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DISTRIBUTED LEDGER TECHNOLOGY AND CROSS-BORDER INSTITUTIONAL PAYMENTS WHITE PAPER

INTRODUCTION

With the advent of blockchain and distributed ledger technology emerging in the past decade, comes the revelation of several challenges within the financial services industry. Especially for commercial banks, investment banks, and international financial bodies that handle over $136 trillion in cross-border payments, these institutions traditionally rely upon aging systems and processes for communication of trade and regulatory data between themselves and regulators[1]. With this web of overlapping inefficiencies, distributed ledger technology offers opportunities to speed up the transfer of currency and transaction information across borders for small and large institutions alike while still providing the necessary compliance checks for federal and institutional regulators. **This paper aims to demonstrate that in light of the pains and immense financial costs of the current institutional payments systems, a superior future-state scenario of distributed ledger technologies is feasible. However, it will likely be rolled-out and implemented in a long and patchy manner due to the inherent risk-averse behaviors of many of today's financial institutions.**

DEFINITION OF TERMS AND SURVEY OF CURRENT-STATE

In today's financial services industry, one of the most popular cross-border payment protocols utilized for the transmission of money is the Society for Worldwide Interbank Financial Telecommunication (SWIFT) system. Within SWIFT, the global standard which American banks primarily use for trade settlement, transfers (templates 900 and 910), and cash credit/debit confirmations (templates 900/910/102/103) with Asian and European banks, there is a standard messaging template used for trades between financial institutions that have an existing relationship on the platform with each other. The template contains economic information (e.g., currency type and amount), origin institution and provider of the money for regulatory purposes, as well as information on where the funds are going.

It is different for institutions that are smaller or do not have a direct relationship with the institution they are transferring funds. First, they must send their money and data to a bank that they have an existing relationship with, who has a relationship with the recipient bank (or a bank that has a relationship with that end-recipient bank). As a result, while the SWIFT network tracks regulatory Know Your Customer (KYC)/Anti-Money Laundering (AML) information very well in its templates, its transactions can often take time due

1. Stanley, Aaron. "Juniper Research: B2B Money Transfer Space 'Ripe For Disruption'." Forbes, Forbes Magazine, 2 Apr. 2018, www.forbes.com/sites/astanley/2018/03/30/juniper-research-b2b-money-transfer-space-ripe-for-disruption/#3dccd2ef278f

to the multiple points that they must hit. In addition, 60 percent of transactions on the SWIFT network require manual processes to intervene, which adds on average 15 minutes of manual effort and time spent per trade[2]. For example, even the current quoted speed for SWIFT's new Global Payment Initiative (GPI), which people tout for its upgraded speed, is same-day, but not instantaneous (although 75 percent of payments credit to accounts within six hours)[3]. Outside of this GPI initiative, transactions between institutions through SWIFT could take up to three days. SWIFT transactions can also accrue fees of two to three percent of the wire's value. Another challenge to the SWIFT system is that the number of inter-bank relationships across borders is consolidating worldwide, which could severely affect smaller jurisdictions' access to the network, thereby increasing the difficulty for them to access such network funds[4].

The first step to describing a solution for distributed ledger technology in the cross-border payments area is to explain several terms pertinent to the technology. First, distributed ledger technology could utilize blockchain but it is not the same thing. Distributed ledger technology is a decentralized database located on multiple nodes, which its users can update and modify. Users updating and modifying the database occurs without the ledger requiring validation or confirmation of a trade from a central location – but the network still stores a record of previous transactions in its multiple nodes[5]. Applicable to this paper is a restricted distributed ledger network – where rejection to access nodes outside those already approved through constant validation of transactions and transfers of data. The key to these networks is consensus: a pre-determined percentage of nodes in the network must approve a given transaction and accept its identification details and details of previous exchanges[6]. An existing example of a platform using this technology is Hyperledger Fabric. The aim of this open-source application is solving enterprise-level problems (which has been used by HSBC and several other firms for trade financing applications)[7].

