



USING REPLICATED LEDGER TO REDUCE SWIFT COSTS

A close-up photograph of a person's hands counting a stack of US dollar bills on a counter. The person is wearing a light-colored shirt. In the background, a cash register is visible, and the counter is made of wood. The scene is brightly lit, and the focus is on the hands and the money.

Introduction

This paper proposes an approach to build a payment product that could be deployed across units of same bank or banks which have correspondent relationships, to reduce SWIFT message costs and to conserve liquidity by reducing need for Settlement and Nostro accounts.

The paper proposes an outline of a product that implements a replicated, single wrapper around existing ledgers of such bank units to enable quick, irrevocable, tamper-proof approach to managing electronic payments between correspondent bank units.

Existing ledgers of the bank would not be replaced or disturbed. Instead a wrapper application would be deployed that tracks specific entries in the ledger and replicates the changes to all members. This enables each member bank to see the same ledger at the same time and also be guaranteed of its accuracy. For this purpose, it is recommended the product be built using Blockchain for established and proven security.

Such a replicated ledger would reduce active, recurring costs of using SWIFT network to pass payment messages. This will also reduce the much larger passive cost of holding funds in a non-remunerative settlement a/c with the correspondent bank.

Challenges

Existing ledger schemes, developed during the 1400s by Luca Pacioli, are based on individual ledgers for each business, thus preserving its own version of truth. There is no “common” agreed-upon version of truth. With each bank seeing only its own

part of the transactions, the view they have is similar to the “six blind men and an elephant”.

To overcome these shortcomings, and process payments between unrelated parties, a central trusted 3rd party is necessary. SWIFT exists to pass payment

messages between Commercial banks. The Central bank (for a given currency) is used to settle payments in central bank money. Both are trusted 3rd parties which do not have a financial stake in the concerned Commercial banks which transmit the messages and handle settlement.

Background of payments

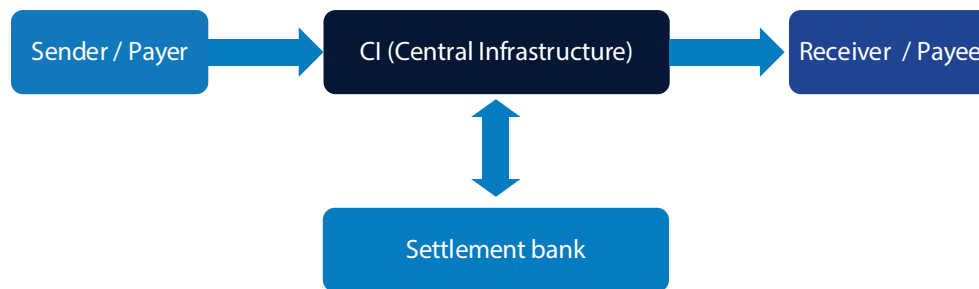


Exhibit 1 – Current payment schemes representation

The above diagram is a representation of how current payment schemes work. This approach is called 4-box Model and is common to all payment schemes and systems. The CI comprises of the Payment scheme and scheme provider.

There are three parts to a payment mechanism:

- Payment message transmission
- Payment reconciliation
- Settlement via Central bank's settlement accounts and ledger entries.

Payment message transmission

Payment messages between Commercial banks are typically fulfilled by the scheme provider's schematics and technical requirements.

Here we take the example of LV local payments that involves using RTGS protocol.

Commercial banks wanting to make payments or receive payments (Push and Pull), send the messages to the CI. The CI acts as a Hub for receiving, collating

and netting payment messages before retransmitting confirmations/denials to Commercial banks.

The scheme provider offers finality of message transmission. In this case, SWIFT.

Payment reconciliation

The CI or the PSP (Payment Scheme Provider) typically acts as the super-agent of all individual Commercial bank ledgers. It calculates and reconciles payments to/from various Commercial banks and then sends the amounts to the Settlement bank (Central bank in most scenarios). The reconciliation ledger entries calculated by CI and sent to Commercial banks and also to the Settlement bank.

