



BANK OF ENGLAND

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A new RTGS service for the United Kingdom: safeguarding stability, enabling innovation

A Consultation Paper

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Introduction and executive summary

1 This consultation document seeks respondents' views on the Bank of England's vision for the next generation of its Real-Time Gross Settlement (RTGS) service.

2 RTGS is not a household name. But as the platform for providing sterling central bank reserves — the electronic counterpart to banknotes, and the ultimate risk-free means of final payment — RTGS lies at the very heart of delivering the Bank's mission for monetary and financial stability. The stock of reserves in the system is currently more than £300 billion — five times that of banknotes. Those reserves are used to provide safe final settlement in central bank money for over half a trillion pounds of transactions a day between banks participating in the seven most systemically important sterling payment systems — equivalent to almost a third of the United Kingdom's annual GDP. Those transactions span, or back, almost every payment in the UK economy — from salaries to company invoices, from car purchases to coffee sales, from pensions to investment flows.

3 Central bank reserves also play a key role in monetary policy — the interest rate paid on reserves is Bank Rate, the rate set by the Monetary Policy Committee in pursuit of the inflation target, which in turn affects every other interest rate in the economy. And other tools of monetary policy, including the recently announced purchase programmes for gilts and corporate bonds and the Term Funding Scheme, involve the creation of reserves held in return for other financial assets. RTGS enables all of this to happen. So its effective operation matters to everyone in the United Kingdom.

4 Earlier this year, as RTGS approached its 20th birthday, the Bank announced its intention to draw up a blueprint for a new generation of RTGS, capable of supporting the future demands placed on it by a rapidly changing environment.⁽¹⁾ Since then, a dedicated Review team has consulted with a wide range of stakeholders, including current and potential future users of the system, UK and overseas authorities, infrastructure providers, academic and industry experts, commentators and broader public interest groups (listed in Annex 2). This document combines the results of that preliminary outreach with the Bank's own internal analysis and policy deliberations to present a high-level vision for the future RTGS service, on which the Bank is now seeking feedback.

5 The Bank's preliminary outreach yielded two key findings. The first was that **RTGS is seen to have served its original**

purposes well, making a material contribution to financial stability in the United Kingdom, and delivering a range of functionality and risk mitigants that compares favourably to similar services in other jurisdictions.⁽²⁾ In light of that, stakeholders wished to see many of its core policy principles replicated in the new service. In particular, they strongly encouraged the Bank to retain as its primary aim the maintenance of the stability of the payments system as a whole, through the provision of a highly reliable, resilient and robust method of providing real-time gross settlement in central bank money of the largest, most system-critical, payments in the economy.

6 There was strong support for the major risk-mitigating policy changes made over the lifespan of RTGS, including: the elimination of deferred net settlement for wholesale payments and the introduction of 'prefunding' in central bank money for two major retail payment schemes; the introduction of 'Delivery versus Payment' for sterling securities transactions via CREST; the adoption of a 'non-similar' third contingency site; and the introduction of a 'Liquidity Saving Mechanism' allowing users to economise on liquidity usage in CHAPS, the UK's High-Value Payment System. The Bank agrees that these functions, re-engineered as necessary for any new technical architecture, should be a core part of the new vision. An overview of the current RTGS service is given in Section 1.

7 Most stakeholders felt that, if the future demands on RTGS were static, the service could probably continue in its current form for some time. But those demands are far from static: the pace of change has picked up sharply — in the needs of the broader payment ecosystem (both nationally and internationally), in the shape of the financial system as a whole, and in the evolving requirements of regulation and monetary policy. The capacity of the current RTGS architecture to respond to that change is limited, posing a number of risks. First, an impaired ability to adapt to changing demands could lead to a reversal in the proportion of payments settled in central bank money, harming financial stability. Second, it could impede stability-enhancing innovation and competition. And, third, it could increase the risks of a future diminution in service quality — whether in

(1) 'A new heart for a changing payments system', January 2016, available at www.bankofengland.co.uk/publications/Documents/speeches/2016/speech878.pdf.
 (2) See for instance the international comparisons in Olivares, A and Tompkins, M (2016), 'Clearing and settlement systems from around the world: a qualitative analysis', available at www.payments.ca/industry-info/our-research/.

terms of meeting the needs of users, or of operational continuity. In light of these considerations, stakeholders agreed that **now was the right time for the Bank to develop a blueprint for the next generation of RTGS.**

8 In choosing a package of change to put forward for consultation, the Bank has had primary regard to its responsibilities for maintaining monetary and financial stability, recognising that RTGS is the main tool through which it provides access to its balance sheet, including secured central bank liquidity facilities. But wherever it can be done without impairing stability, the Bank has also chosen proposals judged likely to promote efficiency, innovation and competition in sterling payments arrangements — both as a contributor to the UK's medium-term economic prospects, and as a means of promoting financial stability, by reducing market concentration, identifying new risk-reducing technologies, and increasing the scope for electronic settlement in central bank money. That is consistent with the Bank's strategy for financial innovation,⁽¹⁾ and the broader policy ambitions of the UK authorities.

9 In support of the Review's aims, the Bank has sought to identify proposals for the future RTGS service that are simple (to develop, operate and use), flexible (in response to changing future demands) and cost effective (both for the Bank, and for the service users and the wider system). Where these conflict, stability and resilience always take precedence. But where different combinations are possible without harming stability (for example, greater flexibility at the expense of less simplicity and higher cost), the Bank is particularly keen to hear respondents' views through this consultation.

What is being proposed and why?

10 The Bank's proposals are designed to respond to five key strategic drivers for change over the likely lifespan of the next generation of RTGS, identified through a combination of the Review team's widespread initial outreach and internal Bank analysis.

11 First, the new RTGS service must be **capable of responding to the changing structure of the financial system.** Pressure on traditional business models, combined with the opportunities presented by new technology, have encouraged a progressive unbundling of financial service provision, leading to the emergence of a range of new competitors to traditional providers of payment and settlement services. Those same pressures, combined with the impact of heightened awareness of conduct risks, have also progressively constrained the ability or willingness of larger banks to offer agency payments services to smaller financial firms.

► To respond, the Bank proposes to expand access to RTGS to non-bank Payment Service Providers (subject to appropriate

safeguards), clarify its existing willingness to provide settlement facilities to new providers of financial market infrastructure and deliver much broader direct participation in CHAPS over time, including through the provision of more cost-effective and secure access options. All firms accessing RTGS will be expected to meet the Bank's high standards of operational robustness and resilience, including in respect of their controls against cyber-risk. Wider access to RTGS should broaden the range of payments settling in central bank money, increase the resilience of the system as a whole, and enable the provision of a range of innovative services.

12 Second, the new RTGS service must **recognise that payment system users want simpler and more resilient pathways for their payments.** Historically, different types of payment have had to be made in very different ways, involving different systems, messaging standards, business models and risk profiles. Dealing with such variation is both costly and risky, since the ability to reroute a payment from one system to another in the event of an operational outage can be low. Differences in operation also create potential barriers for new market entrants. The advent of new technologies, including mobile banking, together with regulatory pressure and the desire by payments users to reduce costs, have led to a strong push towards convergence in payment and settlement systems, both nationally and internationally. Recent examples include the proposal by the UK's Payments Strategy Forum for a Simplified Payments Platform,⁽²⁾ the development of a single set of standards for instant retail payments in Europe, and the proposed integration of TARGET2 and TARGET2-Securities by the European Central Bank.

► To respond, the Bank proposes to ensure that the next generation of RTGS can interoperate directly with a much wider range of payments systems by adopting the international messaging standard ISO 20022, having the technical capacity to operate on a true 24x7 (or near 24x7) basis, and exploring the demand for new functionality allowing systems to synchronise transactions with those in RTGS. The Bank is not proposing to go a stage further and bring the real-time settlement of all retail payments or sterling securities settlement onto RTGS itself. Doing so is unnecessary to eliminate settlement risk, and the Bank sees material resilience benefits in maintaining separate systems for the foreseeable future. The Bank will however continue an in-depth research work programme into the policy, legal and technology questions involved with the potential future

(1) As set out in the Governor's speech, 'Enabling the FinTech transformation: Revolution, Restoration, or Reformation?', June 2016, available at www.bankofengland.co.uk/publications/Documents/speeches/2016/speech914.pdf.

(2) The Payments Strategy Forum's draft strategy, 'Being responsive to user needs', July 2016, available at <https://paymentsforum.uk/sites/default/files/documents/Being%20responsive%20to%20user%20needs%20-%20Draft%20strategy%20for%20consultation.pdf>.

introduction of a central bank digital currency over the medium term.⁽¹⁾

13 Third, the new RTGS service must be capable of **interfacing with a range of new technologies being used in the private sector, including distributed ledgers, if/when they achieve critical mass**. Payments technology has already advanced materially in recent years, with the adoption of real-time retail systems such as Faster Payments, mobile and internet banking and foreign exchange netting services, in particular CLS. To operate at their most efficient levels, these technologies require rich data feeds, high availability and seamless messaging. The concept of the distributed ledger, though still in its infancy, is a potentially much more radical innovation, creating new ways for firms to exchange value without relying on central infrastructure.

► The Bank's response builds on many of the changes already outlined — including improved access for innovative providers of payments and settlements services (subject to appropriate safeguards), strengthened interoperability, and the capacity to operate on a true 24x7 (or near 24x7) basis. In addition, it is proposed that the next generation of RTGS should offer a range of more sophisticated tools for CHAPS direct participants to access richer data and control the timing of individual payments, as well as exploiting the latest advances in proven, secure technology to provide a resilient but flexible settlement platform. Taken together, these changes should allow the next generation of RTGS to communicate with, and support, the adoption of a wide variety of possible future technologies in financial markets. The Bank will also continue to explore the scope for using distributed ledger and other innovative technologies in its own systems, including through its recently announced FinTech Accelerator.⁽²⁾ The resilience characteristics of the distributed ledger in particular are potentially highly attractive from a financial stability perspective. It is however unlikely that this technology will prove sufficiently mature to form the core of the next generation of RTGS itself.

14 Fourth, the new RTGS service must remain **highly resilient to the increasingly diverse range of threats to continuity of service**. Today's risks, including those from cyber-attack and technology-enabled fraud, pose challenges that were not contemplated when many payment systems were first constructed, and are potentially amplified by the adoption of more connected, high-speed technologies. At the same time, households and companies are demanding faster transfer of funds, and as a result the market as a whole has become more sensitive to the impact of operational outages, whatever the cause.

► To respond, the Bank proposes to: base the design of the new RTGS on an explicit resilience framework that stresses

the primacy of data integrity; maintain a so-called 'non-similar' third site or platform built on a separate technology base (as it does today); provide an extra messaging channel to the one RTGS currently relies on; and work with the authorities and industry to promote alternative channels for time-critical retail payments (including housing payments) that are currently reliant on RTGS. The proposed broadening in CHAPS direct participation would reduce the vulnerability of smaller and medium-sized system users to outages at their agent banks. And finally the design of the new RTGS will draw on the long experience and rich resilience framework the Bank has developed over the two decades of operating the current RTGS platform.

15 Fifth, the new RTGS service must have the **capacity to support the future evolution of regulatory and monetary policy tools**. Recent examples of policy changes bearing on RTGS and payment systems more broadly include: the material strengthening in liquidity and reporting requirements since the financial crisis; the greater focus on ensuring operational resilience; innovation in monetary policy operating tools; and the strengthening of regulatory expectations that payment systems operators, such as CHAPS Co, should be able to exercise 'end-to-end' control over their systems.

► To respond, the Bank proposes to: reduce the risk of operational contagion by expanding direct participation of banks and broker-dealers in CHAPS through a combination of requiring direct participation for institutions of systemic importance (many but not all of whom are already direct participants) and providing more cost-effective and secure access options for smaller firms; improve the data and reporting tools available to RTGS users; maintain and develop RTGS' Liquidity Saving Mechanism for high-value payments; ensure the flexibility to implement a wide range of price and quantity-based monetary policy tools; and explore the Bank's role in the delivery of the CHAPS payment system.

16 Taken together, these proposals are aimed at delivering a new RTGS that is resilient but flexible, bolstering financial stability whilst also enabling innovation, by ensuring that a high proportion of payments in the UK economy continue to take place in (or backed by) central bank money, however the structure of financial markets and payments technology develops. Compared to the RTGS of today, that implies a service that has: broader **access**; higher **resilience**; greater **interoperability**; and a wider range of **user functionality**. Those four characteristics are used to structure the more

(1) For more detail on the Bank's work on central bank digital currencies, see the Bank's website: www.bankofengland.co.uk/banknotes/Pages/digitalcurrencies/default.aspx.

(2) For more detail on the FinTech Accelerator, see the Bank's website: www.bankofengland.co.uk/Pages/fintech/default.aspx.

detailed discussion of the proposed changes in Section 2 of this document. **Table A** summarises the overall package, combining those changes with the features of the current RTGS that the Bank expects to be replicated in the new design.

How will the new RTGS service be delivered?

17 A key enabler for delivering these changes will be a comprehensive refresh of the RTGS technology platform. This document is not designed to set out how that might be achieved in detail, focusing instead on securing agreement on the high-level requirements for the service. But the proposals contained here have been informed by an initial assessment of the feasible technology approaches — and the Bank is confident that the application of modern modular design, automated testing and resilience-enhancing technologies can deliver material improvements in resilience, flexibility and user functionality within a reasonable cost envelope.

18 Developing a new RTGS service will nevertheless require material up-front capital expenditure by the Bank. That will be recouped from the future users of the new system in the normal way over time through a temporary increase in the RTGS tariff. Allowance will also need to be made for an ongoing reinvestment programme, as now. Some changes to RTGS may require participants to undertake parallel investment in their own systems, for example where a new messaging standard is adopted. But renewal also creates the opportunity to include features which deliver operational cost savings and efficiencies for participants, for example by automating participant involvement in system testing, and allowing them to offer new products or services, for example through the provision of richer real-time data. The precise cost of the new system will depend on the final requirements and design, which will be shaped by responses to this consultation. This document indicates where the cost impact of different responses will occur, and identifies options which might generate operational savings.

19 Recognising that those costs will be borne by the future users of the RTGS service, the Bank will ensure that there is transparency on key design choices relating to access, interoperability and user functionality for relevant stakeholders, including further stages of consultation where appropriate. Decisions on the resilience of the system, including in particular its cyber-defences, will however be made by the Bank alone, in consultation with GCHQ, the Centre for the Protection of National Infrastructure, the National Cyber Security Centre and other intelligence partners. The broad shape of the framework within which future technology and cost assessments will be made, together with the question about the Bank's future role in CHAPS delivery referred to above, are set out in Section 3.

20 The Bank's current intention is that work on developing the new RTGS service should begin in 2017, with the aim of completing delivery by 2020. That provisional timing will however need to be reviewed in light of responses to this consultation and further analysis of technology options. A more detailed timetable will be issued during 2017. Although it is impossible to be precise about the lifespan of the new service, the intention of rebuilding the system in a modular way is that it can be updated and changed in response to a range of future developments without the need for complete replacement of the core for an extended period. In doing this, the Bank's aim is to provide clarity to direct and indirect users on the future settlement infrastructure on which sterling payments will be based.

21 With that goal in mind, a key priority will be to ensure that the Bank's development timetable interacts effectively with the many other initiatives currently underway, including: proposals for the simplification of UK retail payments and the supporting architecture from the Payments Strategy Forum; the Payment Systems Regulator's wider agenda for access and infrastructure reform; the introduction of new regulation which currently includes the second Payment Services Directive, the Central Securities Depositories Regulation and the ring-fencing of UK banks and their payments operations; and the wide range of industry-led change, including the introduction of cheque imaging, and the widespread adoption of new technologies and standards such as ISO 20022 and Application Programming Interfaces.

22 The individual questions on which the Bank is consulting are embedded in the relevant parts of Sections 1–3, and brought together in Annex 1. The Bank is seeking views from the widest possible range of those with a stake in the future of sterling payments. Responses should be completed by **7 November 2016**. The response template can be accessed and completed electronically at www.bankofengland.co.uk/markets/Pages/paymentsystem/strategy.aspx. Those responses will be used to help shape the Bank's decisions on the final high-level blueprint for the future RTGS service, which will be published in early 2017, alongside a summary of responses received.

Question 1

Widespread external input, combined with the Bank's own analysis, has identified five key strategic drivers for change over the likely lifespan of the next generation of RTGS.

Do you agree that these are the right strategic drivers for change for a future UK RTGS service?

Table A Proposed shape of next generation of the RTGS service

Service characteristic	Retained from current generation of RTGS	Enhancements for consultation
<p>Access: Facilitate greater direct access to central bank money settlement for institutions and infrastructures.</p>	<ul style="list-style-type: none"> • Broad range of settlement models for payment systems and securities settlement platforms. • Direct access to CHAPS required for institutions above value threshold. 	<ul style="list-style-type: none"> • Non-bank Payment Service Providers eligible for RTGS settlement accounts (subject to appropriate safeguards). • Streamlined testing, connectivity and onboarding requirements enabling much wider direct access for banks and broker-dealers. • Costs of access reduced by streamlined connectivity and contingency requirements. • Third-party aggregators able to provide technical connectivity for institutions seeking direct access to CHAPS. • Institutions of systemic importance required to access CHAPS directly.
<p>Resilience: Strengthen resilience of RTGS and flexibility to respond to emerging threats.</p>	<ul style="list-style-type: none"> • Well-defined recovery objectives. • Day-to-day dual-site operation. • Third settlement platform for contingencies. 	<ul style="list-style-type: none"> • Strengthened resilience framework. • Additional messaging channel (either in contingency or in regular operation).
<p>Interoperability: Promote harmonisation and convergence with critical domestic and international payment systems.</p>	<ul style="list-style-type: none"> • Strategic focus on settlement of high-value payments. • Securities ledger remains outside RTGS. 	<ul style="list-style-type: none"> • ISO 20022 messaging. • Payment synchronisation functionality. • Promote alternative processing arrangements for time-critical retail payments.
<p>User functionality: Support emerging user needs in a changing payment environment.</p>	<ul style="list-style-type: none"> • Liquidity Saving Mechanism and collateralised intraday liquidity. • Broad-based reserves account functionality for monetary policy implementation. • Simple Business Intelligence interface. 	<ul style="list-style-type: none"> • True or near-true 24x7 operating capability. • API interface for richer access to payment and liquidity data. • Functionality for tracking CHAPS payments in RTGS. • Forward-dated payment submission. • Greater queue visibility in Liquidity Saving Mechanism.

1 Overview of the current RTGS service

1 This section summarises the development of the RTGS service as part of the broader history of central bank settlement in the United Kingdom, and highlights those policy principles and core design features of the existing service that the Bank proposes should continue to be central in the renewed service.

2 The Bank of England has played an important role in supporting sterling payments for almost 250 years. Settlement of interbank payments started being conducted using Bank of England notes in the 1770s and began taking place over accounts at the Bank in 1854.⁽¹⁾ Through most of this period the Bank's role was largely passive, simply providing a safe asset that banks could use periodically to settle the exposures that developed in privately-operated payment arrangements.

3 This changed in 1996 with the launch of the Bank's RTGS service, when the Bank took on an active role as an infrastructure provider at the centre of the sterling payment system. The decision to launch RTGS was taken jointly by the Bank and the UK payments industry,⁽²⁾ and came at a time of a developing global trend of adoption of real-time settlement for high-value payments which saw the number of central banks offering such payment systems increase from three in 1985 to 90 in 2005.⁽³⁾ In the United Kingdom, as elsewhere, the primary policy aim of moving to real-time settlement was to eliminate the large intraday payment exposures that were being generated by the rapid growth in wholesale financial market transactions. Moving to real-time settlement eliminated risks between direct participants in CHAPS by ensuring that all payments were settled individually, in real time, in central bank money, in advance of them being sent on to the receiving bank.

4 While the initial goal of the move to RTGS was to eliminate settlement risk in CHAPS, it was also intended that it would provide a means of eliminating settlement risk in other key sterling payment systems. In particular, it was intended to enable a move to full Delivery versus Payment (DvP) settlement for sterling securities, achieved in 2001, and to enable Payment versus Payment settlement (PvP) of FX transactions involving sterling to remove foreign exchange settlement risk (also known as Herstatt risk). This was achieved in 2002 through the introduction of CLS.

5 At the launch of RTGS, and through its operational lifespan to date, the Bank has been content for a wide range of

additional payment services that accompany final settlement to take place in the retail and securities settlement systems that use RTGS, and has not actively sought to expand the reach of RTGS beyond the settlement of high-value exposures. This reflects the Bank's continued focus on stability in its operation of RTGS.

6 For example, in the retail payment systems settling across RTGS, such as Faster Payments and Bacs, the submission and exchange of individual payment messages and the process of calculating running balances between participants arising from those messages (known as clearing) are performed outside RTGS. Similarly for sterling securities settlement through CREST, all transfers between securities accounts, and the cash accounts of participants who are not RTGS settlement banks, are operated on a separate ledger housed outside RTGS. As discussed in Section 2.3.4, the Bank is of the view that this broad strategic positioning should be retained in the next generation of RTGS, as it enables the Bank to focus its efforts on providing that relatively narrow set of functions and services that are required to offer a reliable, resilient and robust means of final settlement for high-value sterling payments.

7 Over the intervening 20 years since the launch of RTGS, the service has undergone a series of significant enhancements, expanding the range of institutions and payment systems using it, and the functionality it offers to those users. These changes were implemented for a range of reasons that in many cases mirror the drivers for change that have prompted the Bank to seek to renew RTGS at this juncture. These include the need to mitigate emerging risks in payments, boost the operational resilience of the service, give access to central bank money for new payment infrastructures and institutions and reflect changing user demands. **Table B** provides a chronological summary of notable changes made to RTGS in the past two decades.

8 As **Table B** illustrates, the RTGS service has regularly been enhanced and expanded as the demands placed upon it have evolved over time. The Review team's preliminary outreach

(1) See Norman, B, Shaw, R and Speight, G (2011), 'The history of interbank settlement arrangements: exploring central banks' role in the payment system', available at www.bankofengland.co.uk/research/Documents/workingpapers/2011/wp412.pdf.

