Interim Report

gpi Nostro Proof of Concept

Can Distributed Ledger Technology finally pave the way for real-time Nostro reconciliation and liquidity optimisation?

Contents

Executive summary

Can Distributed Ledger Technology (DLT) – commonly known as Blockchain technology – help financial institutions optimise the liquidity of their Nostro accounts and reduce the significant operational costs associated with reconciliation?

This was the central question in mind when SWIFT – together with 33 leading global transaction banks – kicked-off a proof of concept (PoC) to use DLT to provide real-time visibility on Nostro accounts. Forming a key part of SWIFT's gpi strategic roadmap, the initiative began in January 2017 and is due to conclude at the end of the year.

Based on the business and technical requirements validated by PoC participant banks, SWIFT has developed a DLT Nostro solution consisting of a DLT application and ISO 20022 data model. The solution leverages the new gpi standards – including the unique end-to-end transaction reference – and integrates the Intraday Liquidity Standard developed with the Liquidity Implementation Task Force.

Participating PoC banks have tested thirty-four standard use cases using both the graphical user interface (GUI) of the DLT application, and the supporting back-office simulation tool.

The Nostro PoC was built within the SWIFT DLT sandbox environment – a use case agnostic DLT platform which enables experimentation and collaboration between SWIFT and its community. The environment is a first step towards a potential SWIFT DLT platform, combining leading distributed ledger technology, Hyperledger Fabric v1.0, with SWIFT assets to deliver a unique offering tailored to the needs of the financial industry. This leverages SWIFT's comprehensive governance and identification framework complemented by extensive controls guaranteeing confidentiality and security.

Preliminary results

Preliminary results from the PoC testing are encouraging for this business use case. The Nostro DLT application, combined with the underlying ISO 20022 data model, deliver the business functionalities and data richness required to support real-time liquidity monitoring and reconciliation. The DLT sandbox demonstrates significant progress in the underlying technology with regards to data confidentiality, governance and identification framework, when compared with the results of SWIFT's 2016 assessment of DLTs[1].

However, challenges do remain. The first conclusions demonstrate a clear difference from one financial institution to another in the potential value of a DLT-based solution. A value proposition for each player – catering for differing levels of sophistication, automation of operations and past investments – is yet to be developed and would be key to ensuring the industry-wide adoption.
Further work is also required to assess how to take full advantage of the DLT solution whilst minimising integration costs with legacy back-office applications. And, while significant progress has been made on the technology side, it is still early days for the latest generation of Blockchain technology, and, as such, it will be some time before it is mature enough for mission critical applications.

[1] SWIFT Position Paper on DLT - April 2016

Introduction - Industry background

Improving operational efficiency whilst reducing transactional costs for international payments has become one of the key priorities for banks to respond to, increasing customers' expectations, and regulatory requirements whilst maintaining their competitive position.

On average, 34% of the cost of an international transaction is related to Nostro trapped liquidity caused by the absence of real-time data that would better facilitate Nostro supply and demand. 9% of the cost, meanwhile, is linked to investigations or exceptions mainly driven by a lack of standardisation in the end-to-end payment's process and by the related Nostro account reconciliation[2].

Overfunding of Nostro accounts or alternatively excessive use of credit lines particularly regarding payments settled in a different time zone is mainly driven by the lack of visibility and predictability on intraday in and out flows.

A real-time information mechanism at transactional level would not only reduce costs by enabling liquidity optimisation; it would also enhance banks' ability to provide a better service to their customers by enabling earlier release of payments whilst reducing recalls and liquidity risks.

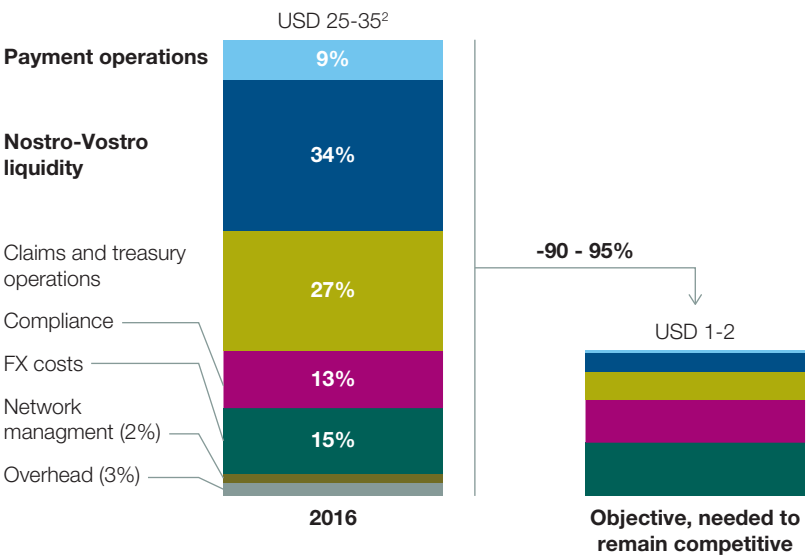
Many banks have initiated projects to implement real-time liquidity management that will deliver substantial benefits beyond their compliance with new regulatory requirements. These include financial savings such as lower funding costs and a reduction of related risks, especially during times of higher market volatility.

To achieve this, banks need the ability to monitor their intraday liquidity usage through a real-time confirmation of each entry on their various Nostro accounts, as well as improving their intraday forecasting through systematic early identification of incoming movements.

Real-time Nostro reconciliation is an integral part of this process, which requires timely matching of all movements on the account. It should enable banks to improve operational efficiency leading to a reduction in the cost related to open entries, including an end of day overdrawn balance or potential charges and interests.

