



DAVID B. YOFFIE
GEORGE GONZALEZ

Ripple: The Business of Crypto

If you wanted to send \$10,000 from New York to London, the fastest way to do that was to drive to JFK or Newark and fly it there.

— Brad Garlinghouse, Ripple CEO

In June 2019, Ripple's CEO Brad Garlinghouse (HBS '97) announced a strategic partnership with MoneyGram, the second-largest money transfer company in the world. In exchange for a capital commitment of up to \$50 million, MoneyGram agreed to use Ripple's "On-Demand Liquidity" product, which facilitated cross-border payments using a cryptocurrency called XRP. Garlinghouse viewed the partnership as a major step forward towards replacing the antiquated global payments system driven by SWIFT and the large correspondent banks like Citi and HSBC. Traditional international wire transfers often took three to five days and cost roughly \$40 in transaction fees.¹ For money transfer firms, like MoneyGram, it also necessitated holding large caches of non-interest-bearing cash for settlement all over the world. In a digital era, Garlinghouse argued this system was hopelessly obsolete. Ripple could process international transfers faster and cheaper, and unlock billions of dollars of underutilized capital. By using its distributed ledger technology, known as RippleNet, the company could settle payments in seconds with an average transaction cost of a fraction of a penny.²

Based in San Francisco, Ripple was not just another fintech startup. On one level, Ripple was an enterprise software company, selling a new way to transfer funds. Indeed, over 200 financial institutions had signed up to participate in RippleNet in mid-2019. At the same time, the firm's most valuable asset was its ownership of almost 60 billion XRP tokens, valued at roughly \$20 billion in mid-2019. Ultimately, Garlinghouse suggested, Ripple's biggest opportunity for creating shareholder value was to make XRP into a highly useful cryptocurrency, which could be readily traded on crypto exchanges. In 2018 alone, Ripple captured over \$500 million from selling XRP.

Garlinghouse's challenge was that cryptocurrencies, in general, were widely viewed as speculative assets, with few proven usage models. While Garlinghouse believed that driving international transfers could address this challenge, other insiders wondered if Ripple was putting too many eggs in one basket. Crypto, they argued, was an exciting, emerging segment: maybe Ripple should diversify into adjacent financial products, such as loans and insurance? Some industry critics even wondered if Ripple would be better off pivoting away from enterprise software and becoming an investor in startups that could stimulate the XRP ecosystem. As the senior team prepared for its next big strategy

Professor David B. Yoffie and Senior Researcher George Gonzalez (California Research Center) prepared this case. It was reviewed and approved before publication by a company designate. Funding for the development of this case was provided by Harvard Business School and not by the company. HBS cases are developed solely as the basis for class discussion. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

Copyright © 2019, 2020 President and Fellows of Harvard College. To order copies or request permission to reproduce materials, call 1-800-545-7685, write Harvard Business School Publishing, Boston, MA 02163, or go to www.hbsp.harvard.edu. This publication may not be digitized, photocopied, or otherwise reproduced, posted, or transmitted, without the permission of Harvard Business School.

meeting, Garlinghouse recalled the day Amazon CEO Jeff Bezos visited his HBS classroom in the late 1990s. Bezos spoke about his vision to dominate book sales before expanding to other verticals. Garlinghouse had a similar dream of disrupting an entire industry. The question for debate was: Like Amazon, should Ripple master one segment first—cross-border payments—before broadening its focus to other blockchain and cryptocurrency applications?

History of Ripple

In 2011, Jed McCaleb, founder of the Bitcoin exchange Mt. Gox had a vision of creating a digital asset like Bitcoin, but one that would not require the expensive processing necessary to run the global Bitcoin network. He wrote in a crypto forum, “It would be cool to come up with a Bitcoin that doesn’t need miners.”³ McCaleb recruited fellow open-source developers David Schwartz and Arthur Britto to explore the possibility of developing a faster, less expensive distributed agreement protocol. He also partnered with Ryan Fugger, founder of a peer-to-peer payments network, RipplePay.⁴

Between 2011 and 2012, McCaleb, Schwartz, and Britto co-developed the XRP Ledger, a decentralized cryptographic ledger, along with its own native digital token, XRP. Its consensus algorithm enabled it to settle transactions in four seconds with fees averaging \$0.0001 per transaction.⁵ Over time, XRP could handle 1,500 transactions per second and could scale up to 50,000, equal to the Visa network.⁶ A total of 100 billion XRP tokens were created. XRP’s co-developers decided to gift 80 billion tokens to a yet-to-be-formed private company (OpenCoin) that would work with the broader developer community to build trust, utility, and liquidity in XRP. In late 2012, McCaleb and Chris Larsen, founder of E-Loan and Prosper Marketplace, formally established OpenCoin in San Francisco.⁷

Focusing the Vision

OpenCoin raised \$1.5 million in seed funding from Andreessen Horowitz, Lightspeed Ventures, and Google Ventures in 2013.⁸ Later that year, the company renamed itself Ripple Labs and helped open-source the XRP protocol. The XRP Ledger served as a distributed multi-currency exchange where parties could send and receive money in fiat or cryptocurrencies. By 2014, Ripple Labs had 87 employees and had begun partnering with banks. The XRP Ledger’s average daily trading volume was \$2 million with a network uptime of over 99%.⁹ After an internal disagreement, McCaleb left the company and launched his own cryptocurrency protocol, Stellar, while Larsen remained CEO. At the time, the market price of XRP on cryptocurrency exchanges was \$0.005.¹⁰

In 2015, Ripple Labs hired Garlinghouse as Chief Operating Officer. A former executive at Hightail, AOL, and Yahoo!, he was known for his leaked memo during his time at Yahoo!, titled “The Peanut Butter Manifesto.” In the memo, he compared Yahoo!’s resource allocation strategy to thinly spreading peanut butter and called for company leaders to narrowly focus the vision.¹¹ He brought a similar outlook to Ripple Labs. “With technology like Ripple’s, we can pursue a lot of paths, but that likely won’t make us a successful business. If you try to do a lot of things, you typically won’t be good at a lot of them. Let’s do a few things really, really well,” noted Garlinghouse.¹² That year, Ripple Labs shortened its name to Ripple. The company raised a \$28 million Series A round, along with a \$4 million strategic investment by Spanish bank Santander.¹³ Ripple continued to grow its payments network through bank integrations.

Like many other cryptocurrency companies, Ripple was looking to identify a wide range of possible use cases for its distributed ledger technology. Committed to his vision, Garlinghouse worked with company leaders to narrow the focus to the single use case of cross-border payments. Global payments revenue topped \$1.5 trillion and was forecast to reach \$2.9 trillion by 2022.¹⁴ Garlinghouse explained

that the team made a “leap of faith,” by recognizing that “we own a digital asset; anything we can do to improve its liquidity, trust, and velocity is going to be good for us at scale and that’s different from anybody else.” The theory was that enabling financial institutions to move money using XRP would increase its utility and value. Demand for XRP would increase its market price, making Ripple’s majority ownership of XRP even more valuable. In 2016, the company also raised \$55 million in a Series B round. By the end of the year, Larsen announced he would transition from CEO to Executive Chairman and named Garlinghouse as his successor.¹⁵

Thirty-Six Thousand Percent

As Garlinghouse transitioned to his new role as CEO and Ripple continued to seek partnerships with banks, cryptocurrency prices began to climb and received mainstream attention. The price of XRP, which had remained less than \$0.05 since its inception, reached \$0.36 by May 2017. The market capitalization of XRP went from \$200 million to \$13 billion^a in a matter of months.¹⁶ In order to promote market stability and quiet any rumors of massive sell-offs, Ripple decided to lock 55 billion of its own XRP in escrow; 1 billion XRP would be unlocked on the first day of every month.¹⁷ As part of its revenue model, Ripple sold between 0.18% and 0.25% of XRP’s daily traded volume on a quarterly basis.

In the first month of 2018 the price of XRP skyrocketed from \$0.20 to \$3.60.¹⁸ Ripple Chief Financial Officer Ron Will had been on the job for only a month and was working on the budget for the following year. He noted, “As we’re putting the final touches on the budget, the price goes from \$0.20 to \$3 over a five-week period. The volumes skyrocket from less than \$200 million to almost \$2 billion a day.” XRP was the highest performing cryptocurrency of 2017 with a 36,000% gain.¹⁹

The momentum, however, did not last more than a few months. The prices of most major cryptocurrencies, including XRP, were correlated with the first major blockchain and cryptocurrency, Bitcoin (BTC). When the price of BTC dropped, so did XRP. Both BTC and XRP prices fell more than 80% in 2018. The crypto winter was in session.

Bitcoin and Blockchain Technology

To understand the value proposition of XRP, it was critical to recognize its similarities and differences with Bitcoin. The concept of Bitcoin was first introduced in 2008 via a white paper published under the pseudonym Satoshi Nakamoto. The document proposed an electronic payments network that did not require the trust of a third-party financial institution. (See **Exhibit 1** for excerpts from the white paper.) The following year, Nakamoto launched the open source Bitcoin network in collaboration with a group of online cryptography developers.²⁰

The primary purpose of Bitcoin was to securely store value in a public, decentralized, and self-sustained system. This was achieved through the open source network referred to as the blockchain. The blockchain served as a series of records cryptographically chained together and maintained by a network of distributed computers. Blockchain enabled the ongoing maintenance of a public ledger with irreversible records that could not be taken down or changed by a central governing body.

