



## RTGS Renewal Programme Proof of Concept: Supporting DLT Settlement Models

### Introduction

In May 2017 the Bank of England set out the Blueprint for a renewed Real-Time Gross Settlement (RTGS) service that will deliver a resilient, flexible and innovative sterling payment system for the United Kingdom to meet the challenges posed by a rapidly changing landscape<sup>1</sup>. In the Blueprint, the Bank stated that the renewed RTGS service would offer a diverse and flexible range of settlement models, to enable existing and emerging payment infrastructures to access central bank money.

On 27 March 2018 the Bank announced that it was running a Proof of Concept (POC) with Baton Systems (Baton), Clearmatics Technologies Ltd (Clearmatics), R3 and Token<sup>2</sup>. The purpose was to understand how a renewed RTGS service could be capable of supporting settlement in systems operating on innovative payment technologies, such as those built on Distributed Ledger Technology (DLT). The outcomes of that work are summarised in this document.

All participants confirmed that the functionality offered by the renewed RTGS service would enable their systems to connect and to achieve settlement in central bank money. A number of recommendations were received to ensure optimal access to central bank money. Based on these recommendations the Bank will:

- Consider how different account structures could be used in the renewed RTGS service;
- Investigate whether the renewed RTGS service could provide and consume acceptable forms of cryptographic proofs; and
- Continue to engage with Fintech firms to keep up to date with innovation in payment technology.

### The purpose of the POC

The Bank ran the POC to understand how the renewed RTGS service could support settlement for systems operating on innovative payment technologies, such as those built on DLT. By understanding the different approaches that future payment systems may use for settlement, the Bank can facilitate capability for the renewed RTGS service to interface with new technologies as and when they are developed to provide sterling payment services.

The primary aims of the POC were to understand:

- Whether the planned prefunded settlement functionality would enable settlement platforms using innovative technology to access central bank money in the renewed RTGS service; and
- What additional functionality the renewed RTGS service would need to provide in order to enable platforms using innovative technology to optimise their access to central bank money settlement.

---

<sup>1</sup> See <https://www.bankofengland.co.uk/paper/2017/a-blueprint-for-a-new-rtgs-service-for-the-uk>

<sup>2</sup> See <https://www.bankofengland.co.uk/news/2018/march/rtgs-renewal-proof-of-concept>



The POC was used to explore the functionality of a renewed RTGS service and assess generic demands that may be placed on the system. The legal and regulatory perspectives of connecting RTGS to different settlement platforms were out of scope of the POC, as was any assessment of the viability of participants' platforms.

### Box 1: Settlement models in RTGS

The Bank currently supports four settlement models for payment systems (schemes): real-time gross settlement, delivery versus payment, and prefunded and unfunded models for deferred net settlement (DNS). Further detail, including the Bank's Settlement Account Policy can be found on the Bank's website\*.

This POC focused on DNS with prefunding, which is the settlement model in RTGS that we feel is most relevant to emerging payment infrastructures.

#### Deferred Net Settlement

Schemes settle obligations between participants periodically in batches on a net basis through RTGS. In the periods between settlement cycles, potential settlement risk can arise between direct participants.

**DNS with prefunding:** The introduction of prefunding in 2015 eliminated settlement risk in certain systems by capping the maximum net obligations of participants in the system and by requiring members to hold funds in a segregated account in RTGS equal to that cap, guaranteeing the fulfilment of the participants' net obligations.

This model is currently used by Bacs, Faster Payments and Cheque and Credit.

\*See <https://www.bankofengland.co.uk/payment-and-settlement>

### How the POC worked: cloud-based test RTGS service

The POC used a cloud-based test RTGS service, which is separate from live Bank systems. No live data was used, and no access to live RTGS was given. POC participants were able to interact with this service through an application programming interface (API). The setup enabled POC participants to test prefunded deferred net settlement (see Box 1) as part of their business operations. During the test the participants acted as both a payment scheme and as an RTGS member using that payment scheme. Participants were able to move funds between accounts and fund and defund collateral accounts. When funding and defunding it was important to ensure balances in RTGS and the payment scheme were fully aligned. Payments were then made within the participant's payment scheme, resulting in net exposures between RTGS members which couldn't exceed the level of funds held by those members' in RTGS. The participant then originated a settlement message from the scheme to settle net exposures.



Participants interacted with the POC in different ways. Detail on the solutions can be found in Table 1.