(2) See Bank of England (1994), 'The development of a UK real-time gross settlement system', *Bank of England Quarterly Bulletin*, May, available at www.bankofengland.co.uk/archive/Documents/historicpubs/qb/1994/qb940206.pdf.

(3) See Bech, M L and Hobijn, B (2006), 'Technology diffusion within central banking: the case of real-time gross settlement', available at www.newyorkfed.org/research/staff_reports/sr260.html.

Table B History of change in RTGS

Year implemented	Description of change	Aim of change
2001	Introduction of SWIFT-based network, replacing the legacy bilateral CHAPS messaging service (which pre-dated RTGS).	Reduce costs of messaging arrangements which were approaching obsolescence.
2001	Real-time 'Delivery versus Payment' settlement of CREST equity, gilt and corporate debt security transactions across RTGS.	Eliminate settlement risk created by lags between settlement of security and cash legs of these transactions.
2002	CLS offers 'Payment versus Payment' settlement for sterling FX transactions via CHAPS.	Eliminate settlement risk (known as Herstatt risk) on FX transactions.
2006	Overnight reserves accounts added to RTGS.	New regime for implementation of monetary policy.
2010–13	'Business Intelligence' service for users introduced; additional SWIFT message fields received by RTGS to facilitate richer data.	Enable banks to comply with new regulatory reporting requirements.
2013	Central queuing algorithm and Liquidity Saving Mechanism introduced.	Mitigate potential delays to CHAPS payments arising from banks adjusting to strengthened intraday liquidity regulations.
2014	Market Infrastructure Resiliency Service (MIRS) introduced, a back-up RTGS system hosted by SWIFT.	Provide additional layer of contingency as MIRS is operated at a separate location on distinct software.
2014	Settlement account access expanded to broker-dealers and CCPs.	Mirror expansion of reserves account framework and encourage settlement in central bank money.
2015	Prefunding of Bacs and Faster Payments settlement introduced.	Eliminate settlement risk by ensuring payments are backed by reserves.
2016	Extended opening hours (system close moved from 16:20 to 18:00).	Provide greater flexibility to make payments later in the day, reducing operational risk.

and policy deliberations suggest that many of those design features should be retained in the future incarnation of RTGS. Those features are summarised below, under the same four characteristics (access, resilience, interoperability and user functionality) used in Section 2 to set out the planned enhancements to the service being proposed in this Review.

1.1 Existing access features

9 Over the operational lifespan of RTGS, the Bank has worked to promote access to settlement accounts for a broader range of payment systems and institutions. It has made these changes to promote access to central bank money settlement for emerging payment providers and to mitigate settlement risk in systemic payment schemes.

10 From the outset, RTGS was designed to support settlement in a range of sterling payment schemes, and it was always the Bank's intention to expand the reach of the service to capture payments in other systemically important infrastructures over time and as these emerged. To enable this expansion, new models of settlement have been developed, notably real-time 'Delivery versus Payment' settlement in 2001 for the CREST system and prefunded settlement arrangements for the Bacs and Faster Payments deferred net schemes in 2015. These settlement agent models are set out in Box 1. It is the Bank's intention to retain these models in the next generation of the RTGS service as together they provide most flexibility to infrastructures over the most appropriate way to gain access to central bank money settlement. **Table C** sets out figures for daily settlement volumes and values of the seven schemes that currently settle across RTGS.

Table C Average daily RTGS settlement volumes and values

	2011	2012	2013	2014	2015
CHAPS values (£ millions)	£254,489	£284,591	£277,229	£268,615	£270,400
CHAPS volumes	135,555	134,665	138,245	144,353	148,412
CREST DvP values (£ millions)	£322,118	£293,293	£303,717	£274,257	£240,480
CREST DvP volumes	6,859	7,325	8,388	9,050	9,391
Faster Payments net values (£ millions)	£188	£502	£586	£606	£663
Bacs net values (£ millions)	£3,269	£3,190	£3,071	£3,122	£3,159
Cheque and Credit net values (£ millions)	£220	£232	£211	£196	£190
LINK net values (£ millions)	£216	£235	£249	£271	£294
Visa net values (£ millions)	n.a.	n.a.	£1,144	£1,149	£1,425

Source: Bank of England.

Notes: All data are daily averages of transactions settled within the RTGS system. CREST DvP activity in RTGS is measured by the debits applied to CREST settlement accounts at the end of each CREST settlement cycle, not the total volume or value of transactions in CREST itself. Retail payment system (Faster Payments, Bacs, Cheque and Credit, LINK, Visa) values represent the net interbank value of each system's settlement across RTGS. Net interbank settlement for retail payment systems takes place within defined clearing cycles at specific points during the RTGS operating day. Therefore, no volume data are available. Visa began settling its sterling net interbank obligations across RTGS in November 2013.

11 The range of firms accessing RTGS directly by operating their own central bank money settlement accounts has also expanded over time, increasing from 19 institutions at the end of 2005 to 48 by end-August 2016. One driver of this increase has been efforts by the Bank and CHAPS Co to require the most active users of CHAPS to become RTGS settlement account holders. In addition, the increased number of payment systems settling through RTGS has led institutions who were direct participants in those systems to open an RTGS settlement account. In 2014, the Bank's settlement

Box 1

The Bank's settlement agent models

(a) Real-Time Gross Settlement

Payment obligations between direct participants in a scheme are settled individually on a gross basis throughout the business day. Settlement risk is eliminated, at the cost of an increased need for liquidity, making this model best suited to a High-Value Payment System with the largest potential systemic risk.

This model is currently used only by CHAPS.

(b) The DvP link

This model is currently used by CREST, which settles securities transactions on a Delivery versus Payment (DvP) basis in a series of very high frequency cycles through the day. After each cycle, RTGS is advised of the debits and credits to be made to the RTGS accounts of CREST direct participants. Settlement risk has been eliminated as transactions are settled with finality in real time against segregated liquidity.

(c) Net settlement with prefunding

Schemes that do not settle on a real-time gross basis, instead settle obligations between participants periodically in batches on a net basis. In the periods between settlement cycles, potential settlement risk can arise between direct participants. The introduction of prefunding eliminates settlement risk 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' obligations.

This prefunding model is currently used by Bacs and Faster Payments. Cheque and Credit plans to move to this model in 2017.

(d) Net settlement without prefunding

This is periodic batch settlement between direct participants on a multilateral net basis. Settlement risk exists in these systems, mitigated by arrangements in the individual schemes.

This model is used by Visa and LINK.

account policy was altered to extend eligibility to settlement accounts to broker-dealers and CCPs.

12 A new category of RTGS account was created in 2006 with the introduction of reserves accounts, which provide facilities for financial institutions to hold overnight balances at the Bank remunerated at Bank Rate, to support the implementation of monetary policy. There are currently 173 institutions that hold reserve accounts in RTGS, of which a subset have their accounts configured as settlement accounts available to settle transactions from the payment and securities settlement schemes that use RTGS. The Bank intends to continue to promote an expansion in the numbers of schemes and institutions accessing RTGS through its renewal of the service. Section 2.1 sets out proposals to achieve this.

1.2 Existing resilience features

13 Ensuring high levels of operational availability and resilience has been a high priority for the Bank throughout the lifespan of RTGS. Over time as new threats to resilience have emerged or enhanced technologies to combat risks have been developed, these have been incorporated into the service, contributing to its strong track record on availability.⁽¹⁾

14 An example of this process of continuous improvement is in the range of measures developed to introduce greater redundancy and mitigate the impact of physical or technological threats to the operation of the core RTGS processor. In a series of incremental steps, the capacity to

switch live operation of the system to a backup operational site in the event of a problem has been enhanced by the introduction of split-site working and the regular switching of operations between primary and secondary sites as part of the RTGS timetable.

15 A new dimension of contingency was implemented in 2014 with the introduction of the Market Infrastructure Resiliency Service (MIRS), a third platform standby-RTGS system provided by SWIFT. This system not only operates from a location separate from the core system, but also runs a completely different implementation of the software. This creates resilience to catastrophic failures such as the loss of both data centres or a cyber-attack which renders the core RTGS software inoperative.⁽²⁾

16 On 20 October 2014, RTGS experienced an outage of approximately nine hours, which meant that the operating hours of the system were extended until 20:00 to ensure all submitted payments could be settled. An independent review into the causes of the outage led the Bank to implement a number of improvements to governance, change management and testing arrangements to strengthen operational resilience.⁽³⁾

(1) Since September 2005 the RTGS service has experienced a total of 21 hours and 3 minutes of downtime.

(2) Further details on MIRS and the drivers for its introduction can be found here: www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2014/qb14q305.pdf.

(3) The independent review and the Bank's final response can be found respectively at www.bankofengland.co.uk/publications/Documents/news/2015/rtsdeloitte.pdf and www.bankofengland.co.uk/markets/Documents/paymentsystems/deloitteactions.pdf.

17 In renewing RTGS, the Bank intends to retain key design features that underpin its current operational resilience offering, including the availability of a third settlement platform, where those continue to provide the most sound means to address threats in a redesigned system. However, as discussed in Section 2.2, it also intends to use the opportunity of rebuilding the system to enhance its safeguards against operational risks further.

1.3 Existing interoperability features

18 One of the Bank's aims in operating RTGS has been to promote harmonisation with international standards for payment messaging, and to facilitate interactions with other financial market infrastructures — delivering so-called 'interoperability'. This has been done to remove barriers to direct access to RTGS, to facilitate UK banks' access to international payment systems and to enable settlement banks to streamline their payment operations.

19 When CHAPS started to settle through RTGS in 1996, direct participants exchanged payment messages between themselves and with RTGS over a private communications network that imposed significant barriers to entry due to the large upfront costs of building the capacity to use the network. In 2001, the 'NewCHAPS' project implemented a move to SWIFT messaging which substantially reduced barriers to entry to RTGS settlement by enabling banks to make use of established communications networks for their CHAPS payments. By adopting SWIFT's 'MT' messaging standard, RTGS was able to promote the propagation of what at the time was the emerging international standard for payment messaging. As set out in Section 2.3.1, the Bank proposes to continue that commitment to promoting harmonisation and interoperability by using the opportunity of RTGS renewal to move to the next emerging international payment standard, ISO 20022.

20 In 2002, the Bank implemented changes to RTGS to enable sterling to participate in the CLS system, created to eliminate Herstatt risk on FX transactions. And for the period between 1999 and 2008, RTGS was expanded to offer a CHAPS euro service which formed the UK component of the cross-border TARGET system for euro settlement. This functionality, which permitted access to euro payments for banks operating in the United Kingdom, was decommissioned following the European Central Bank's implementation of the TARGET2 payment service in 2008.

21 The Bank proposes to continue promoting interoperability with other payments systems to expand the range of safe settlement arrangements available to users of RTGS. To this end, this consultation seeks input on a range of proposals, including enhanced functionality offering synchronisation of RTGS transfers with settlements in other infrastructures as

described in Section 2.3.2. As discussed above, however, the Bank will not seek to promote interoperability by shifting the focus of RTGS away from the settlement of high-value exposures that has been the core aim of the existing service.

1.4 Existing user functionality features

22 Many aspects of the functionality that RTGS offers to users have been modernised over the past twenty years in response to emerging user demands to mitigate liquidity risk in the system, provide richer access to data for regulatory reporting purposes and expand the operating hours of the service. Changes in the Bank's monetary policy operations have also required modifications to the design of RTGS.

23 Earlier in 2016, the operating hours of the RTGS service were extended, with CHAPS and CREST now closing at 18:00 rather than 16:20. This enhancement was implemented to provide greater flexibility to make payments later in the day and hence reduce operational risks. As discussed in Section 2.4.2, the Bank expects to expand the operating capacity of a renewed RTGS platform to enable further extensions of the RTGS operating day, if needed towards 24x7 operation in future.

24 Between 2010 and 2013, 'Business Intelligence' functionality was incorporated into RTGS to provide users with access to detailed payment and liquidity data to enable regulatory reporting. Section 2.4.3 sets out a proposal to enhance this functionality to streamline access to this valuable data further.

25 The move to real-time settlement of high-value payments had the potential to increase intraday liquidity demands placed on CHAPS direct participants. That in turn could create incentives to delay the release of payments to conserve liquidity, leading to elevated operational risks in the processing of high-value payments.⁽¹⁾ To counteract this, the Bank has from the outset made collateralised intraday credit available to direct participants in CHAPS and CREST. This facility will be retained for real-time settlement in the renewed service. In 2013, the Bank introduced a Liquidity Saving Mechanism into RTGS allowing banks to queue CHAPS payments centrally and offset them against queued payments from other participants. This was done to make CHAPS settlement more liquidity efficient and prevent the introduction of Basel III liquidity regulation for banks from having a detrimental effect on incentives to submit payments promptly in the system, mitigating operational risk. As discussed in Section 2.4.4, the renewed RTGS service will continue to offer a Liquidity Saving Mechanism.

(1) A fuller discussion of the liquidity implications of RTGS settlement and how these are addressed are available at www.bankofengland.co.uk/publications/Documents/quarterlybulletin/qb120304.pdf.

26 In 2006, the Bank expanded the functionality of RTGS to incorporate the paying of interest on overnight reserves balances in response to changes in the way the Monetary Policy Committee's decisions were implemented through the Sterling Monetary Framework. The use of this functionality has been modified over time as changes to the way the Bank pays interest on reserves balances have been made. The Bank proposes to enhance its flexibility to modify the way reserves accounts are offered in RTGS to enable it to adapt to any future changes to the Sterling Monetary Framework.

27 **Table D** summarises the key features of the existing system that the Bank intends to preserve in its design of a renewed RTGS service.

Table D Features of the current RTGS service proposed for retention in the renewed service

Characteristic	Retained from current generation of RTGS
Access	<ul style="list-style-type: none"> • Broad range of settlement models for payment systems and securities settlement platforms. • Direct access to CHAPS required for institutions above value threshold.
Resilience	<ul style="list-style-type: none"> • Well-defined recovery objectives. • Day-to-day dual-site operation. • Third settlement platform.
Interoperability	<ul style="list-style-type: none"> • Strategic focus on settlement of high-value payments. • Securities ledger remains outside RTGS.
User functionality	<ul style="list-style-type: none"> • Liquidity Saving Mechanism and collateralised intraday liquidity. • Broad-based reserves account functionality for monetary policy implementation. • Simple Business Intelligence interface.

Question 2

The Bank has introduced a wide range of enhancements to RTGS over its 20 years of operation to expand the range of institutions and payment systems using it, and the functionality it offers to those users. It intends to preserve the bulk of these enhancements in renewing RTGS as summarised in Table D.

Do you agree with the Bank's proposals to retain many of the policy principles and core design features of the existing RTGS service in the renewed service?

2 What features should the new RTGS service have?

1 This section sets out in more detail the changes the Bank is proposing to introduce in the next generation of the RTGS service, and the questions on which it is seeking feedback as part of this consultation. These changes, taken together with the core design features the Bank proposes to retain from the current RTGS service, are intended to safeguard stability whilst also enabling innovation in a changing payment landscape, responding to the strategic drivers for change set out in the Introduction and executive summary.

2 The changes are grouped under four characteristics: access, resilience, interoperability and user functionality, covered in Sections 2.1–2.4 respectively. **Table A** in the Introduction and executive summary summarises the package as a whole.

3 The primary focus of this consultation paper is on reaching agreement on a high-level design blueprint, rather than the practical questions of how such a blueprint should be delivered. But the Bank is conscious that every design decision will have resource implications for the Bank, RTGS participants and users of the payment system as a whole. Some of those resource implications are potentially positive: through the provision of new user functionality, wider access and interoperability, the Bank intends for the design of the new system to offer opportunities for new efficiency gains and service offerings from the payments market as a whole. But there will also be implications for costs: including those directly incurred by the Bank in building and operating the new system (which will be passed to RTGS users through the RTGS tariff); and those incurred indirectly by participants, both in adapting their own systems to interface with changes at the centre, and the ongoing operational costs they face once the new system has been implemented. At this stage it is not possible to indicate the precise cost implications of the options set out in this consultation. But Section 3.4 summarises how the choices being presented in this consultation might influence these distinct elements of central and participant cost, including where functionality could result in cost savings for participants.

2.1 Access

2.1.1 Introduction

4 As the Introduction and executive summary sets out, the United Kingdom's payment and securities settlement landscape is becoming increasingly diverse through the entrance of new players (such as challenger banks and non-bank Payment Service Providers) and the prospective

entry of new payment infrastructures. The Bank's aim is to promote direct access to settlement in central bank money among these new players for the maintenance of financial stability, and to enable innovation (where that can be achieved without impacting the integrity of RTGS). The Bank is also seeking to promote materially greater direct access among established players.

5 Supporting the expansion of central bank money settlement for institutions through more widespread direct participation relates directly to the Bank's mission of maintaining financial stability in two key ways:

- (a) Reducing operational reliance on a small number of banks. Currently an operational outage at a sponsor bank (ie a direct participant of payment schemes that provides services to indirect participants) could prevent indirect participants settling payments, potentially with knock-on effects for other financial institutions.
- (b) Reducing credit exposures. Indirect access to payment systems usually involves exposures between direct and indirect participants. The exposures are particularly large in High-Value Payment Systems like CHAPS, and if crystallised, those exposures could affect the system as a whole.

6 The Bank is also seeking to encourage further settlement in central bank money among financial market infrastructures. The broad principle that settlement should take place at a central bank where practical and available is enshrined in the internationally-agreed Principles for Financial Market Infrastructures (PFMIs).⁽¹⁾

7 A further benefit of more widespread direct access is that it could also enable a more innovative and competitive market in payments, allowing new participants to offer enhanced payment services to customers. Such innovation, where it can be achieved without detriment to resilience, contributes to the United Kingdom's medium-term economic prospects, while also promoting financial stability by creating an environment in which market concentration is reduced and new risk-reduction technologies may be identified.

(1) The PFMIs are internationally agreed standards published by the Committee on Payments and Market Infrastructures (CPMI) and the International Organisation of Securities Commissions (IOSCO). In July 2016, the Bank of England published a self-assessment of RTGS against the Principles. See www.bankofengland.co.uk/markets/Pages/paymentsystem/rtpspfmia.aspx.

8 In support of these aims, the Bank already offers a variety of different access models for RTGS to institutions and FMIs, as described in Section 1.1. These will continue to be offered in the next generation of RTGS. The Bank proposes a number of further steps to widen awareness of these options, tailor them to emerging needs, and develop them to reflect changing needs from new players.

9 In promoting greater direct participation in CHAPS, the Bank will not compromise its primary focus on maintaining the resilience of the RTGS infrastructure. New participants and schemes will be expected to meet the Bank's high security and resilience standards.

10 The rest of this section sets out the Bank's proposals to extend direct access in more detail:

- (a) The Bank intends to promote greater participation in CHAPS for banks and broker-dealers including through the provision of more cost-effective (but also secure) access models, and a requirement of direct access for the small number of institutions of systemic importance that remain indirect participants in CHAPS. This is outlined in Section 2.1.2.
- (b) Section 2.1.3 elaborates on the Bank's intention to extend access to RTGS to non-bank Payment Service Providers, subject to suitable safeguards, as announced by the Governor in June 2016.
- (c) Section 2.1.4 describes the Bank's interest in exploring ways to facilitate direct participation in CHAPS by CCPs and in use of RTGS by other financial market infrastructures.
- (d) Section 2.1.5 explains the boundaries of the Bank's proposed expansion of RTGS access. The Bank does not propose to offer non-financial corporates or households the option of holding an account in RTGS at this time, though the Bank is pursuing a separate longer-term workstream to consider such questions.

2.1.2 Promoting greater direct participation in CHAPS for banks and broker-dealers

11 Institutions that wish to process transactions through a payment or securities settlement scheme either have to be direct participants in that scheme (giving them so-called 'direct access') or use services offered by one of the direct participants in the scheme (giving them 'indirect access'). Direct participation in a scheme provides an institution with operational independence (in that the institution does not need to be reliant on the technology of any other direct participant to access the scheme), removing a layer of potential operational risk. It allows the institution to utilise the full functionality that the scheme offers, for example permitting the full use of operating hours and avoiding the

introduction of any delays in the submission and receipt of payments. And it may also enable participation in the governance of the scheme. But direct participation also places substantial demands on institutions, requiring access to a range of balance sheet and technical tools needed to manage the risks and requirements of direct participation. Among those requirements, most payment scheme operators require direct participants to have access to an RTGS settlement account.⁽¹⁾

12 Historically, the fraction of financial institutions taking up the option of direct participation in sterling payment schemes settling across RTGS has been relatively low (see **Table D**). The majority of institutions have chosen to access sterling payment schemes via an agent bank, reflecting the significant economies of scale involved in developing and maintaining the technological and operational capacity to send and receive payments as a direct participant in a scheme. Agent banks are also able to provide indirect participants with intraday credit to fund their outgoing payments before the incoming ones are credited, and additional agency services such as confirmation of payments.

Table D Institutions using RTGS accounts to settle scheme obligations, August 2016^(a)

	Number of institutions with RTGS settlement accounts
Banks and building societies	46
Broker-dealers	0
Central counterparties (CCPs)	0
Other financial market infrastructures	2

Source: Bank of England.

(a) Institutions hold RTGS settlement accounts for access to one or more of the seven payment and securities settlement schemes settling in RTGS.

13 For some years, the Bank has actively sought to expand the number of major banks accessing CHAPS directly to promote financial stability, for the reasons described in Section 2.1.1: ie reducing operational reliance on a small number of banks, and reducing credit exposures. In 2011, the Bank and CHAPS Co targeted six large indirect participants to become direct participants in CHAPS, selected based on the overall values of CHAPS payments they were processing via their agent banks.⁽²⁾

14 The number of direct participants in CHAPS nevertheless remains low compared to other countries (see **Table E**). Stakeholders identified a number of reasons for this during the Review's preliminary outreach. First, it was seen as reflecting features specific to the UK banking sector relative to those in

(1) The LINK and Visa schemes are exceptions to this requirement: direct participants can use the RTGS account of another direct participant to participate in these schemes.