Network Nodes In order to join the network, users installed the Bitcoin open source software on a computer. The computer would connect to the rest of the nodes on the network and download the

^a There was a debate around the market capitalization of XRP. Some market research data companies used all existing XRP in the calculations, others only the circulating tokens that were not in escrow. As a result, XRP market data reporting varied. For example, one cryptocurrency research firm claimed XRP’s market capitalization was overstated by \$6.1 billion.

latest Bitcoin blockchain. This software served as a node on the network and allowed users to send and receive BTC digital coins. The original Bitcoin software was named the Satoshi Client (see **Exhibit 2** for the graphical user interface). By 2019, the network had over 10,000 Bitcoin nodes.²¹

Transactions Each user had a 34-character public key that served as a Bitcoin address as well as a 64-character private key that functioned as a password. These keys were commonly encrypted, backed up, and stored offline to prevent hackers from sending or withdrawing unauthorized funds. When a user sent BTC, the transaction was bundled in a block with 1,000 to 2,500 other transactions and published to the network. Transaction data included the BTC amount,^b sender and recipient public keys, transaction fee, time stamps, as well as a unique identifier called a hash. Once a block was confirmed by the network, it was added to the blockchain. As of 2019, there were over 500,000 blocks on the Bitcoin blockchain.²²

Proof-of-Work Bitcoin used the proof-of-work (PoW) method to incentivize nodes on the network to validate transactions. Nodes on the network, called Bitcoin miners, validated a transaction by referencing the historical records on the blockchain to assure the sender had sufficient funds. Validated transactions were bundled into a block; however, there was an additional step in the process. In order to determine which miner published the latest block, Bitcoin nodes utilized computer processing power to solve a complex numerical problem. The first node to complete the task published the next block to the blockchain and was rewarded with 50 new BTC as well as any associated transaction fees. This created a competition for the most processing power. On average, it took the fastest miners 10 minutes to solve the problem, resulting in a 10-minute confirmation time per transaction. (A Bitcoin transaction was considered finalized after six confirmations, hence a 60-minute transaction time.) A limitation of the Bitcoin blockchain was its throughput of seven transactions per second. Proof-of-work mining was the only way new BTC entered circulation. By design, the reward halved after 210,000 new blocks, about every four years, until reaching the maximum supply of 21 million coins.²³ Profitable mining relied on having the most processing power and the cheapest electricity. Half of all BTC were mined in China.²⁴

Forks During the Bitcoin mining process, if two miners solved the algorithm and won the reward at the same time, the blockchain would split into two. This “fork” was temporary, however, since eventually one chain would grow faster and become the official record. Other times, forks occurred as a result of a disagreement in the protocol. In 2017, a prominent figure in the crypto community proposed an update that increased the size of the Bitcoin block to allow for lower fees and a higher transaction throughput. His proposal gained traction among miners and the fork resulted in a new coin called Bitcoin Cash.²⁵ This was essentially a new cryptocurrency with its own rules and protocols. While anyone could propose a change to the system, only the most popular forks survived. Thus, the open source nature of the blockchain allowed cryptocurrencies to evolve organically.

Exchanges Intrinsically, BTC had no value. Similar to fiat currencies, its market price was determined by demand on Bitcoin exchanges. These exchanges functioned similarly to stock exchanges where users could buy and sell cryptocurrencies. Unlike the stock market, cryptocurrency exchanges were not constrained by trading hours and ran 24 hours a day. Cryptocurrency regulation was yet to be defined; therefore, many of these exchanges did not require users to provide official identification. The first exchange, BitcoinMarket.com, was created by an anonymous founder in 2010. At the time, the BTC price was \$0.0003.²⁶ Later that year, software developer and serial entrepreneur Jed McCaleb launched and sold the second Bitcoin exchange, Mt. Gox. The price of BTC reached \$1 in 2011, \$10 in 2012, and \$1,000 in 2013.²⁷ In 2014, the market capitalization of BTC was over \$10 billion and 70% of all

^b BTC could be sent in fractions of a single unit. The smallest fraction recorded was 0.00000001 BTC.

transactions passed through Mt. Gox.²⁸ The market capitalization of BTC peaked around \$300 billion in 2017 before dropping to \$60 billion two years later.²⁹ (See **Exhibit 3** for the historical price of BTC.) By 2019, there were hundreds of crypto exchanges around the world.

Security Exchanges also posed a security risk for the Bitcoin ecosystem. Since user public and private keys were managed by a central exchange, they were at risk of being hacked. The Mt. Gox exchange experienced two major public hacks that resulted in the loss of several thousand BTC in 2011 and over 600,000 in 2014; the losses equated to about 7% of all BTC in circulation (over \$400 million).³⁰ Security was also a major concern for Bitcoin wallets. If a computer was hacked or private keys were misplaced, BTC could be permanently lost. Given that Bitcoin was not managed by a centralized entity, there was no customer support or password recovery feature. As a result, hardware wallets that allowed users to encrypt and secure cryptocurrencies offline became popular; these were considered the safest wallets because hackers could not access them through the internet. In addition, exchanges began offering cloud-based wallet services that managed Bitcoin accounts and provided customer service. Similar to exchanges, if cloud wallets were hacked, users could lose their BTC as well. Therefore, top cryptocurrency exchanges stored 98% of digital assets on offline hardware wallets to maximize security.³¹ The remaining 2% of assets stored online were covered by private insurance policies that protected against hacks.³²

Software Bugs Like any software, the Bitcoin client used by network nodes was susceptible to bugs. There had been 39 bugs identified and addressed in the Bitcoin software from 2010 to 2018.³³ One early error in the code allowed a user to unofficially create 92 billion new BTC; however, the open source nature of the software allowed the community of users to correct the problem.³⁴ When faced with potential bugs, developers could submit a Bitcoin Improvement Proposal (BIP) and nodes on the network voted whether to include it or not as a part of the mining process. The BIPs that were accepted by the majority of nodes would be implemented throughout the network. As a result, parties with a vested interest in maintaining the security and stability of the blockchain would be responsible for maintaining the Bitcoin software.

51% Attack Bitcoin's proof-of-work mining methodology relied on the honesty of the majority of nodes. In theory, a single entity controlling more than 51% of the network's computing power could validate fraudulent transactions. Controlling so much of the network, however, would be expensive and impractical. It was estimated that a 51% attack on the Bitcoin network would require over 5 million specialized mining computers, costing \$1.4 billion and consuming as much electricity as the country of Morocco.³⁵ Moreover, any perceived flaws or doubts in the system could result in major devaluation of BTC.

Illegal Activity The anonymous nature of Bitcoin made it a currency of choice for online black markets. Illegal drug marketplace Silk Road launched in 2011 and used Bitcoin to process anonymous transactions. In 2013, law enforcement agencies seized the website along with 144,000 BTC.³⁶ The investigation found that Silk Road earned profits of \$80 million on revenues of over \$1 billion (9.5 million BTC).³⁷ A 2017 study found that 24 million Bitcoin accounts used the digital currency for illegal purposes, accounting for \$70 billion in transactions.³⁸ While this only represented about 8% of total Bitcoin transactions that year, mainstream attention surrounding Silk Road made Bitcoin synonymous with illegal activity.

Altcoins

Soon after the creation of Bitcoin, many new cryptocurrencies, known as alternative coins or altcoins, emerged. It took two years after the creation of Bitcoin for a second coin to be created; by 2019 there were over 2,000. While many altcoins used a similar proof-of-work approach, some began to introduce new standards and methods of validation in the network. The market capitalization of all cryptocurrencies aside from BTC grew from \$2 billion in 2017 to \$55 billion in 2019.³⁹ (See **Exhibit 4** for historical cryptocurrency market capitalization.)

XRP

XRP was designed for rapid, low-cost transactions. It was the eighth cryptocurrency to be developed and first project to pursue a consensus mechanism that did not rely on mining. As a result, XRP offered one of the fastest and cheapest cryptocurrencies with negligible energy consumption.

Consensus Network XRP used a consensus network of validators to process transactions. Unlike Bitcoin mining, where a single node won and published the next block, the entire XRP consensus network participated in updating the ledger. The network would agree on groups of transactions to execute as a unit every four seconds. The number of validators grew to 150 around the world, including clients, users, and company servers; notable validators included Microsoft and Massachusetts Institute of Technology (MIT).⁴⁰ To prevent malicious activity, each validator had a list of trusted servers with whom it would compare transactions. The network was designed to rely on trusted parties that grew organically while pushing out dishonest nodes. While validators were not financially rewarded, they were able to vote on updates and had an interest in the success of the network. “In a distributive agreement protocol with no incentive, if you and I are both honest participants, we’re aligned. We want the network to be as efficient and fast as possible,” said Schwartz.