Since a theoretical distributed ledger network will require assets or currencies that do not wildly fluctuate in value to serve as an underpinning for trade and conversion between parties, stablecoins can exist as a potential solution. As their name suggests, the goal of stablecoins is to be stable and predictable in their price, so that financial institutions and enterprises can use them for operations and trading for their own needs. Due to their stable nature and their ability to be accepted by different members of a network, stablecoins could efficiently act as a vehicle for cross-border trading between institutions. Stablecoins are stabilized in several ways, first, being backed by another asset (e.g., gold, dollars, or other cryptocurrencies). In the case of cryptocurrencies backing Stablecoin, a larger reserve is held across the network to prevent price shocks of the underlying cryptocurrency from affecting the Stablecoin. These stablecoins can also be backed by algorithms that are changed and validated from central banks into their networks- similar to how a government can print more currency[8].

2. "How Blockchain Could Disrupt Banking." CB Insights Research, 18 Dec. 2018, www.cbinsights.com/research/blockchain-disrupting-banking/
3. "SWIFT Trials Instant Cross-Border Gpi Payments through TIPS." SWIFT, 21 May 2019, www.swift.com/news-events/press-releases/swift-trials-instant-cross-border-gpi-payments-through-tips
4. Holden, Henry. "New Correspondent Banking Data - the Decline Continues*." The Bank for International Settlements, 27 May 2019, www.bis.org/cpmi/paysysinfo/corr_bank_data/corr_bank_data_commentary_1905.htm
5. Pinna, Andrea, and Wiebe Ruttenberg. "Distributed Ledger Technologies in Securities Post-Trading." European Central Bank, Apr. 2016, www.ecb.europa.eu/pub/pdf/scpops/ecbop172.en.pdf
6. Ibid
7. Wang, Xin & xu, Xiaomin & Feagan, Lance & Huang, Sheng & Jiao, Limei & Zhao, Wei. (2018). Inter-Bank Payment System on Enterprise Blockchain Platform. 614-621. 10.1109/CLOUD.2018.00085
8. Sharma, R. (2018). Why are stablecoins becoming popular?. New York: Newstex. Retrieved from http://ezproxy.cul.columbia.edu/login?url=https://search-proquest-com.ezproxy.cul.columbia.edu/docview/2251448264?accountid=10226

CURRENT AND POTENTIAL APPLICATIONS OF THE TECHNOLOGY

To demonstrate the potential benefits and drawbacks of distributed ledger technology in financial services cross-border payments, the following high-level example, followed by examples that exist in the marketplace, is to serve as a demonstration of how the result of such an implementation could appear. In this paper's future hypothetical example, each financial institution would have a node that connects to the other institutions' nodes in a closed distributed ledger network. These firms would also have each of their nodes tie into their internal systems, for recordkeeping in whatever notation the firm requires, and for the authorization of transfer of money. Such recordkeeping could also occur on the distributed ledger network to handle the clearing and settlement processes of daily trades. In order for a transaction to occur between two institutions, consensus must be reached by a pre-agreed upon percentage of nodes in the network. They acknowledge that the nodes and their transaction data are valid, which is then saved and captured as completed within the ecosystem's nodes. For security purposes, the identification data that is held of each transaction can be sent through all nodes for validation, but only be visible for specified parties through a zero-knowledge proof, a cryptographical tactic used to demonstrate knowledge of certain variables, but nothing outside those variables[9]. Note, that such cryptographical techniques as zero-knowledge proofs are still in development.