Individual ledger entries of banks have to be reconciled with what the CI entry shows, thus making the CI as a super-ledger of all ledgers. The CI provides finality of reconciliation.

Settlement via Central Bank and ledger entries

The Settlement bank (Central bank mostly) receives the settlement figures and transfers the money between the

Commercial banks using the settlement account to reflect the changes.

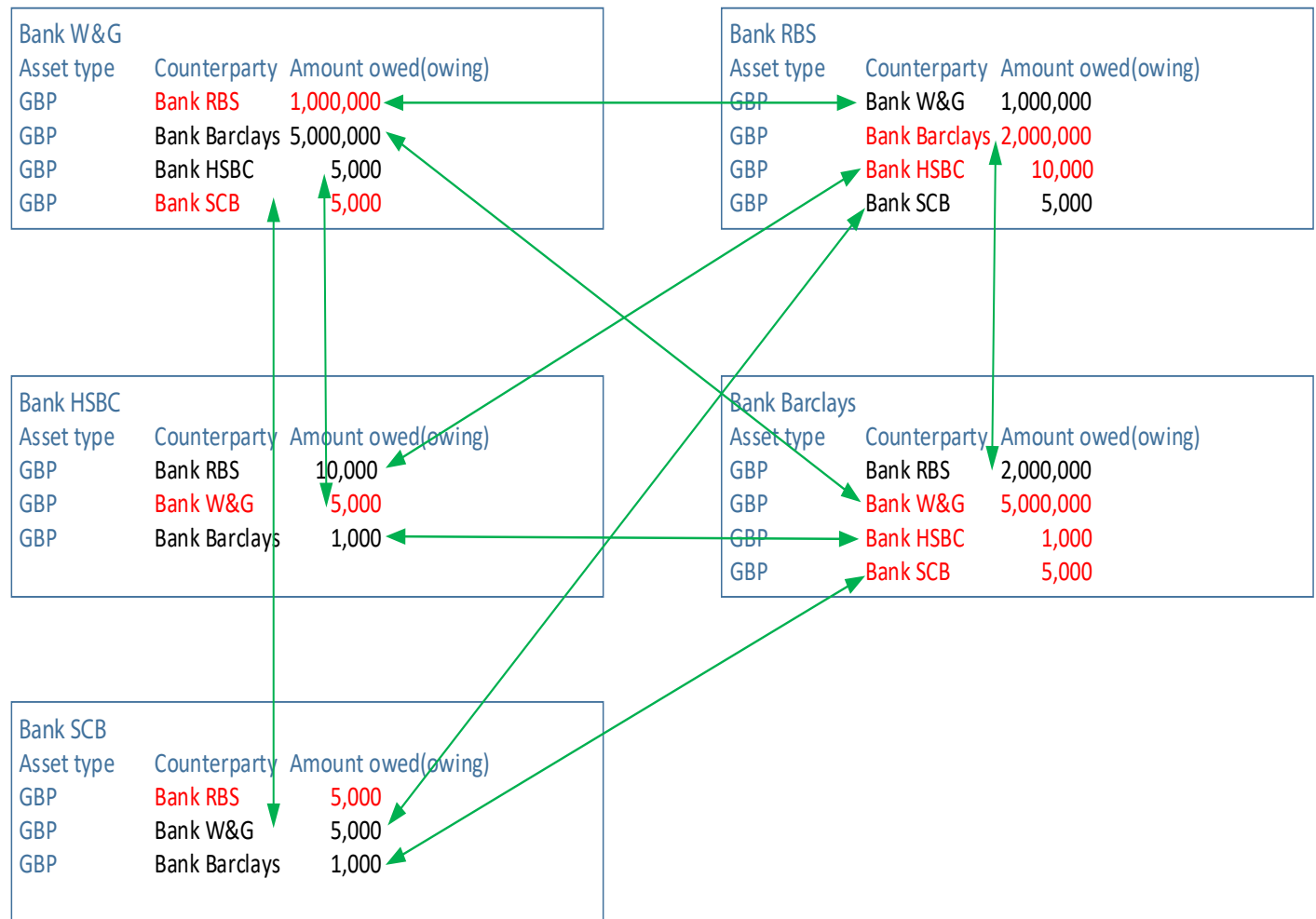
The settlement bank offers finality of payment. If it is settled in Central bank money, it offers a guarantee that funds will be available to the receiver. To reduce risk to itself, the settlement bank expects all member Commercial banks to fund and maintain funds in a settlement account which is funded with enough money to meet daily obligations. The settlement bank could also offer to lend its own money at overdraft charges to meet temporary/overnight shortfalls. It can also demand collateral in addition to settlement account funding to ensure enough funds are available to avoid a freeze in payments.