(2) Of these six firms State Street joined CHAPS in 2012, BNY Mellon joined in 2014, BNP Paribas joined in 2015 and Northern Trust and Société Générale both joined in 2016. ING is also planning to become a direct participant in due course.

other countries, including the sector's relatively high degree of market concentration, and the higher proportion of overseas banks. And, second, it was seen as reflecting broad satisfaction with the quality of indirect access offering from agent banks from many traditional users.⁽¹⁾

Table E Direct participants in High-Value Payment Systems around the world

Country	Payment system	Direct participants
United Kingdom	CHAPS	24
United States	Fedwire	7,866
	CHIPS	49
Eurozone	TARGET2	1,599
	EURO1	199
Japan	BOJ-NET FTS	538
Switzerland	SIC	358
Canada	LVTS	16
Australia	RITS	59

Sources: BIS, CPI Red Book (2014) and Bank of England (2016) data for the United Kingdom.

15 But, third, limited direct participation was felt to reflect a number of costs and technical barriers to direct participation in the current service, in particular:

- (a) the length and requirements of the onboarding process;
- (b) the ongoing testing requirements for direct participants, and the associated operational costs; and
- (c) the fixed costs of connecting to RTGS, including access to messaging networks and maintenance of separate contingency sites for each direct participant.

16 Banks and building societies felt that the renewal of RTGS presented a valuable opportunity to utilise modern technology to lower these barriers to direct participation in CHAPS — though (crucially) only where that could be achieved without compromising resilience standards. The Bank agrees with that conclusion — noting that there is also a strong case for delivering materially broader direct participation in CHAPS over time from the perspective of assuring the resilience of the broader system in the future. The strategic trends identified in the Introduction and executive summary — a more diverse threat environment, lower tolerance for operational outages, and the progressive 'de-risking' by larger agent banks — mean the payment system of the future will need to ensure it has fewer single points of failure, with a greater capacity to reroute payments held up by operational outages in specific parts of the private market, including in agent banks. Direct participation in payments schemes, including CHAPS, offers one response to that challenge, provided it can be achieved without having to accept reductions in the overall resilience of RTGS.

17 The Bank therefore intends to review the technical barriers to entry to CHAPS identified above, and to seek to find ways

to reduce them through the design of the technical architecture and business processes of the next generation of RTGS. For example, the Bank will examine the potential for introducing automated testing and developing simulators as a means to lowering the burdens currently placed on direct participants, for legitimate risk mitigation reasons, during the existing onboarding and testing processes.

18 One possible way to promote wider direct access to CHAPS is to examine the case for a more proportionate approach to managing the risks that direct participants pose in RTGS, tailoring the mitigation approach to the size of the institution and the potential broader impacts of outages or failures of these institutions. Some risks to the system are proportional to the size of a participant's flows — for example, the drain on other participants' liquidity that follows from a direct participant's inability to connect.⁽²⁾ Other sources of risk, however, such as cyber-risk, are not proportional to a direct participant's size. Opening up an additional entry point to RTGS introduces potential vulnerabilities to cyber-attack regardless of how many payments the additional direct participant sends. For that reason, all firms accessing the future generation of RTGS will be expected to meet the Bank's high standards of operational robustness and resilience, including in respect of their controls against cyber-risk.

Question 3

Stakeholders have identified three key practical barriers for banks that want to use RTGS to join CHAPS:

- (a) *the length and requirements of the onboarding process;*
- (b) *the ongoing testing requirements for direct participants, and the associated operational costs; and*
- (c) *the fixed costs of connecting to RTGS, including access to messaging networks and maintenance of separate contingency sites for each direct participant.*

To what extent do you feel these barriers discourage firms (including where relevant your own institution) from becoming a participant in CHAPS? Please provide indicative cost estimates where possible.

Are there other steps the Bank could take to reduce the costs of accessing RTGS to make CHAPS payments, whilst maintaining the resilience of the service?

(1) Consistent with the conclusions of the Payment Systems Regulator, market review into the supply of indirect access to payment systems: <https://www.psr.org.uk/psr-publications/market-reviews/MR1513-final-report-supply-of-indirect-access-payment-systems>.

(2) Liquidity drains occur when a direct participant is unable to send payments and the other direct participants have to find additional liquidity to make up for the incoming payments from that direct participant that they would normally expect to receive.

19 At present, CHAPS direct participants are required to develop their own arrangements for messaging connectivity to enable the sending and receiving of CHAPS payments via RTGS. This approach has the potential to impose significant fixed costs on a firm seeking to develop a direct access capability. Recently, technical aggregator models have begun to emerge for sterling retail schemes, notably Faster Payments, that are designed to enable third parties to provide connectivity to a central payment infrastructure for multiple institutions, with the intention of reducing the fixed costs of individually developing the capability to access that infrastructure directly. The Bank is keen to explore whether enabling aggregators to provide technical connectivity services to institutions seeking to make CHAPS payments would provide an additional means of lowering barriers to direct access. An additional potential benefit from enabling the use of technical aggregators for CHAPS payments would be to promote interoperability with other sterling payment systems where the use of aggregator models is being actively promoted.⁽¹⁾

20 In developing the next generation of RTGS to enable third-party providers to supply connectivity services, the Bank would not anticipate significant changes to the responsibilities placed on CHAPS members. That is, an account holder using an aggregator would continue to have responsibility for the operation of their settlement account and the management of liquidity on that account. The aggregator's role would simply be to enable the flow of payment messages between RTGS and the settlement account holder's internal systems. To protect the resilience of RTGS, an aggregator would be expected to meet the high operational and financial standards demanded of a direct participant sending the equivalent flows through CHAPS. A bank using an aggregator would have an operational dependence on the aggregator for access to the system; thus, this model is likely not to be considered to be appropriate for the largest participants in the CHAPS scheme.

Question 4

The Bank proposes to permit the development of technical aggregators as a means to facilitate broader access to RTGS settlement accounts to make CHAPS payments.

Is a technical aggregator service something that your institution would be interested in supplying, or a service that your institution would be interested in using to access RTGS for CHAPS payments?

Are there any risks that the Bank should consider in permitting technical aggregator services to develop?

Do you perceive any existing RTGS features that could act as barriers to the development of a technical aggregator service?

21 In addition to lowering the barriers to entry, the Bank has for years favoured requiring direct participation in CHAPS for institutions above a value threshold and continues to hold this view. When the new system is operational (and subject to appropriate transitional arrangements), the Bank intends to make direct participation in CHAPS a requirement for institutions of systemic importance to the UK financial system. The exact criteria by which this will be judged will need to be determined as part of the development of the new generation of RTGS service, but could include: (i) using existing definitions used by the Bank, such as those of the Prudential Regulation Authority, and (ii) using measures of the size of payment flows sent through CHAPS (similar to the current threshold of 2% of the total value of CHAPS payments) or through other systemic infrastructures using CHAPS payments.

2.1.3 Extending RTGS access to non-bank Payment Service Providers (PSPs)

22 A further way through which the Bank will achieve its aim of greater participation in RTGS is to extend eligibility for RTGS accounts to non-bank PSPs.

23 Over recent years, the United Kingdom has seen a dramatic growth in the number of PSPs, which seek to compete with banks in the provision of payments. The number of PSPs in the UK is far greater than in most other EU countries (**Chart 1**). Box 2 summarises the typical business models of PSPs. During its initial outreach with stakeholders, the Bank met with several PSPs that would like to access RTGS directly for the purpose of joining (in particular) the Faster Payments Service. As these firms grow, some of them want to reduce their reliance on the systems, service levels, risk appetite and goodwill of the very banks with whom they are competing. The promotion of aggregators in Faster Payments has further increased demand from PSPs for access to RTGS.

24 The Governor of the Bank of England announced in June 2016 that the Bank intended to extend direct RTGS access to PSPs as part of its strategy for financial innovation. By extending RTGS access, the Bank's aim is to increase competition and innovation in the market for payment services by allowing PSPs to compete on a level playing field with banks. The change in the Bank's policy enables direct access for those PSPs that see this option as the most suitable for them; the Bank expects a minority of PSPs to choose to use RTGS accounts (as is the case with the proportion of currently eligible institutions that directly access RTGS).

(1) The introduction of aggregators is a key part of Faster Payments' New Access Model. See www.fasterpayments.org.uk/access-payments/vision-new-access-model for further information. Bacs also recently announced that it will permit aggregators in future to provide technical connectivity services. See www.bacs.co.uk/Access/PaymentServiceProviderAccess/Pages/TechnicalAccess.aspx for further information.

Box 2

What are non-bank Payment Service Providers (PSPs)?

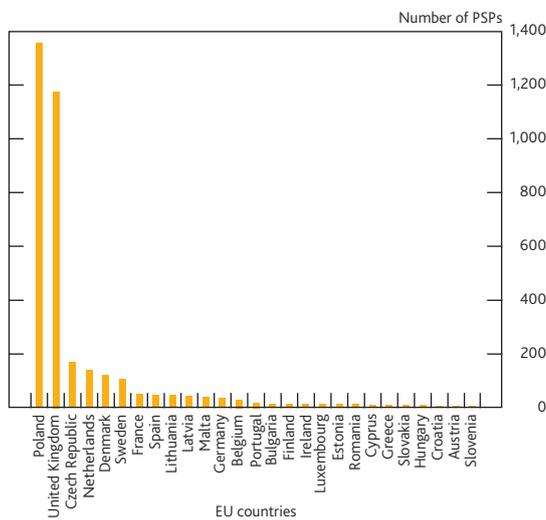
'PSP' is the term used for two regulatory categories of institutions that are not banks but specialise in providing payment services: E-Money Institutions and Payment Institutions. Many of these institutions are emerging payment fintech firms.

E-Money Institutions mainly provide prepaid cash cards and prepaid online and mobile accounts. These range from retail gift cards to online accounts with similar functionality to

traditional bank current accounts (for example, the capability to make ATM withdrawals, direct debits and internet payments as well as have a debit card).

Payment Institutions tend to follow one of three models. The majority of Payment Institutions provide overseas money remittance and foreign exchange services. Other Payment Institutions are 'merchant acquirers' who provide the payment processing infrastructure that allows retailers to take card payments in-store or online. The other key business model of Payment Institutions is issuing credit cards to consumers and businesses.

Chart 1 Number of PSPs based in EU countries, 2016



Source: National bodies responsible for maintaining registers of PSPs. Data for Italy not published. Data for Finland from 2015.

25 The Bank is of the view that in the longer-term, the innovation that will stem from expanding access to PSPs can also promote financial stability: by creating more diverse payment arrangements with less dependence on individual large firms, by identifying and developing new risk-reducing technologies, and by expanding the range of transactions that can take place electronically and be settled in RTGS.

26 As access to RTGS is extended to PSPs, the Bank will safeguard the resilience of the service in the following ways:

- The Bank is working with the FCA and HMRC (as the supervisors of PSPs) to develop a strengthened supervisory regime for PSPs that have direct access to RTGS. This will give assurance that PSPs can safely take their place at the heart of the United Kingdom's payment system.
- Legislative changes will be required to allow PSPs to access RTGS safely⁽¹⁾ HM Treasury has committed to

make these necessary changes, but the precise timing is dependent on the Parliamentary timetable.

- The Bank is designing the appropriate RTGS account arrangements for PSPs, including the level of remuneration on overnight balances. As the Governor announced in June, the Bank does not intend to extend facilities to PSPs for which they have no need. Non-bank PSPs will not therefore be eligible for membership of the Sterling Monetary Framework — and in particular the Bank's credit facilities.⁽²⁾

27 Further updates on the progress towards implementation of the policy announcement of access to RTGS for PSPs will be provided in the blueprint for the future RTGS service to be published in early 2017. All of the necessary barriers to opening an RTGS account (including legislative changes, as well as the implementation of any necessary technical changes to the current RTGS system) will need to be removed before the first PSP can open an account, which will involve a time lag.

28 The Bank's proposals to expand RTGS access to PSPs followed a review of its access policy. The Bank will continue to review its access policy for RTGS periodically to ensure it remains appropriate for different types of financial institutions in the future service.

(1) The legislative changes include adding Payment Institutions to the list of regulated entities to whom the Settlement Finality Regulations apply, modifying the Payment Services and Electronic Money Regulations to enable safeguarded funds held by E-Money Institutions and Payment Institutions to be posted with the Bank and amending the Banking Act to expand HM Treasury's powers to grant the Bank of England the ability to supervise any relevant payments systems if they ultimately grow large enough to pose a systemic threat. The first is essential to enable these firms to benefit from the critical protections the Settlement Finality Regulations offer to users of major UK payment systems. The second is needed to enable these firms to deposit monies in RTGS on behalf of their customers. The final change provides assurance that any longer-term stability implications of these changes can be addressed under the Bank's prudential remit.

(2) That is because PSPs are not part of the monetary policy transmission mechanism or exposed to inherent overnight liquidity risk. The Bank may also take steps to limit PSPs' capacity to hold unlimited overnight balances on their settlement accounts.

2.1.4 Access to RTGS for Financial Market Infrastructures (FMIs)

29 An important priority for the Bank in renewing RTGS is to ensure that it can continue to promote settlement in central bank money for existing payment and securities settlement schemes, and provide greater flexibility to respond to changes in demand for access to RTGS for new models of settlement that may emerge in the future. Enabling new infrastructures to access safe settlement in central bank money has clear stability benefits, and also has the potential to support greater innovation and competition in the provision of financial market infrastructure. The Bank believes that the four existing models of settlement agent services offered to FMIs (set out in Section 1.1) already offer considerable scope to deliver these benefits for new infrastructures, and wishes to use this Review to underscore that commitment and improve awareness of these existing, but arguably under-recognised, channels. In addition, Section 2.3.3 proposes new synchronisation functionality capable of delivering DvP and Pvp services to a new generation of emerging FMIs.

30 As discussed in Section 1, the Bank of England extended access to RTGS settlement accounts to CCPs in 2014. To date, no CCP has chosen to utilise this facility to become a direct participant in CHAPS. This may be partly because the Bank had already put arrangements in place to provide account services to regulated CCPs, ensuring that payments already settled in central bank money. The IMF, in its 2016 Financial Sector Assessment Program for the United Kingdom, nevertheless felt that there was a case for CCPs becoming direct participants in CHAPS to deliver further reductions in operational risk. The Bank would like to hear views from respondents on whether they believe there is a stability case for CCPs to become direct participants of CHAPS, and if so, whether there are any functional changes that might be required in a renewed RTGS system to promote direct access by CCPs.

Question 5

CCPs are currently eligible to hold RTGS accounts, but none have joined CHAPS.

Do you believe there is a case for CCPs to join CHAPS as direct participants? If so, is there any functionality that would be required in the next generation of RTGS to enable this?

2.1.5 Central bank digital currency

31 The Bank does not propose to extend direct participation in the new RTGS service to non-financial corporates or households in the United Kingdom.⁽¹⁾ This is for two reasons:

- (a) Such a change in access would raise fundamental questions about the nature of banking, the shape of the financial system and the role of the central bank that need to be researched over a longer timeframe.⁽²⁾
- (b) Attempting to accommodate a dramatic extension of access would create very material technological and security challenges for RTGS that would have significant implications for the cost and timeframe for renewing the system and would fundamentally alter the resilience and operational availability requirements of the service.

32 The Bank has a research agenda on digital currencies established for the coming years.⁽³⁾ The research will analyse the economic and financial stability impact of a potential central bank digital currency, including how it could interact with monetary, financial stability and fiscal policy. The research agenda also includes how a central bank digital currency could be technically implemented.

2.2 Resilience

2.2.1 Introduction

33 The provision of safe settlement in central bank money lies at the heart of the Bank's financial stability objective. To achieve this, RTGS needs to be resilient to the full range of incidents, errors and shocks that could disrupt its operation. Resilience in this context refers not only to the defences that have been put in place around the system, but also the ability to detect that an incident or error has occurred and continue operation following unexpected incidents such as component failure, or abnormally high volume, and to recover operations in the event of a severe incident.

34 Since its introduction in 1996, the current RTGS system has aimed to be at the forefront of industry and international best practice thinking on the priorities for resilience design. In the late 1990s, much of this focus was on equipment failure, with investment made in fault-tolerant hardware, backup power sources and diverse telecommunications. Following the events in the United States in September 2001, attention turned to geographic dispersion of both data centres and business operations. The RTGS system was designed from the outset to operate from either one of a pair of data centres, and it switches regularly between the two. Business operations are split across two sites, with no dependency between the location of business operation and system operation.

(1) See the Governor's June 2016 speech, available at www.bankofengland.co.uk/publications/Documents/speeches/2016/speech914.pdf.
 (2) See the Deputy Governor for Monetary Policy's speech, 'Central banks and digital currencies', 2016, available at www.bankofengland.co.uk/publications/Pages/speeches/2016/886.aspx.
 (3) For more detail on the Bank's central bank digital currency research workstream, see www.bankofengland.co.uk/banknotes/Pages/digitalcurrencies/default.aspx.

35 More recently cyber-threats have come to the fore, generating a focus on network and system security, and creating a need to undertake structured testing and improvement using frameworks such as the United Kingdom's CBEST programme.⁽¹⁾

36 To combat low likelihood, high-impact events, a 'third platform' standby-RTGS system was added to RTGS in 2014. The first of its type for an RTGS system anywhere in the world, the third platform is a backup for the core functions of RTGS. This system — which is known as MIRS (Market Infrastructure Resiliency Service) and is provided for the Bank by SWIFT — not only operates from a location separate from the core system, but also runs a completely different implementation of the software.⁽²⁾ This creates resilience to catastrophic failures, such as the loss of both data centres or a cyber-attack which renders the core RTGS software inoperative, but does so in a way that also avoids making the core RTGS system itself overly complex. The Bank proposes that the next generation of RTGS should also include a third platform, the design of which will be influenced by the requirements of the service, to address low likelihood high-impact events such as the ones outlined above.

37 The range and complexity of threats facing RTGS systems are continuing to expand — and, as they do so, the responses to these threats will need to expand to meet them. There has been an increased international focus on the infrastructure that sits at the heart of financial markets in recent years culminating in the emergence of a number of international standards, most prominently the Principles for Financial Market Infrastructures (PFMIs). Box 3 describes how the Bank proposes to apply the PFMIs on operational resilience to the next generation of RTGS.

38 The rest of the section is organised as follows:

- (a) Renewing the RTGS system provides the opportunity to design the infrastructure against a set of updated resilience design principles, outlined in Section 2.2.2. Notably these principles lead to the conclusion that, wherever there is a conflict, data integrity of the RTGS system should take precedence over service availability.
- (b) The Bank proposes to retain the existing recovery objectives for the system, namely that RTGS will have a near-zero tolerance for any data loss when the service is restored after an interruption, and that normal operation should be recovered within two hours following an interruption. This is discussed in more detail in Section 2.2.3.
- (c) Section 2.2.4 outlines an operational resilience framework. The framework seeks to articulate the set of threats that the Bank believes it needs to protect against, the appropriate countermeasures to meet those threats,

and the mapping between the two. The aim of this approach is to ensure a rigorous resilience model which combines the lessons of the past two decades with the need to address new threats that have already been identified (eg cyber-attack), and those which have yet to emerge, but will do so over the lifespan of the service. Box 4 covers cyber-risks in more detail.

- (d) The Bank is proposing to introduce additional functionality to mitigate the impact of an outage in the core SWIFT infrastructure, should it ever occur. The Bank is asking stakeholders for their views on the relative merits of introducing an enhanced contingency procedure or increasing the number of message networks that RTGS relies upon to remove the current single point of failure. The different options are outlined in Section 2.2.5.

39 This consultation does not describe the full suite of resilience measures, as there is a strong dependency on the other high-level requirements for the system which are being consulted upon. This suite will be developed once the requirements for the system are finalised and the appropriate architectural design has been identified.

2.2.2 Resilience design principles

40 The Bank has defined a set of resilience design principles which will shape the design process for the renewal of the RTGS system. These principles define the minimum standard necessary to achieve the level of operational resilience expected for the future RTGS service. The purpose of the principles is to guide the Bank's future decision-making and to ensure that any trade-offs are explicit.

41 The Bank defines operational resilience as the ability to maintain defined service levels and data integrity when incidents occur. This is distinct from business continuity which is concerned with the definition and testing of processes used to manage incidents.⁽³⁾

42 The proposed design principles are as follows:

- (i) **Near-zero data loss.** It is impossible to guarantee that data will never be lost under any circumstance, but this principle implies that all reasonable steps will be taken to prevent data being lost. This might include holding duplicate copies of data that are always up-to-date and designing equipment and processes that can rapidly recover data in the event of failure.

(1) For more information on CBEST, see www.bankofengland.co.uk/financialstability/fsc/Pages/cbest.aspx.

(2) For further details on MIRS and the drivers for its introduction, see www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2014/qb14q305.pdf.

(3) As a response to the RTGS outage on 20 October 2014, the Bank implemented a Critical Incident Management Framework, based upon UK government best practice for business continuity.

Box 3

RTGS and the Principles for Financial Market Infrastructures (PFMIs)

The PFMIs are internationally-agreed standards published by the Committee on Payments and Market Infrastructures (CPMI) and the International Organisation of Securities Commissions (IOSCO).

The Bank's operational resilience framework for the next generation of RTGS has been written in light of the PFMIs, in particular the seven key considerations under Principle 17 on Operational Risk. This box sets out how the framework addresses those considerations.

PFMI 17.1 An FMI should establish a robust operational risk-management framework with appropriate systems, policies, procedures, and controls to identify, monitor, and manage operational risks.

PFMI 17.2 An FMI's board of directors should clearly define the roles and responsibilities for addressing operational risk and should endorse the FMI's operational risk-management framework. Systems, operational policies, procedures, and controls should be reviewed, audited, and tested periodically and after significant changes.