Security In order for malicious activity to occur in the XRP Ledger, hackers would have to simultaneously take control over the majority of nodes on the consensus network. This would be an incredible challenge given the distribution of over 100 nodes across various organizations and geographical locations. Another security vulnerability was in potential XRP software bugs. Similar to Bitcoin and other protocols, bugs in the code could be exploited by hackers. As XRP evolved, it later introduced an innovative function called invariant checking to find bugs before they caused any problems in the ledger. “When the Ledger executes a transaction, it executes it in a scratchpad. The Ledger doesn’t actually commit it until it runs an invariance checker on the scratchpad that will sum how much XRP disappears and appears. If more XRP appears than disappears, the invariance checker will throw the scratchpad away and create a new scratchpad that basically says this transaction violated a system invariant. That will sit in the ledger as a permanent record,” said Schwartz.

Ethereum

Vitalik Buterin, cofounder of *Bitcoin Magazine* and a Thiel Fellowship^c recipient, proposed the Ethereum blockchain in a 2013 white paper. The following year, Buterin and a small team of developers held a crowdsale, known as an Initial Coin Offering (ICO), in which members of the public could preorder Ether (ETH) coins in exchange for BTC. The team raised over \$18 million in BTC to fund their development efforts.⁴¹ In 2015, Ethereum officially launched its own blockchain that also used proof-of-work, but with a different hashing algorithm that allowed block confirmations of only 15 seconds and the processing of 15 transactions per second. Ethereum offered a constant mining reward with no

^c The Thiel Fellowship paid \$100,000 to students under the age of 23 to drop out of college and pursue a startup or other passion.

cap on the total supply of ETH. Its key differentiator, however, was that it enabled the development of decentralized applications known as DApps or smart contracts. While Bitcoin processed transaction records, Ethereum enabled the storing and execution of code, allowing software applications to run on the blockchain. Traditional applications required paying large technology companies such as Amazon or Google for cloud storage. If those servers were hacked or had downtime, the applications would be directly impacted. DApps, on the other hand, would be executed by Ethereum miners who competed on the basis of processing power. Smart contracts gave software applications the benefits of decentralization and security that came with the blockchain. As of early 2019, the market capitalization of ETH was about \$14 billion.⁴²

Proof-of-Stake (PoS) In 2017, Ethereum announced it would eventually transition from a proof-of-work to a proof-of-stake protocol where miners offered a certain amount of ETH to be locked in a bound wallet. Miners would then be selected to process transactions based on their stake amount and historical record of validating and processing transactions. If a miner was found to have processed a fraudulent transaction, the ETH stake would be lost. As a result, Ethereum mining would be trusted to those risking the highest amounts of ETH. In theory, miners would have a vested interest in not losing their stake as well as maintaining the integrity and price of the cryptocurrency. A major benefit of proof-of-stake was it did not require the intense processing power used in proof-of-work and would reduce energy consumption by 99%.⁴³ (It was estimated that all the energy used by Bitcoin proof-of-work mining was enough to power the entire country of Singapore.⁴⁴) In addition, proof-of-stake reduced the likelihood of a 51% attack, given that attackers would have to acquire several billion dollars of ETH to offer as a stake.

ERC-20 Tokens Ethereum smart contracts also enabled the creation of digital coins without having to write new code from scratch. The ERC-20 standard was developed in 2015 to mint new digital tokens on Ethereum for the purpose of new coins, loyalty points, certificates, or native tokens to be used in DApps.⁴⁵ With as few as 70 lines of code, anyone with basic programming skills could mint a new coin on the Ethereum blockchain. ERC-20 opened the floodgates: ICO fundraising grew from \$5 million in 2015 to over \$4 billion in 2017.⁴⁶ By 2019, over 1,000 tokens were launched on Ethereum.⁴⁷

Cryptocurrency Exchanges As new coins were created, hundreds of cryptocurrency exchanges emerged around the world. Top exchanges by volume included Binance (Malta), OKEEx (Hong Kong), and DigiFinex (Singapore). These crypto-only exchanges enabled the trading of hundreds of altcoins using BTC or other major cryptocurrencies. To trade on these exchanges, users needed to transfer BTC purchased from a fiat-to-crypto exchange, such as Coinbase or Kraken.

The Rise and Fall of Crypto

Over the course of 2017, the price of BTC rose from \$800 to \$18,000 and “Bitcoin” was the second most searched term on Google that year.⁴⁸ Coinbase, a cryptocurrency exchange and wallet, grew its users from 400,000 in 2017 to over 11 million in 2018, briefly surpassing Charles Schwab’s 10 million active investment accounts.⁴⁹ Venture capital investment in blockchain companies also increased from about \$500 million in 2015 to almost \$4 billion in 2018.⁵⁰

The cryptocurrency honeymoon period did not last very long. In 2018, the price of BTC fell below \$4,000, along with the price of most altcoins. Goldman Sachs abandoned plans to launch a cryptocurrency trading desk. One study published at the time reported that 80% of ICOs were scams.^{51,52} By 2019, over 200 digital tokens were inactive and over 500 had trading volumes of less than \$100 a day.⁵³ The total market capitalization of all cryptocurrencies dropped from a peak of \$800 billion in 2018 to \$120 billion in 2019.⁵⁴ Bitcoin “obituaries” began populating headlines even though crypto-

currency prices were still more than three times higher than in early 2017. Expert opinions on the cause of the crash varied widely. While some compared the crash to the dot-com bubble, others viewed the movements as part of natural market cycles.

Regulation

A total of eight countries, including Pakistan, Egypt, and Iraq, had an absolute ban on cryptocurrencies; China, Bangladesh, Saudi Arabia, and 12 other countries had an implicit ban.⁵⁵ These bans, while difficult to enforce on the consumer level, led top blockchain companies to move to Malta, where regulation was crypto-friendly.⁵⁶ The United Kingdom, Sweden, Russia, and 13 other countries had implemented tax laws on cryptocurrencies.⁵⁷ Meanwhile, China, Ireland, Venezuela, and 10 other countries were in the process of exploring issuing a national digital currency.⁵⁸ In the United States, cryptocurrencies were classified as a commodity and taxed as property.⁵⁹ The challenge in the taxing of digital assets was the tracking of transactions in the blockchain. Because blockchain records were anonymous, users could move money in and out of the country outside of the scope of the government. The U.S. Securities and Exchange Commission (SEC) stated that ICOs could be considered security offerings and would need to be officially registered. While some ICOs were being charged or investigated, the regulatory landscape for cryptocurrency was still in very early stages. The highly uncertain regulatory environment created both opportunities and challenges for firms like Ripple.

Ripple in 2019

By June 2019, Ripple had 300 employees and offices in San Francisco, New York, London, Sydney, India, Singapore, and Mumbai. Over 200 customers in 40+ countries had purchased its payments solutions. For Garlinghouse, cross-border payments were just the first step in creating the “Internet of Value.” He explained:

Our vision is for value to be exchanged as easily as information. Although information moves around the world instantly, a single payment from one country to another is slow, expensive, and unreliable. Worldwide, there are \$180 trillion worth of cross-border payments made every year, with a combined cost of more than \$1.7 trillion a year. With the Internet of Value, a value transaction such as a foreign currency payment, can happen instantly, just as how people have been sharing words, images, and videos online for decades. And it’s not just money. The Internet of Value will enable the exchange of any asset that is of value to someone, including stocks, votes, frequent flyer points, securities, intellectual property, music, scientific discoveries, and more.

Garlinghouse believed that making payments more efficient had implications on the entire financial industry. He gave an example of how inefficient payment processing impacted many industries, including payroll and mortgages:

We have an entire ecosystem built upon the expectation of friction of payments. Why do we get paid every two weeks? Because of the friction of processing payroll. They used to have to cut a physical check and we got used to it. We pay our mortgages once a month. Why not every day? Because we only get paid once a month. As a company, what if I could pay you every day or even every hour? If you reduce the friction in payments to zero, you’re going to see downstream implications that are very difficult to forecast.

Garlinghouse often spoke with financial institutions and governments. He sought to educate audiences on how Ripple was not a libertarian, anti-government cryptocurrency, but instead a

payments software provider that worked with banks and regulators to improve upon the existing financial infrastructure. He noted, “Many people hear Bitcoin and think of black-market activity. We’re an experienced team of businesspeople from tech, banking, and payments. We show up in suits.”

RippleNet

Sending money globally traditionally involved using the Society for Worldwide Financial Telecommunications (SWIFT), a service that allowed banks to send messages with payment information. Once the payment was confirmed, manual input was required to transfer the funds. If the transacting banks did not have an existing relationship, the funds were routed through intermediary banks. As a result, transaction costs could have unexpected fees and delays. Garlinghouse noted, “Swift’s published error rate is 6%. Imagine if 6% of your emails didn’t go through without additional human intervention.”⁶⁰ Ripple’s alternative solution to SWIFT was RippleNet, a payments network that enabled banks to instantly and reliably transfer funds across borders. If a financial institution used RippleNet without its on-demand liquidity feature, the main advantages were speed, accuracy and end-to-end traceability. When financial institutions employed its on-demand liquidity product, they could lower their liquidity costs for cross-border transfers by leveraging XRP.^d As long as there were liquid markets for XRP against the local currency, no nostro/vostro accounts (where one bank keeps another bank’s capital on deposit) were required. In 2019, there were liquid markets for XR with the USD, Mexican pesos, and Philippine pesos; and Ripple expected to add in the near term the Australian dollar and Euros. Network members for RippleNet included banks and payment providers. (See **Exhibit 5** for a sample of Ripple’s customers.)