This is solely because no single bank, not even the settlement bank, has a single picture of all ownership of funds. This means no single bank/CI/settlement bank can know the assets and balances of Commercial bank beyond what is held in the settlement account.

The only account the settlement bank can trust and access immediately is the settlement account of each Commercial bank held with it.

¹Netting is not done for RTGS payments. The Central bank typically owns the CI and runs it. It also acts as a settlement bank.

Ledger activities during the transfer



This is how individual ledgers will look like when transferring funds to/from other banks or units in a country or a currency. Same principle happens in cross-currency too.

Exhibit 2 – Ledger activities during transfer

Shortcomings in As-Is process

- Since no two banks can agree on a transaction based on their own ledger, SWIFT came into being to guarantee and confirm message transmission. Central banks operated as settlement agents to guarantee payments.
- SWIFT charges the Bank for processing the payment orders of both receiving and sending banks.
- Commercial banks' paid SWIFT about \$600mn to transmit 5.6bn payment messages between 10,800 institutions.
- Many of these are branches and subsidiaries of same bank group.
- Banks seek to reduce cost on payment processing and a good starting point is reduction or zero cost on transfers between subsidiaries.
- A trusted 3rd party with powers to overwrite and overturn ledger activities needed to have a unified view. In UK, the CI transmits the amounts due/from each bank at end of every settlement cycle. The BoE makes entries in the settlement accounts of each bank which is final and binding. This enforces a cost on the entire payments mechanism.
- A Central bank typically insists that commercial banks maintain massively funded settlement accounts with it to cover the payments due from the Commercial bank.
- Central banks play the role of arbitrator of ledger, guaranteeing payment with their central bank money. This results in high costs of payments and also forces the commercial banks to deposit and retain large sums of money in settlement accounts to cover payments via Central bank money.