The Bank has a robust enterprise-wide operational risk management framework. Following the Bank's Court of Directors approving a Bank-wide risk tolerance statement in late 2015, the Bank's RTGS Strategy Board will determine how principles in this statement should apply to the new RTGS service.

PFMI 17.3 An FMI should have clearly defined operational reliability objectives and should have policies in place that are designed to achieve those objectives.

As outlined in Section 2.2.3, the Bank has identified recovery objectives for the new service in line with the requirements of the PFMIs for critical IT systems to resume operations within two hours of a failure, allowing settlement to be completed by the end of the day even in extreme scenarios.

PFMI 17.4 An FMI should ensure that it has scalable capacity adequate to handle increasing stress volumes and to achieve its service-level objectives.

The new RTGS will be built so that it is capable of scaling to the expected demands of payment flows over its lifespan, and cope with peaks of demand on specific days.

PFMI 17.5 An FMI should have comprehensive physical and information security policies that address all potential vulnerabilities and threats.

The Bank has a clear Information Security Framework, appropriately restricted physical and logical access, an appropriate degree of staff security vetting before being allowed unescorted access within the Bank, and local representatives for data protection and Freedom of Information as well as central teams.

PFMI 17.6 An FMI should have a business continuity plan that addresses events posing a significant risk of disrupting operations, including events that could cause a wide-scale or major disruption. The plan should incorporate the use of a secondary site and should be designed to ensure that critical information technology (IT) systems can resume operations within two hours following disruptive events. The plan should be designed to enable the FMI to complete settlement by the end of the day of the disruption, even in case of extreme circumstances. The FMI should regularly test these arrangements.

The Bank has formal business continuity arrangements for RTGS which will be updated to reflect changes that a new system requires. As outlined in Section 2.2.1, the Bank intends to maintain a non-similar third platform in the new system to address the risk of low likelihood but high-impact events such as the loss of two data centres. The movement of the system between data centres or to the third platform during operational hours needs to preserve data integrity, meaning that operations may stop for short periods while the move takes place.

PFMI 17.7 An FMI should identify, monitor, and manage the risks that key participants, other FMIs, and service and utility providers might pose to its operations. In addition, an FMI should identify, monitor, and manage the risks its operations might pose to other FMIs.

The Bank will continue to maintain and update a risk register capturing risks that operating RTGS poses to the Bank. Formal contracts, including service level agreements with third-party service providers will continue to be put in place and monitored. As outlined in Section 2.2.5, the Bank is proposing to increase messaging resilience, among other changes.

Box 4

Responding to the cyber-threat in the next generation of RTGS

The reliable operation and data integrity of the RTGS system are essential for the smooth running of the UK financial system. Transactions must be settled in a timely manner, and the integrity of the transaction and balance data must be maintained so that the ledger is accurate and can be trusted. Since the current RTGS system went live in 1996, cyber-threats have grown in both volume and sophistication — as day-to-day life has become more digitised, the economic interests of adversaries to exploit cyber-defences have also increased. The defensive measures that the Bank has put in place have therefore had to evolve to meet this growth.

Cyber-attacks can be launched by a wide range of actors, including nation states, organised crime groups, disgruntled employees, terrorists, or politically-motivated hacking groups. Those attacks may range from a denial of service that attempts to render services inoperable, hijacking of systems to insert fraudulent transactions or stealing of sensitive data. 'Advanced persistent threats' typically involve an attacker gaining access to a system or network and then remaining in place for a period of time before deciding on an intended action or outcome.

The response to these threats extends beyond strong network defences and virus checking — although these remain important. To combat the full range of threats the Bank will continue to pursue best practice in developing capability that focuses on the full range (threats, vulnerabilities and impacts) of people, process and technology facets. Drawing on advice from GCHQ, the Centre for the Protection of National Infrastructure, the National Cyber Security Centre and referencing the CPMI cyber principles,⁽¹⁾ these include but are not limited to: penetration testing; least-privilege access controls that gives users only the system access they require; and secure coding techniques to avoid creating vulnerabilities as the system is changed.

During the implementation and running of the new RTGS service, the Bank will continue to monitor the evolution of cyber-threats, drawing on all of the available intelligence and extending the Bank's defences accordingly. The security design for the new system will also need to adapt to as-yet-unidentified threats as they emerge, as well as addressing the changes to the threat landscape brought about by the extended participation in the system.

(1) CPMI-IOSCO (2016), 'Guidance on cyber resilience for financial market infrastructures', available at www.bis.org/cpmi/publ/d146.pdf.

- (ii) **Data integrity must be maintained.** This means that data should be protected from deliberate tampering, or accidental corruption. This may be achieved for example through a combination of security measures to limit access and software checks designed to detect unexpected changes in the data.
- (iii) **Data integrity takes precedence over service availability.** The Bank has prioritised the accuracy of each payment, transaction and account balance over system availability. In turn, this means that, in the unlikely event that there were to be a problem with data integrity, the system would be halted while the problem is resolved. The reason for this precedence is that, given the high value of the payments in RTGS, a single error in applying a payment or updating a balance has the potential to affect every subsequent payment in the system. Subsequent payments may be prevented from settling where they should have, or be allowed to settle where they should not.
- (iv) **Data confidentiality must be maintained.** Details of transactions, balances and activities must not be accidentally or maliciously disclosed — either between participants in the RTGS service, or by the Bank.
- (v) **All payments should be settled by the end of the operating day.** In the case of an extreme event where normal recovery procedures cannot be invoked, there will be a contingency process which completes the settlement of payments, and this must be complete before the settlement for the following day commences.
- (vi) **There should be no single point of failure during the normal operation of the RTGS service.** This implies a rigorous process of identifying all of the components that comprise any future system, to ensure there are two or more instances of each component available for immediate use. This includes both physical components (eg hardware, telecoms, power supplies) and software components.
- (vii) **Finality must be clearly defined in all modes of operation in the future RTGS service.** The Settlement Finality Directive requires that systems must document when payments enter the system (after which they shall be legally enforceable and binding on third parties, provided they entered the system before an insolvency event). This 'point of entry' is normally the point at which a transaction is committed to a database, or similar, within the system. When a failure occurs that is not sufficiently serious to stop the RTGS service

completely (the failure of a specific storage device for example), it is possible that this 'point of entry' will be slightly different while the failure is being resolved. This principle means the Bank will define 'points of entry' for all the possible modes of the system.

(viii) **The principal RTGS system should not aspire to be resilient to concurrent catastrophic failures.** This principle seeks to place a reasonable limit on the extent to which the principal RTGS system can be made resilient and address highly unlikely pairs of events — for example, a flood in one data centre and a cyber-attack on another. These types of event are better addressed through the use of a third platform.

43 These proposed principles are intended to apply to the parts of the core RTGS service and not the rest of the payments ecosystem.

2.2.3 Recovery objectives

44 A 'Recovery Point Objective' (RPO) is the maximum amount of data that may be lost when service is restored after an interruption. The RPO is expressed as a length of time before the failure. For example, an RPO of 'one day' could be supported by daily backups, and up to 24 hours of data may be lost.

45 A 'Recovery Time Objective' (RTO) is the maximum time allowed for the recovery of a service following an interruption, for example 'by the start of business the next working day' or 'within two hours'.

46 In order to set plausible values for these objectives for the future RTGS service, the Bank has identified the set of products that are supported by RTGS currently. The products are CHAPS, CREST Delivery versus Payment (DvP), Deferred Net Settlement (DNS) schemes (Bacs, Cheque and Credit, LINK, Visa, Faster Payments), CLS, reserves accounting and Business Intelligence and data services.

47 For the future RTGS system, the Bank proposes an RTO for the system of within two hours. The proposed RPO is near zero, meaning that data loss must be as close to zero as possible (with the exception of the Business Intelligence service which has an RPO of 24 hours).

48 The recovery objectives defined above are in line with PFMI Principle 17.6, which states that in the event of a failure, critical IT systems should resume within two hours and settlement should be completed by the end of the day (see Box 3).

49 The near-zero RPO for the future RTGS system is in line with design principle (i) of near-zero data loss. This objective replicates that for the current service.

50 During the outreach phase of the Review, the Bank also confirmed that these parameters are broadly in line with other comparable RTGS systems around the world.

Question 6

The Bank proposes a Recovery Point Objective of near zero and a Recovery Time Objective of within two hours for the future RTGS service (other than for Business Intelligence).

Do you agree with these proposals?

2.2.4 Operational resilience framework

51 To strengthen the resilience of RTGS and ensure it has the flexibility to respond to emerging threats, the Bank intends to design the renewed system using a resilience framework centred on the concept of threats and countermeasures. Threats are potential events that may cause disruption to the RTGS service. Examples of threats range from a denial of service attack on the core settlement service through to a fire in the RTGS data centre. Countermeasures are capabilities of the system which provide resilience and enable the service to continue processing when a threat has crystallised. So, for example, countermeasures for a denial of service could include proactive monitoring and strong cyber-defences. Countermeasures for a fire in the RTGS data centre could include having a second data centre.

52 To implement such a resilience framework in the design of RTGS, a three-phase approach will be utilised:

- (i) *Define* — a phase where a framework of threats to the operation of the RTGS service are identified and assessed for likelihood, impact and risk appetite, and countermeasures designed to mitigate the threats.
- (ii) *Implement* — use the output from the definition phase to inform the design for the new system.
- (iii) *Review* — continuously review the new system over its lifespan to ensure that existing threats have the correct countermeasures and new threats are identified and dealt with appropriately. This is a key part of the framework as the risk landscape will continue to evolve over time.

53 The process of modelling threats to live operations and designing and implementing countermeasures to those threats should enable the Bank to be explicit about the mapping between threats and countermeasures and identify existing or emerging threats that are not being countered.

54 The framework encompasses six separate risk categories that describe the full range of existing and emerging

Figure 1 The six risks categories used to describe the existing and emerging operational risks

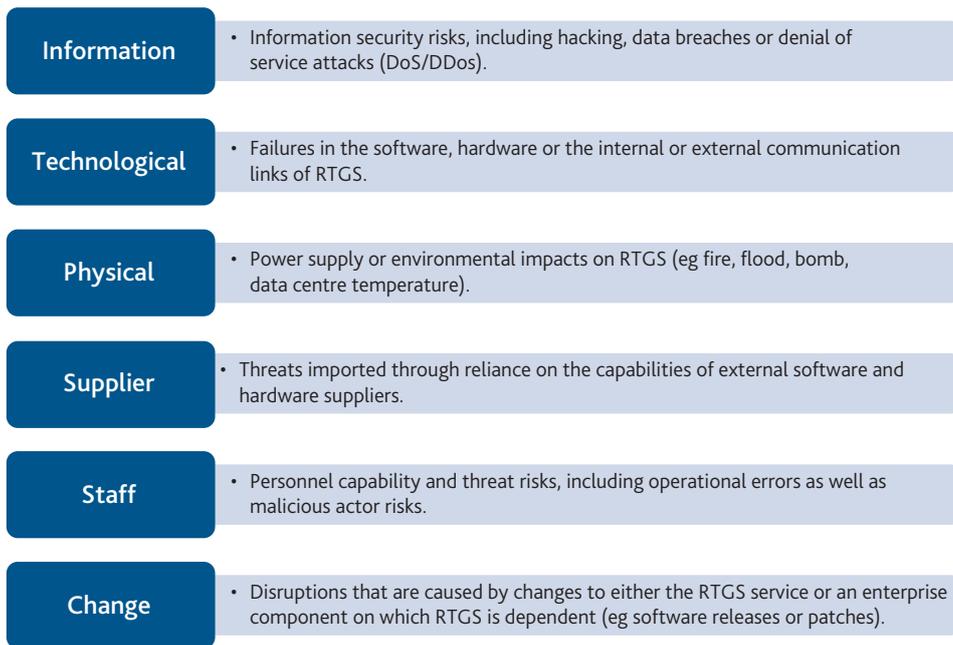
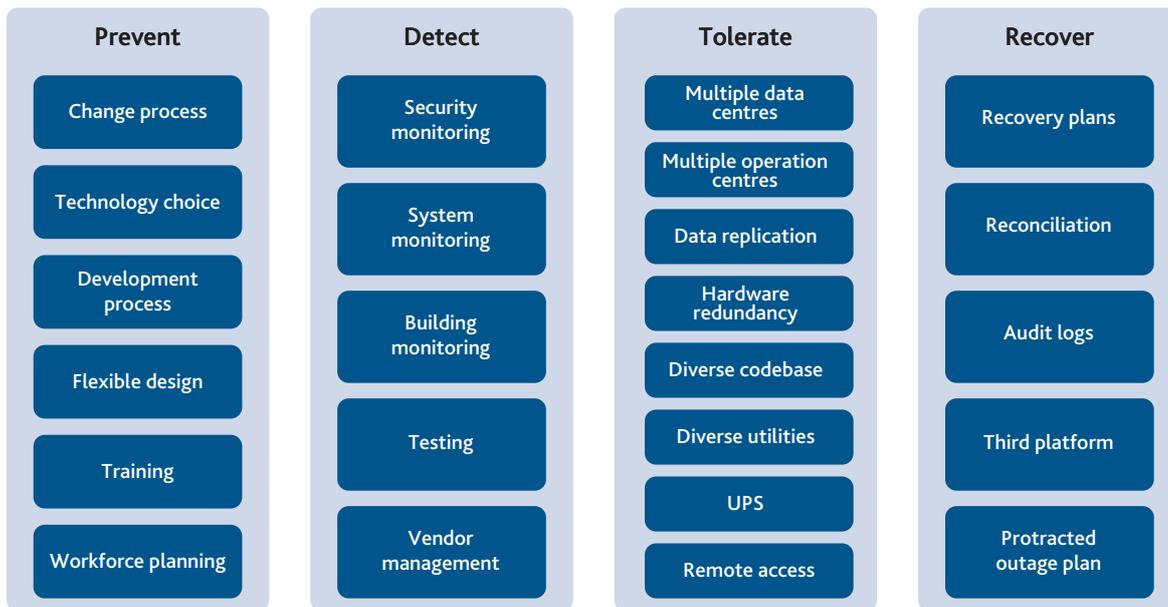


Figure 2 The four categories of countermeasure



operational risks which could threaten the system’s smooth operation. These are shown in **Figure 1**.

prevent, detect, tolerate and recover. **Figure 2** shows how the specific countermeasures are grouped into the four categories.

55 When a possible threat crystallises it becomes an incident which must be dealt with by the RTGS system. The first line of defence is to try and prevent the incident from occurring, eg through robust operational processes. For incidents that cannot be prevented, it is important to have timely and accurate detection so that corrective actions can be taken. Once the incident has been detected, the system must either be able to continue running, through fault tolerant design, or, where fault tolerance is not possible, be able to be recovered quickly. This creates four categories of countermeasures;

56 Each threat can be met with one or more countermeasures, and equally each countermeasure may address more than one threat in a many-to-many mapping. Some of the countermeasures represent good practice, such as strong development processes to avoid coding errors, or comprehensive audit logging to quickly diagnose problems. Others involve larger investment decisions, such as multiple data centres.

57 The next generation of RTGS will adopt a 'recovery by design' approach which seeks to ensure that tools and information are available to support system recovery in the event of a problem. The aim is to reduce the time needed not only to diagnose problems, but also to undertake reconciliation checks and integrity checks before resuming the service. The recovery approach will also include a 'third platform' to support recovery from total failure of the core system; and a protracted outage plan which will define how the Bank would cope with a system outage that lasted for days combined with the non-availability of the third platform.

2.2.5 Messaging network resilience

58 Network functionality connecting participants to the current RTGS service is provided by SWIFT. This includes the messaging network, payment messages, identification, non-repudiation and authentication. In common with many central bank RTGS systems, high-value payments in the United Kingdom are reliant on this network. Without it RTGS is unable to process CHAPS payments in large volumes. Applying the design principles set out in Section 2.2.2, this represents a single point of failure which needs to be addressed to strengthen the resilience of the next generation of RTGS.

59 There are a number of scenarios that can be envisaged that could result in a loss of the messaging network.

- (a) RTGS losing the ability to connect to the SWIFT network.
- (b) A situation in which the integrity of the SWIFT network was compromised or uncertain.
- (c) A total operational outage of the SWIFT network.

60 Given the resilience measures that RTGS and SWIFT have in place to address these risks, and the strong track record of managing them to date, a message network outage can be considered a low likelihood but high-impact event. Nevertheless, the increasing range and complexity of threats emerging around financial messaging underscores the importance of re-examining these protections in the design of the future service.

61 In the current RTGS system, a manual contingency arrangement is in place for these scenarios. This ensures that end-of-cycle settlements of retail schemes can continue, and also enables each participant to submit a small number of CHAPS payments for settlement by an alternative means. It is the Bank's intention in renewing RTGS to strengthen the contingency arrangements in place to enable RTGS to continue to meet its recovery objectives in a scenario where the RTGS messaging network is not available. Two options for doing this are being consulted upon:

- (A) Replace the current contingency process with an updated and more automated process capable of handling a full day of RTGS traffic if required. This would most likely be implemented as part of the user interface, and provide facilities to upload large batches of payments for processing. The facility would only be enabled in the event of a message network outage affecting either an individual participant or the entire system.
- (B) Build full support for two network providers, each of which could provide a full range of identification, authentication, non-repudiation and transport services in normal RTGS operation. In the event of a loss of one messaging network direct participants would then continue to be able to use the other. For this arrangement to work, participants would need to have permanent operational connections to both providers.

62 Option (A) would offer an improvement over the current contingency arrangement in the volume of payments that could be processed through greater automation. It would also potentially remove the need for participants to decide which subset of payments to select for submission in such an outage. However, as a contingency measure there would probably be some delay in switching to this mechanism in the event of an outage, and it would not offer the same level of functionality as the primary processing method, meaning that processes such as authentication and reconciliation would be more operationally burdensome while it was in operation. Regular testing of the arrangement would also be required to ensure participants had the capability to utilise it when required. Ensuring such an arrangement could be utilised without compromising the security of the central infrastructure would be an important focus for the Bank in the design process.

63 Option (B) would allow for processing to continue in the same, or similar way it does in day-to-day running and at similar volumes and frequency, without a delay to invoke the contingency arrangement and without loss of functionality. It would however result in an increase in system complexity requiring both the central RTGS system and participants' systems to build and maintain two sets of messaging interfaces. Twin interfaces would also increase the amount of maintenance and testing required. This option would therefore come at a significantly higher central build and ongoing operating cost and would potential impose significant additional costs on participants to develop and maintain multiple messaging providers. The Bank would need to consider carefully how to implement the requirement to have access to multiple messaging interfaces, and whether it would be proportionate to require this for lower volume users of RTGS, whose failure to connect would have a lower impact on the functioning of the overall system.

Question 7

The Bank has set out two options for mitigating RTGS's reliance on a single messaging provider. Option A is a contingency mechanism for file submission via an alternative network for use in an outage. Option B is for the Bank to require some or all RTGS participants to use two messaging providers.

Which option do you prefer?

2.3 Interoperability

2.3.1 Introduction

64 Households and companies increasingly expect payment and settlement services to work seamlessly across time zones, borders and currencies. To respond to this demand, RTGS account holders are active in multiple systems, both retail and wholesale, cash and securities, within the United Kingdom and spanning international borders. But engaging with such a wide range of systems and their differing technologies, business processes and data protocols is complex, expensive and operationally risky. The resulting demand for simpler and more resilient pathways for payments is increasing pressure for convergence between payment systems, a trend that the Bank judges is likely to continue over the lifespan of the next generation of RTGS.

65 This convergence can be met in two ways: (a) through the merger of currently-separate systems; and (b) through the introduction of tools aimed at increasing the level of harmonisation between separate domestic and international infrastructures — so-called 'interoperability'.

66 A prominent recent example of this drive to rationalise core financial infrastructure is the proposal by the United Kingdom's industry-based Payments Strategy Forum (PSF) for a new single architecture for retail payments based on common standards for messaging and accessing data.⁽¹⁾ Other examples include: the creation of the Single European Payments Area (SEPA), which establishes a common set of standards for retail payments across Europe; and the ECB's proposals to merge its TARGET2 euro payments and TARGET2-Securities settlement systems.

67 The Bank's view is that, although there is scope to consolidate the number of retail payment schemes, as proposed by the PSF, there remain material resilience benefits to retain the existence of separate retail and high-value payment systems. For similar reasons, the Bank is not proposing to alter the arrangements currently in place to support the link with the CREST securities settlement system. Consequently, the proposals in this section are aimed at enhancing interoperability, rather than merging systems.

68 Promoting interoperability between CHAPS and other payment systems is not new ground for the Bank, as discussed in Section 1. For example, CHAPS Co adopted SWIFT's standardised MT messaging, the prevailing international standard, for CHAPS in 2001. In securities settlement, the Bank established direct operational links with CREST to support 'Delivery versus Payment', also in 2001. And in foreign exchange settlement, the Bank introduced functionality allowing CLS to offer 'Payment versus Payment' settlement for sterling FX transactions via CHAPS in 2002.

69 The rest of Section 2.3 proposes two specific measures to promote the interoperability of RTGS with other major payment and settlement infrastructures, to support resilient, efficient and innovative payment arrangements for users of the system. It also outlines the Bank's analysis on the interaction between high-value and retail payment systems.