To remain competitive, back office cost for international payment should drop by 90 to 95%

Cost per international payment transactiont



[2] Global Payments Report 2016, McKinsey

What are the main issues we are aiming to address?

Data gaps

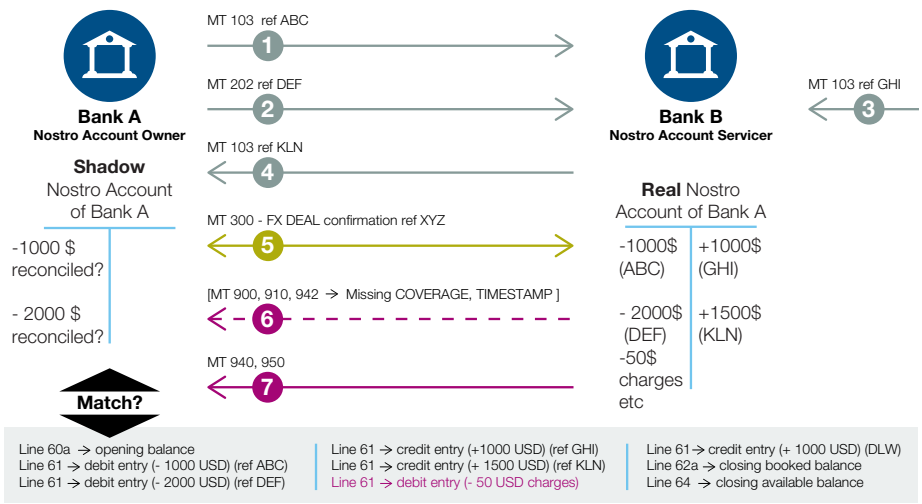
Real-time Nostro liquidity and reconciliation management requires banks to collect transaction-by-transaction debit and credit confirmations in real-time.

Despite the new intraday liquidity rules derived from the recommendations expressed by the Basel Committee on Banking Supervision (BCBS) 248 advocating for improvements in intra-day reporting industry, practice, there are still important data gaps.

Results of the last market consultation on intraday liquidity carried out at Sibos Geneva in October 2016, reveals that progress has been made though the industry is still facing data challenges:

- Too few transactions reported on a real-time basis (18% of responses)
- Lack of timeliness of the reporting (19% of responses)
- Lack of granularity of the information provided including the required time stamps (21% of responses)
- No business practice for the usage of credit notifications in support of intraday liquidity forecasting (15% of responses)

Many large account servicers have invested heavily in their real-time reporting capabilities for top currencies. However, the majority is still facing challenges to provide the real-time feeds requested by their customers for some transaction types. Any intraday projection from these Account owners will be based on their internal forecasting system and not on the timed confirmations from their account servicers. This will potentially have a substantial impact on their ability to calculate their real-time balance. Transactions leading to such issues will typically include book transfers with no underlying payment instruction, or cash entries related to transactions managed by other business lines such as payments related to corporate actions.



Simplified current Nostro flows

The lack of data centralisation and integration

A number of institutions have not yet centralised the management of their Nostro accounts.
Legal entities within the same group may use different payment hubs distributed around the world to send their instructions and receive confirmation messages from both their internal and external clearing service providers.

Treasury and reconciliation systems have, in most cases, not been integrated across regions and currencies. Being able to rely on a single source of aggregated data is a desired objective of larger institutions but there remains a data standardization and distribution challenge in order to build a view of real-time of positions at entity wide level for key currencies. The complexity and cost related to such projects represent major obstacles to their implementation.

Exceptions and investigations

Exceptions and investigations have a multiplier effect on the overall payment cost.

Issues related to pending transactions on Nostro accounts (payments and receipts that have not yet settled or cash receipts that have not been pre-advised) which are reported through the end of day statement are only identified towards the end of the day.

From a funding perspective, especially close to the cut-off for a specific currency, it is a key need for banks to identify potential pending transactions or unexpected ones.

Investigations related to post-settlement or to unmatched items (either unreconciled or unconfirmed entries) also result in a highly manual resolution process.
In treasury operations in particular, invoicing of both regular and exceptional payments processing fees based on bilateral price agreement leads to a complex monthly reconciliation process resulting in a number of expensive claims managed manually.

[3] BCBS – Basel Committee on Banking Supervision 248 – Monitoring tools for intraday liquidity management

How does the DLT PoC support the the gpi initiative and future development

gpi v1 (in production since January 2017) brings to corporate customers same day use of funds, transparency, traceability, and unaltered transmission of remittance data for their international payments. The improved visibility of payment statuses is also expected to reduce the volumes of investigations. Finally, it already provides the foundational layer thanks to the use by all gpi member banks of a Unique End-to-end Transaction Reference (UETR), to link the real-time status on the payments with the entry status on the related Nostro Account potentially leading to an impact on the intraday balances.

gpi v2 (scheduled for live deployment as from November 2018) is aimed at strengthening the value proposition with value added services including the ability to "stop-recall" a gpi payment directly with the bank holding the payment at that time or an "International Payment Assistant" improving end-to-end Straight-Through-Processing (STP) rate for cross border payments. It will provide intelligence at origin while remaining complementary to banks' current STP validations.

As from November 2018 gpi will also extend its value proposition for banks' liquidity management function through potential tracking of all payment types allowing for the identification of their incoming payments flows as soon as they have been initiated.

gpi v3 covered in this interim report, is the new technology innovation stream targeted at enhancing correspondent banking services and operational processes through the usage of the latest technology developments. This includes SWIFT's exploration of distributed ledgers for the real-time liquidity and reconciliation of Nostro accounts. Additionally, as part of the v3 stream, SWIFT launched the gpi Industry Challenge to encourage FinTech companies to build overlay services leveraging the gpi platform, solving incremental challenges faced by corporate treasurers.