For this enclosed distributed-ledger ecosystem to work, a vehicle is required to transfer funds between accounts. A scenario where institutions consistently agree upon conversion rates for each trade value would slow transactions down considerably. Instead, the institutions could utilize a Stablecoin of choice, such as Ripple (XRP), or one developed in their consortium. According to Ripple, cross-border transactions using its system take under seven seconds to occur[10]. Each member bank could purchase an amount of the Stablecoin. They then peg to the value of their currency of choice at the time of the transaction, and trade it across the network to then be cashed out on the receiving end for the currency of choice. Each member bank would then have the option of using a Stablecoin to enable transactions across the border and conduct the transactions over multiple currencies and forms of collateral.

One of the most substantial requirements of resources in financial transactions is recordkeeping around requirements from national and international governmental bodies. These recordkeeping requirements are especially strong within the KYC and AML areas- which aim to prevent money laundering and access to international funds to blacklisted individuals and organizations. Current KYC and AML processes occur internally in each financial services firm and require manual reconciliation of trade data and false flags. Such procedures cost financial institutions tens to hundreds of millions of dollars yearly[11]. Blockchain and distributed ledger technologies are uniquely suited in this area for recordkeeping. With each transaction on a distributed ledger, the transaction is acknowledged by the network's member nodes and is assigned an identifier code. In order to amend the data in a given transaction, there must be a set percentage of member nodes that reach consensus and allow for edits. As a result, for a given transaction, it is easy to track where its funding originates and any other required fields attached to the transaction as well[12]. For this use-case, financial instructions could pass KYC and AML data in each

9. Pinna and Ruttenberg, 31
10. Zmudzinski, Adrian. "SWIFT Catching Up to Ripple in Speed After Instant Remittance Trial." Cointelegraph, Cointelegraph, 23 July 2019, cointelegraph.com/news/watch-out-ripple-swift-says-its-fastest-remittance-is-down-to-13-secs
11. Middleton, Ryan. "Using Blockchain for KYC/AML Compliance." Dentons, 2019, www.dentons.com/en/insights/articles/2019/may/28/using-blockchain-for-kyc-aml-compliance
12. Weinberg, Bryan. "Blockchain and KYC: Know Your Customer Better." OpenLedger Insights, 31 May 2019, openledger.info/insights/blockchain-kyc/

transaction, but could also create a private distributed ledger (using zero-knowledge proof cryptology, as mentioned above, to make data available on a need-to-know basis) among each other to regularly make such data available between each other, preventing significant effort to reconcile data internally in each firm and decreasing the occurrence of incorrect flags that delay such transactions[13]. With that being said, each firm would need to be able to reconcile the KYC data coming in through the distributed ledger network with their own KYC/AML processing engines and CRMs – since they likely won't have KYC/AML information, data, and processing happen exclusively on the blockchain during the beginning implementation period. In support of this use case, there are estimates that blockchain technology could produce a savings of six to eight billion dollars a year, largely from the technology's inherent advantages in the compliance area[14].

EXAMPLES:

Moving the discussion out of the realm of theory and into real usages of the blockchain and distributed ledger technologies, multiple financial services institutions have created their pilots for several use cases. Please note that the following examples are selected examples and are not an exhaustive list of progress in the blockchain payments space.

1. The most relevant real-world example of a distributed ledger technology adaptation for this paper's subject is with CLS Net- the distributed ledger settlement offering by the CLS Group[15]. With nine large investment banks as its participants, CLS Net utilizes its underlying technology to be an intermediary and automate settlement and reconciliation between banks. This reduces the need for multiple transactions and associated costs between two counterparties for a given transaction- if Bank A owes Bank B $100,000 - which owes Bank A $50,000, then Bank A can do one net payment of $50,000 to Bank B)[16].

2. Last year, Commerzbank and Daimler Trucks announced that they created a blockchain network to exchange and settle payments between electric charging systems and Daimler – without the need for human touch-points[17]. To do so, Commerzbank converted Euros used for payments into digital tokens, to then be credited and deducted from end-users' digital wallets.

3. Next, the central banks of two countries, Canada and Singapore, announced a successful test of their cross-border blockchain payments mechanism. What makes this example even more of interest is that they were able to connect their own independent and internal blockchain networks to handle settlement between each other without a mediating institution[18].