Domestic transfer through the central bank (BoE) as example

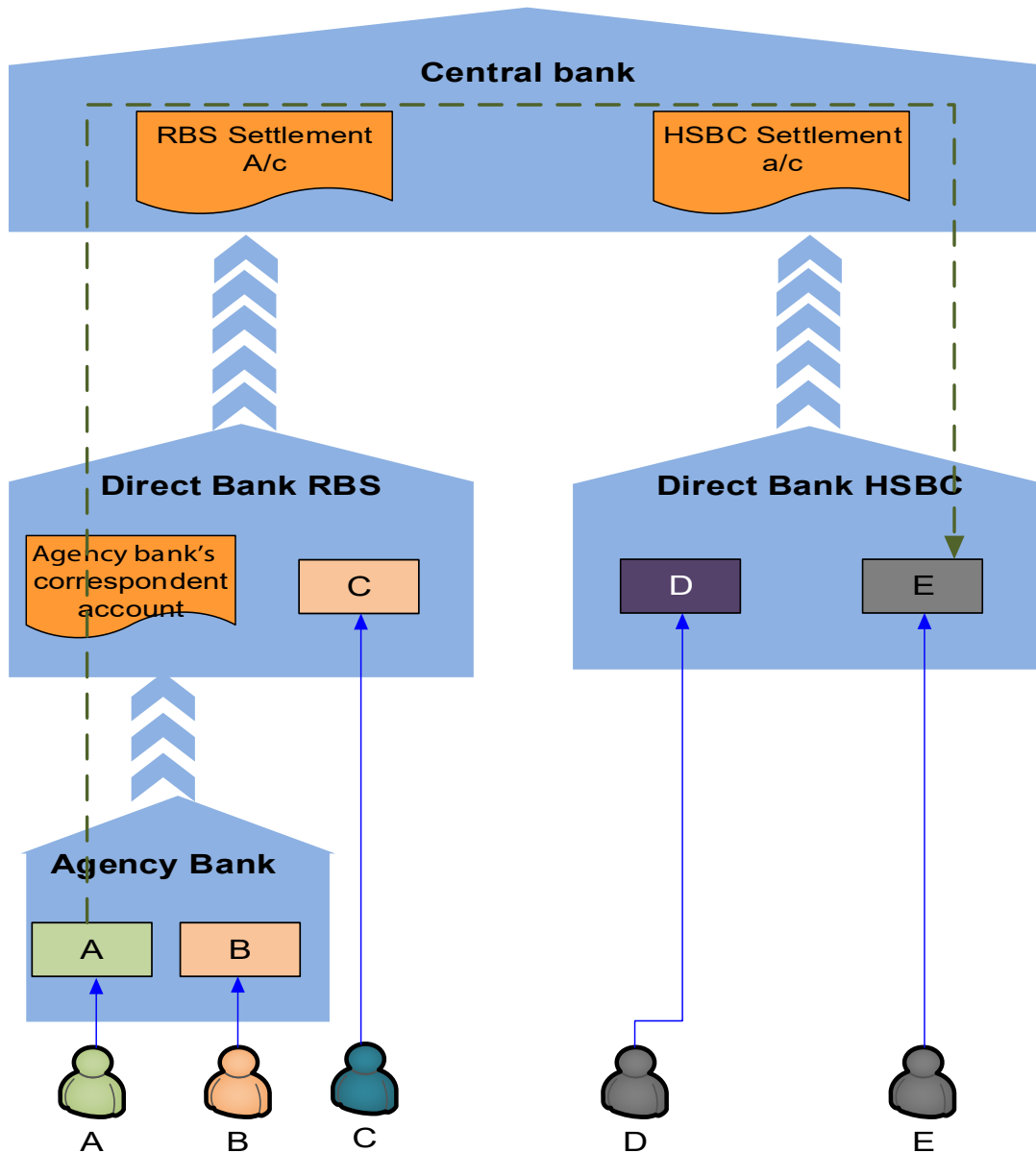
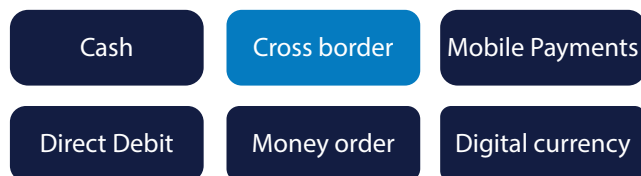


Exhibit 3 – domestic transfer through the central bank. Dotted line represents To-be

Value Proposition / Introduction to the Technology and Approach

Scope of coverage of instruments



The scope of instruments covered are outlined in blue. Those not in scope of this paper are outlined in gray background and white text.

Exhibit 4 – Scope of coverage of instruments



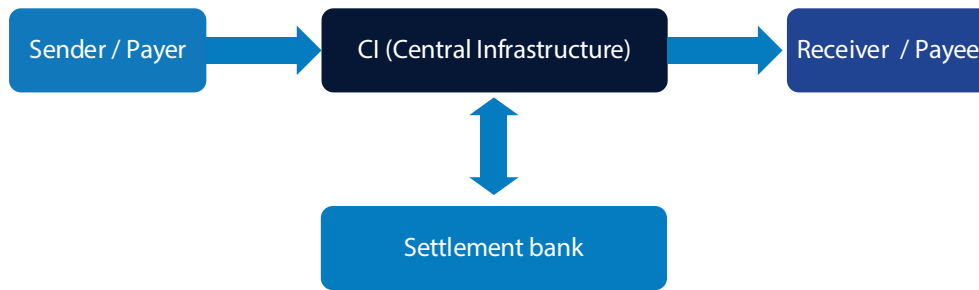


Exhibit 5 – The 4-Box model with Blockchain

A better way would be for a single view of the ledger of all participants, with the ledger state replicated between the participant banks, monitored by central bank. This approach needs to be tamper-proof, irrevocable and with a traceable

history.