Objectives and scope for the DLT PoC initiative

Business objectives

The aim of the PoC is to demonstrate whether such solution could help resolve the identified issues such as:

- Liquidity savings through an optimised real-time position management enabled through real-time visibility of the account's entries and by the monitoring of the related intraday expected and available balances;
- Operational savings through increased efficiency for Nostro reconciliation.

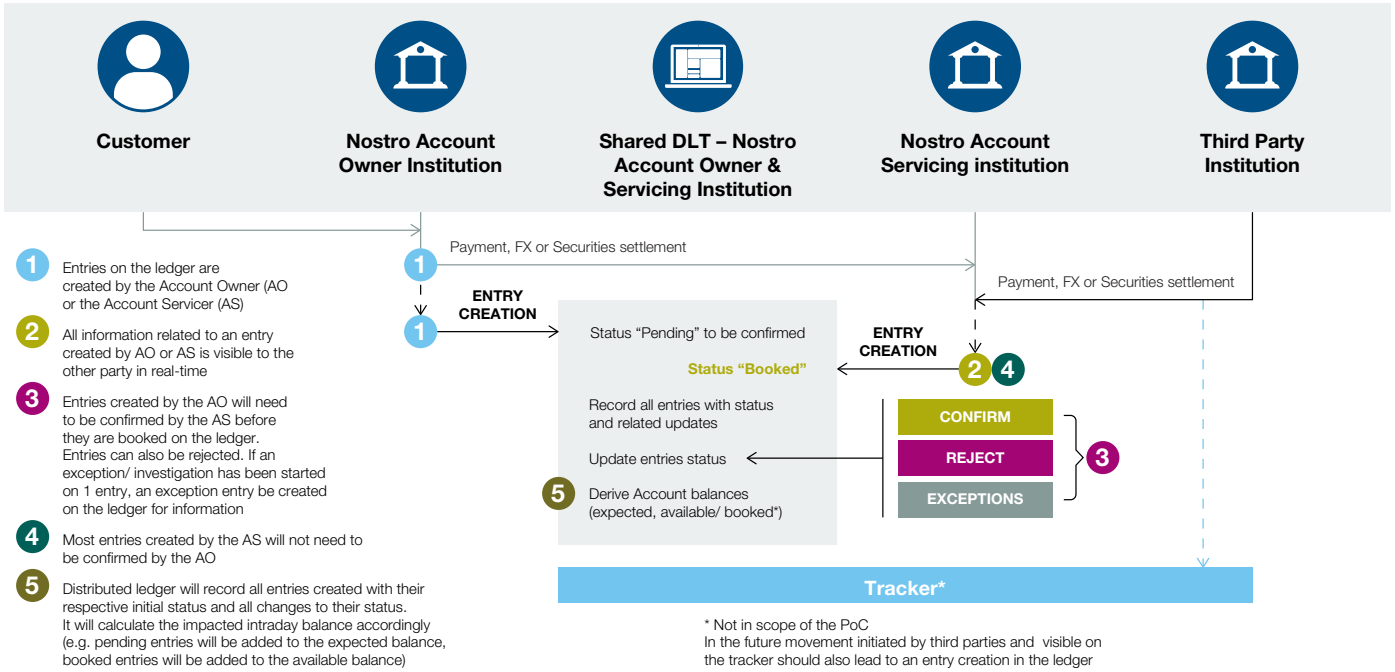
End-to-End Nostro account entries workflow

The PoC needs to demonstrate that the distributed ledger solution provides real-time visibility of relevant information for both the Account Owner and the Account Servicing Institutions related to:

- The status of a transaction entry in the Nostro Account as well as of any related account entries (e.g. charges);
- The status of the underlying payment processing that could have an impact on the entry status in the Nostro account (e.g. rejected payments or cancellations) or that could delay the booking process (e.g. payments under investigation or on hold);
- The impact on the related Nostro account intraday balance (expected and/ or available balance).
- All entries such as charges related to a same transaction (e.g. customer payment) shall be identifiable through the use of a common reference in order to support the reconciliation process.

The life cycle of entries in the DLT Nostro account should be directly synchronized with the payment process because any event in the payment process could have an impact on the related entry. Therefore the DLT solution and should cater for the creation of exceptions entries to identify close to real-time the underlying reason for pending entries. It should also enable the account owner to identify whether it could delay the confirmation process and have an impact on the intraday account balance.

The end-to-end account entries workflow concept (see figure below) was tested during the PoC for a representative number of transaction types and use cases.



DLT PoC End-to-End entries lifecycle

Audit trail

The distributed ledger needs to provide non-repudiation evidence for each entry on the account and would be used in a mutualised way as a trusted data source for liquidity and liquidity risk management, or even for regulatory reporting purposes. A full audit trail being automatically created would provide the evidence of the liquidity transfer in case of dispute or provide trusted underlying information in case of a regulatory investigation.

An important condition to support an audit trail of the entry in the ledger is the availability of a unique end-to-end transaction reference (UETR) for each entry in the shared ledger provided by either the Account Owner or the Account Servicer, depending on the use case.

Common Standards

A key success factor in an industry solution for real-time Nostro liquidity and reconciliation is the development of common standards created from a set of common business rules and technical specifications.

The data model of the PoC is based on the ISO 20022 standards and is aligned with the existing and newly developed gpi best practices and standards for payments and SWIFT Intraday Liquidity for Nostro reporting[4] .