- Section 2.3.2 proposes the use of ISO 20022 messaging standards in the next generation of RTGS to harmonise the service with the messaging standards being adopted in other key systems accessed by RTGS users. This supports the Bank's stability objectives by allowing payments to clear in the most appropriate system and enabling the redirection of traffic in the event of an outage, providing an extra layer of resilience for the system as a whole. ISO 20022 would enable richer data to be carried by RTGS; and common messaging standards would also enable efficiency gains for users and new entrants by reducing the need to maintain multiple systems for accessing different payment schemes.
- Section 2.3.3 explores whether the new generation of RTGS should have the capacity to synchronise movements of central bank money with related movements of cash or assets in other systems. Such a mechanism could encourage broader settlement in central bank money, supporting the Bank's stability objectives and facilitating the emergence of new settlement systems and types of payment activity.
- Section 2.3.4 explains why the Bank believes there is no current stability case for settling all UK retail payments individually in real time in RTGS nor for expanding RTGS to include the ledger of securities holdings currently housed in CREST, to enable the integrated settlement of cash and securities for sterling denominated gilts, equities and corporate bonds.
- Section 2.3.5 sets out a proposed strategy for promoting alternative settlement methods for time-critical retail

(1) The Payments Strategy Forum's draft strategy, 'Being responsive to user needs', July 2016, is available at <https://paymentsforum.uk/sites/default/files/documents/Being%20responsive%20to%20user%20needs%20-%20Draft%20strategy%20for%20consultation.pdf>.

payments that currently settle in CHAPS. The Bank is designing the next generation of RTGS primarily for low-volume, high-value, time-critical payments. Although the Bank has no plans to put a barrier in the way of other payments being settled in CHAPS, its preferred strategy is to take advantage of the interoperability benefits promoted by the adoption of ISO 20022 to ensure lower value time-critical payments can be redirected into retail infrastructures if needed, for example in the event of an outage.

2.3.2 Messaging standards (ISO 20022)

70 Any payment system requires a messaging standard, ie a common set of rules for encoding relevant payment information, in order to enable efficient communication with participants and related infrastructures. Messaging standards cover such things as: how senders and receivers identify each other; how key properties of a payment message such as currency, amount and value date are encoded; what additional information can be included alongside a payment message; and in what format.

71 The current RTGS infrastructure uses SWIFT MT messaging standards for CHAPS payments, which have served the system well. The Bank has the option of choosing to use the same standards in the next-generation system. But the messaging demands that will be placed on RTGS over the coming years are likely to change radically as users demand richer payments data to enhance the payment services offered to customers. The Bank therefore judges that it should take advantage of the opportunity provided by RTGS renewal to ensure that it uses the most appropriate messaging standards to support the financial system in the coming years.

72 RTGS renewal represents an opportunity to deliver common messaging standards. Such standards remove a barrier to switching payments between systems, during a prolonged outage in one infrastructure for example, which would support the Bank's stability objectives by providing a valuable layer of resilience. This supports the Bank's commitment to eliminating single points of failure in the RTGS service, outlined in the resilience principles set out in Section 2.2.2.

73 Another key component of a new messaging standard should be the ability to provide much richer data about the nature and purpose of individual high-value payments. This would support financial service firms in their use of advanced data analytics techniques to support customer business. Equally, richer data could prove valuable to regulators and firms as they implement the next generation of rules on anti-money laundering, 'know your customer' and combatting the financing of terrorism. For these reasons, during its initial outreach phase, the Bank's Review team heard strong support from a wide range of users for the next generation of RTGS

moving for high-value payments to ISO 20022, a global open standard for creating payment and other financial messages. For the Bank itself, analysis of the richer data contained in high-value payments could yield insights on the health of the economy. For example, transactions linked to particular components of economic activity, such as housing transactions, could be 'flagged' giving the Bank an additional and rapidly accessible dataset.

74 ISO 20022 is becoming the prevailing standard for payment messaging. Many other major High-Value Payment Systems including Fedwire (USA), BOJ-NET FTS (Japan) and TARGET2 (Eurozone) are also in the process of implementing, or have already implemented, ISO 20022. And indeed, a significant number of the larger financial firms consulted during outreach already operate internal systems compatible with ISO 20022.

75 An additional benefit to interoperable messaging standards is that they remove (or reduce) the need to maintain multiple systems to access different schemes. In turn that can increase efficiency, competition and innovation by reducing costs and removing barriers to new entrants, allowing a broader and more diverse range of payment services to be offered to customers.

76 Based on the weight of evidence, the Bank plans to use ISO 20022 messaging standards in the new RTGS infrastructure. This means that payments sent through CHAPS will need to be ISO 20022 compliant.

77 As **Table F** shows, UK payment systems currently use many different standards. It may be appropriate for certain systems continue to use a different standard, eg the card schemes which already operate on an appropriate globally interoperable standard. But there is an opportunity to align other systems on ISO 20022. ISO 20022 is however a broad standard, meaning that it is possible to develop specific implementations of the standard which may be incompatible with one another. Delivering the benefits set out above from implementing ISO 20022 in the next generation of RTGS therefore requires co-ordination between industry and regulators, to ensure a harmonised implementation both domestically and internationally — a point underscored by industry during the Review team's outreach phase.

78 In this respect, the Bank welcomes the strong support from the UK Payment Strategy Forum and Payment Systems Regulator⁽¹⁾ for the transition of the sterling retail schemes Bacs and Faster Payments to a common international messaging standard. The UK authorities are united in their desire to move towards common standards, and the Bank will

(1) See Payment Systems Regulator, market review into the ownership and competitiveness of infrastructure provision, 2016, available at www.psr.org.uk/psr-focus/market-reviews.

Table F Messaging standards in UK payment systems remain fragmented^(a)

System	Standard
CHAPS	SWIFT MT
Faster Payments	ISO 8583 (bespoke)
Bacs	Standard 18
LINK	LIS5 (bespoke)
Visa	ISO 8583
MasterCard	ISO 8583

Source: Payment Systems Regulator, market review into the ownership and competitiveness of infrastructure provision, 2016.

work with the PSR, the PSF, the payment scheme companies and existing domestic and international standards-setting groups over the coming months in order to realise the benefits effectively.

79 Ideally, the output of this process would be one unified standard that could be used both in the United Kingdom and in other jurisdictions. There may, however, be potential trade-offs between working towards harmonisation domestically and internationally, which may in turn entail a prioritisation between aligning the future UK High-Value Payment System's messaging standards with overseas High-Value Payment Systems, such as TARGET2 and Fedwire, or with domestic retail and securities clearing infrastructures. This is the basis for the second half of **Question 8**, below, where the Bank seeks input from system participants on the form of harmonisation they would prefer to see prioritised.

Question 8

The Bank plans to use ISO 20022 messaging standards for CHAPS in the new RTGS system.

Do you support this proposal?

Please explain where your institution could see the benefits in terms of domestic or international harmonisation of standards or both. Are there specific ways in which ISO 20022 messaging standards would need to be implemented to realise these benefits?

2.3.3 Synchronisation

80 Settlement risk can arise where payment transfers linked to the same underlying economic transaction occur in different systems, at different times, in different currencies, or in different locations. The Bank's second proposal for enhancing interoperability is to provide functionality that could enable the synchronisation of cash movements in RTGS with cash or other asset movements made in other systems. This section proposes two specific use cases for such

functionality and seeks feedback on the potential level of demand for such functionality in future.

81 Synchronisation draws together several different themes that emerged from the Bank's outreach phase. These include: (a) whether the Bank could design the new RTGS in order to support multicurrency transactions and cross-border payments, where both technology firms and RTGS participants reported an active search for new solutions; and (b) the relationship between central bank settlement and possible future clearing and settlement venues emerging as the result of technological change in payments.

82 Through its operation of RTGS, the Bank has been able to promote the mitigation of two key risks associated with large interbank financial exposures. First, for the past two decades the Bank's strategy has been to move settlement away from commercial bank money, and towards central bank money, reducing the risks posed by the potential failure of a private settlement agent. Second, the Bank has worked to mitigate settlement risk by settling high-value payments in real time and introducing cash prefunding for deferred net settlement schemes. The synchronisation functionality outlined here would potentially allow for a wider and more varied set of transactions to be settled in real-time in central bank money, while also providing an opportunity to support innovative new methods of settlement, consistent with the Bank's strategy for financial innovation.

83 The Bank believes these benefits could be delivered by introducing a standardised bundle of functions into the next generation of RTGS, enabling users to synchronise payments in RTGS with movements in other systems:

- Queuing functionality** to enable payments with specific priority flags to be queued and released automatically based on predefined conditions.
- Earmarking functionality, supported by appropriate legal agreements**, to enable liquidity held on a settlement account to be set aside for the purpose of making a specific payment or set of payments; and
- Interface functionality** to allow RTGS to receive and respond to: (i) queries on the status of a specific payment or payments queued within RTGS; and (ii) instructions to alter the state of that payment, using a standardised messaging protocol for communications between ledgers.

84 These are not new concepts and the first two are already included in the current RTGS platform and will be replicated in the new system regardless of the demand for synchronisation functionality. What this proposal entails is the packaging of these two features with an interface, (c) above, in a

Box 5
Synchronisation use case 1: Enabling more cross-border payments to be settled 'Payment versus Payment' (PvP)

Modern corporate supply chains are global and supported by complex correspondent banking networks. The interbank flows that back this activity are settled across time zones and currencies and, where they are not mitigated, these mismatches create 'Herstatt risk', as described in Section 1. This is a specific form of settlement risk that arises in foreign exchange markets. It crystallises in the event that one party to a trade defaults on its obligations when its counterparty has already fulfilled its obligations.

The Bank strongly supported the introduction of CLS in 2002. The majority of FX transactions by value in eligible currencies are settled on this platform using national RTGS systems, eliminating the Herstatt risk associated with them. But a material number of cross-currency transactions between major currencies, including some with a sterling leg, are still settled either on a bilaterally netted or otherwise non-PvP basis, meaning that some Herstatt risk remains in the system. The Bank is interested in whether synchronisation would be a viable method for settling more of these transactions on a 'Payment versus Payment' basis.

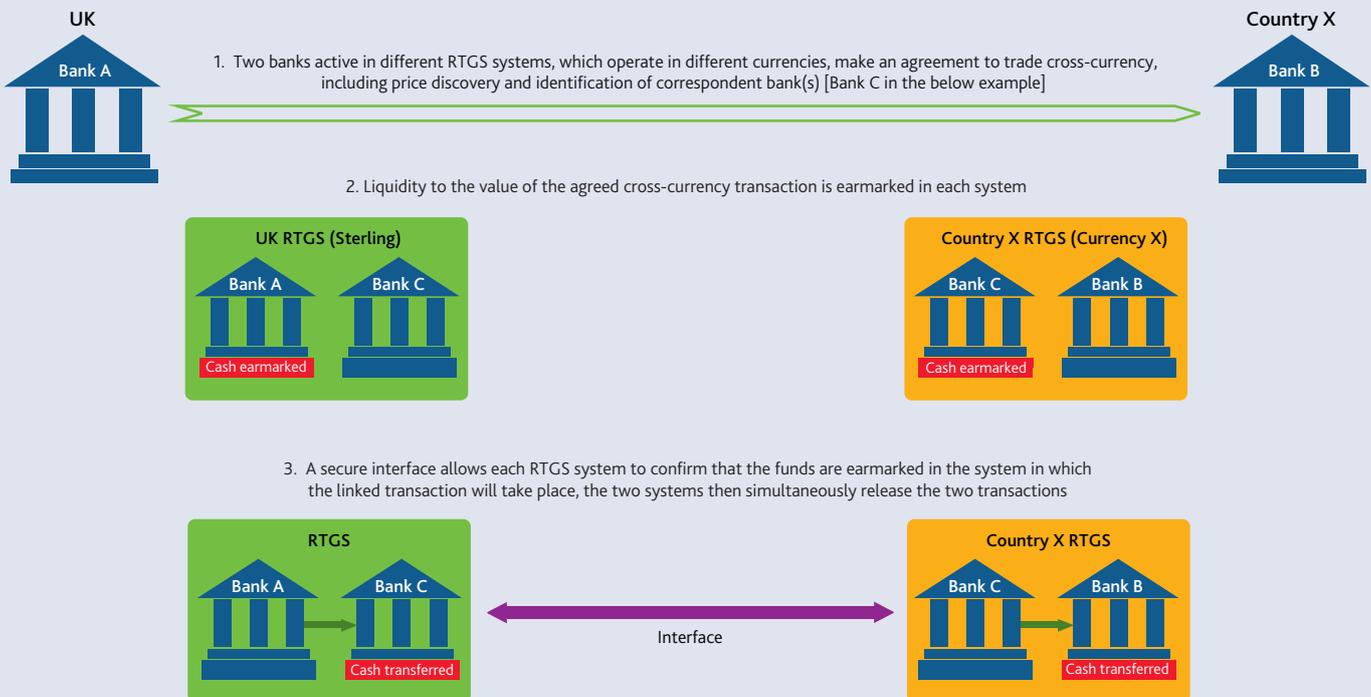
At the same time, corporates and consumers in one country are increasingly interconnected with those in others and have begun to expect cross-border payment services that reflect this including, for example, a reduced or zero time lag between trade and settlement. Synchronising cross-border transactions may also be a route to reducing these time lags.

Figure A provides a stylised example of how synchronisation functionality might be used to support a cross-border transaction made in exchange for goods or services in the real economy.

In this case the principal benefits of enabling synchronisation of a transaction made in the United Kingdom's RTGS and one made in another RTGS would be: (a) mitigate settlement risk involved in the transaction and (b) smooth the passage of the transaction by reducing any associated time lag.

The Bank welcomes comments on the feasibility and desirability of this proposal from current and prospective market infrastructures as well as market participants.

Figure A Synchronising cross-border transactions



Source: Bank of England.

Box 6 Synchronisation use case 2: Supporting new settlement venues

A typical settlement chain can involve many different intermediaries, meaning securities settlement is comparatively slow. Transactions that take nanoseconds to execute settle in days. This also means increased costs and operational risk. This is leading to a growing interest in new settlement venues as a method of making securities markets more efficient.

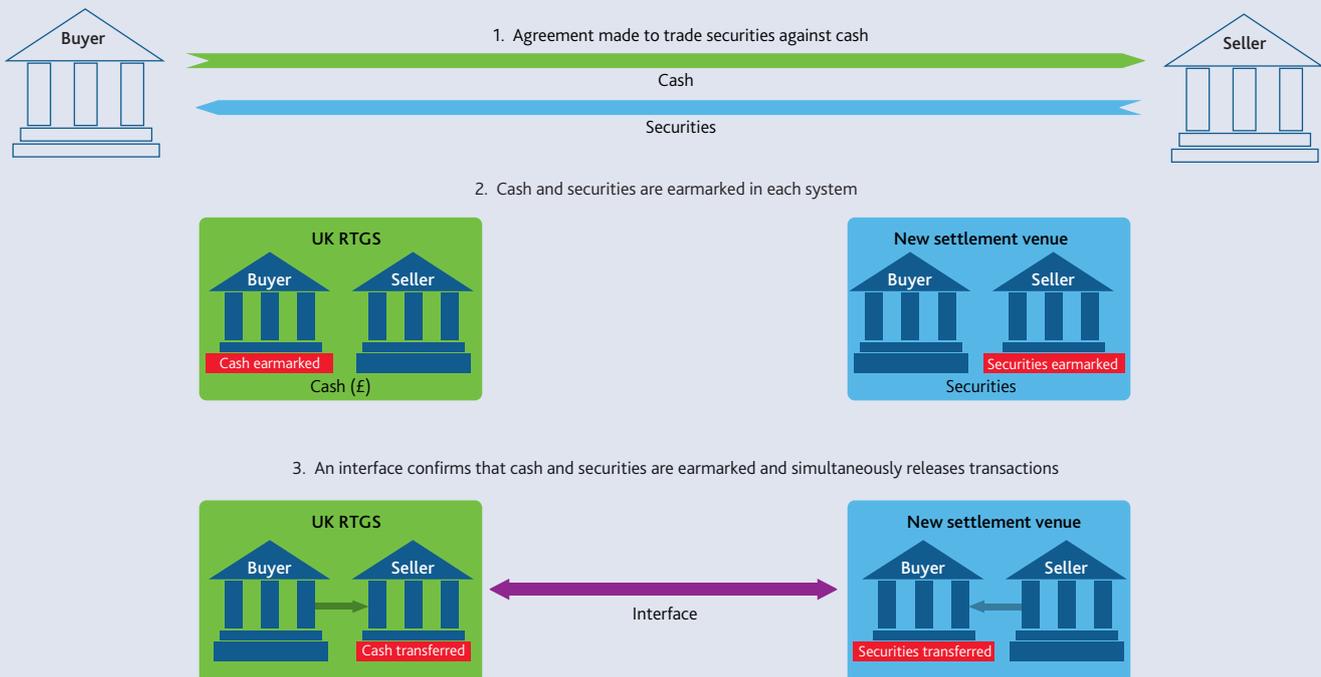
There is a risk that the creation of such new infrastructures could lead to material financial exposures arising in commercial bank money, should new competitors rapidly gain market share. This could reintroduce settlement risk to the system, which would run counter to the Bank’s objectives. Equally, it is arguable that market participants value the reduction in risk provided by central bank money settlement, so providing access to central bank money to new infrastructures could enable innovative settlement venues to emerge.

As the Governor of the Bank of England stated in remarks made earlier in the year,⁽¹⁾ the Bank is open to providing access to central bank money settlement to operationally robust systems of an appropriate scale. A potential second use case for synchronisation therefore is enabling new settlement venues to access Delivery versus Payment settlement in central bank money.

Figure A provides a stylised example of the cash movement associated with a securities transaction, that has been made in another system, being settled in real time in central bank money ('Delivery versus Payment') using synchronisation functionality.

(1) As set out in the Governor of the Bank of England’s speech, 'Enabling the FinTech transformation: Revolution, Restoration, or Reformation?', June 2016, available at www.bankofengland.co.uk/publications/Documents/speeches/2016/speech914.pdf.

Figure A Synchronising securities transactions



Source: Bank of England.

standardised, generic offering to enable synchronisation of RTGS transfers with movements in other systems.

85 The Bank has identified at least two potential use cases for this functionality, consistent with its aim to safeguarding stability while enabling innovation. The first offers the potential to mitigate the settlement risks associated with a wider range of cross-border transactions, by enabling an alternative method of 'Payment versus Payment' settlement. The second gives the Bank the ability to support new securities settlement venues where the movement of cash and assets may lead to material interbank financial exposures. These two use cases are set out in Boxes 5 and 6.

86 The Bank is seeking input from existing and prospective infrastructures and service companies as well as from market participants on three related questions:

- Whether respondents see merit in including standardised synchronisation functionality of the type described in this section in the next generation of RTGS. On the one hand, such functionality would expand the range of services that RTGS could support, giving it greater flexibility in supporting future demands on the system. On the other hand, it could — at least at the margin — increase the complexity of the core platform. So it is important for the Bank to form a view on the potential demand for its future use.
- Whether respondents view one or both of the identified use cases as viable over the lifespan of the next generation of RTGS.
- Whether respondents judge that a standardised set of synchronisation functions might be adaptable to other use cases not identified here but which may also help to further the Bank's aims for operating RTGS.

The Bank will weigh these responses carefully in deciding whether to include the functionality in the final blueprint.

Question 9

The Bank has proposed incorporating synchronisation functionality into the new RTGS system, to enable real-time payments to be queued and then released automatically based on pre-defined conditions. There are at least two purposes for which the Bank believes this functionality may be of use. The first is by offering an additional route for mitigating the risks associated with cross-border payments by enabling an alternative method of Payment versus Payment settlement. The second is by supporting new settlement venues where the movement of cash and assets may entail material financial exposures.

Do you believe that there is merit in introducing this functionality?

Do you believe that one or both of the proposed use cases will be viable over the lifetime of the system?

Do you believe that a standardised set of synchronisation functionality would be adaptable to use cases, beyond those listed here?

2.3.4 Possible expansions to the scope of RTGS

87 Convergence of payment architecture is one of the key strategic drivers for change underpinning this Review. As set out in Section 2.3.1 one possible means to promote such convergence would be to expand the reach of the RTGS service so that it incorporates some of the functions currently being provided by other sterling payment and settlement infrastructures. As part of its Review, the Bank has considered whether there is a case for the reach of a renewed RTGS to be expanded in two possible ways:

- (a) Developing a system capable of individually settling in real time through RTGS the bulk of payments currently processed by the major UK retail payment schemes, eliminating the settlement risk that exists in these deferred net settlement systems;
- (b) Expanding RTGS to include the ledger of securities holdings currently housed in CREST, to enable the integrated settlement of cash and securities for sterling denominated gilts, equities and corporate bonds.

88 The Bank has concluded that there is not a strong case for either change. On balance there are resilience benefits from the current allocation of functions between RTGS and other UK payment and settlement infrastructures. Outreach discussions with RTGS participants also did not reveal any strong desire for a change to the Bank's approach in these areas.

89 The Bank's conclusion on the involvement of RTGS with the settlement of individual retail payments has been reached for four reasons:

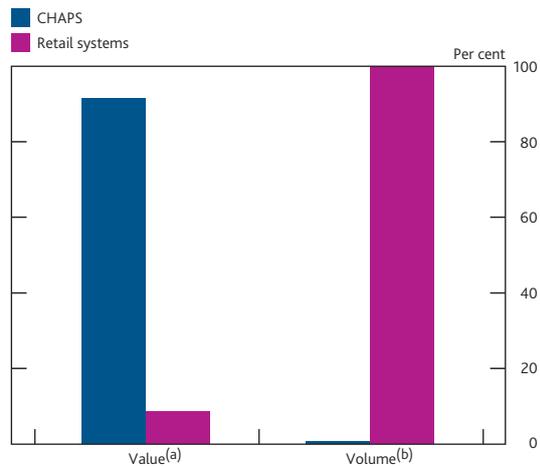
- (a) The purpose of real-time settlement is to eliminate settlement risk. But prefunding in central bank money can also achieve this and has already been implemented for Faster Payments and Bacs, as described in Section 1. Increasing the frequency of settlement cycles in RTGS is another tool that can be used to reduce this risk if prefunding is not favoured for a specific scheme. Relative to such tools, there is no further settlement risk reduction benefit to real-time settlement of retail payments.

To ensure that cash prefunding remains fit for purpose the Bank will nevertheless continue to examine the possibility of further enhancements with the Faster Payments and Bacs scheme companies, direct participants and other future users.