13. Middleton
14. "Using Blockchain for KYC/AML Compliance." JD Supra, www.jdsupra.com/legalnews/using-blockchain-for-kyc-aml-compliance-25325/
15. "CLSNet - Follow the Leaders." CLSNet | CLS's Bilateral Payment Netting Solution | CLS Group, www.cls-group.com/products/processing/clsnet/
16. Morris, Nicky. "Morgan Stanley, Goldman Go Live on CLS/IBM FX Blockchain." Ledger Insights - Enterprise Blockchain, 28 Nov. 2018, www.ledgerinsights.com/morgan-stanley-goldman-cls-blockchain-fx-clsnet/
17. Zmudzinski, Adrian. "Commerzbank Tests Blockchain Machine to Machine Payments with Daimler." Cointelegraph, Cointelegraph, 20 Aug. 2019, cointelegraph.com/news/commerzbank-tests-blockchain-machine-to-machine-payments-with-daimler
18. Khatri, Yogita. "Central Banks Settle Cross-Border Payments With Blockchain for First Time." CoinDesk, CoinDesk, 2 May 2019, www.coindesk.com/central-banks-settle-cross-border-payments-with-blockchain-for-first-time

4. In a similar vein, JP Morgan announced in 2017 the creation of its Interbank Information Network (IIN). The IIN payment verification system serves as a private ledger for different financial institutions to link their ecosystems together for transaction information (they also announced Royal Bank of Canada and New Zealand Banking Group as signing onto the network). JP Morgan's press statement on IIN cited its advantages in decreasing transaction information processing time, as well as the effort required to satisfy compliance requirements[19]. In September 2019, JP Morgan announced that the IIN has over 330 banks signed up to use the network – with 65 of them as live users[20]. Supplementing IIN's ability to transfer information on the blockchain, JP Morgan announced in February 2019 its own exploratory pilot of its wholesale business' Stablecoin. JPM Coin, that is pegged to the value of the dollar and will initially be used internally to JP Morgan customers[21].

5. Outside of the JPM network, American Express and Santander Bank announced in 2017 that they would underpin their FX International Payments platform by RippleNet. RippleNet is an enterprise blockchain payments platform – to transfer money quickly and in a traceable manner between US and UK based clients[22]. IBM also announced the successful testing of its World Wire network in March 2019 to handle cross-border transactions using both Stablecoins and cryptocurrencies. This network handles payment messaging, clearing, settlement, and settlement currency selection all on the same network. The interconnected APIs in the network transfers the transaction information between end-users and then follows up by transferring the digital asset once the transfer of information is acknowledged[23].

The selected examples above demonstrate interest and significant initial effort and investment in developing blockchain and distributed ledger payments platforms by technology firms, central banks, and financial services institutions. As these networks grow in membership and their advantages in transaction time and regulatory reporting become clearer, they could demonstrate their viability to other financial services institutions and governmental agencies alike.

19. "J.P. Morgan Deploys Blockchain with New Correspondent Banking Network." J.P. Morgan Deploys Blockchain with New Correspondent Banking Network | J.P. Morgan, www.jpmorgan.com/country/US/en/detail/1320562088910
20. "J.P Morgan Interbank Information Network® Grows to 300+ Banks." J.P Morgan Interbank Information Network® Grows to 300+ Banks | J.P. Morgan, www.jpmorgan.com/country/US/en/detail/1320575182345
21. "J.P Morgan Interbank Information Network® Grows to 300+ Banks." J.P Morgan Interbank Information Network® Grows to 300+ Banks | J.P. Morgan, www.jpmorgan.com/country/US/en/detail/1320575182345
22. Browne, Ryan. "American Express, Santander Team up with Ripple for Cross-Border Payments via Blockchain." CNBC, CNBC, 16 Nov. 2017, www.cnbc.com/2017/11/16/american-express-santander-team-up-with-ripple-on-blockchain-platform.html
23. Browne, Ryan. "American Express, Santander Team up with Ripple for Cross-Border Payments via Blockchain." CNBC, CNBC, 16 Nov. 2017, www.cnbc.com/2017/11/16/american-express-santander-team-up-with-ripple-on-blockchain-platform.html