Network Access Access to RippleNet allowed payment providers and banks to send and receive real-time payments with payment tracking, pre-transaction validation of fees, as well as the ability to include invoices and other rich payment data. Network participants could confirm payment details before initiating transactions to ensure settlement certainty, minimizing settlement risk and failures. (See **Exhibit 8** for a diagram explaining how it works). In order to expedite transactions, institutions often pre-funded accounts in local currencies across various emerging markets.)

On-Demand Liquidity RippleNet also allowed payment providers and financial institutions to reduce liquidity costs by leveraging XRP to fund liquidity in real time, thus eliminating the need for pre-funded accounts (see **Exhibit 9** for a diagram explaining how it works). “There’s trillions of dollars parked around the world, prefunded in between banks, between corporates, corporates at banks, and if we can make that—those trillions of dollars more efficient—we make the entire global financial ecosystem more efficient,” noted Garlinghouse.⁶¹ Customers leveraging On-Demand Liquidity included payment provider MercuryFX (U.K.), Cullix Bank (U.S.), and Catalyst Corporate Federal Credit Union (U.S.).

Asheesh Birla, Senior Vice President of Product, noted, “Customers using On-Demand Liquidity are largely fintechs. If they’re banks, they are challenger banks.^e For them, it is absolutely a game changer not having to pre-fund destination accounts. It releases all of that capital, making it available to reinvest in the business.” For small to mid-sized financial institutions building out their infrastructure, Ripple made sense. With larger institutions, switching costs proved to be a challenge. Money transfer company Western Union began testing RippleNet and six months into the trial, its CEO publicly stated he had not yet seen any financial benefit.⁶² The comments prompted a wider discussion

^d To enable this, the originating currency was converted to XRP on a domestic digital asset exchange, sent across the XRP Ledger, and then converted back to fiat at an exchange in the destination country. This took place in a matter of seconds.

^e Challenger banks were small retail banks that competed with larger established banks.

in the payments community around the effectiveness of Ripple's solutions. Birla responded, "Western Union has rows and rows of treasury people doing hedging for all the currencies they hold around the world." The cost of maintaining the traditional ecosystem diminished the average savings from RippleNet, which Birla calculated to be up to 50%. "Unless you're going to take those fixed costs out of the ecosystem, it's not going to be worth it for them," he noted. "There's this middle ground where you find these financial institutions that are very good regionally, but maybe not globally. That has been our sweet spot."⁶³

In June 2019, Ripple and MoneyGram announced that they had entered into a strategic partnership focused on On-Demand Liquidity.⁶⁴ Ripple agreed to invest up to \$50 million in MoneyGram to acquire ~10% stake in the business, while MoneyGram committed to use RippleNet with On-Demand Liquidity in a number of its corridors. MoneyGram planned to start using RippleNet with On-Demand Liquidity in five corridors by the end of 2019, with one of those corridors accounting for over \$10 million a week in volume (\$500 million/year run-rate). MoneyGram, like every major money transmitter, struggled with maintaining capital in foreign accounts to power its global payments service. This was an extremely inefficient use of working capital; MoneyGram had over \$1.4 billion in cash as non-interest-bearing settlement assets, sitting in cash around the world. Using RippleNet with On-Demand Liquidity, Ripple enabled MoneyGram to eliminate the need for settlement cash, unlocking over time the \$1.4 billion. Garlinghouse noted that "MoneyGram is one of the largest money transfer companies in the world and the partnership will continue to further the reach of Ripple's network."⁶⁵

Business Model RippleNet had a software as a service (SaaS) model with a subscription fee along with tiered pricing based on the number of transactions per year. Ripple's main revenue source was XRP sales. At the same time, Ripple was committed to supporting healthy XRP markets. As a consequence, Ripple limited the selling of its XRP holdings as a percentage of traded volume. (See **Exhibit 6** for historical XRP sales.) By 2019, the company had sold a total of approximately 20 billion XRP. Ripple still owned 60 billion XRP, which was worth roughly \$20 billion.

While RippleNet revenues were insignificant compared to XRP token sales, the software business was key in driving the adoption and value of XRP. "The Ripple business model is unlike any traditional business model I've ever seen. It's unlike anything I was taught at business school," said Garlinghouse. Human capital accounted for most of Ripple's expenses. For typical SaaS businesses, sales and product development each accounted for about one-third of expenses; the remaining was marketing and administrative costs.⁶⁶

Finance Ripple's unusual business model meant that CFO Ron Will was frequently challenged when it came to measuring the success of investments and programs within the company. Rather than focus on traditional metrics in a software business, like bookings, Will set company metrics that indicated network growth, like new customers, deployments, and volume. The dependence on XRP sales also made budgeting and forecasting a challenge. "We sell between 15 to 25 basis points every quarter of global trading volume," he said. "But there's extreme volatility. Volume has ranged from \$200 million to \$4 billion a day this year alone. How should I forecast?"

Sales John Mitchell, Senior Vice President of Sales, led a team of 13 salespeople and 19 support staff. Since many financial institutions believed that crypto might be the future, according to Mitchell, they wanted to move early and Ripple's offering was the most enterprise-ready with the strongest proposition. Unlike traditional enterprise software sales teams, who were incentivized to increase bookings and revenue, Ripple took a different approach. Garlinghouse noted, "Whether we charge a bank \$50,000 or \$500,000, or \$5 million, it doesn't matter. If anything, you can argue it's better to give

away our software.” Therefore, the company moved away from a bookings and revenue-based incentive plan and adopted a commission system around strategic point value. Mitchell noted, “We assign financial institutions points on a number of different factors. How much do they send per year? How many transactions? Do they do foreign exchange? Are they an international bank?” In addition, pricing was adjusted to promote XRP usage. Will added, “For someone who is looking at a multimillion-dollar integration project, we charge a \$100,000 integration fee. If they go live within a certain time period, we get rid of that. If they hit certain volume numbers, we also give them discounts on the subscription price.” The Ripple sales team also faced challenges that came with selling a global payments solution. “We’re moving money cross-border, which is something that gets the attention of governments and regulators,” noted Mitchell. “For every institution, in every single country we operate in, the regulator has to approve. It can take anywhere from a couple of weeks to nine months.”

Marketing Monica Long, Senior Vice President of Marketing, had a difficult assignment: Her responsibility was to shape the narrative around Ripple. Long noted her job was to first educate the market about the constructive and practical applications of blockchain and cryptocurrencies in finance, and to establish Ripple’s credibility in the banking and payments industry. Part and parcel to that task, she had to define and clarify the relationship between Ripple the company and XRP the cryptocurrency in a market that often confused the two (see **Exhibit 7**). Working closely with Birla and others, she identified the right customer segments, use cases, geographies, and value propositions at various stages of network growth. The marketing team began developing specific target accounts for sales based on the go-to-market strategy in 2019. “There are many blockchain tourists,” noted Long. “We no longer will take on a customer who only wants to do a pilot. We want to know there’s a path to commercialization.”

Technology Ripple’s engineering and product teams were organized around the key modules of the software providing access to RippleNet and On-Demand Liquidity. Birla noted, “The software doesn’t take long to build. But, I have to go out and meet with regulators to educate them. Then I take our customers to the regulators to make sure they’re in compliance and won’t get in trouble for using crypto products.” In addition to the core product team, there was a customer success team comprised of 50 employees that helped customers with deployments and integrations. The industry average time for enterprise software implementations was three to six months.⁶⁷

Corporate Development Financial services veteran Kahina Van Dyke, Senior Vice President of Business and Corporate Development, joined Ripple in 2018. She was hired to explore acquisition opportunities for the company. Through early 2019, Ripple had yet to make an acquisition. The problem, Van Dyke noted, was that, “On our current growth trajectory, we will not reach critical mass in the next five years when it comes to global payments. We’re looking at opportunities to accelerate growth beyond what’s organically possible.”

Xpring

In May 2018, Ripple launched Xpring, an initiative to increase the utilization of XRP by investing in an ecosystem of companies around it. Ethan Beard, Senior Vice President of Xpring, was tasked with exploring any XRP use cases outside of cross-border payments. He noted, “How do you drive adoption of XRP as a currency? There are a thousand other things we could be building. We could be doing consumer payments, ecommerce, or debt.” Xpring invested in Coil, a web monetization service; Omni, a digital marketplace of rentable goods; and Dharma, a decentralized lending platform. Its largest investment was a \$100 million fund in partnership with gaming platform Forte to accelerate the adoption of blockchain technology in the \$140 billion gaming industry.⁶⁸

Xpring also focused on promoting interoperability across digital coins and blockchains. “Interoperability is critical to the ecosystem. There may be thousands of coins, but each wallet and processor won’t work with all of them,” noted Beard. Xpring supported the development of an open source standard for interoperability across blockchains, called Interledger Protocol (ILP). ILP was created by a former Ripple employee in 2015 to allow all networks, traditional and cryptocurrency, to communicate, similar to internet standards HTTP and TCP/IP. “You can pay and receive in the currency of your choice. ILP network finds the most efficient and liquid route going from one currency to another,” noted Beard. “We are building out the team of engineers to continue to advance the technology, along with an ecosystem of exchanges and wallets that support this protocol.”