- (b) Real-time settlement is not necessary to provide immediate real-time clearing of retail payments to consumers. In the United Kingdom, customers already have the ability to make payments on a near-instant basis through a wide variety of channels, including when using online payments via Faster Payments, card systems like Visa, or ATMs with LINK. This is achieved without the need to settle interbank obligations at the central bank in real time.
- (c) If all retail payments were settled individually in RTGS, electronic payments in the United Kingdom would become entirely reliant on one piece of infrastructure, ie RTGS. The availability and resilience standards this infrastructure would have to meet would have to be exceptionally high, as the impact of any operational incident would be large, reaching to all corners of the economy. The system as a whole may be more resilient with separate retail and wholesale infrastructures, with improved interoperability facilitated by the use of a harmonised ISO 20022 messaging standard, as discussed in Section 2.3.2.
- (d) Introducing the architecture required to ensure that RTGS had the capability to process significant additional volume to support retail payments (see **Chart 2**) would require a materially more expensive and complex technology project, including the provision of many types of functionality that do not relate directly to the Bank's stability objectives.

90 The Bank's conclusion that there would not be benefits from integrating the CREST sterling securities accounts in RTGS has been reached for four reasons:

Chart 2 Percentage of total sterling payments settled in CHAPS versus UK retail payment schemes



Sources: LINK, Payments UK and the UK Cards Association.

(a) Value: CHAPS 91%, Retail systems 9%.

(b) Volume: CHAPS 0.2%, Retail systems 99.8%.

- (a) the current sterling settlement arrangements for UK securities, which involve a high frequency interface between RTGS and the CREST system, have provided a robust means of providing real-time DvP settlement and eliminating settlement risk since 2001;
- (b) the existing arrangement provides an additional layer of operational resilience by enabling CREST to continue operating securities settlement in a contingency mode⁽¹⁾ if the RTGS system is not available;
- (c) the high frequency interaction between CREST and RTGS means that in practice intraday liquidity can flow freely between the two systems, meaning that there is little practical impact on users of the operational separation between the two processors; and
- (d) maintaining separate payments and securities settlement systems, with a range of alternative access models, allows for the possibility of other innovative private sector solutions developing for securities settlement.

Question 10

The Bank is proposing to maintain the existing scope of RTGS settlement, and not to extend it to (a) have the capability to provide individual settlement of payments currently settled by the major sterling retail payment schemes; or (b) integrate the ledger of sterling securities accounts onto the system.

Do you agree with this proposal?

⁽¹⁾ This contingency mode ('recycle mode') enables CREST to continue to function in the event that the link between CREST and RTGS is lost by recycling the liquidity already in CREST to support further settlement.

2.3.5 Treatment of retail payments currently in CHAPS

91 One of the benefits of stronger interoperability between payment systems should be an improvement to the resilience of the system as a whole. Fragmentation in the messaging standards and networks employed by different payment channels increases the impact of an operational problem in one of those channels by inhibiting rerouting of payments. The strategic drive towards convergence of payment schemes, combined with the increasing number and diversity of security threats, reinforces the desirability for developing contingency procedures across payment channels to mitigate the impact of operational outages and ensure continuity of service for the sterling payment system as a whole.

92 As outlined in Section 2.2, the Bank will take a number of steps to ensure that the next generation of RTGS meets the highest standards of resilience and availability. In spite of this, a system outage will always remain a high-impact, albeit very low probability, event.

93 In the event of such an outage, the Bank aims to ensure that RTGS settles all payments by the end of the day. However, the Bank's responsibility for ensuring financial stability means that data integrity must be prioritised over service availability. So, if RTGS suffers an operational outage that raises questions over data integrity, it may be necessary to delay the resumption of service whilst data integrity is assured. There is a potential tension between this principle and 'time-critical' payments that need to be made to meet strict intraday deadlines.

94 For time-critical *high-value* payments, such as sterling pay-ins to the foreign exchange settlement system CLS, which tend to be low in volume, the Bank has alternative processing procedures in place to ensure that they can be made in the event of an RTGS outage. But it is more challenging to provide an equivalent contingency in such circumstances for time-critical *retail* payments in CHAPS, such as housing transactions, which typically occur in much higher volumes. In the absence of such a contingency, the settlement of these payments could be delayed, leading to consequences for economic activity.

95 To facilitate greater optionality for the settlement of time-critical retail payments the Bank has considered two possible courses of action:

(a) Facilitate the development of interoperability between CHAPS and one or more retail systems (eg Faster Payments) so that in the event of an RTGS outage time-critical payments could be re-routed rapidly into an alternative system. To be effective this would involve direct participants being able to identify time-critical payments in order to re-route them.

(b) Take steps to encourage (or require) participants to clear and settle time-critical retail payments in an alternative system on a business as usual basis.

96 The Bank's proposed approach in renewing RTGS is to focus initially on the first option, ie to seek to promote interoperability between CHAPS and the UK retail schemes in the medium term. Doing so would ensure that CHAPS and retail schemes can act as partial substitutes for one another, enabling rerouting in either direction if an outage occurs. As set out in Section 2.3.1 above, the introduction of ISO 20022 messaging standards will be an important part of facilitating this.

97 Further, in the longer term, the UK retail schemes would seem more natural places for some categories of time-critical retail payments to settle in. So at the same time, the Bank intends to work with the authorities and industry to promote alternative channels for time-critical retail payments that are currently in CHAPS, and therefore reliant on RTGS, by addressing some or all of the barriers listed in Box 7.

98 The Bank has reached this conclusion because of the resilience improvements that interoperability of payment systems will provide. Consumers will benefit as time-critical retail payments will still be able to settle even in the event of disruption.

Question 11

The Bank proposes to work with the industry to ensure there are options for time-critical retail payments to be made via retail schemes rather than CHAPS.

Do you agree with this proposal?

2.4 User functionality

2.4.1 Introduction

99 The United Kingdom's payments landscape, and hence the needs of RTGS users, has undergone significant changes over the period since the introduction of RTGS in 1996. As outlined in Section 1, these changes have required the Bank to enhance and expand the functionality offered by the service to adapt to the emerging needs of RTGS users. These enhancements, including the introduction of liquidity saving functionality, the expansion of system operating hours, the provision of a 'business intelligence' capability and the introduction of reserves accounts, have provided participants with material improvements in functionality, leading to a system which is considerably more advanced than it was at its inception.

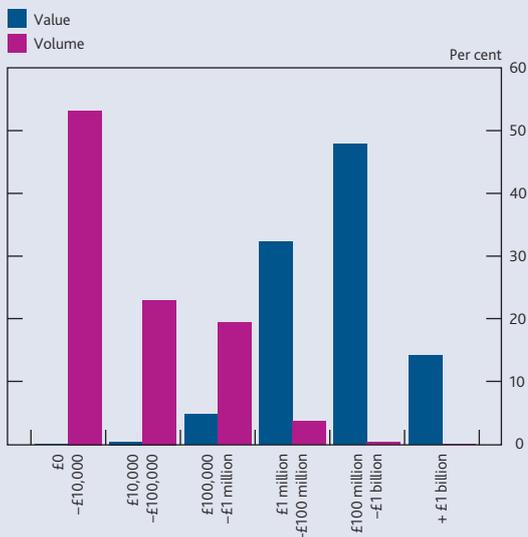
100 However, as the Introduction and executive summary sets out, the pace of change in the sterling payments industry continues to rise, reflecting changes in the structure of the financial system, greater demands for convergence in payment

Box 7

What are time-critical retail payments, and why are some settled in CHAPS?

Despite the fact that CHAPS is predominantly a high-value payment scheme, there is also a large volume of low-value payments made in the system. In fact half of all CHAPS payments by volume are for under £10,000 (Chart A). However, these payments do not make up a significant amount of the total value settled in the system: over 90% of the value of payments settled in CHAPS comes from payments worth more than £1 million.

Chart A Percentage of CHAPS payment volume and value by payment band



Source: Bank of England.

Evidence indicates that the most numerous category of time-critical retail payments in CHAPS are house purchases. Other categories of time-critical retail payments that are made in CHAPS include, for example, high-value auctioneer payments, for cars or art, where consumers need to pay quickly in order to receive the goods on the day. Similarly some tax and duty payments to HMRC which need to be made to meet certain intraday deadlines are made using CHAPS.

The Bank's outreach suggests a number of reasons why some households and companies prefer to make retail payments in CHAPS, rather than schemes explicitly designed to handle retail payments, such as Faster Payments:

- Guaranteed same-day settlement:** although some retail systems processed the vast majority of their payments on the same day, CHAPS remains the only guaranteed same-day settlement system, which is valued by some consumers.
- Value limit:** for some payments no other system meets the value requirements of users. CHAPS has no value limit on payments, while other retail schemes may cap the size of transactions (and banks participating in those schemes typically offer materially lower limits to their customers).
- Real-time data:** the full data in a payment message is transferred to the receiver with the CHAPS payment message in real time, whereas for other systems banks may only transmit abridged data with the remainder being sent with a lag or for an additional fee.
- Inertia:** some back office processes simply route payments into CHAPS automatically, and participants may be reluctant to incur the fixed costs involved in changing these processes until they perceive a sufficiently large business case for doing so.

systems, the emergence of new payment technologies, a greater focus on operational resilience and changes in regulation. Those changes are creating new demands for enhancements to the functionality that RTGS offers to its users. In building an RTGS system for the next decade or more the Bank must not only satisfy existing user demands, but also those that may emerge in the future.

101 Therefore a priority of the RTGS Review is to develop a renewed system that has the flexibility to accommodate potential future demands for enhanced system functionality from users. This section presents how the Bank proposes to achieve this. The Bank’s proposals are as follows:

- (a) The Bank proposes to build an RTGS system that has the technological capability to operate considerably longer hours — potentially up to true 24x7 if required — even if this functionality is not utilised immediately. This will allow RTGS to respond to the changing needs of the market, including greater demand to make payments, or to mobilise sterling liquidity, outside of traditional working hours. This is discussed in more detail in Section 2.4.2.
- (b) The Bank proposes to provide RTGS users with richer data that is easier to access, allowing users to respond more effectively to internal, customer, or regulatory reporting demands for data. This could be achieved through introducing an Application Programming Interface (API) to allow RTGS participants to access their own data flexibly. This is discussed in more detail in Section 2.4.3.
- (c) The Bank proposes to provide direct participants with a range of tools to allow for efficient management of liquidity to ensure that they are able to respond to different liquidity environments. This will be achieved by maintaining current liquidity management functionality,

including the Liquidity Saving Mechanism for high-value payments, as well as introducing additional features. This is discussed in more detail in Section 2.4.4.

- (d) The Bank proposes additional functionality to allow CHAPS direct participants to manage the time at which payments settle flexibly, by forward-dating them. By allowing direct participants to submit payments in advance, the Bank aims to reduce liquidity usage and operational risk. This is detailed further in Section 2.4.5.

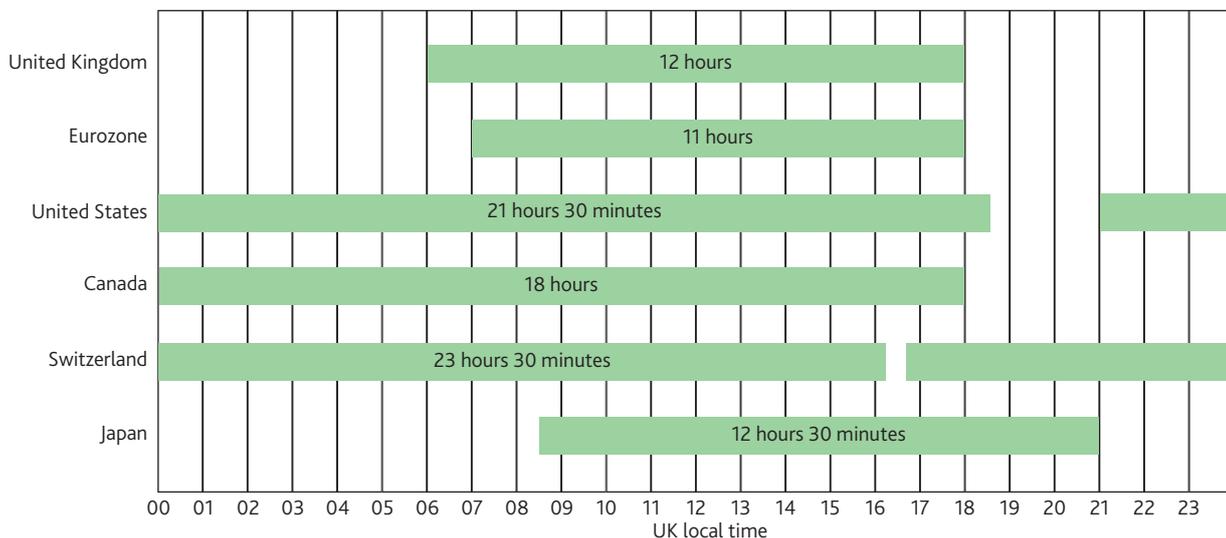
102 These functional features of RTGS represent only a subset of the steps the Bank could take to create a more flexible system. Another important aspect is the underlying technological architecture that RTGS is operated on. Designing a new RTGS provides an important opportunity for the Bank to create a system with an architecture explicitly designed to be adaptable as the demands placed upon RTGS change over time. How this might be done is explored further in Section 3.1.

2.4.2 Operating hours capability

103 One area where designing in flexibility for the future will be important is in the operating timetable that the RTGS system is capable of supporting. Currently RTGS is open for settlement between 06:00 and 18:00 every weekday, with the exception of UK bank holidays. The Bank recently implemented an extension to the CHAPS and CREST settlement day, by extending the closing time of RTGS from 16:20. This decision was made following a review instigated in 2014.

104 The current operating hours of RTGS are shown in **Figure 3**, alongside other central banks’ RTGS operating hours. This shows that some major central banks have found it necessary to expand significantly the operational capability of their RTGS services to enable settlement to be available for

Figure 3 Weekday operating hours of RTGS systems globally, adjusted for time zones



Source: RTGS operators

close to 24 hours per weekday. At present, there is less evidence of a trend towards RTGS systems operating during the weekend.

105 The Bank is not seeking at this stage to define the operational timetable that a renewed RTGS service would adopt from its inception. The question for this Review is how to respond to the potential future demands on the operational timetable of the next generation of RTGS in the design specification for that service.

106 The Review team's initial outreach programme identified a broad consensus that the next generation of RTGS should be able to facilitate a materially expanded operational timetable even if this functionality might not need to be utilised immediately. Stakeholders mentioned this demand could be driven by the increasingly internationalised nature of payments and liquidity, with users having operational centres distributed around the globe and hence likely increasingly to demand the ability to make payments outside of conventional UK business hours. An expanded timetable would give greater flexibility to provide timely central bank money settlement of exposures in retail schemes, which can currently only occur on weekdays, or for new settlement infrastructures that might emerge and seek to settle in sterling in future. Respondents also noted the severe cost and complexity implications of attempting to retrofit the capability to extend the operational timetable of a payment system. The Bank has therefore concluded that a future RTGS will be required to have the capability to support stability and innovation through enabling future expansions of the operational timetable of the system.

107 In the Bank's outreach discussions, views were mixed on whether this expansion of operating capacity should be done with the aim of enabling the RTGS service to offer true 24x7 operating capability, or whether it would be sufficient for the service to be capable of supporting near 24x7 capability with scheduled periods of downtime either at the end of the operational day or at weekends (or both) to enable maintenance and updates.

108 The Bank's analysis and outreach discussions have highlighted the following potential benefits of true 24x7 operational capability:

- (a) providing full operational flexibility against future demands arising from the rapid pace of change in the demands placed on payment infrastructures;
- (b) enabling full interoperability with other major global payment systems or domestic sterling systems which will move or already have moved to true 24x7 operation (including supporting any such demands that arise from the implementation of synchronisation functionality as described in Section 2.3.3);

- (c) aligning with the operational capability of users' internal payment systems which are increasingly being developed with true 24x7 capability when renewed; and
- (d) providing the indirect operational resilience and flexibility benefits that arise from designing a system capable of being updated during live operation.

109 However, discussions with stakeholders also revealed some arguments for why near 24x7 operational capacity might be sufficient in the next generation of RTGS, including:

- (a) the drivers for true 24x7 operation were perceived as largely in the retail payment space, with the settlement of high-value payments being more strongly tied to the operating hours of associated funding markets which have shown less tendency to expand beyond traditional business hours; and
- (b) incorporating the additional redundancy to support true 24x7 functionality would add costs and complexity to the design of RTGS.

110 The Bank is seeking guidance from stakeholders as to whether true 24x7 operational capability will be necessary, or whether near 24x7 capability is sufficient. Specific guidance is sought on the timescale over which participants might expect to see demand for extended operational capability, and whether this will be driven more strongly by demand for extended hours during the current business week, or for greater capacity to operate during the weekend.

Question 12

The Bank intends to build a new RTGS system that has the capability to operate to a near 24x7 timetable as a minimum. It seeks views on whether it should target true 24x7 capability, and to understand in more detail respondents' views on the likely drivers for an extended operational timetable in future.

Do you anticipate demand for RTGS to offer true 24x7 capability over the next decade or more?

What do you expect to be the main drivers for RTGS having an extended operating timetable over that horizon?

2.4.3 Delivering data to participants in a new RTGS system

111 The financial sector, regulators and technology firms are all looking to make better use of their transactional payments and liquidity usage data, reflecting:

- (a) **More demanding post-crisis regulatory requirements:** Firms are increasingly required to understand and report

their usage of intraday liquidity to comply with prudential liquidity regulations and their payment flows to meet regulatory requirements on anti-money laundering, 'know your customer' and combatting the financing of terrorism.

- (b) **A desire to offer new services to customers:** Firms are attempting to provide new and innovative value-added services to customers through making better use of payments data. These services are often being offered by new players, leading to an increasingly diverse payments ecosystem, especially with the application of modern technology.

112 While the current uses of payments data are fairly well understood, there is a much greater degree of uncertainty over how firms will need to use payments data in the future. In order to respond to these changing demands, RTGS will need the capability to deliver data to its users in a form that allows it to be manipulated in many different ways.

113 The Bank's proposal for flexibly delivering data to participants therefore focuses on two key principles:

- (a) **Providing richer, more comprehensive data:** Richer data could allow the creating of value-added products to underlying payments users.
- (b) **Easier access to data:** Providing participants with easier access to their own data will allow them to create services using this data to fulfil their internal needs, potentially allowing for better liquidity management, supporting the Bank's stability objectives.

114 RTGS currently holds data on the intraday account balances of participants in RTGS, end-of-day reserves account balances, payment-by-payment transaction data for CHAPS and end-of-cycle settlements of CREST and the retail schemes. In 2010–13, the Bank made enhancements to the provision of those data to RTGS participants to aid firms in meeting post-crisis liquidity regulations.

115 The cornerstone of the Bank's proposal to provide more comprehensive data in the next generation of RTGS is the implementation of ISO 20022 messaging standards, as described in detail in Section 2.3.2. The standards will allow more data to be transferred within payment messages. So long as ISO 20022 standards are applied in a consistent way this will help to meet the increasing demands for richer data that RTGS will face over its lifetime, both externally and from the Bank's own analytical departments.

116 During the Bank's outreach discussions, a number of participants argued for enhancements to the way that they access their own payments and liquidity data held in RTGS. Potential developments mentioned included improvements in real-time reconciliation of payment traffic, enhanced analysis of intraday liquidity needs and the development of early

warning indicators for payment shocks. Corporates who accessed CHAPS indirectly also argued that there would be wider economic benefits from the better flow of information on the status of high-value payments within the system to end-users.

117 RTGS renewal gives an opportunity to improve how the Bank provides centrally-held data to direct participants. The Bank can utilise new technology to help participants gain easier access to their data. The industry standard method of providing flexible access to data is via an Application Programming Interface (API). The Bank proposes to provide an API, which will provide firms with real-time access to their own data. Box 8 provides one case study of how the data provided may be used.

118 The key benefit of this approach is flexibility. If RTGS participants are not dependent on the Bank's reporting tools for access to their data, they can build their own functionality based on the underlying data and better integrate it into their own reporting. The Bank seeks input on the benefits and likely uptake of an API if one were provided.

119 A standard piece of software could be provided for smaller firms to fulfil their reporting obligations, as the Bank recognises that the resource requirement to develop individual reporting tools for data reporting may be arduous for smaller participants.

Question 13

The Bank currently offers a Business Intelligence service to RTGS participants.

As an RTGS participant, what are the shortcomings of this service?

The Bank is proposing to provide an application programming interface (API), which will allow firms to access their own data in real time.

Do you anticipate this being a useful service? For what purposes could your institution utilise the API?

In conversations with the Bank, corporates and other end-users of payments said that they would find it useful to be able to track payments in CHAPS from their own account through to the beneficiary's account, referred to as 'track-and-trace' functionality. The Bank can only provide status updates on the parts of the transaction that occur in RTGS. The Bank is proposing to contribute to the development of 'track-and-trace' services, but not to develop this service itself.

Are there changes to the way in which the Bank delivers information about the status of payments in RTGS that could help facilitate the development of 'track-and-trace' functionality?

Box 8

A case study in the use of richer, more accessible data: 'tracking and tracing' payments

One particular functional aspect that the Bank could help to facilitate is the introduction of 'track-and-trace' functionality for high-value payments.

