridlock can lead to a loss of confidence in the payment.[190]

Ripple, however, presents different liquidity risks than traditional payment systems. Payments made with Ripple are not likely to lead to liquidity risks because a bank will not run out of central bank deposits.[191] A gateway need not hold deposits in any third-party institution.[192] On the other hand, cross-border payments on Ripple do generate liquidity risk because there must be sufficient currency on the buy side for the market maker to facilitate the payment.[193] But each Ripple payment involves an atomic transaction and straight through path from a payer to a payee, minimizing the risk of gridlock. If there is not enough liquidity of the currency on the buy side, the payment does not occur at all.[194] However, a lack of liquidity in the underlying assets—for example, a particular currency—could prevent the processing of transactions.[195] Ripple mitigates this risk 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.[196]

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.[197] A gateway might not be able to

187. 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 id.*; FIN. CRISIS INQUIRY COMM'N, THE FINANCIAL CRISIS INQUIRY REPORT 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. FIN. CRISIS INQUIRY COMM'N, *supra*, at 341, 345–46.

188. CPSIPS, *supra* note 152, at 24.

189. *See* THE PFMIs, *supra* note 134, at 57–61.

190. *See id.*

191. *Cf. supra* notes 44–46 and accompanying text.

192. *See* THE RIPPLE PROTOCOL, *supra* note 1, at 4.

193. *See id.* at 12–13.

194. *See id.* at 11–13.

195. *See id.* at 15.

196. *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.

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

honor its obligation to repay a user the amount in her deposit balance, if, for example, the gateway became insolvent. The trust lines, however, help users manage the credit risk between them and their gateway.[198] Imprudent use of these trust lines to unstable gateways may lead to large exposures.[199] Regulators should make sure that users fully understand the use of trust lines and encourage them to be vigilant in minimizing credit risk.

It is important for regulators to ensure that Ripple users acknowledge that the source of Ripple's liquidity and credit risks are different from those of traditional payment systems. Although 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 or settlement institution, these tactics would do little to account for Ripple's risks.[200] It might be useful, however, 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.

D. *Principle IV: Transparency: Ensure Regulators and Market Participants Understand the Ripple Protocol*

The PFMIs 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.[201] In particular, the PFMIs explain that payment systems facilitate parties' understanding of the risks they pose by providing clear and comprehensive rules, procedures, market data, and fees.[202] The parties must understand the basic design of the system so that they can determine their rights, obligations, and the potential risks they may face.[203]

The Ripple protocol exemplifies transparency at the most basic level because it is a free, open protocol;[204] anyone can view the specific code of the protocol and the public ledger at any time.[205] Regulators should ensure,

198. *See* Bryant Gehring, *Understanding Trust Lines*, Ripple (Sept. 18, 2014), https://ripple.com/knowledge_center/understanding-connecting-to-a-gateway-trust-lines-2/ [http://perma.cc/BR9M-3DNF].

199. *See id.*

200. *See, e.g.*, The PFMIs, *supra* note 134, at 36–53 (explaining the standard use of collection of collateral, margin, and position limits to minimize credit and liquidity risks).

201. *Id.* at 121.

202. *Id.*

203. *Id.*

204. The Ripple Protocol, *supra* note 1, at 4.

205. *Open-Source*, New Oxford American Dictionary (3d ed. 2010); Gehring, *supra* note 64.

however, that resources communicate to Ripple users how it works (in digestible ways, such as 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.[206]

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.[207] 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 how-to guides. It should also, as this Note has attempted to do, explain the theoretical design principles behind the protocol and any subsequent changes.

E. *Principle V: Operational Risk Management of Vital Participants: Focusing on Nodes, the Consensus Algorithm, and the Ripple Protocol*

A payment system should be designed and operated with a high degree of security and operational reliability.[208] The security of any system is "only as strong as its weakest link."[209] Thus, regulatory 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.[210] This extends beyond the system's interface and includes operations by participants that could adversely affect the payment system.[211] This principle is especially important for payments conducted through Ripple, which relies on a new Internet-based 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 consensus that the transaction is authentic.[212] The integrity of the process depends on the trustworthiness of the validating nodes,

206. *See* THE RIPPLE PROTOCOL, *supra* note 1, at 4; *supra* note 2 and accompanying text.