A standard input to the shared ledger defines the data set and the format to be provided by participants to create, confirm or reject an entry. The standard includes a common time stamping model that distinguishes the creation time of an entry from its booking time or its value time.

[4] Please refer to SWIFT.com page about Intraday Liquidity Standard

Business Scope

Ten business dimensions have been identified for the development of a DLT based real-time Nostro liquidity and reconciliation solution. While any production solution would need to address those ten dimensions, the scope of the PoC has been limited to the key dimensions required to demonstrate the value of a transaction life cycle whilst ensuring the highest volume coverage.

Thirty four standard business use cases have been specified and developed to cover the selected dimensions and to be used as the reference for testing by all participants.

A number of detailed objective exit criteria have been agreed in relation to the identified business promises in scope for the PoC (see table in Annex).

Business dimensions	In scope for the PoC	Not in scope for the PoC
Roles	– Account Owner institution – Account Servicing Institution – Shared ledger with smart contract	– Tracker
Transaction entry	– Debit entry instructed by AO – Debit - funding other Nostro Account – Credit entry instructed by third party – Debit / credit enrty with no payment instruction – Debit entry instructed by AS (pre-agreed) – Debit entry instructed by AO	– Debit entry instructed by Third Party – Credit entry instructed by third party with COVER – Cheques clearing: single entry settled in bulk – Return / Reversal – Inward / Onward debit – Bulk Low value payments – Debit / credit advice
Charge entries	– OUR charges – Processing charges (CAT2) – Charges on payments excepions (e.g. repair)	– Charges billed on other Nostro – Rebate on Processing charges
Sub-entries	– Exception entry	– Credit interests – Debit interests – Negative Credit interests – Account's management
Account entry status	– Pending – Booked – Rejected	
Balanced Type	– Opening available – Closing available – interim available – Expected	– Opening booked – Closing booked – Interim Booked
FX		– FX indication in MT103
Role in payment chain	– Book entry – Non book entry	
Back / Forward entry	– Forward value entry	– Back value entry
Payment status		– Pending (ASCP) – Completed (ACSC) – Rejected (RJCT)

Technical objectives

At SWIFT we have been analysing and testing for some time now the potential application of distributed ledger technology in the financial industry. In April 2016 we conducted an in-depth assessment of DLTs which determined that the technology was not yet mature enough to fulfil the requirements of the financial community. While this conclusion still holds true today, we have seen a number of major advancements in the past year in the critical requirements that need to be addressed for the technology to achieve industry-wide adoption.

From a technology point of view, the objective of the Proof of Concept is threefold:

1. To assess whether DLT is the best fit for the use case - that is, ensuring that DLT can bring concrete benefits over other centralized or decentralized architectures
2. To assess whether these new technology advancements, combined with SWIFT assets, allow the fulfilment of key industry requirements such as governance, security and data privacy
3. To check the current level of maturity for production grade and mission critical financial applications.

Using the SWIFT DLT sandbox to meet the PoC technical requirements

The Nostro proof of concept has been built within the SWIFT DLT sandbox environment. The SWIFT DLT sandbox environment is a use case agnostic DLT platform which provides the foundations for building proof of concepts and experimenting together with the SWIFT community. It is a first step towards a potential SWIFT DLT platform, combining leading distributed ledger technology with SWIFT assets to deliver a unique offering tailored to the needs of the financial industry.

Hyperledger Fabric v1.0 was selected as the underlying technology for the SWIFT DLT sandbox for its support of the following features:

- It is a private permissioned ledger solution which is able to strictly control access to the blockchain.
- It supports selective data distribution, allowing not only secure data access but also physical data storage to relevant nodes only.
- It supports native integration with a certification authority, allowing for all access keys used for parties identification and transaction signing to be certified, providing trust in key authenticity and in the identity of parties.
- It provides a smart contract based platform – chaincode in Hyperledger Fabric terminology- that can be leveraged to implement business logic and workflows on the ledgers.

Next to those technical reasons, Hyperledger is an open source initiative driven primarily by the needs of the financial industry. SWIFT, as well as a number of the participants to the proof-of-concept, being Hyperledger members, makes the latter a good fit.

The SWIFT DLT sandbox has been built to meet 6 of the 8 industry requirements identified by SWIFT in its previous paper and illustrated in the above figure. The below section summarizes for each one of them:

- How this requirement is translated for Nostro reconciliation use case.
- How this requirement is being met in the proof of concept using SWIFT DLT sandbox.

Compliance with regulatory requirements and security are the last two industry requirements which were identified as part of SWIFT's position paper. The Proof of concept does not focus on those two aspects, primarily because we believe that the technology is too new to undergo a security assessment and the regulatory developments remain in their infancy.

[5] Development of the PoC started on Hyperledger Fabric v1.0 alpha. Migration to Hyperledger Fabric v1.0.1 was performed following its availability.

Requirements
Strong governance

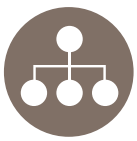
Requirement

Access to the solution must be restricted to the relevant institutions while updates and consultation of a particular account must only be allowed to the actual account owner or servicer. Furthermore, distinction shall be made between the privileges of an Nostro account owner and of its account servicer as for example only the account servicer must be able to effectively confirm a debit or a credit on the account once it has been successfully been processed.

DLT sandbox Implementation

2 types of users are defined – SWIFT and participants – with a different set of privileges. SWIFT users are responsible for the administrative and management function (e.g. user management and provisioning, creation of genesis block, smart contract provisioning) while the participants users have access to the actual business functionalities.