## Limitations identified

Some participants asked whether the renewed RTGS service could have a more flexible approach to account structure to cater to new settlement models being developed. For example, one participant highlighted a preference to operate through a single-account structure, rather than settling through a separate account for each member. Under this model, members would fund (or defund) a single account dedicated to the scheme, increasing (or decreasing) the amount of central bank money in that account. Transfer of fund ownership would occur on the scheme's systems, with the scheme maintaining the record of ownership of funds within the single account.

Two participants used an intermediary interface to settle over RTGS. The interface was designed to fulfil some actions not provided by the cloud RTGS functionality, including translating messages between RTGS and the participant's system, and providing proof of transfer of funds. Participants noted that this setup reintroduced some of the problems that innovative technologies are looking to solve: in particular, the existence of unnecessary points of trust and failure in the network. This issue could potentially be mitigated if the RTGS service was capable of supplying a cryptographic proof.

Participants also highlighted the importance of continued engagement with Fintech firms, noting the need for the Bank to continue to keep pace with developments in technology and payment system innovation.



Table 1: Participant solutions

Baton	<p>Baton connected their DLT-based platform to the API and simulated the ability to process settlements on behalf of members.</p> <p>Baton demonstrated the ability to set minimum balances, make margin payments, fund and defund accounts, and settle obligations using central bank money, reconciling balances between their ledger and RTGS. Baton additionally demonstrated both bilateral and multilateral net settlement of trades processed through their ledger. Baton also demonstrated the capability of a regulatory node to view market risks in real-time.</p> <p>Baton provided feedback on further developments of the model, including the use of synchronisation functionality and continued interaction between the Bank and the developer community.</p>	<p><b>Clearmatics</b></p> <p>Clearmatics connected to the API to investigate interoperability of their DLT platform and proposed RTGS functionality.</p> <p>They were able to test funding and defunding of RTGS collateral accounts, reflecting these movements on their ledger. Clearmatics could then simulate trades between account holders on their DLT system and apply the net settlement to RTGS accounts.</p> <p>In order to connect to RTGS, Clearmatics developed an additional interface. This interface sat between RTGS and Clearmatics' system and generated appropriate messages to allow the two systems to interact.</p> <p>Clearmatics provided feedback on account structures and also on how the provision of cryptographic signatures and certain proof schemes may allow providers to build truly decentralised systems.</p>
R3	<p>R3 based their recommendations on analysis of materials on RTGS functionality provided by the Bank and did not build a solution to connect physically to the API.</p> <p>R3 mapped a design that would connect Corda (R3's DLT-based platform) to RTGS functionality via an 'oracle'. R3 feedback included noting that a DLT platform could interact with RTGS more efficiently if the Bank ran a node on the network or if a cryptographic proof was provided to show that a particular transaction had occurred.</p>	<p><b>Token</b></p> <p>Token based their recommendations on analysis of materials on RTGS functionality provided by the Bank and did not build a solution to connect physically to the API.</p> <p>Token framework runs a centralised ledger, rather than being underpinned by DLT. But they noted that this would not preclude them from being able to connect to the functionality provided and enable onward settlement.</p> <p>Token provided feedback on the account structure, in particular how settlement and collateralisation accounts interact.</p>



## How the Renewal Programme has been informed by the POC

Based on feedback from the POC the RTGS Renewal Programme will:

- Consider how different account structures, including a single-account structure, could be used in the renewed RTGS service. The account structure influences legal and regulatory treatment of funds, as well as how a payment system is structured.
- Investigate whether the renewed RTGS service can provide and consume acceptable forms of cryptographic proofs. This is not intended to be available in an early phase of the Programme, but the Bank will investigate how cryptographic proofs could fit into the design of RTGS architecture. The Bank will monitor changes in methodologies and evolving technology for cryptographic proofs (see Box 2).
- Continue to engage with Fintech firms throughout the life of the programme to maintain an understanding of how technology developments and approaches to payment systems will change the demands on RTGS.

For the latest information on the RTGS Renewal Programme please visit the Bank's website or contact the team by emailing [RTGSEngagement@bankofengland.co.uk](mailto:RTGSEngagement@bankofengland.co.uk).

### Box 2: Cryptographic Proofs

A cryptographic proof uses a combination of functions to ensure trust in systems and between parties. A cryptographic proof can be used for user authentication and to protect data from theft or alteration. There are three key stages of enabling cryptographic proofs:

1. **A Proof of identity** uses cryptography (through private or public 'keys') to provide assurance that a message was sent by the stated party.
2. **Attestation state** ensures that a party can make a statement about something they know about another party. But this introduces a risk. Although it is cryptographically possible to verify that the statement was made by a specific party, it is not possible to verify that what they have stated is actually accurate.
3. **Proof of state** ensures that the recipient of the information can verify that a statement is accurate, without requiring access to the underlying data.