HURDLES TO ADOPTION

While the above examples could show a way to successful widespread implementation of blockchain and distributed ledger technologies within cross-border payments, several large drawbacks and hurdles exist for the technologies. The first area is regulatory, which for the sake of transparency, the author of this paper was unable to find much collateral on existing regulation in this technology area. However, this paper will speculate on potential hurdles in this area, nonetheless based on previous regulatory scrutiny in adjacent areas and applications of existing laws on blockchain. Even though blockchain and distributed ledger technologies' transparency capabilities are advantageous, regulators will be very keen to make sure that the ledgers are not able to be manipulated to falsify records, especially from an AML and KYC perspective. For example, Ripple Labs in 2015 was fined $700,000 from the US' Financial Crimes Enforcement Network for not building out a sufficiently robust AML capability that could track transactions over an extended period, as well as for selling a non-registered digital currency[24]. In addition, financial regulators will take a keen interest in data privacy in distributed ledger networks- especially given the large number of parties that will have access to a shared ledger's fabric. As a result, developments and implementation of advanced cryptography and zero-knowledge proofs will be crucial to make sure that PII and transaction data will only be visible to requested parties.

Outside of the regulatory space, the sheer effort required to build and onboard blockchain network and ensure its compatibility in-house with legacy systems will be considerable. Firms will need to ensure that the data that they send into the ecosystem from their internal systems follow a standardized template format to be received by other firms' nodes (similar to how they work with SWIFT templates). In addition, they will need to make sure that their systems and their reference data are built/maintained in a way to make sure that incoming data can be mapped correctly. On top of this, the very rules, procedures, and consensus-building behavior of the shared ledger will need to be aligned upon in a way that is acceptable to current members. They will be conducive to efficiently onboarding more members as the ledger's network expands.

24. "FinCEN Fines Ripple Labs Inc. in First Civil Enforcement Action Against a Virtual Currency Exchanger." FinCEN Fines Ripple Labs Inc. in First Civil Enforcement Action Against a Virtual Currency Exchanger | FinCEN.gov, www.fincen.gov/news/news-releases/fincen-fines-ripple-labs-inc-first-civil-enforcement-action-against-virtual

CONCLUSION

While the imagined above future state and current pilots point to a bright future for blockchain and distributed ledger technologies in the cross-border payments space, there is still a long road ahead for these technologies and their handlers to mature to the point of growing to scale enough to replace existing payments messaging systems and processes – which are improving in their own right as well. Despite this, the technologies could quickly proliferate in other areas (such as peer to peer payments), which could, in turn, lead to efficiencies and improvements that could assuage regulatory concerns. However, this ignores one key factor- whether financial institutions- private, public, or governmental, are willing to invest in brand new yet still largely untested on an enterprise-level technology to replace their extremely flawed but functional systems. Although several institutions, such as JP Morgan and HSBC, have invested in piloting such technologies to one day replace their internal systems, numerous ones have also elected to pass. If these firms and bodies have ignored such calls in the past and have been willing to swallow fines instead of completely overhauling their imperfect systems, then severe pressure will be required to convince firm management that investment in changing their existing systems stacks and processes over to blockchain is absolutely essential, even if the technology fully matures. In the meanwhile, the near future will likely bring more pilots that will expand- but their ecosystems will be patchy and incomplete until a large critical mass of institutions onboard these platforms. This is why the ease of onboard an institution into this technology must be essential. Otherwise, the financial services system can and will be left in a web of competing technologies that will create more webs than blockchain was initially intended to untangle.

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ABOUT CAPCO

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