Criticisms

The cryptocurrency community criticized Ripple for its willingness to work with the banks and regulators that Bitcoin originally aimed to bypass. In addition, some Bitcoin advocates claimed XRP was not truly a decentralized cryptocurrency. Common points of contention revolved around the company’s ownership of the majority of XRP as well as its ledger technology that was heavily influenced by Ripple developers. Bitcoin was not overseen by a corporate entity and anyone could mine, without requiring the trust of an existing network. Schwartz responded, “China controls most of the mining hardware. The Chinese government could exert pressure on the Bitcoin blockchain. It’s not neutral.” Bitcoin miners that solved the algorithms and won the reward had complete control over that specific block, whereas the XRP consensus network required agreement by all nodes.

In addition, some questioned whether Ripple’s products translated well from theory to practice. While RippleNet had over 200 customers signed to the network, transaction volumes in 2018 were low. As of early 2019, only eight financial institutions were using the six-month-old On-Demand Liquidity product. For customers that went live, there were questions around transaction speeds and cost savings. Santander’s One Pay money transfer application, which used RippleNet, stated that transactions could take up to two days to process; this was the case if the payment cleared outside of RippleNet over the traditional ACH network.⁶⁹ Ultimately, until the majority of financial institutions joined RippleNet, customers would have to maintain both the new and legacy payment systems, thus impacting the average savings and performance metrics.

Competitive Landscape

The established player in cross-border payments was SWIFT. Founded in 1973, SWIFT was a consortium of over 200 banks that came together to create a messaging platform and standard for cross-border payments. By 2019, over 11,000 financial institutions from 200 countries were on the platform. Traditional SWIFT transfers took three to five days and charged \$35 to \$50.⁷⁰ Due to mounting pressure from new technologies, the organization launched SWIFT Global Payments Innovation (SWIFT.gpi) that enabled same-day transfers, end-to-end tracking, and fee transparency. While faster, SWIFT.gpi was no cheaper than SWIFT’s existing fees. In 2017, SWIFT’s annual revenue reached €780 million.⁷¹

Liquidity Providers

While many saw SWIFT as Ripple’s primary competitor, SWIFT did not transfer actual funds and only addressed the communication aspect of money transfers. Garlinghouse noted, “I don’t just want to beat SWIFT. I want to beat Citibank, the number one liquidity provider on the planet. It has 13% market share of SWIFT messages and profits of \$8 billion a year from its cross-border transactions business.” Global payments revenue was forecast to reach \$2.9 trillion by 2022, with liquidity costs

representing nearly half of that number.^{72,73} “If you use RippleNet with On-Demand Liquidity, you no longer need SWIFT and Citi,” said Garlinghouse.

Fintech

Chinese fintech Ant Financial was on Ripple’s radar as a potential threat. Founded in 2016, Ant Financial was valued at over \$150 billion.⁷⁴ Birla noted, “Ant Financial is big and ambitious. They have over 1 billion consumers on their mobile wallets. Credit card penetration is low in these regions. Fewer than 6% of people have credit cards in India, but 30% have Paytm wallets. Even the fruit stand guy accepts Paytm payments.” Ant Financial was a major stakeholder in Paytm, an Indian payments and mobile wallet company. Asia Pacific was forecast to account for 64% of global payments revenue growth from 2017 to 2022.⁷⁵ “Where On-Demand Liquidity is really taking off is not so much with the incumbents. It’s these new financial providers that are entering the market for the first time in Asia. Grab Financial, a mobile wallet in Asia, is essentially everyone’s bank account,” said Birla.

Social Networks

Ripple also monitored social networks that could potentially enter the cross-border payments space. Mitchell noted, “WhatsApp is processing 10 million payments per month in India. What if suddenly WhatsApp becomes a cross-border payment app?” The WhatsApp messaging platform, owned by Facebook, had over 1.5 billion users worldwide.⁷⁶ “I think there are scenarios that could be threatening if PayPal started to use the same model as crypto,” noted Long. PayPal had over 250 million active accounts and an annual payment volume of \$578 billion.⁷⁷

Bank Coins

In 2019, the largest bank in the world, J.P. Morgan Chase, announced the creation of its own fiat-backed digital asset called JPM Coin. The prototype was built on Quorum, the company’s proprietary blockchain, and was being tested by select clients.⁷⁸ This was not the first blockchain initiative launched by a bank. In 2016, UBS, Deutsche Bank, Santander, and BNY Mellon announced a partnership to launch a coin for clearing and settling trades.⁷⁹ Goldman Sachs was also reportedly working on its own coin, SETLcoin.⁸⁰ Garlinghouse commented, “We strongly believe banks need an independent digital asset to enable truly efficient settlement . . . It goes back to the fundamentals of what makes digital assets unique and special – they’re universal currencies, meaning anyone can use them as units of value anywhere in the world.”⁸¹

Altcoins

Other cryptocurrency solutions also attempted to address the global payments market. One of the original creators of Ripple, Jed McCaleb, founded the Stellar Development Foundation (SDF), a nonprofit that created a blockchain for low-cost payments. Its mission was to promote global financial access, literacy, and inclusion. SDF’s native cryptocurrency was Stellar Lumens (XLM), which enabled transactions under five seconds and had a throughput of 1,000 transactions per second. XLM traded on cryptocurrency exchanges and had a market capitalization of about \$2 billion.⁸² In 2018, SDF partnered with IBM to launch a cross-border payments solution using the Stellar blockchain. IBM later announced Blockchain World Wire, a global payments network with partnerships in 72 countries, 47 currencies, and 44 banking endpoints.⁸³

Looking Forward

Every week Ripple's leadership met to discuss the state of the digital asset ecosystem. While the team believed that cryptocurrencies and blockchain technology would transform the world, they each had different views on how that would unfold in the near term. Garlinghouse predicted, "In five years, we will have 5,000 to 10,000 financial institutions on our network. It's just a matter of more salespeople engaging with banks, increased customer success, and deployment engineering on-site." Birla added, "By 2025, not much will have changed in the developed world. But, new players in the emerging markets will default to using blockchain." Meanwhile, Van Dyke forecasted a mass extinction in the crypto space. She opined, "There's going to be a big shakeout from today's 2,000 coins and massive volatility. In the next 24 months, the companies that don't have utility, much like the internet companies of 1999, will disappear." With these various visions of the future in mind, Garlinghouse needed to make decisions regarding the direction of the business.

Ripple could follow one of three paths. First, the company could stay the course and remain focused on cross-border payments. Garlinghouse noted, "We only get permission to do other verticals if we're successful in payments." Ripple's current market opportunity was large enough to stay in a single vertical. Birla agreed, "Visa is focused on a sliver of the payment space. They do retail consumer payments, for the most part, and they're a \$300 billion company. We can turn Ripple into a massive company in payments alone." Ripple's recent partnership with MoneyGram lent to the plausibility of continuing to follow this first path.

Second, Ripple could diversify its portfolio with complementary financial products. Van Dyke suggested, "When I first came in, I said we need diversification. I asked, 'What if we're dead wrong in our attempts to make the big bet on cross-border payments?'" Birla also saw the potential merit in diversification. He mentioned, "Beyond our current focus, I advocate going after customers in emerging markets. They are getting mobile phones and moving from cash to digital, where the phone is their bank. They probably need a \$200 microloan, but that is not economic today. We can help solve that."

Third, Ripple could become a more aggressive investor in the XRP ecosystem. Beard thought about the drivers that made Bitcoin successful. He noted, "Nobody's making software for Bitcoin. Why are we making software?" Will echoed, "Why aren't we spending more on developing the market for XRP? If you look at where our headcount is, it's on the software business. The amount of people that have anything to do with XRP is fairly small."