Participant Membership is managed through a Closed User Group (CUG) while a Role Based Access Control (RBAC) service defines business roles for participants in the CUG. Two roles have been defined - Account Owner and Servicer – and the combination of the participant identity together with the role assigned determines what actions are allowed. For example, only the Account Servicer may confirm a pending payment to effectively debit or credit the account. Both CUG and RBAC functionalities are implemented through chaincodes on the ledger.
The strict segregation between SWIFT and business participants together with the CUG and RBAC functionalities delivers a comprehensive governance framework where roles and responsibilities are clearly defined and strictly enforced.



Requirement

Access to the data about a particular Nostro/Vostro account must be granted only to the actual account owner and servicer. Next to securing access to the data, data must also be physically stored only on the nodes of the relevant parties – the account owner and its servicer – rather than disseminated through the entire network. Selective data distribution reduces the risk of malevolent access to the data as even the strongest encryption algorithms may not pass the test of time.

DLT sandbox Implementation

To ensure confidentiality of the Nostro accounts, the DLT sandbox relies on the following controls:

1. Access to a particular account is limited to its Owner and to its Servicer. The Account Owner and Account Servicer roles define the type of actions that can be performed on the account
2. Information about a particular Nostro account is only stored (and is only accessible) on the nodes of the account owner and of the account servicer and on the ordering service nodes. This is enforced using the "channel" functionality of Hyperledger Fabric v1.0. A channel is being defined for each bilateral business relationship; effectively creating a dedicated ledger storing all information related to the accounts those two institutions hold with each other. This generates a significant number of channels. If there are n participants, the theoretical maximum is n*(n-1)/2 channels if all participants have a business relationship with each other.
3. As part of the consensus process, a transaction on the Nostro account is only seen and approved by the account owner and the account servicer and checked by the ordering service which is operated by SWIFT.

Further to these 3 controls, encryption of the data was not implemented as part of the PoC for timing constraints but would be considered for any production implementation.

Requirements
Standardisation

Requirement

Existing MT and ISO 20022 standards providing transaction statement for Nostro account are widely used in the industry. To foster adoption of the solution and minimize the implementation cost, it was a key requirement to leverage existing standards to adapt them to a paradigm where information is shared between transaction parties rather than exchanged through messages.

DLT sandbox Implementation

The Nostro reconciliation proof of concept has been built leveraging existing business standards. In particular, the data model used to store all transactions on Nostro accounts is inspired by the ISO 20022 BankToCustomerStatement (camt.053). ISO 20022 was selected over the MT equivalent (MT950) for its increased richness and granularity. Data quality is an essential requirement to be able to improve transaction reconciliation, one of the key business objectives of the proof of concept.

Next to the data model, the business workflows supporting all 34 user cases covered as part of the proof of concept have been implemented using chaincode based on the ISO20022 standards and in line with the Liquidity Implementation Task Force rule book (LITF).

Thanks to the data model and the workflow being inspired by ISO 20022, API calls that have been defined to support the various interactions with the ledger have also been defined using ISO 20022 data elements. Although these were not exposed to participants of the proof of concept as all updates were done through a web interface, this would, enable easier integration and interoperability with back office applications which are becoming more ISO 20022 compatible.

Requirements
Identity framework

Requirement

Transactions posted on a Nostro accounts are very sensitive in nature and it is therefore critical to ensure a strong identity framework where parties are identified through a legal identifier such as the Business Identifier Code (BIC) or the Legal Entity Identifier (LEI). A neutral trusted third party is required to register participants and certify authenticity of security keys. The central registration authority ensures a much stronger identity framework compared to public blockchain models where identities are pseudo-anonymized and keys self-certified.

DLT sandbox Implementation

The DLT sandbox relies on a two level participant identification scheme whereby:

- Participants are identified and addressed through a legal identifier. The BIC was used as part of the proof-of-concept. Membership to the CUG is defined at the participant level.
- Keys used by participants to access/sign transactions are certified by a SWIFT controlled Certification Authority, through the issuance of Certificates. Those keys are tied to the participant through their distinguished name (DN) which contains the business identifier code identifying participant ownership for each of the keys.

Note that as part of the PoC, all keys used are stored on disk. For a production implementation, hardware security modules (HSM) that offer suitable protection against key theft would be considered.

Requirements
Reliability

Requirement

With DLT technology progressing, the main objective of the PoC as far as reliability is concerned is to:

1. Assess the technology maturity and stability and;
2. To assess the impact of running a DLT based solution for mission critical applications, taking into account the significant architectural changes undergone by DLT solutions to meet the needs of the financial industry.

DLT sandbox Implementation

To cater for the data privacy, strong identification and scalability requirements of the financial industry, the architecture of distributed ledger solutions had to adapt significantly. Emerging technologies are moving from fully distributed architecture to hybrid models whereby some of the components are distributed, others are centralized. Hyperledger Fabric is not different in that respect and that was reflected in the DLT sandbox. While the participant nodes storing information on the Nostro accounts are fully distributed, they rely on a number of "central" components operated by SWIFT.

In particular, the following infrastructure is operated by SWIFT:

- A set of nodes in charge of the user and role management. Those nodes have no access to data related to Nostro accounts
- A central certification authority in charge of issuing certificates and of maintaining a certificate revocation list.
- An ordering service in charge of ordering transactions, within a channel, into blocks

To ensure a resilient setup, resiliency for the participant nodes as well as for the SWIFT operated components was foreseen. For example, the ordering service was operated as a cluster of 4 nodes.

The resiliency of each participant relies on other nodes from the same participants, on the nodes of its accounts servicers/owners for the accounts it owns/services, or on the ordering service.