The proposed technology concept is Blockchain. Blockchain can be used to implement a replicated ledger between Banks with all the safety measures listed above. This also makes it possible for

the banks to have a bilateral visible, immutable, transfer of value, adjudicated by the settlement agency. The central bank in this case would move away from the role of a settlement agency and instead act as an adjudicator.

Bank W & G		
Asset type	Counterparty	Amount owed(owing)
GBP	Bank RBS	1,000,000
GBP	Bank Barclays	5,000,000
GBP	Bank HSBC	5,000
GBP	Bank SCB	5,000

Bank RBS		
Asset type	Counterparty	Amount owed(owing)
GBP	Bank W&G	1,000,000
GBP	Bank Barclays	2,000,000
GBP	Bank HSBC	10,000
GBP	Bank SCB	5,000

Bank Barclays		
Asset type	Counterparty	Amount owed(owing)
GBP	Bank RBS	2,000,000
GBP	Bank W&G	5,000,000
GBP	Bank HSBC	1,000
GBP	Bank SCB	5,000

Bank HSBC		
Asset type	Counterparty	Amount owed(owing)
GBP	Bank RBS	10,000
GBP	Bank W&G	5,000
GBP	Bank Barclays	1,000

Bank SCB		
Asset type	Counterparty	Amount owed(owing)
GBP	Bank RBS	5,000
GBP	Bank W&G	5,000
GBP	Bank Barclays	1,000

Issuer	Holder	Asset	Amount
W&G	RBS	GBP	1,000,000
W&G	Bank SCB	GBP	5,000
RBS	Barclays	GBP	2,000,000
RBS	Bank HSBC	GBP	10,000
Barclays	W&G	GBP	5,000,000
Barclays	Bank HSBC	GBP	1,000
Barclays	Bank SCB	GBP	5,000
Bank HSBC	W&G	GBP	5,000
Bank SCB	RBS	GBP	5,000

Exhibit 6 – Single view of the ledger in a replicated blockchain.

Based on above examples, we can conclude that in a replicated ledger concept, A's bank initiates the payment, and customer E is

credited for value directly. BoE is operating as an adjudicator to ensure compliance and regulations are met. This reduces its

settlement risk. At present most RTGS payments worldwide, are done using SWIFT CUGs. E.g., CHAPS, FedWire, SMA, HKMA, etc.



Blockchain replicated ledger solution

This approach is to initially map a Blockchain ledger as a Virtual Ledger over existing ledgers of the bank. This way banks can utilize existing infrastructure

with minimal change and payments to other banks can process via SWIFT. Payments to same bank/recognized banks are converted to Blockchain Transactions and confirmations and posted to the distributed ledger. This is

picked up by all other distributed ledgers connected to each other and the data replicated. The transaction is processed by the concerned / targeted bank and the amount credited to the corporate/ business account.