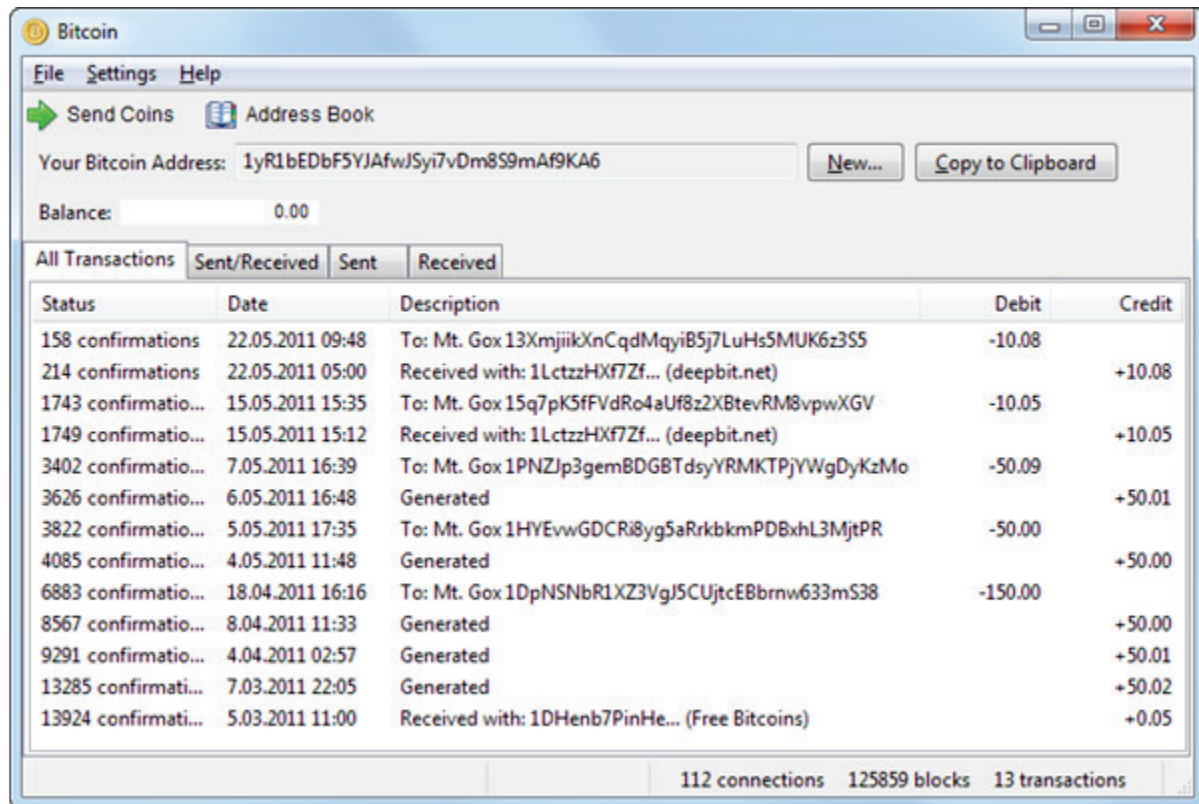
Garlinghouse and Schwartz pondered where future profits would end up as the cryptocurrency industry unfolded. "Originally, it looked like there was no money in the search industry. What if Google made an operating system and browser instead? That would have been a huge screwup," noted Schwartz. "We know we can't build everything. We're not going to be the exchange, wallet, the whole system. We have to get other people to build things. To extend the analogy, what if we get people to build the things where the money is and we end up making the browser? That's something we struggle with."

Exhibit 1 Select Excerpts from Bitcoin White Paper

Abstract. A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of CPU power. As long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they'll generate the longest chain and outpace attackers. The network itself requires minimal structure. Messages are broadcast on a best effort basis, and nodes can leave and rejoin the network at will, accepting the longest proof-of-work chain as proof of what happened while they were gone

1. Introduction. Commerce on the Internet has come to rely almost exclusively on financial institutions serving as trusted third parties to process electronic payments. While the system works well enough for most transactions, it still suffers from the inherent weaknesses of the trust based model. Completely non-reversible transactions are not really possible, since financial institutions cannot avoid mediating disputes. The cost of mediation increases transaction costs, limiting the minimum practical transaction size and cutting off the possibility for small casual transactions, and there is a broader cost in the loss of ability to make non-reversible payments for nonreversible services. With the possibility of reversal, the need for trust spreads. Merchants must be wary of their customers, hassling them for more information than they would otherwise need. A certain percentage of fraud is accepted as unavoidable. These costs and payment uncertainties can be avoided in person by using physical currency, but no mechanism exists to make payments over a communications channel without a trusted party.

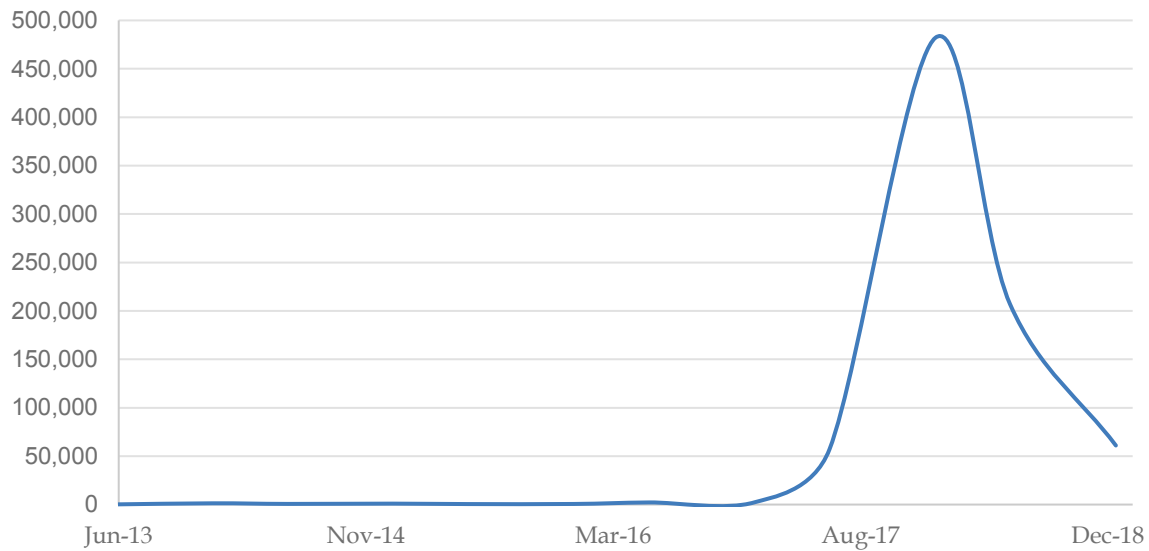
Source: Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," Bitcoin.org, October 31, 2008.

Exhibit 2 First Bitcoin Software, Satoshi Client

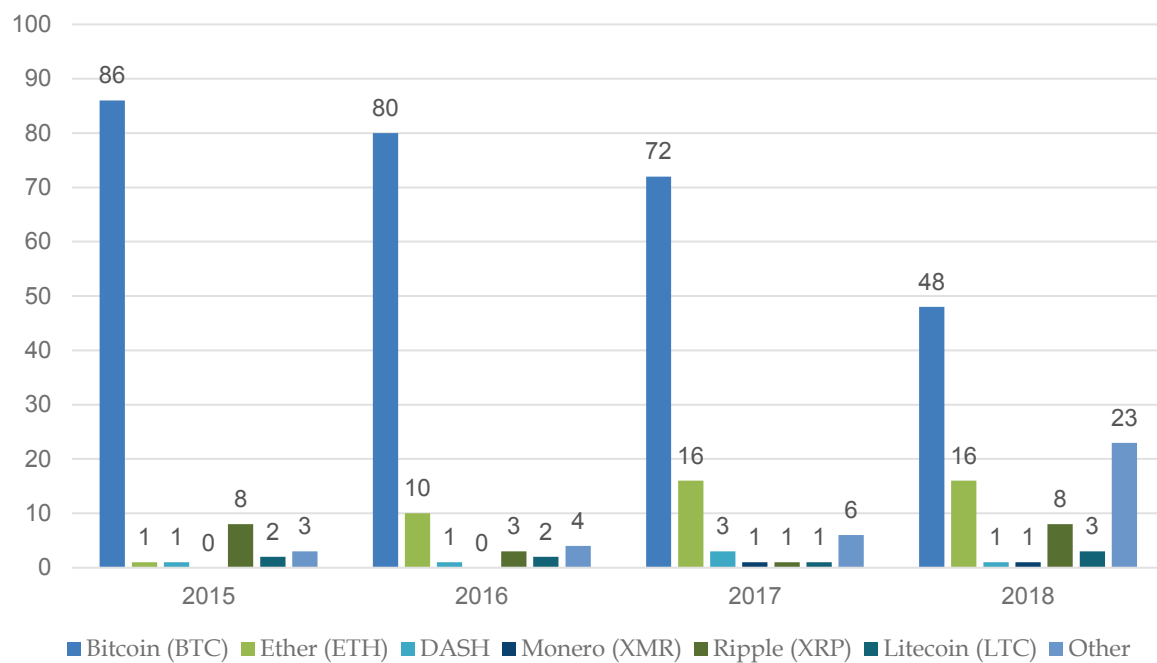
Source: "Bitcoin," Bitcoin Stack Exchange, <https://bitcoin.stackexchange.com/questions/41512/was-there-ever-reasoning-presented-for-the-size-of-a-satoshi-i-e-the-minimum>, accessed February 2, 2019.

Exhibit 3 Historical Market Price of BTC (in USD)

Source: Casewriter, adapted from "Bitcoin," Investing.com, <https://www.investing.com/crypto/bitcoin>, accessed February 15, 2019.

Exhibit 4a Total Cryptocurrency Market Capitalization, Excluding Bitcoin (in millions USD)

Source: Casewriter, adapted from "Cryptocurrency Market Capitalizations," Investing.com, <https://www.investing.com/crypto/charts>, accessed February 17, 2019.

Exhibit 4b Distribution of Leading Cryptocurrencies by Market Capitalization (%)

Source: Casewriter, adapted from "Distribution of leading cryptocurrencies from 2015 to 2018, by market capitalization," Statista, <https://www.statista.com/statistics/730782/cryptocurrencies-market-capitalization/>, accessed February 17, 2019.

Exhibit 5 Select List of Ripple Customers

Customer	Type
PNC Financial Services	Bank
Cargilis Bank	Bank
Banco Santander	Bank
InstaRem	Money Transfer
Beetech	Money Transfer
UniPAY	Money Transfer
MoneyGram	Money Transfer
FairFX	Foreign Exchange
Saudi Arabian Monetary Authority	Central Bank

Source: Casewriter, adapted from <http://rppl.info/>, featured in Nathan Bentley, "Who Is Using Ripple? A Comprehensive List of Ripples Partnerships," CryptoDaily, April 12, 2018.