99,999%

Requirements
Scalability

Requirement

Scalability needs are very dependent of the use case. For Nostro reconciliation, the focus is on ensuring that DLT can provide real-time visibility on the Nostro accounts and that as such consensus is achieved within 5 seconds. The latency will need to remain stable as the number of Nostro/Vostro relationship increases quadratically as the number of parties grows.

DLT sandbox Implementation

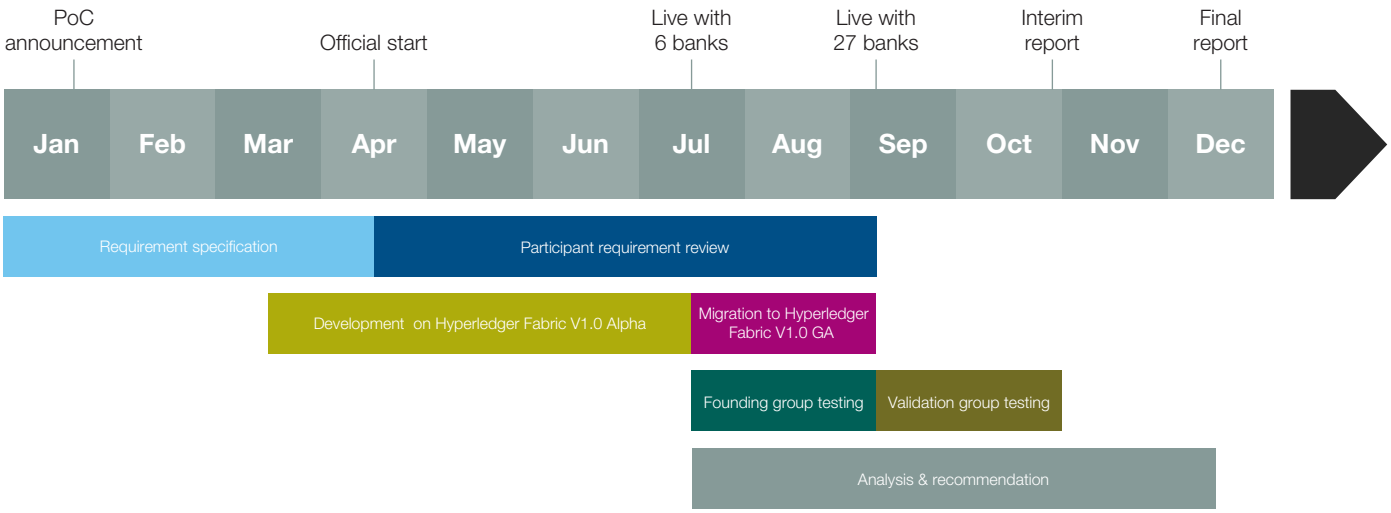
To make sure that consensus is reached within 5 seconds for each transaction, irrespective of participant location, the consensus algorithm parameters of the SWIFT DLT sandbox were fine-tuned so that consensus would take place every 2 seconds.

Further to that aspect, the DLT sandbox environment was scaled to support the number of participants (33) and of the related number of channels (528).

Testing strategy

Nostro reconciliation has been identified by the gpi Vision group as a priority use case for DLT exploration. SWIFT is therefore facilitating a collaborative approach and has engaged with a number of banks with an interest in this initiative. As a result this DLT proof of concept has been initiated in January of 2017.

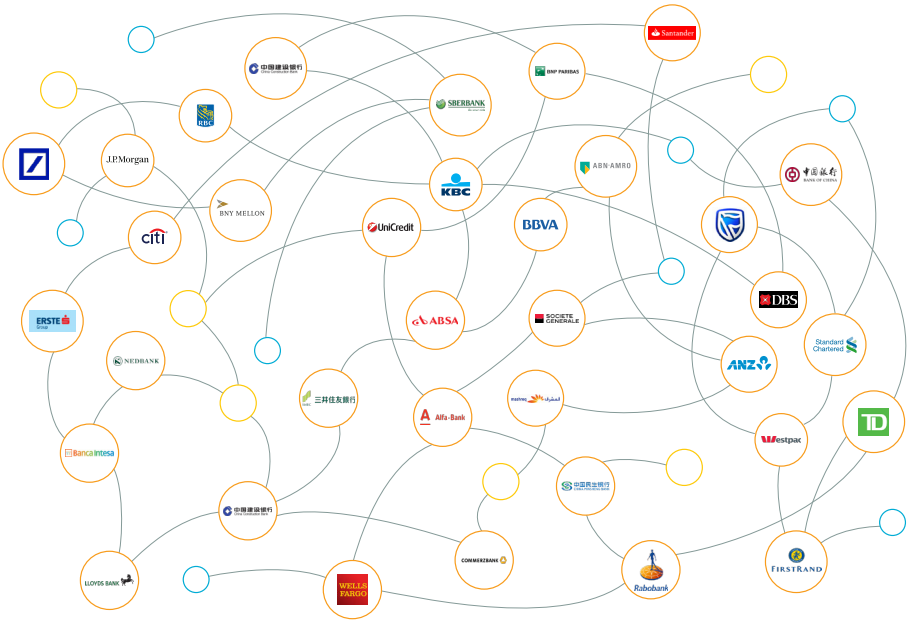
Timeline Summary



In total 33 banks are involved in the proof of concept segmented between two groups.

The initial 6 financial institutions formed the founding group with the goal of working with SWIFT to explore and define the standards, data model, business and functional specifications that would be the foundation of the concept application. The founding group were the first to test the application that they have contributed to design and their feedback and change requests enabled to improve the application prior to the start of final phase with the validation group in September.