207. *See, e.g.*, CPSIPS, *supra* note 152, at 21.

208. *Id.* at 37.

209. *Id.*

210. *Id.*

211. *Id.*

212. *See* THE RIPPLE PROTOCOL, *supra* note 1, at 11; *see also Consensus,* RIPPLE WIKI, https://wiki.ripple.com/Consensus [http://perma.cc/M4NR-CXM7] (last updated Jan. 6, 2015, 5:39 PM).

which are not subject to any review.[213] Although every honest node's goal is to verify good transactions and vote against bad transactions, users may trust the wrong nodes such that they could compromise the consensus process.[214] While this risk may be small, systems, in the form of consumer-protection rules, should ensure that new users know how to avoid making bad node selections.[215]

In addition to screening for nodes' honesty, regulators should run periodic stress tests.[216] 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.[217] If the algorithm is somehow faulty or presents greater risk than expected, the network users and regulators need to adjust their risk-management procedures. Although this requires the expenditure of public funds and energy, in the post-Dodd-Frank regulatory world, stress tests are an increasingly important and commonly used regulatory tool.[218] As discussed in conjunction with 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 must monitor the risk of forks in the Ripple protocol.[219] 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

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213. *See* SCHWARTZ, ET AL., *supra* note 68, at 3–5.

214. *See id.* at 4–7. According to Ripple Labs, the properties of the consensus algorithm make it difficult for bad nodes to take over the network. *See 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. *See Consensus*, *supra* note 212.

215. *See* SCHWARTZ ET AL., *supra* note 68, at 4–7.

216. Stress tests are simulations in which regulators test the stability of an institution in adverse market conditions. *See* GLOSSARY, *supra* note 12, at 47 (defining "stress testing" as "the estimation of credit and liquidity exposures that would result from the realisation of extreme price and implied volatility scenarios"). These stress tests should also focus on things like whether Ripple's defense to Denial of Service attacks—in the form of its XRP transaction fees—would be sufficient to withstand attacks from well-financed malicious users. *See supra* notes 71–84 and accompanying text.

217. Although Ripple Labs provided a mathematical proof that the consensus process is completely secure, SCHWARTZ ET AL, *supra* note 68, at 1–4, regulators should not depend entirely on that analysis and should actually test the system.

218. *See, e.g.*, *Stress Tests and Capital Planning: About*, BOARD GOVERNORS FED. RES. SYS., http://www.federalreserve.gov/bankinforeg/stress-tests-capital-planning.htm [http://perma.cc/MK98-87AE] (last updated June 25, 2014); 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 [http://perma.cc/W7RX-RYQS] (explaining that stress tests are a common regulatory device in the post-Dodd-Frank world).

219. *See* discussion *supra* Section II.C.

or settlement process).[220] 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.[221] Users have already made several fork attempts during Ripple's lifetime.[222] Some of these, like Stellar, could become direct competitors to the Ripple protocol.[223] 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 must 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 too many users leave the network. The PFMIs suggest parties should use business continuity arrangements to ensure that the agreed-upon service levels are met even in the event of one or more components of the system failing.[224]

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. Although traditional payment systems exist in physical institutions, like CHIPS in the Clearing House Corporation, DIPPs like Ripple rely on far more flexible and easy to change code-based protocols. Regulatory approaches must recognize the inherent flexibility of DIPPs to try to effectively keep up with their development.

F. *Principle VI: Risk Management of Ripple Users: Systemic Risk and AML/KYC*

This Note has emphasized a common theme: that Ripple largely plugs into existing legal frameworks instead of displacing them. Ensuring the

220. *See* discussion *supra* Section II.C.