Exhibit 6 Historical XRP Sales

	Q4 '16	Q1 '17	Q2 '17	Q3 '17	Q4 '17	Q1 '18	Q2 '18	Q3 '18	Q4 '18
XRP Sales (millions USD)	4.6	6.7	31.3	52.2	91.6	167.7	73.5	163.3	129

Source: "Ripple XRP Markets Report," Ripple, <https://ripple.com/insights/q4-2018-xrp-markets-report/>, accessed March 1, 2019.

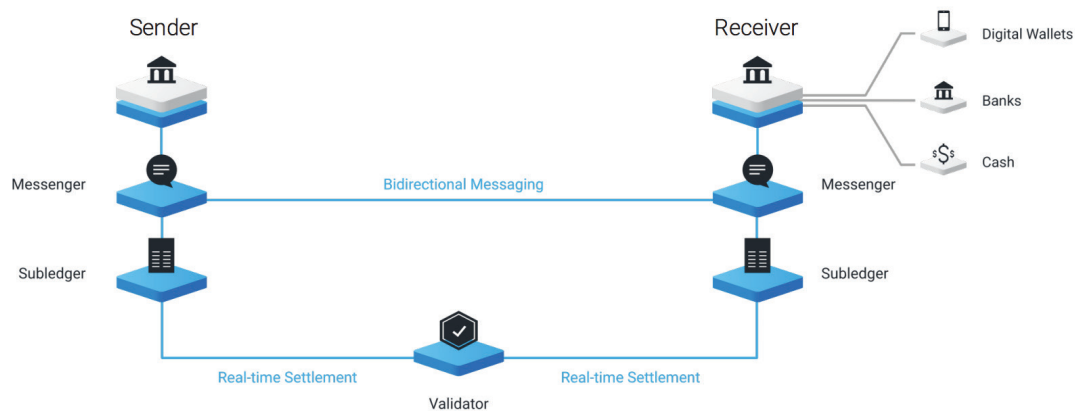
Exhibit 7 Ripple vs. XRP

		
What is it?	A software company that provides the most efficient solutions for sending money globally.	An independent digital asset . The XRP Ledger is the open source blockchain behind it.
How is it related to each other?	Ripple utilizes XRP in one of its products, On-Demand Liquidity. Ripple's engineering team also contributes to the further development of XRP Ledger.	The XRP Ledger cannot be owned by any single entity -- it exists independent of any one person or business , including Ripple. The XRP Ledger is an open-source project, in which anyone can get involved.
Who uses it?	Financial institutions use Ripple's enterprise products.	Anyone can use XRP, build on the XRP Ledger and list XRP on their exchange.

Source: Company documents.

Exhibit 8 How Fiat Transactions on RippleNet Work

Step-by-Step Guide to RippleNet Transactions

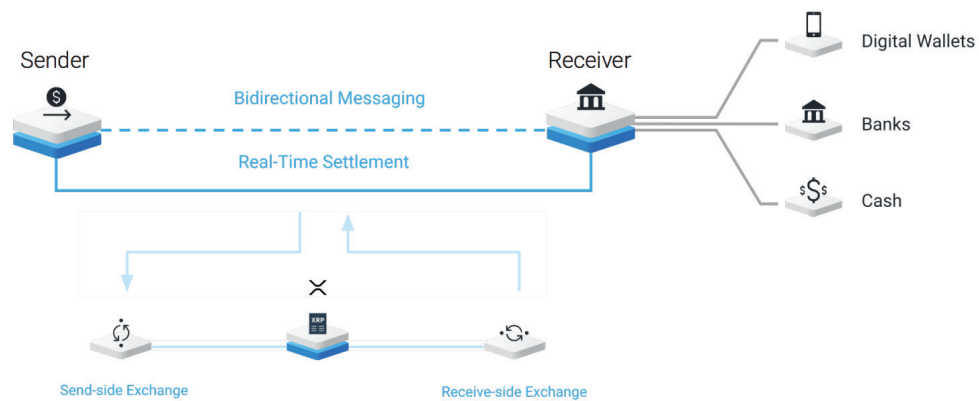


1. The sender requests a quote from the receiver on pricing and FX.
2. The receiver responds with a quote on pricing and FX.
3. The sender accepts the quote, and provides the receiver with the relevant compliance information.
4. The receiver completes compliance checks and locks the payment for the sender.
5. The sender initiates the payment.
6. Ripple's technology confirms both parties are abiding by the agreed upon terms.
7. Funds are instantly debited and credited on the subledgers of the sender and receiver.
8. The receiver forwards the payment over domestic rails if necessary.
9. The receiver notifies the sender that the payment has been delivered.
10. The sender and receiver confirm the transaction is complete.

Source: Company documents.

Exhibit 9 How On-Demand Liquidity Works

Step-by-Step Guide to On-Demand Liquidity



1. The sender requests a quote on pricing and FX.
2. Ripple's technology calculates the pricing and FX across all parties, and returns a quote to the sender.
3. The sender accepts the quote and submits payment instructions, initiating the payment.
4. The send-side exchange debits the sender's account, and converts that amount (less fees) into XRP.
5. XRP is sent across the XRP Ledger (settles in 3 seconds) from the send-side exchange to the receive-side exchange.
6. The receive-side exchange converts XRP into local currency, and credits the sender's account (less fees).
7. Ripple's technology confirms the amount received is accurate, and will top up the sender's account if needed.
8. The receive-side exchange forwards the payment to the receiver.
9. The receiver forwards the payment if necessary.
10. The sender and receiver confirm the transaction is complete.

Source: Company documents.

Endnotes

- ¹ “6 steps to make an International Wire Transfer,” TransferWise blog, <https://transferwise.com/us/blog/making-an-international-wire-transfer>, accessed February 1, 2019.
- ² “XRP: The Digital Asset for Payments,” Ripple, <https://ripple.com/xrp/>, accessed February 3, 2019.
- ³ “Bitcoin without mining,” Bitcoin Forum, <https://bitcointalk.org/index.php?topic=10193.0;all>, accessed February 4, 2019.
- ⁴ Bailey Reutzel, “Disruptor Chris Larsen Returns with a Bitcoin-Like Payment System,” *American Banker*, December 7, 2012.
- ⁵ “XRP Avg. Transaction Fee historical chart,” Bitinfo Charts, <https://bitinfocharts.com/comparison/xrp-transactionfees.html>, accessed February 1, 2019.
- ⁶ “XRP: The Digital Asset for Payments,” Ripple, <https://ripple.com/xrp/>, accessed February 5, 2019.
- ⁷ Jake Frankenfield, “Cryptocurrency,” Investopedia, February 12, 2019.
- ⁸ Shirley Siluk, “Google Ventures invests in Bitcoin competitor OpenCoin,” CoinDesk, May 14, 2013.
- ⁹ Alec Liu, “Ripple Labs 2014: A Year in Review,” Ripple Insights, December 22, 2014.
- ¹⁰ “XRP,” CoinMarketCap, <https://coinmarketcap.com/currencies/ripple/>, accessed February 9, 2019.
- ¹¹ “Yahoo Memo: The ‘Peanut Butter Manifesto,’” Wall Street Journal, November 18, 2006.
- ¹² Alec Liu, “Welcome COO Brad Garlinghouse to Ripple Labs,” Ripple Insights, April 16, 2015.
- ¹³ Alec Liu, “Ripple Labs 2015: A Year in Review,” Ripple Insights, December 28, 2015.
- ¹⁴ “Total payments revenues worldwide from 2008 to 2022 (in trillion U.S. dollars),” Statista, <https://www.statista.com/statistics/724810/total-global-payments-revenues/>, accessed February 20, 2019.
- ¹⁵ Meghan Ellison, “Ripple Labs 2016: A Year in Review,” Ripple Insights, December 28, 2016.
- ¹⁶ “XRP,” CoinMarketCap, <https://coinmarketcap.com/currencies/ripple/>.
- ¹⁷ “Ripple Escrows 55 Billion XRP for Supply Predictability,” Ripple Insights, December 7, 2017.
- ¹⁸ “XRP,” CoinMarketCap.
- ¹⁹ Joon Ian Wong, “Here are the top 10 cryptoassets of 2017 (and bitcoin’s 1,000% rise doesn’t even make the list),” Quartz, January 1, 2018.
- ²⁰ Usman W. Chohan, “A History of Bitcoin,” Notes on the 21st Century, September 30, 2017.
- ²¹ “Nodes,” Bitnodes, <https://bitnodes.earn.com/dashboard/>, accessed February 17, 2019.
- ²² “Blockchain Charts,” Blockchain, <https://www.blockchain.com/en/charts>, accessed February 11, 2019.
- ²³ Billy Bambrough, “A Bitcoin Halvening Is Two Years Away -- Here’s What’ll Happen To The Bitcoin Price,” *Forbes*, May 29, 2018.
- ²⁴ Jimmy Aki, “Report Links 74% of Bitcoin Mining to China, Sees Threat to Network,” *Bitcoin Magazine*, October 10, 2018.
- ²⁵ Jemima Kelly, “Bitcoin cash is expanding into the void,” *Financial Times*, May 15, 2018.
- ²⁶ Kai Sedgwick, “Bitcoin History Part 6: The First Bitcoin Exchange,” Bitcoin.com, December 25, 2018.
- ²⁷ “Bitcoin Core (BTC) Price,” Bitcoin.com, <https://charts.bitcoin.com/btc/chart/price>, accessed March 1, 2019.
- ²⁸ Jake Frankenfield, “Mt. Gox,” Investopedia, July 5, 2018.
- ²⁹ “Bitcoin,” CoinMarketCap, <https://coinmarketcap.com/currencies/bitcoin/>, accessed February 15, 2019.
- ³⁰ Jake Frankenfield, “Mt. Gox,” Investopedia, July 5, 2018.
- ³¹ “Security for your peace of mind,” Coinbase, <https://www.coinbase.com/security>, accessed February 22, 2019.