The validation group of 27 financial institutions are tasked with executing the testing with the objective of providing independently generated results. The size of the group also provides an opportunity to see how the technology scales with the increase in number of Nostro relationships.



Business validation

Testing primarily aims to demonstrate across a set of representative standard business use cases that the concept meets its functional requirements and can bring real business value for both the liquidity and reconciliation processes. Qualification of the related benefits is done individually by participants and collected through a business validation questionnaire and individual review meetings.

In addition participants are being asked to validate the 34 standard use cases and to check functional completeness of the data model and of the DLT based application. Participants were asked to confirm potential liquidity savings that could be derived from the real-time monitoring of liquidity positions across accounts provided by such shared ledger solution. Therefore participants are requested to test obfuscated real production data for one or several days and compare the current situation with a simulation of the real-time based scenario.
By doing so participants can:

a. Evaluate the impact on the intraday balance peaks and troughs, and their associated timings and potential mismatches between credit and debit entries;
b. Identify with other participating banks on the potential liquidity savings.

Technical testing

The technical testing focused on validating whether the underlying Hyperledger Fabric technology is able to meet the PoC technical requirements in terms of governance, data controls, standardization, identification framework, reliability and scalability.
Next to that, throughout the development and testing of the proof of concept, objective was also to test the maturity of Hyperledger Fabric v1 and its readiness for mission critical financial applications and to understand the impact it would have for SWIFT and for its participants.

Thirdly, a theoretical integration impact assessment was completed by the banks to evaluate the integration of a Nostro overlay solution and how this may impact their current systems. This allows SWIFT to evaluate where the current technical gaps are and the readiness of participating institutions.

Preliminary conclusions for the DLT PoC

At the time of issuance of this report, the PoC is still ongoing with the validation group. Preliminary conclusions can already be shared based on the testing and input provided by the six founding banks.

Adequacy of the DLT based Nostro solution as defined by the functional requirements

Testing of the thirty four standard use cases by the six banks of the DLT PoC founding group demonstrated that the DLT PoC application delivered the expected business functionalities. It also confirms that the ISO 20022 data model provided the required data richness to support both real-time liquidity monitoring and reconciliation.

For liquidity, the DLT based solution provides real-time visibility across accounts to both the account owner and the account servicer on account's entries status, derived expected and available account balances and timed data.

For reconciliation, the solution enables for real-time simplified account entries confirmation, identification of pending entries and potential related issues and an allocation of charge entries to a specific payment.

Value of DLT solution will depend on bank's liquidity management capabilities, level of automation and centralisation

Aside from the lack of maturity on the technology side, banks from the founding group expect the implementation impact of a DLT based Nostro solution to be substantial at the level of the industry.

The value for a DLT based Nostro solution is inherently additive to the benefits provided by the gpi tracker in capturing of the essential accounting elements. The challenge however is the requirement for completeness since balance computations are only relevant when all transactions are available.

The final value proposition of a DLT based solution will depend on bank's settlement model for their key currencies, their individual existing model to access intraday liquidity data and their level of internal liquidity monitoring and management process automation.

Global transaction banks are usually are relying on their own internal entities for the settlement of their payments in key currencies representing the largest share of a bank's liquidity at group level. In most cases these banks have implemented a real-time automated data capture from the different high value payments settlement systems to which they are connected. They have also built transactional databases which are not only leveraged to feed in real-time their internal sophisticated liquidity tools but also to provide services to their different types of customers (both financial institutions and corporates or retail customers).

The added value from a real-time enabled DLT solution as a liquidity user for these banks would therefore be rather limited unless they don't have a centralised and aggregated view or are not feeding their internal entities in real time.

The value of a DLT shared ledger solution will be higher for mid-tier banks that settle a very large share of their payments through various Nostro Account Servicers and have not yet implemented a real-time liquidity monitoring solution for these flows. It is felt that the DLT based solution could provide these banks with a cost effective real-time liquidity and reconciliation capability. SWIFT would hereby automate the population of key transactional data from the tracker and help complementing with feeds coming from their back office systems.

A "one size fits all" DLT solution will not work

Larger financial institutions who have made substantial investments in existing real-time reporting and messaging will be reluctant to duplicate the efforts to integrate data feeds into DLT nodes. For these banks as well as for their larger financial institution customers, adding these intraday reporting messaging flows or their ISO equivalent to the gpi Payments Tracker capability through the use of the same UETR as the underlying payments would be less impactful than replacing all the messaging flows by API calls sent to a multitude of DLT nodes.

There is a need for a clear segmentation with an implementation model that best integrates with existing operations and leverages the central gpi tracker infrastructure to minimize the impact and ensure the value of the DLT based elements can be grasped.

The integration of DLT technology in the correspondent banking space can only follow an incremental path, avoiding disruption and preventing for the need large service providers to subsidy a large part of the industry deployment. In addition, to support industry adoption there will be a need to develop a collaborative service with a common rule book and technical specifications based on agreed standards.

From that perspective the underlying technology should not be a factor in determining if the solution is fit for purpose. Additionally from a service consumption point of view, any final solution would be presented through the usual messaging or API interface with the underlying DLT technology upon which it is based being completely transparent to the consumer.