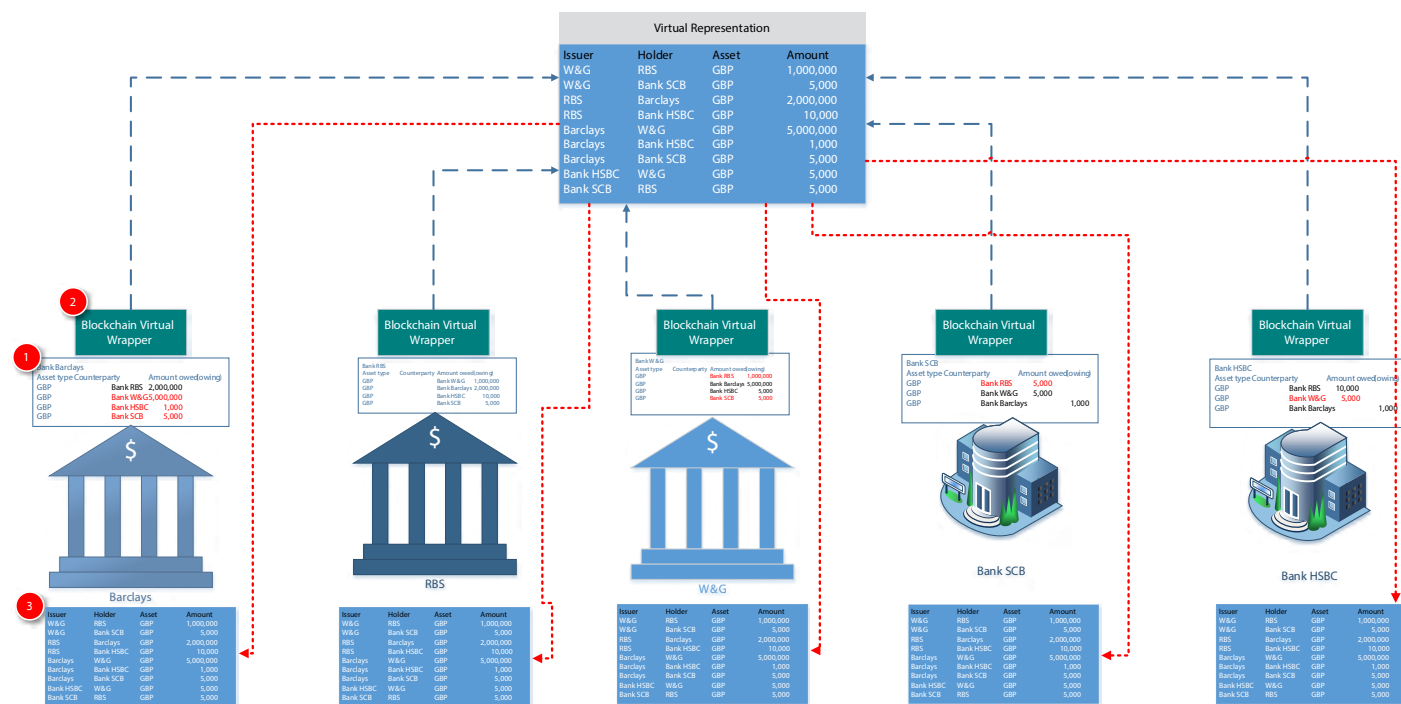


Exhibit 7 – Blockchain replicated ledger solution

In above diagram, each bank holds the entire history of changes to the ledger. So, no one bank will be able to double-spend or defraud others. Every transaction entered into the bank's own internal ledger is fed through the proposed Product, which acts as a Blackbox, and replicates the changes to

the ledger copies maintained by all other associated banks. This would enable each bank to see the exact balances available and to confirm or deny a Payment, without going through the convoluted approach of using SWIFT and correspondent banks and settlement accounts.

This proposed Blockchain-based product can be built as a ledger and can be incorporated into any Core Banking System, like Commercial bank to ensure banks operating with this CBS could opt for a Blockchain based ledger to reduce collateral and liquid funds needed at the central bank.



Why Blockchain in this scenario?

Blockchain based distributed database	Centralized ledger used currently
<p>No single centralized database. Blockchain is a database that contains all the payment history (ledger of activities) of banks connected to the product.</p> <p>This database is replicated across all banks so that all banks see the same picture.</p>	<p>A single centralized database</p>
<p>Architecture prevents revision or modification of data entered. You can add, but not delete or edit once entered.</p> <p>At any point of time you can activate or deactivate the entities (BICs) of the same Parent Bank.</p>	<p>Data can be edited and revised. Security precautions need to be taken to prevent that. That is why a trusted party maintains the central ledger (BoE or the Settlement Agency)</p>
<p>A Blockchain consists of Transactions which are created by Business Entity within the same parent Bank and sent into the system. Blocks are confirmations of those transactions which freeze the transaction. These blocks actually replace the SWIFT confirmations.</p>	<p>Ledger records the transfer of bills of currencies. A SWIFT order set provides unequivocal proof to both banks that the transaction was completed.</p>
<p>Every instance of the Database is synced with all others via the Blockchain protocol. This uses Blocks to confirm the transactions. Transactions and Blocks (confirmations) are part of the transmission and hence inherently secure.</p>	<p>A centralized ledger ensures a Master-Slave relationship between units and requires a high-cost data transmission. Data itself is insecure and needs to be secured separately.</p>
<p>Easier to add more bank branches and in fact more scalable as it grows</p>	<p>Cost rises exponentially to maintain a single central DB. Hence you have regional Data Centers.</p>