- ³² “How is Coinbase insured?” Coinbase Support, <https://support.coinbase.com/customer/portal/articles/1662379-how-is-coinbase-insured->, accessed February 23, 2019.
- ³³ “Common Vulnerabilities and Exposures,” Bitcoin IT, https://en.bitcoin.it/wiki/Common_Vulnerabilities_and_Exposures, accessed February 22, 2019.
- ³⁴ Kadhim Shubber, “The 9 Biggest Screwups in Bitcoin History,” CoinDesk, July 20, 2014.
- ³⁵ Mitchell Moos, “Analysis: Bitcoin Costs \$1.4 Billion to 51% Attack, Consumes as Much Electricity as Morocco,” CryptoSlate, November 29, 2018.
- ³⁶ Joshua Bearman, “The Untold Story of Silk Road, Part 1,” *Wired*, May 1, 2017.
- ³⁷ Tim Fernholz, “Silk Road Collected 9.5 Million Bitcoin-and Only 11.75 Million Exist,” Quartz, October 2, 2013.
- ³⁸ Jonathan K. Karlsen, “Sex, drugs, and bitcoin: How much illegal activity is financed through cryptocurrencies?” University of Oxford blog, February 19, 2018.
- ³⁹ “Global Charts,” CoinMarketCap, <https://coinmarketcap.com/charts/>, accessed February 17, 2019.
- ⁴⁰ Sarah Marquer, “XRP Ledger Decentralizes Further With Expansion to 55 Validator Nodes,” Ripple Insights, July 17, 2017.
- ⁴¹ Kate Rooney, “Ethereum falls on report that the second-biggest cryptocurrency is under regulatory scrutiny,” CNBC, May 1, 2018.
- ⁴² “All Cryptocurrencies,” CoinMarketCap, <https://coinmarketcap.com/all/views/all/>, accessed March 1, 2019.
- ⁴³ Julio Gil-Pulgar, “Ethereum 2.0’ POS blockchain aims to cut energy use by 99%,” Bitcoinist, January 4, 2019.
- ⁴⁴ “Bitcoin Energy Consumption Index,” Digiconomist, <https://digiconomist.net/bitcoin-energy-consumption>, accessed March 1, 2019.
- ⁴⁵ “Create your own cryptocurrency with Ethereum,” Ethereum, <https://www.ethereum.org/token>, accessed February 12, 2019.
- ⁴⁶ “Comparison of initial coin offering and venture capital funding worldwide from 2015 to 2017 (in million U.S. dollars),” Statista, <https://www.statista.com/statistics/863762/vc-vs-ico-funding-globally/>, accessed March 1, 2019.
- ⁴⁷ “ERC20 Tokens List,” Eidoo, <https://eidoo.io/erc20-tokens-list/>, accessed March 2, 2019.
- ⁴⁸ John Koetsier, “Bitcoin Is The Second Most-Searched Global News Term Of 2017,” *Forbes*, December 13, 2017.
- ⁴⁹ Evelyn Cheng, “Bitcoin exchange Coinbase has more users than stock brokerage Schwab,” CNBC, November 27, 2017.
- ⁵⁰ Daniel Palmer, “VC Investment in Blockchain Startups Is Up 280% So Far This Year,” CoinDesk, October 2, 2018.
- ⁵¹ Daniel Palmer, “Goldman Sachs Said to Have Sidelined Plans for Crypto Trading Desk,” CoinDesk, September 5, 2018.
- ⁵² Shobhit Seth, “80% of ICOs Are Scams: Report,” Investopedia, April 2, 2018.
- ⁵³ “All Cryptocurrencies,” CoinMarketCap, <https://coinmarketcap.com/all/views/all/>.
- ⁵⁴ “Global Charts,” CoinMarketCap, <https://coinmarketcap.com/charts/>, accessed February 17, 2019.
- ⁵⁵ “Regulation of Cryptocurrency Around the World,” Library of Congress, <https://www.loc.gov/law/help/cryptocurrency/world-survey.php>, accessed March 1, 2019.
- ⁵⁶ Chris Osborne, “15 Crypto Companies in Malta You Should Get to Know,” Kintu, July 3, 2018.
- ⁵⁷ “Regulation of Cryptocurrency Around the World,” Library of Congress, <https://www.loc.gov/law/help/cryptocurrency/world-survey.php>.
- ⁵⁸ “Regulation of Cryptocurrency Around the World,” Library of Congress, <https://www.loc.gov/law/help/cryptocurrency/world-survey.php>.
- ⁵⁹ “IRS Virtual Currency Guidance: Virtual Currency Is Treated as Property for U.S. Federal Tax Purposes; General Rules for Property Transactions Apply,” IRS News Release, March 25, 2014.

- 60 "Ripple," Ripple Twitter Account, <https://twitter.com/ripple/status/973405454960287745>, accessed March 1, 2019.
- 61 Arjun Kharpal, "CNBC Interview with Brad Garlinghouse, Ripple CEO," CNBC, June 5, 2018.
- 62 Jen Wiczner and Lucinda Shen, "Ripple's XRP Isn't Making Western Union's Payments Cheaper, CEO Says," *Fortune*, June 13, 2018.
- 63 Jen Wiczner and Shen, "Ripple's XRP Isn't Making Western Union's Payments Cheaper, CEO Says," *Fortune*, June 13, 2018.
- 64 MoneyGram press release, "MoneyGram Announces Strategic Partnership with Ripple," June 17, 2019, <http://ir.moneygram.com/news-releases/news-release-details/moneygram-announces-strategic-partnership-ripple>, accessed December 5, 2019.
- 65 MoneyGram press release, "MoneyGram Announces Strategic Partnership with Ripple," June 17, 2019.
- 66 Rob Belcher, "What Should a SaaS Income Statement Look Like?" SaaS Capital, April 20, 2015.
- 67 "How Long Will it Take to Implement a New Accounting System?" RineHimerBaker Cloud Solutions, February 28, 2017.
- 68 "Forte And Ripple's Xpring Form \$100 Million Fund To Accelerate Mainstream Use Of Blockchain In Games," PR Newswire, March 12, 2019.
- 69 "One Pay," Santander, <https://www.bancosantander.es/es/particulares/banca-online/one-pay>, accessed March 19, 2019.
- 70 Spencer Tierney, "Wire Transfers: What Banks Charge," NerdWallet, March 6, 2018.
- 71 "SWIFT Annual Review," SWIFT, <https://www.swift.com/about-us/financials>, accessed February 25, 2019.
- 72 Sukriti Bansal, Philip Brun, and Marc Niederkorn, "Global payments: Expansive growth, targeted opportunities," McKinsey & Company, October 2018.
- 73 Bansal, Brun, and Niederkorn, "Global payments: Expansive growth, targeted opportunities."
- 74 Evelyn Cheng, "How Ant Financial grew larger than Goldman Sachs," CNBC, June 8, 2018.
- 75 Bansal, Brun, and Niederkorn, "Global payments: Expansive growth, targeted opportunities."
- 76 "Number of monthly active WhatsApp users worldwide from April 2013 to December 2017 (in millions)," Statista, <https://www.statista.com/statistics/260819/number-of-monthly-active-whatsapp-users/>, accessed March 1, 2019.
- 77 "PayPal - Statistics & Facts," Statista, <https://www.statista.com/topics/2411/paypal/>, accessed February 19, 2019.
- 78 "J.P. Morgan Creates Digital Coin for Payments," J.P. Morgan, <https://www.jpmorgan.com/global/news/digital-coin-payments>, accessed March 10, 2019.
- 79 David Meyer, "More Banks Join UBS-Led Blockchain Scheme to Speed Up Settlements," *Fortune*, August 31, 2017.
- 80 Tanaya Macheel, "Goldman Sachs Files Patent for Cryptocurrency System SETLcoin," *American Banker*, December 3, 2015.
- 81 Brad Garlinghouse, "The Case Against Bankcoin," LinkedIn, August 24, 2016.
- 82 "Stellar," CoinMarketCap, <https://coinmarketcap.com/currencies/stellar/>, accessed February 15, 2019.
- 83 "IBM Blockchain World Wire, a New Global Payment Network, to Support Payments and Foreign Exchange in More Than 50 Countries," IBM, <https://newsroom.ibm.com/2019-03-18-IBM-Blockchain-World-Wire-a-New-Global-Payment-Network-to-Support-Payments-and-Foreign-Exchange-in-More-Than-50-Countries>, accessed March 19, 2019.