221. *See supra* note 113.

222. These attempts 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. *Forks*, Ripple Wiki, https://wiki.ripple.com/Forks [http://perma.cc/F32U-K5BB] (last modified May 10, 2015, 2:03 AM).

223. *See* Michael J. Casey & Paul Vigna, *Mt. Gox, Ripple Founder Unveils Stellar, a New Digital Currency Project*, Wall St. J.: MoneyBeat (July 31, 2014, 12:00 PM), http://blogs.wsj.com/moneybeat/2014/07/31/mt-gox-ripple-founder-unveils-stellar-a-new-digital-currency-project/ [http://perma.cc/7975-TG54?type=image].

224. The PFMIs, *supra* note 134, at 34. For example, regulators could ensure that payments that the protocol would have settled but for a fork occur despite that fork.

safety and soundness of Ripple, then, requires regulators to ensure the safety and soundness of the financial institutions and other entities that use Ripple. Although 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.[225] Regulating gateways for their safety and soundness and their AML/KYC risks will ultimately promote the safety and soundness of the Ripple protocol and encourage its adoption.

Cryptocurrencies receive significant attention for their anonymity features.[226] Like Bitcoin, if users do not tell others that the addresses they use on Ripple belongs to them, they reveal no personally identifiable information.[227] This includes when users make trades through gateways. Unless the sender, receiver, or gateway reveals his identity, Ripple transactions are not traceable.[228] "This allows people to mask their total payments and disassociate their spending from the general public."[229] It is unsurprising, then, that Ripple and other DIPPs present KYC and AML risks.

Regulators are cracking down on DIPPs' noncompliance with AML/KYC laws.[230] 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.[231] It fined Ripple Labs for "selling its virtual currency . . . XRP[ ] without registering [it] . . ., and by failing to implement and maintain an adequate . . . AML[ ] program designed to protect its products from use by money launderers or terrorist financiers."[232]

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225. In the United States, there are two major anti-money laundering statutes. PROTIVITI, GUIDE TO U.S. ANTI-MONEY LAUNDERING REQUIREMENTS 11 (5th ed. 2012), http://www.protiviti.com/en-US/Documents/Resource-Guides/Guide-to-US-AML-Requirements-5thEdition-Protiviti.pdf [http://perma.cc/F8JQ-BA28]. 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) enhances the Bank Secrecy Act's scope, and, most significantly, 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.*

226. *See* Peter J. Henning, *More Bitcoin Regulation Is Inevitable*, N.Y. TIMES: DEALBOOK (Feb. 3, 2014, 6:12 PM), http://dealbook.nytimes.com/2014/02/03/more-bitcoin-regulation-is-inevitable/?_r=0 [http://perma.cc/G2MN-H2VC] (explaining the debate attending Bitcoin's anonymity and scandals involving its use in online criminal enterprises).

227. *FAQ*, *supra* note 109.

228. *Id.*

229. *Id.*

230. Henning, *supra* note 226.

231. *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 [http://perma.cc/L8CF-CDHS].

232. *Id.*

Regulators will ensure that AML/KYC compliance processes exist. Considering 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.[233] But the gateways themselves may be nontraditional and require regulatory attention they may not have otherwise received. For example, SnapSwap, Inc., is a popular, nonbank gateway that may not otherwise deserve regulatory attention but for the AML/KYC risks it poses.[234] Regardless, this Principle maintains that regulators should focus on the regulation of Ripple users—especially gateways—for both their systemic and AML/KYC risks. 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, 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 principles-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, depends on understanding, support, and flexibility from international regulators.

233. *See* Gehring, *supra* note 205.

234. *See* Julian Martinez, *Popular Gateways*, Ripple (Apr. 26, 2015), https://ripple.com/knowledge_center/gateway-information/ [http://perma.cc/VT54-98RF]; *see also About*, SnapSwap, https://snapswap.us/#/about [http://perma.cc/RGE5-SLVU]. 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.