Conclusion

Changing Capital and Liquidity regulations force commercial banks to hold large funds in settlement and Nostro accounts. Payment transfer costs including SWIFT costs are increasing. The issue is the current independent ledger approach with each bank seeing its own view of the accounts. To overcome shortcomings of this 400-year approach, independent operators like Nostro accounts, ACH and Settlement accounts with central bank have risen. This document proposes an approach to a Product which can reduce cost of funds and payment costs by adopting a replicated ledger wrapper that ensures a single virtual ledger exists between correspondent banks. This ensures a single view of funds and ledger entries for all participant banks, and solves the 400-year-old problem in accounting and ledgers. This replicated ledger is proposed to be built using Blockchain as a protocol to ensure safety, irrevocability and visibility.



About the Authors



Anandasubramanian Pranatharthy

Principal Consultant

Anandasubramanian Pranatharthy is a Principal Consultant with the Infosys Commercial Banking Practice and is currently heading the Commercial banking Analytics practice. He has 19 years of consulting experience across the investment, corporate and retail banking value chains at CSFB, HSBC and RBS, with expertise in process innovation like Machine learning in banking, data analytics, payments and liquidity risk solutions (CHAPS, FPS) core banking revamp at RBS. He has also innovated a real-time pricing of corporate loans based on a MtM approach. He has recently won the FINOVATE award for the most innovative idea at Infosys in 2016. He is a Certified Banker and has a MBA in Banking & Finance. He can be reached at Anandasubramanian_P@infosys.com

Somdip Sinha

Senior Consultant

Somdip Sinha is a Senior Consultant with the Infosys Commercial Banking Practice and is currently working as a Payment and SWIFT Messaging Platform SME. He has around 10 years of consulting experience across the UK, USA, EUROPE, SINGAPORE, AUSTRALIA, CANADA Payments, Treasury Management, Liquidity Management, Cheque and Credit Clearing with expertise in process innovation and all kinds of SWIFT Messages (Like MT, MX, ISO8583, Bacs Standard 18 etc.). He has done his engineering in Computer Science and completed Executive Programme in Global Business Management from IIM Calcutta. He is a Six Sigma Green Belt certified professional as well as pursuing CSPO and FRM Part 1. He can be reached at somdip_sinha@infosys.com.



Karna Suresh Dange

Senior Associate Consultant

Karna Suresh Dange is a Senior Associate Consultant with the Infosys Commercial Banking Practice. He has more than 6 years of experience in Financial Services domain consulting and development projects across Corporate Banking, Risk Management and Capital Markets. He holds B.Tech and PGDM-Finance degrees and is a certified FRM. He can be reached at karnasuresh_dange@infosys.com. He has recently won the Commercial FINOVATE award for the most innovative idea at Infosys in 2016 along with Anandasubramanian Pranatharthy.

For more information, contact askus@infosys.com



© 2018 Infosys Limited, Bengaluru, India. All Rights Reserved. Infosys believes the information in this document is accurate as of its publication date; such information is subject to change without notice. Infosys acknowledges the proprietary rights of other companies to the trademarks, product names and such other intellectual property rights mentioned in this document. Except as expressly permitted, neither this documentation nor any part of it may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, printing, photocopying, recording or otherwise, without the prior permission of Infosys Limited and/ or any named intellectual property rights holders under this document.