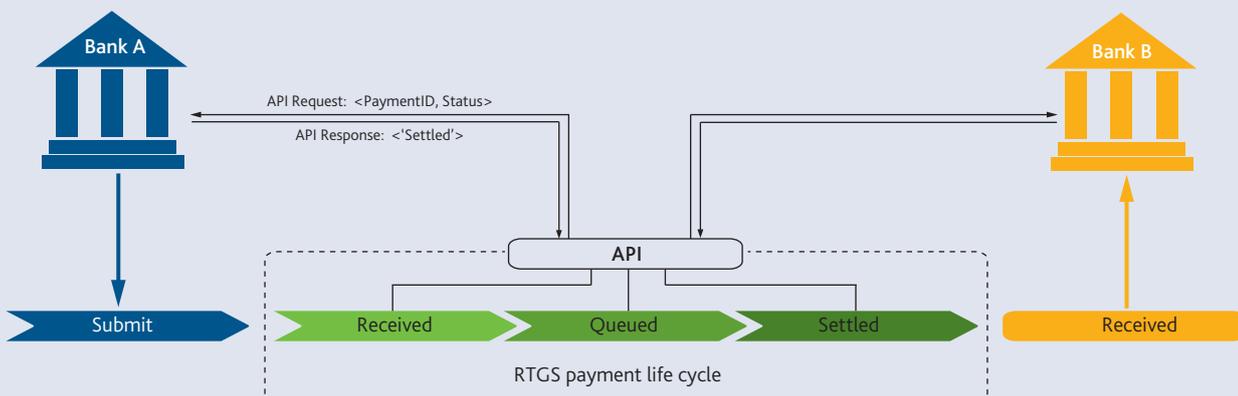
The purpose of track and trace is to create an end-to-end view of the system to allow participants to query exactly where a payment is within its journey through the system as a whole. Put simply, it is like tracking the progress of a parcel. Outreach discussions revealed that end-users, particularly corporates, would like notification on how far critical payments have got in their journey from the sender's account to the receiver's account and the location and status of a payment within the payment system as a whole.

For the full benefits of track-and-trace functionality to be realised, users need end-to-end data access. The Bank would only be able to provide one aspect of this, as RTGS is only part of a payment's journey through the system. To enable tracking of a payment over its whole lifespan, direct participants would also need to provide information about the location of payments within their systems, including whether they have credited the underlying accounts as outlined in **Figure A**. The Bank's role is to act as a facilitator providing access to their data in RTGS.

The Bank is therefore interested in whether there are any barriers to introducing this functionality in the current RTGS infrastructure that it could seek to remove in renewing the service.

There are trade-offs to manage in providing these features. Any tool providing greater access to data must be appropriately secured and it would need to be carefully evaluated.

Figure A Track-and-trace functionality



2.4.4 Efficient liquidity management tools

120 The key benefit of real-time settlement is the ability to settle payments with immediate finality, payment by payment, eliminating settlement risk. At the same time, the need to have funds available, in central bank money, for all payments immediately makes them materially more liquidity intensive than Deferred Net Settlement systems such as Bacs or Faster Payments. In real-time systems, payments can also be large, urgent and unpredictable, which can lead to mismatches between the value of payments sent and received for any single participant. These mismatches need to be met by direct participants, and therefore intraday liquidity requirements can be substantial, even if they only last a few minutes.

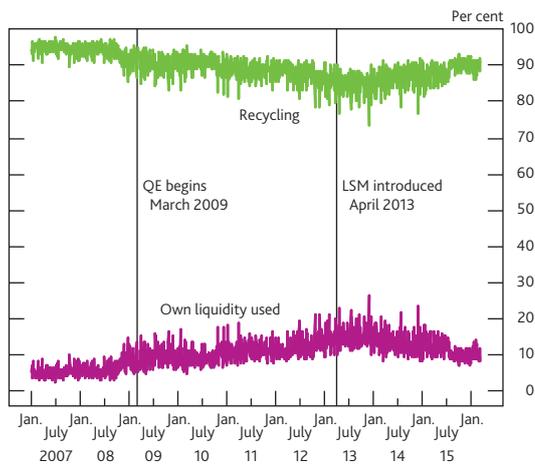
121 It supports the Bank's financial stability objective to mitigate the risks that these increased liquidity demands can create. It is therefore important that RTGS provides tools that allow direct participants to use their liquidity as efficiently as possible, while also maintaining the efficiency of sterling

high-value payment settlement. These tools will facilitate the flexible management of liquidity and will ensure that RTGS can effectively respond to different liquidity environments and requirements of participants.

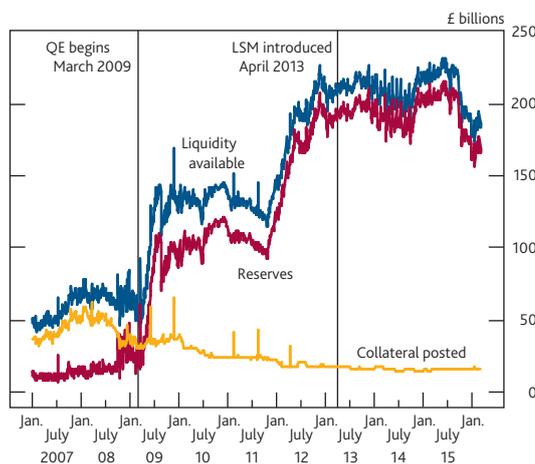
122 Direct participants in CHAPS have a number of sources of liquidity to fund payments. Participants can:

- Recycle liquidity from incoming payments to make their own payments. This is currently by far the main source of liquidity for CHAPS payments (see **Chart 3**).⁽¹⁾
- Fund payments through reserves balances that direct participants in CHAPS hold overnight in RTGS. Since the start of the Bank's quantitative easing programme, around 90% of funds available to use for CHAPS payments (other

(1) For further discussion on funding sources for CHAPS payments, see Benos, E and Harper, G (2016), 'Recycling is good for the liquidity environment', available at <https://bankunderground.co.uk/2016/05/18/recycling-is-good-for-the-liquidity-environment-why-ending-qe-shouldnt-stop-banks-from-being-able-to-make-chaps-payments/>.

Chart 3 Funding sources of CHAPS payments

Source: Bank of England.

Chart 4 Sources of own liquidity available

Source: Bank of England.

than the recycled funds discussed in (a) above) has been in this form (see **Chart 4**).

- (c) Repo high-quality collateral (Level A) in exchange for liquidity in the form of additional reserves. The Bank provides secured intraday cash free of charge and subject to haircuts in the valuations. By accepting assets such as gilts that are highly liquid, the Bank avoids adverse liquidity effects in collateral markets.
- (d) Deliver euros to the Bank in exchange for sterling liquidity in RTGS (with a haircut to account for market risk).

123 But even with abundant provision of liquidity in place, direct participants may have incentives to attempt to economise on their use of intraday liquidity by delaying payments. As described in Section 1, a Liquidity Saving Mechanism (LSM) was introduced in 2013 to mitigate potential delays arising from banks adjusting to strengthened intraday liquidity regulations. There is a broad consensus

among CHAPS direct participants that the current LSM is a valuable tool for liquidity management, and its introduction has resulted in substantial liquidity savings.⁽¹⁾ The LSM enables payments to be 'queued' temporarily and provides an algorithm that matches up groups of queued, offsetting payments and settles them simultaneously. Box 9 describes the LSM in RTGS.

124 One of the strategic drivers of the Review is to build a system that is flexible to adapt to the evolution of regulatory and monetary policy tools. The following factors justify continuing with the policy of abundant and flexible provision of liquidity in the new system:

- (a) Intraday liquidity requirements have become a permanent feature of the regulatory framework.
- (b) RTGS needs to be adaptable to future possible sterling monetary policy environments that are potentially very different from the current one where the impact of quantitative easing means that liquidity is typically abundant for payment banks.
- (c) Liquidity shocks in the future could be at least as large as those experienced in the recent past, given the rise in interconnections in the financial system worldwide.

125 Given the drivers above the Bank has concluded that:

- (a) The current framework for provision of intraday liquidity does not need to be fundamentally changed.
- (b) The Bank proposes to maintain Liquidity Saving Mechanism functionality similar to that in the current RTGS system.

126 The enhanced data functionality proposals described in Section 2.4.2 will help with the request for additional real-time information for liquidity management by participants. This in turn should lead to more efficient liquidity usage.

127 The Bank is open to considering enhancements to the LSM that users may find valuable in the renewed RTGS system and would welcome input from respondents on this, including any functionality that is thought to be useful in other RTGS systems internationally. For example, some stakeholders raised 'queue visibility' in CHAPS as an additional function within the central scheduler during the Review team's initial outreach. Queue visibility would allow direct participants to see which other participants had payments queued against

(1) For further information on liquidity savings see Seaward, D (2016), 'Saving liquidity in a liquidity-abundant world', 2016, available at: <https://bankunderground.co.uk/2016/02/08/saving-liquidity-in-a-liquidity-abundant-world-why-dont-banks-use-less-liquidity-when-making-high-value-payments/>.

Box 9

The Liquidity Saving Mechanism in RTGS

CHAPS payments in RTGS can be submitted as urgent and eligible for immediate settlement or non-urgent and eligible for offsetting with incoming payments. These non-urgent payments use the 'Liquidity Saving Mechanism' (LSM). Non-urgent payments are queued in the RTGS system. CHAPS direct participants are able to queue CHAPS payments using a program in RTGS called the 'central scheduler' to control when payments are settled.

RTGS is available to settle CHAPS payments classified as urgent immediately for 85% of the settlement day. For the remaining 15% of the day, RTGS briefly suspends the immediate processing of urgent payments in order to settle payments classified as 'non-urgent'. These payments are settled in 'matching cycles' that last on average just over 25 seconds. At the start of a matching cycle, an algorithm attempts to find groups of broadly offsetting payments from different banks. At the end of the matching cycle, all payments identified as eligible by the algorithm settle at precisely the same time. Any non-urgent payments not settled by the end of a matching cycle will remain in the queue for subsequent matching cycles. This settlement model is illustrated in **Figure A**.

In the central scheduler, settlement banks have tools to adjust their parameters to their preferences in the trade-off between liquidity savings and delay to payments inherent in all queuing mechanisms. Settlement banks can:

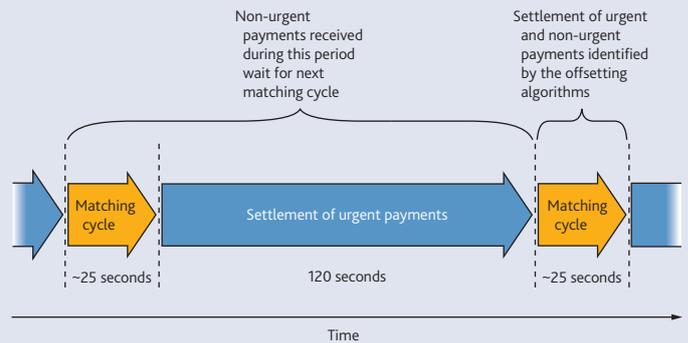
them, allowing them to adjust their parameters accordingly to ensure liquidity-efficient settlement. But such functionality could also affect participants' behaviour under stressed circumstances — for instance, banks could try and infer whether another direct participant is under liquidity stress from changes in the amount of queued payments against them. The Bank would need to be comfortable that any additional liquidity features did not have adverse impacts on financial stability.

Question 14

The Bank intends to continue to provide a Liquidity Saving Mechanism for payments in CHAPS.

Are there any liquidity management tools such as queue visibility in CHAPS or any others that you would find useful? Can you give a list of advantages and disadvantages of your proposals?

Figure A The matching cycle process



- Limit the amount of funds they are willing to contribute to any one matching cycle (non-urgent balance).
- Limit the value of payments they are willing to send to another CHAPS direct participant in excess of the value they have received from them (bilateral limits).
- Limit the value of payments they are willing to send to all other banks in excess of the value they have received from them as a whole (multilateral limits).
- Change the priority of a payment after it has been submitted to RTGS, eg from non-urgent to urgent.
- Prevent a payment from settling without the bank's specific authorisation if it breaches a certain value limit, or if it is destined for a particular settlement bank.
- Remove payments from RTGS prior to settlement.

2.4.5 Forward-dating and specific timing of payments

128 During outreach, stakeholders mentioned two related features present in other High-Value Payment Systems that they would value in a renewed RTGS: (i) submission of payments into RTGS's central scheduler to be settled at a future date, known as 'forward-dating'; and (ii) the ability to specify a time within the day for the settlement of individual payments sent to the system.

129 Direct participants already have the ability to manage payments within their own internal systems until the day when they would like to settle them. However, there are some stability advantages to submitting such payments to the scheduler within RTGS and having them held there. Forward-dating centrally would allow a large batch of payments to be settled at the same time when the system opens. This could promote early settlement of payments and reduce liquidity usage due to the increased probability of finding offsetting payments in a large batch of pre-submitted

payments. It could also mitigate the impact of participant operational outages, if payments had already been submitted to RTGS.

130 Some users also mentioned as a possible enhancement the ability to send payments to RTGS with a specified time period for settlement (either before a certain time, after a certain time, or within an interval). Direct participants may find this functionality useful because it automates what they would otherwise need to manage themselves actively in releasing their payments to RTGS. It could have benefits for the system too, as it could facilitate the prioritisation of payments in recovery following an outage. This would however need to be implemented in such a way to minimise conflict with settings in the central scheduler such as bilateral or multilateral limits.

Question 15

The Bank is considering functionality that would allow CHAPS payments to be submitted with a specified date and time for settlement.

Would you find functionality to submit payments in advance of the day of settlement useful?

Would you find functionality to set the time at which a payment should settle useful?

If you favour any of these functionalities, what specific features would your institution find useful?

Functionality of the future RTGS service

131 Section 2.4 has set out the user functionality that the Bank proposes to include in the future RTGS service. The Bank would like to hear from respondents about any additional features that they would like to see included.

Question 16

The Bank has set out the functionality it proposes to build into the future RTGS service.

Is there any other functionality that you want to see the Bank build into the new RTGS service?

If Yes, please explain your answer, including the priority you would ascribe to this new functionality compared to the other functionalities proposed by the Bank.

Overall vision for the future RTGS service

132 Section 2 has provided the details of how the vision for the future RTGS service set out in the Introduction and executive summary could be delivered. The Bank would like to hear views on whether this is the right vision, on what elements are most valuable, and on any perceived gaps in it.

Question 17

In this consultation, the Bank sets out a proposed vision that is aimed at delivering a new RTGS that compared to the RTGS of today, has broader access, higher resilience, stronger interoperability, and a wider range of user functionality. The details of how it proposes to achieve these enhancements are set out in Section 2.

Do you agree that this is the right vision for the future RTGS service? Which elements of the proposed enhancements do you expect to be most valuable to you over the coming decade or more? Do you believe there are any important gaps in the vision the Bank is setting out?

3 How will the new RTGS service be delivered?

1 This section provides a high-level overview on how the Bank will develop and operate a new RTGS service. Specifically, it:

- (a) describes how recent developments in technology could be exploited to respond to the strategic drivers for change outlined in the Introduction and executive summary, while also maintaining or improving resilience, efficiency and flexibility to change (Section 3.1);
- (b) sets out the role of the Bank in the delivery of a new system looking both at the delivery model for the HVPS service (Section 3.2), and how the future system might be sourced, maintained and operated (Section 3.3); and
- (c) describes the principles the Bank will follow for recovering the costs of building a new system, as well as setting out where options for a future system may incur additional costs, or yield savings (Section 3.4).

2 This section also asks for any further feedback on any topic to contribute to the Bank's Review of its RTGS service (Section 3.5).

3.1 What technology will underpin the future RTGS service?

3 The primary purpose of this consultation is to set out the Bank's vision for the high-level design requirements for the next generation of the RTGS service, and seek feedback from the market. Judging how best to deliver this need in technology terms falls largely to the next phase of this project. The choice of technology is nevertheless crucial to enable development and innovation and to manage the risks that this change brings. This section therefore outlines how the characteristics outlined in Sections 1–2 will influence technology choices. Consideration of distributed ledger technology in the context of the next generation of the RTGS service is outlined in Box 10.

4 The changes that will have the biggest impact upon the system design are the widening of RTGS access, the need for interoperability and the ability to operate on (or near) a 24x7 basis. Current connection requirements for RTGS have the effect of limiting direct participation in CHAPS to those who have a large and sophisticated technology set-up. Opening RTGS to a broader range of institutions and to

non-bank Payment Service Providers implies a design that allows both large and small organisations to connect, while maintaining robust security and resilience. Interoperability with retail schemes and other High-Value Payment Systems requires common message standards and a protocol for synchronising payments with the movement of other assets. Adopting the ISO 20022 standard for high-value payments should provide a strong platform for interoperability and richer data, but will also require a low-risk approach to standards changes and harmonisation. Synchronisation protocols are in their infancy and more work is needed to identify the common features of the emerging standards and ensure future compatibility. The ability to operate on (or near) a 24x7 basis requires a system in which one or more components can be taken down for maintenance while the system as a whole continues to operate. This type of architecture can also be exploited to increase resilience.

5 These requirements must be met while maintaining performance, integrity, security and resilience, and also supporting change. The core parts of the system which deal with message queuing, liquidity management and settlement lend themselves to a modular service-orientated architecture based upon so-called 'microservice' concepts. Integration services will enable the functionality of the system to be segregated into discrete modules that communicate together to perform well-defined tasks. When combined with automated testing, this approach will support lower risk system change; by restricting the impact of change to affected modules, it will be easier to understand and test a given change.

6 A 'service management' layer will also be put in place to underpin the overall operation of the platform ensuring effective monitoring, management, measurement and control and maintaining service levels and transaction throughput over time.

7 It is envisaged that physical hosting of the system will be in secure, 'geo-resilient' data centres providing both physical and cyber protection. 'Load balancing' the system modules across multiple servers in different locations should provide physical protection and resilience against hardware failure. Strong security in the communication between the modules should also increase the overall security of the system. This could open the possibility of hosting non-production environments in the cloud at some point in the future.

Box 10

Distributed ledgers and RTGS

The concept of a distributed ledger — the technology that underpins Bitcoin and other cryptocurrencies — has generated significant attention in the banking and payments industries. Although originally designed to obviate the need for banks, there are a number of features of distributed ledger technology that make it a potentially attractive platform for banking applications over the medium term.

For the purposes of this Review, distributed ledgers are potentially relevant in three contexts; first, as a possible platform for core RTGS settlement; second, as a platform for externally-managed securities settlement DvP or foreign exchange PvP services that require access to central bank money; and, third, as a platform for a possible future digital currency that might need to interoperate with RTGS.

Three key potential benefits of distributed ledgers are trust, resilience and shared state. The trust arises from the consensus required to update the ledger, the resilience from the geographical and technical diversity of the network, and the shared state from being able to prove that a node is up-to-date. Of these three, the chief potential benefit when applied to core settlement in an RTGS system is resilience; trust is already created by the central bank operating as a neutral party, and state is managed through relatively simple reconciliations. The ability to distribute nodes physically that may run differing software implementations, combined with full data duplication across the network could potentially provide an RTGS system with strong defence against physical events and cyber-attacks.

The research conducted so far in the Bank and elsewhere shows that asset transfer and gross settlement can

successfully operate on a distributed ledger, and demonstrates many of the features of network resilience in a small-scale application. In its current state, however, this work has also highlighted that the technology is not sufficiently mature to provide the exceptionally high levels of robustness required for RTGS settlement. Further work is required to address privacy and system scalability in particular, and these and other topics suggested by this initial work will drive the Bank's future research programme on this technology.

Support for DvP and PvP platforms, and potential future private sector digital currencies, requires interoperability with RTGS. One method of achieving this would be for reserves held in RTGS to back cryptographic 'tokens' to be used by distributed ledger settlement platforms. These new platforms could bring DvP and PvP to venues where it is not currently available, and potentially offer competition in places where it is. Designs for these platforms are still in their infancy, and more work is required to understand how the interfaces between ledgers need to operate, as well as the legal and regulatory frameworks required.

The Bank nevertheless recognises that these new technologies have the potential to reshape the future payment landscape. The new system will therefore be designed to support the level of interoperability and scale that may be required, in order to promote the safe final settlement of obligations arising in new settlement venues. The Bank will also pursue an active research agenda exploring the scalability, security, privacy, interoperability and sustainability of distributed ledger platforms and solutions. This research will be undertaken in partnership with academia, other central banks, and through the FinTech Accelerator.⁽¹⁾

(1) For more detail on the FinTech Accelerator, see www.bankofengland.co.uk/Pages/fintech/default.aspx.

8 The user interfaces and data analytics service for the current RTGS infrastructure are provided centrally. For the new service the use of clearly defined, secure APIs could offer greater flexibility to system participants while retaining strong security over the core system functions and data. A user interface API built to industry technology standards opens the possibility for participants to integrate their own back office systems, and for an external market in user interface provision, supporting a wider range of platforms and browsers. In a similar way, enabling users to have secure API access to historical payment data would allow them greater flexibility to analyse their data in addition to the current reporting formats.

3.2 Future delivery of CHAPS, the United Kingdom's High-Value Payment System

9 As part of this Review, the Bank is looking at its own role in delivering payment and settlement services, including the model for the delivery of the United Kingdom's High-Value Payments System (HVPS), CHAPS. Currently, the payment system operator for the United Kingdom's HVPS is CHAPS Co, a private sector entity. CHAPS Co is responsible for managing the scheme's governance and rulebook and, as a central component of its responsibilities, managing risks to the payment system. But the core infrastructure for the real-time settlement of CHAPS payments across accounts in central

bank money is provided by the Bank, in the form of RTGS.⁽¹⁾ This separation of responsibility for scheme and infrastructure for the HVPS is highly unusual internationally. In a survey of 107 countries, the World Bank found that central banks had sole responsibility for both roles in the overwhelming majority of cases.⁽²⁾

10 In recent years, and particularly since the financial crisis, regulatory expectations of financial market infrastructures — as enshrined in the international Principles for FIMs⁽³⁾ — have stressed the importance of payment system operators being able to assess and manage the full range of risks arising at all points in the system: requiring them to be 'end-to-end' risk managers. That focus has intensified further against the backdrop of a growing range of threats capable of striking at any part of a payment system, such as a cyber-attack.