New hybrid DLT architectures bring significant progress but it is still early days

Although technology assessment is not finished, the DLT sandbox demonstrated significant progress of DLT towards maturity, especially with regards to data confidentiality, governance, identification framework and scalability. The DLT sandbox provides a very strong governance framework where access is controlled and where roles define what actions participants can perform. Selective data distribution ensures that data is stored only on the peers having a stake in the transaction guaranteeing data confidentiality. Participants are identified through their BIC and their PKI keys are certified by SWIFT certification authority ensuring a very strong identity framework. Moreover, the Hyperledger Fabric v1 consensus algorithm demonstrated a very low latency and promises to support very high throughput.

While significant progress has been made on the technology side, one must realize that it is still early days for the newer generation of blockchain. These new solutions have a very different architecture, moving towards a hybrid model where some components are distributed and where others are centralized and operated by a neutral third party. The architectural decisions bring significant advantages as they are tailored for the financial industry but their impact also needs to be carefully assessed.

Data resiliency in particular becomes more complex. Since data is physically segregated to ensure data confidentiality, one node can no longer recover from any node. Instead, it will need to rely either on some local resiliency setup within its own institution, on its counterparty's nodes or on a central service (such as the ordering service in Hyperledger Fabric). Another area for investigation is linked to the smart contracts versioning. As smart contracts need to be installed on each peer and instantiated in each and every channel rather than deployed only once, it may bring new operational challenges in case a smart contract update is required to ensure version consistency amongst the peers. SWIFT will be looking at assessing those points during the remainder of the testing.

Next steps

SWIFT is currently working with the validation group of banks to complete the testing programme by November 2017 and will release a whitepaper with its final conclusions in December 2017. The paper will:

- Provide final conclusions on the viability of DLT as a means to eliminate reconciliation and boost real-time liquidity capability for bank and on pro's and con's compared to potential alternatives;
- Share SWIFT's technical experience in using Hyperledger Fabric as the underlying DLT technology stack to support this use case;
- Provide high level view on whether and how such DLT solution could fit with the wider gpi initiative.

Annex

Requirement	PoC scope
Transparency: increase visibility of a transaction entry status and allow for an early identification of an issue that could have an impact on the account's position	Demonstrate provision of real time transaction entry status by the shared ledger according to the agreed standard based on input/ action by the Account Owner and Servicing Institutions according to the test cases in scope for the PoC. Time stamps will be provided for each update.
Real-time visibility of account's balances	Demonstrate that intraday and the end of day balances are derived in real-time by the shared ledger and visible to both the Account Owner and Account Servicer based on entry status creation, confirmation or rejection as per the defined use cases.
Reduce the number of manual investigations related to charges	Demonstrate that the PoC provides the foundational layer to decrease the number of investigations related to the charges entries on the Nostro account thanks to its audit trail functionality and identify which would be the required integration or smart contract developed required to grasp the full value of this benefit
Reduce the number of investigations related to being Unable to Apply on the Nostro Account	Demonstrate that entry creation on the shared ledger by the Account Owner simultaneously with the payment instruction prevents the loss of data through data truncation and that the creation or the confirmation of an entry by the Account servicer based on the UETR will help reduce the number of investigations for the Account Owner related to un-matched entries.
Accuracy of the values and data derived in the shared ledger	Demonstrate transaction entry details and value processed through the distributed ledger is consistent with the data input (e.g. CSV file) from participants. Participants will also verify that entries status and related intraday balance are derived correctly according to the defined standard.
Support of life-cycle transaction concept	Demonstrate that the shared ledger provides a full audit trail of entries lifecycle according to the defined standards for each standard use cases.
Intraday liquidity usage curve	DLT GUI In full…should update in real-time the intraday liquidity curves respectively for the expected and the available balances based on each status update to an entry on the account with an impact on the balance as per the standard user case.
Support of intraday liquidity forecasting	Establish through the manual testing of the standard use cases the evidence that the solution provides a more accurate real-time liquidity forecasting through a systematic use of expected entries (notifications) by both the Account Owner and Servicer based.
Intraday liquidity savings	PoC testing should provide the evidence on a number of liquidity benefits through a real-time monitoring of Nostro Account's entries and balances. Next to a qualitative evaluation of the benefits through manual testing of the standard use cases, a number of participants will also run a more quantitative test to look at the potential impact on the visibility of intraday liquidity position/ curve by testing the "AS IS" and the "FUTURE" scenarios: – From a time bucket vision to real-time vision: difference in Real Time balance & peaks calculations – Identification of imbalances between credit/ debit entries and of opportunities for funding optimisation – Visibility on credit lines usage – Better data for intraday liquidity forecasting. – Participants will be able to make further analysis/ calculations on expected liquidity benefits based on their current level of reporting for each service provider.

About SWIFT

SWIFT is a global member-owned cooperative and the world's leading provider of secure financial messaging services. We provide our community with a platform for messaging and standards for communicating, and we offer products and services to facilitate access and integration, identification, analysis and financial crime compliance.

Our messaging platform, products and services connect more than 11,000 banking and securities organisations, market infrastructures and corporate customers in more than 200 countries and territories, enabling them to communicate securely and exchange standardised financial messages in a reliable way.

As their trusted provider, we facilitate global and local financial flows, support trade and commerce all around the world; we relentlessly pursue operational excellence and continually seek ways to lower costs, reduce risks and eliminate operational inefficiencies.

Headquartered in Belgium, SWIFT's international governance and oversight reinforces the neutral, global character of its cooperative structure. SWIFT's global office network ensures an active presence in all the major financial centres.

To find out more about SWIFT's work on distributed ledger technologies, please contact DLT@swift.com

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Disclaimer

This report is an interim report and does not contain any final conclusions. The final report will be published in December 2017. Moreover, the views expressed in this report are SWIFT's views and interpretation of the first results arising out of the PoC and do not necessarily reflect all individual participating bank's views.

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