11 Applied to CHAPS, this means that the Bank, as supervisor, holds CHAPS Co accountable for the risk management of the CHAPS system as a whole, including risks emanating from the core RTGS infrastructure. CHAPS Co and the Bank (as RTGS operator) have worked collaboratively in pursuit of this requirement in recent years, enriching the information that flows in both directions, and agreeing enhanced procedures for co-operation. However, it is not possible to provide CHAPS Co with all of the information and control needed to assess and manage risks throughout the whole payment system:

- (a) There are limits to the extent to which the Bank can share information with CHAPS Co about the risks (and associated mitigants) to the Bank's core IT systems, necessary to enable it to take an end-to-end view of the risks to CHAPS. In particular, the Bank has concluded that it would not be appropriate to share information about the Bank's cyber-defences, many of which protect the full range of the Bank's functions, including monetary policy, market operations and prudential regulation. Additionally, as the provider of reserves accounts and intraday and overnight liquidity to RTGS participants, the Bank cannot share confidential information on their liquidity positions with CHAPS Co.
- (b) Similarly, the Bank cannot provide CHAPS Co with control over the RTGS infrastructure itself, since RTGS provides the accounting infrastructure for a number of central banking functions that are key to the Bank's mission for maintaining monetary and financial stability. As Section 1 explains, RTGS provides the reserves accounts through which monetary policy is implemented, and provides interbank settlement for six other payment and securities settlement systems in addition to CHAPS. Consequently, while a range of stakeholders — including CHAPS Co — are closely consulted on the operation and development of RTGS, final decision-making must rest with the Bank,

based on its holistic assessment of potentially competing aims.

12 In light of these challenges, the IMF recommended earlier this year, as part of its Financial Sector Assessment Program for the United Kingdom, that the Bank should consider alternative structures to reduce the current constraints related to the oversight and management of risk within CHAPS.⁽⁴⁾

13 One response, being developed by CHAPS Co, is to strengthen its ability to assess and manage risks throughout the whole payment system. The Bank has been actively engaged with this analysis. But it is right that the Bank also takes the opportunity of this Review to explore the advantages and disadvantages of adopting the more common international model in which the Bank would be both the infrastructure provider and the payment system operator. The Bank will draw its conclusions on this issue in parallel with other aspects of the RTGS Review at end-2016, and would welcome feedback from respondents as an important input to that process.

Question 18

The Bank's Review is considering alternative structures for the HVPS delivery model, including one in which the Bank is both the infrastructure provider and the payment system operator, which is the predominant delivery model internationally. Informed by feedback from this consultation, the Bank will draw its conclusions in parallel with other aspects of the RTGS Review at end-2016.

What, in your view, would be the most appropriate model for delivering the United Kingdom's HVPS?

3.3 Sourcing of the new system

14 The Bank will consider a wide range of options for the outsourcing or insourcing of the building, maintenance and data hosting of the new system. The different options will be assessed over the expected lifetime of the new system, including considering how they will affect the flexibility to accommodate future policy needs and respond to changes in the external environment.

15 Under all of the models under consideration, the Bank intends to retain operational control of the new system.

(1) In contrast, as discussed in Section 1, retail payment systems (Bacs, Cheque & Credit, Faster Payments, LINK and Visa) settle on a deferred, net basis. The clearing and exchange of customer payments for the retail payment systems occurs in other infrastructure, outside of the RTGS system and operated by other organisations.

(2) See World Bank, *Global Payment Systems Survey 2012*.

(3) The PFIMs underpin the Bank's supervisory approach for payments schemes, which is outlined at www.bankofengland.co.uk/financialstability/Documents/fmi/fmisupervision.pdf.

(4) See the IMF's report at www.imf.org/external/pubs/ft/scr/2016/cr16156.pdf.

RTGS provides the accounts through which monetary policy is implemented; the liquidity provided in RTGS intraday results in an expansion of the Bank's balance sheet; and RTGS is the tool where any crisis intervention by the Bank takes place. Given the central role of RTGS for the monetary and financial stability of the United Kingdom, the Bank judges that retaining operational control is a necessity.

16 In addition to operational control, when examining all the options for sourcing the different functions externally or internally, the Bank will take the following criteria into account:

- the model that best enables the Bank to fulfil its mission;
- the security requirements of RTGS;
- where the best skills lie;
- cost effectiveness;
- vendor management models;
- business and operational risks;
- the optimal way to deliver the functionality required; and
- compliance with supervisory requirements, including the international Principles for FMs.

17 The blueprint to be published early next year will include the outcome of the Bank's assessment of the different options. Recognising that the costs of the new service will be borne by future users, the Bank will ensure there is transparency on key design choices for relevant stakeholders, including further stages of consultation where appropriate. Decisions on the resilience of the system, including in particular its cyber-defences, will however be made by the Bank alone, in consultation with GCHQ, the Centre for the Protection of National Infrastructure, the National Cyber Security Centre and other intelligence partners.

3.4 Cost recovery

3.4.1 Recovery of build costs

18 The Bank recovers the costs incurred through the provision of the RTGS service in the form of an account management fee and a per-item tariff for the different services provided. These tariffs are re-evaluated each year.

19 The tariffs are set according to the following principles:

- (a) the Bank aims to recover all the costs it incurs in the provision of RTGS services, without generating any long-term profit or loss;
- (b) to smooth CHAPS and DvP tariff volatility, costs are recovered over a four-year period; and
- (c) there should be no cross-subsidisation of one service by another.

20 Recent capital investment in RTGS has been recovered on the same basis. Projects such as introducing the LSM, or MIRS, both had their costs fully recovered via the RTGS tariffs.

21 The Bank intends to continue to operate RTGS on a full cost recovery basis. It is therefore the Bank's intention that the redevelopment of RTGS will be funded entirely from future RTGS users, via the annual RTGS tariff. The new system is also likely to see continued development as it adapts and extends to accelerating demand. Post-live development of this kind will also be recovered from RTGS users via the tariff.

22 In the past, the Bank has endeavoured to smooth the volatility of the tariff by amortising the cost of projects over their useful economic life. The Bank will continue this process in recovering the costs of an RTGS redevelopment. Taken together this means that the tariff is likely to be elevated for a period after the new system is complete.

3.4.2 Cost and value of consultation options

23 Building the new system will require a large capital investment. The exact size of the investment is not currently known and will depend upon design decisions that are yet to be made. From a cost point of view, the system can be thought of as containing a set of core features without which it cannot operate (such as settlement, messaging and resilience) and a set of functional extensions (such as true 24x7, or near 24x7, operation and synchronised settlement). This section describes how the cost and value for both the core features and functional extensions will be assessed.

24 For both the core features and functional extensions, there are four areas of cost:

- (a) The cost of designing, building, testing and implementing the new system and associated processes, referred to here as the **build cost**.
- (b) The costs incurred by the Bank in operating the new system once it is live, referred to here as the **operating cost**.
- (c) The costs incurred by participating institutions as a result of connecting to and using the new system, referred to here as the **participation cost**. Participation cost is in turn divided into one-off change costs for existing participants (eg to implement ISO 20022 compatibility for those who do not already have it) and ongoing costs of connection and participation.
- (d) The **end-user** costs incurred by the ultimate users of the RTGS service and the UK payments network as a whole — ie UK households and companies.

25 For both the core functions, and the functional extensions, the Bank will consider not only the build costs, but also the operating, participation and end-user costs of the new system. In some cases a trade-off exists between the different areas of cost. For example, investing in additional functionality may cause a higher build cost but yield lower operating and participation costs than exist today.

26 In Section 2, the areas of functionality which potentially have material future cost implications have been identified. The features with the largest potential impact on the central build and operation costs are the choices made on operating hours capability and messaging provision. Adding functionality to provide richer business intelligence data and synchronisation of payments would also have some impact on the central build and run costs. From a participant perspective the items most likely to increase the implementation and operational costs would be the choice made on messaging provision and the move to ISO 20022 for high-value payments. All of these changes however potentially lower the end-user cost of the system over the medium term, to the extent that they improve the degree of resilience, competition, innovation, efficiency and service offering available from the RTGS service as a whole. Design changes to streamline system testing and onboarding processes have the greatest potential to reduce participant costs.

27 It is important that the new system represents sound value for money. For the core features of the system, ensuring value for money is a process of making sure that the design of the core components has made due consideration of the balance between build, operation, participant and end-user costs, while still delivering a resilient and effective service.

28 The value of functional extensions will be established by assessing each option against the following criteria:

- (a) whether it improves the Bank's ability to meet one or more of its policy aims for RTGS;
- (b) whether it reduces the operating costs for RTGS;
- (c) whether it reduces participation costs for RTGS;
- (d) whether it reduces end-user costs; and
- (e) whether it could facilitate gains through new services to users.

29 The delivery of the new system will follow a robust process of cost modelling, challenge and procurement best practice. This will ensure that the new system meets all its aims at an acceptable quality, while making effective use of resources.

Question 19

The Bank has set out its approach to capital investment and costs for the next generation of RTGS. This includes identifying those features it believes will entail the most significant cost increases and savings for participants.

Of the proposals in this consultation paper, which do you expect will have the most material impact on the costs of your participation in RTGS (either by increasing or reducing them)?

3.5 Other issues

30 The Bank would welcome any additional feedback on its proposals for the next generation of RTGS as set out in this consultation.

Question 20

Please provide any other comments that your institution would like to contribute to the Bank's Review of its RTGS service.

Annex 1 Question list and response template

The Bank of England is seeking responses to its consultation on the future RTGS service from the widest possible range of those with a stake in the future of sterling payments. In answering the questions, respondents are strongly encouraged to provide forward-looking answers, reflecting their views on the likely trends in their businesses over the next decade and beyond.

Responses should be completed by **7 November 2016**. The response template can be accessed and completed electronically at www.bankofengland.co.uk/markets/Pages/paymentssystem/strategy.aspx.

The responses to this consultation will be used to help shape the Bank's decisions on the final high-level blueprint for the future RTGS service, which will be published in early 2017 alongside a summary of responses received.

The Bank does not intend to publish any responses verbatim. Information provided in response to this consultation, including personal information, may nevertheless be subject to publication or release to other parties or to disclosure, in accordance with access to information regimes under the Freedom of Information Act 2000 or the Data Protection Act 1998, or otherwise as required by law or in discharge of statutory functions. Respondents should indicate if they regard all, or some of, the information they provide as confidential. If a request for disclosure of this information is received, respondents' indications will be taken into account, but no assurance can be given that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by a respondent's IT system on emails will not, of itself, be treated as constituting notice that such respondent regards any information supplied as confidential.

Response template

Name(s)	
Institution	
Contact e-mail address	
Date	

Introduction and executive summary

Question 1

Widespread external input, combined with the Bank's own analysis, has identified five key strategic drivers for change over the likely lifespan of the next generation of RTGS.

See the **Introduction and executive summary** for more information.

Do you agree that these are the right strategic drivers for change for a future UK RTGS service?

Yes

No

Please explain your answer.

Overview of the current RTGS service

Question 2

The Bank has introduced a wide range of enhancements to RTGS over its 20 years of operation to expand the range of institutions and payment systems using it, and the functionality it offers to those users. It intends to preserve the bulk of these enhancements in renewing RTGS as summarised in Table D.

See **Section 1** for more information.

Do you agree with the Bank's proposals to retain many of the policy principles and core design features of the existing RTGS service in the renewed service?

Yes

No

Please explain your answer.

Access

Question 3

Stakeholders have identified three key practical barriers for banks that want to use RTGS to join CHAPS:

- the length and requirements of the onboarding process;*
- the ongoing testing requirements for direct participants, and the associated operational costs; and*
- the fixed costs of connecting to RTGS, including access to messaging networks and maintenance of separate contingency sites for each participant.*

See [Section 2.1.2](#) for more information.

To what extent do you feel these barriers discourage firms (including where relevant your own institution) from becoming a participant in CHAPS? Please provide cost estimates where possible.

Are there other steps the Bank could take to reduce the costs of accessing RTGS to join CHAPS or make payments in CHAPS whilst maintaining the resilience of the service?

Question 4

The Bank proposes to permit development of technical aggregators as a means to facilitate broader access to RTGS settlement accounts to make CHAPS payments.

See [Section 2.1.2](#) for more information.

Is a technical aggregator service something that your institution would be interested in supplying, or a service that your institution would be interested in using to access RTGS for CHAPS payments.

- Interested in supplying
- Interested in using
- Not interested in either supplying or using

Please explain your answer.

Are there any risks that the Bank should consider in permitting technical aggregator services to develop?

Do you perceive any RTGS features that could act as barriers to the development of a technical aggregator service?

Question 5

CCPs are currently eligible to hold RTGS accounts, but none has joined CHAPS.

See [Section 2.1.4](#) for more information.

Do you believe there is a case for CCPs to join CHAPS as direct participants?

- Yes
- No

Please explain your answer.

If Yes, is there any functionality that would be required in the next generation of RTGS to enable this?

Resilience

Question 6

The Bank proposes a Recovery Point Objective of near zero and a Recovery Time Objective of within two hours for the future RTGS service (other than for Business Intelligence).

See [Section 2.2.3](#) for more information.

Do you agree with these proposals?

- Yes
- No

Please explain your answer.

Question 7

The Bank has set out two options for mitigating RTGS’s reliance on a single messaging provider. Option A is a contingency mechanism for file submission via an alternative network for use in an outage. Option B is for the Bank to require some or all RTGS participants to use two messaging providers.

See Section 2.2.5 for more information.

Which option do you prefer?

- Option A
- Option B

Please explain your answer.

Interoperability

Question 8

The Bank plans to use ISO 20022 messaging standards for CHAPS in the new RTGS system.

See Section 2.3.2 for more information.

Do you support this proposal?

- Yes
- No

Please explain your answer.

Please explain where your institution could see the benefits in terms of domestic or international harmonisation of standards or both. Are there ways in which ISO 20022 messaging standards would need to be implemented to realise these benefits?

Question 9

The Bank has proposed incorporating synchronisation functionality into the new RTGS system, to enable real-time payments to be queued and then released automatically based on pre-defined conditions. There are at least two purposes for which the Bank believes this functionality may be of use. The first is by offering an additional route for mitigating the risks associated with cross-border payments by enabling an alternative method of Payment versus Payment settlement. The second is by supporting new settlement venues where the movement of cash and assets may entail material financial exposures.

See Section 2.3.3 for more information.

Do you believe that there is merit in introducing this functionality?

- Yes
- No

Do you believe that one or both of the proposed use cases will be viable over the lifespan of the system?

- Yes
- No

Do you believe that a standardised set of synchronisation functionality would be adaptable to use cases, beyond those listed here?

- Yes
- No

Please explain your answer.

Question 10

The Bank is proposing to maintain the existing scope of RTGS settlement, and not to extend it to (a) have the capability to provide individual settlement of payments currently settled by the major sterling retail payment schemes; or (b) integrate the ledger of sterling securities accounts onto the system.

See Section 2.3.4 for more information.

Do you agree with this proposal?

Yes
No

Please explain your answer.

Question 11

The Bank proposes to work with the industry to ensure there are options for time-critical retail payments to be made via retail schemes rather than CHAPS.

See Section 2.3.5 for more information.

Do you agree with this proposal?

Yes
No

Please explain your answer.

User Functionality**Question 12**

The Bank intends to build a new RTGS system that has the capability to operate to a near 24x7 timetable as a minimum. It seeks views on whether it should target true 24x7 capability, and to understand in more detail respondents' views on the likely drivers for an extended operational timetable in future.

See Section 2.4.2 for more information.

Do you anticipate demand for RTGS to offer true 24x7 capability over the next decade or more?

Yes
No

What do you expect to be the main drivers for RTGS having an extended operating timetable over that horizon?

Question 13

The Bank currently offers a Business Intelligence service to RTGS participants.

See Section 2.4.3 for more information.

As an RTGS participant, what are the shortcomings of this service?

The Bank is proposing to provide an application programming interface (API), which will allow firms to access their own data in real time.

Do you anticipate this being a useful service?

Yes
No

For what purposes could your institution utilise the API?

Improved liquidity management
Quicker reconciliation
Develop early warning indicators for payment shocks
Other (please specify below)

In conversations with the Bank, corporates and other end-users of payments said that they would find it useful to be able to track CHAPS payments from their own account through to the beneficiary's account, referred to as 'track-and-trace' functionality. The Bank can only provide status updates on the parts of the transaction that occur in RTGS. The Bank is proposing to contribute to the development of 'track-and-trace' services, but not to develop this service itself.

Are there changes to the way in which the Bank delivers information about the status of payments in RTGS that could help facilitate the development of 'track-and-trace' functionality?

Yes

No

Please explain your answer.

Question 14

The Bank intends to continue to provide a Liquidity Saving Mechanism for payments in CHAPS.

See Section 2.4.4 for more information.

Are there any liquidity management tools such as queue visibility in CHAPS or any others that you would find useful? Can you give a list of advantages and disadvantages of your proposals?

Question 15

The Bank is considering functionality that would allow CHAPS payments to be submitted with a specified date and time for settlement.

See Section 2.4.5 for more information.

Would you find functionality to submit payments in advance of the day of settlement useful?

Yes

No

Would you find functionality to set the time at which a payment should settle useful?

Yes

No

If you would want any of these functionalities, what specific features would your institution find useful?

Question 16

The Bank has set out the functionality it proposes to build into the future RTGS service.

See Section 2 for more information.

Is there any other functionality that you want to see the Bank build into the new RTGS service?

Yes

No

If Yes, please explain your answer, including the priority you would ascribe to this new functionality compared to the other functionalities proposed by the Bank.

Question 17

In this consultation, the Bank sets out a proposed vision that is aimed at delivering a new RTGS that compared to the RTGS of today, has broader access, higher resilience, stronger interoperability, and a wider range of user functionality. The details of how it proposes to achieve these enhancements are set out in Section 2.

See Section 2 for more information.

Do you agree that this is the right vision for the future RTGS service?

Yes

No

Which elements of the proposed enhancements do you expect to be most valuable to you over the coming decade or more?

Do you believe there are any important gaps in the vision the Bank is setting out?

Future delivery of CHAPS, the United Kingdom's High-Value Payment System

Question 18

The Bank's Review is considering alternative structures for the HVPS delivery model, including one in which the Bank is both the infrastructure provider and the payment system operator, which is the predominant delivery model internationally. Informed by feedback from this consultation, the Bank will draw its conclusions in parallel with other aspects of the RTGS Review at end-2016.

See [Section 3.2](#) for more information.

What, in your view, would be the most appropriate model for delivering the United Kingdom's HVPS?

Cost recovery

Question 19

The Bank has set out its approach to capital investment and costs for the next generation of RTGS. This includes identifying those features it believes will entail the most significant cost increases and savings for participants.

See [Section 3.4](#) for more information.

Of the proposals in this consultation paper, which do you expect will have the most material impact on the costs of your participation in RTGS (either by increasing or reducing them)?

Other issues

Question 20

Please provide any other comments that you would like to contribute to the Bank's Review of its RTGS service.

Annex 2 List of outreach participants

When the Bank announced its plan to develop a blueprint for the next generation of RTGS in January 2016, it committed to seeking the input of a wide range of stakeholders. The purpose of engaging stakeholders was to ensure that the scope of the Review was appropriate and to determine the strategic drivers to which the Bank needed to respond.

During the first half of the year, the Bank held more than one hundred meetings with a wide range of stakeholders, including current and potential future users of the system, UK and overseas authorities, infrastructure providers and financial institutions, academic and industry experts, commentators and broader public interest groups.

The Bank is grateful to the parties listed below for their time and input:

ACI Worldwide
 Advanced Payment Solutions
 Association of British Credit Unions Limited
 Association of Corporate Treasurers
 Association of Foreign Banks
 Bacs Payment Schemes Limited
 Bank of America Merrill Lynch
 Bank of Canada
 Bank of New York Mellon
 Bank of Japan
 Barclays Bank
 BNP Paribas
 Bottomline Technologies
 British Bankers' Association
 BT
 The Building Societies Association
 CGI
 CHAPS Clearing Company Limited
 Cheque and Credit Clearing Company
 Citibank
 CLS Bank International
 Clydesdale Bank
 Cobalt
 David Sheppard
 Danmarks Nationalbank
 UK Debt Management Office
 Deutsche Bank
 Digital Asset Holdings
 Ebury
 Electronic Money Association

Elliptic
 Emerging Payments Association
 Euroclear UK & Ireland
 European Central Bank
 Faster Payments Scheme Limited
 Federal Reserve System
 Financial Conduct Authority
 Gartner
 Goldman Sachs
 Government Banking Service
 Hewlett Packard Enterprise
 HM Revenue and Customs
 HM Treasury
 Hong Kong Monetary Authority
 HSBC
 IBM
 IG index
 Investec
 ipagoo
 itBit
 J.P. Morgan Chase
 LCH.Clearnet
 LINK
 Liquidity Managers Group
 Lloyds Banking Group
 London School of Economics and Political Science
 Massachusetts Institute of Technology
 McKinsey & Company
 Metro Bank
 Moneycorp
 MoneyGram
 MoneyNet
 Montran
 Nationwide Building Society
 Norges Bank
 Northern Bank
 NTT Data
 Oracle
 Payment Systems Regulator
 Payments Canada
 Payments UK
 PayPal
 Paysafe
 Perago
 Pillsbury Winthrop Shaw Pittman LLP
 Positive Money
 PwC

R3
Raphaels Bank
Reserve Bank of Australia
Reserve Bank of New Zealand
Riksbank
Ripple
The Royal Bank of Scotland Group
Santander UK
SETL
Société Générale
Sopra Steria
South African Reserve Bank
State Street
Stripe
SWIFT
Swiss National Bank
thinkmoney

TransferWise
Transpact
The UK Cards Association
University of California Santa Barbara
Verizon
Virgin Money
Visa
Vocalink
Warwick Business School
Western Union Business Solutions
Worldpay
Z/Yen Group

The Bank is also grateful to Sandy Boss, Kevin Brown, Lazaro Campos, Charles Kahn, Matthew Proud and Hugh Simpson who participated on an external challenge panel examining ideas being developed for this consultation.

Annex 3 Glossary

Application Programming Interface (API): A set of functions and procedures that allow the creation of applications which access the features or data of an operating system, application, or other service.

Bacs: The United Kingdom's 'automated clearing house', processing Direct Debits (utility bills, subscriptions) and Direct Credits (salaries, pensions, benefits) across a three-day cycle with net settlement taking place once a business day in RTGS.

Bank for International Settlements (BIS): The international financial organisation based in Basel, Switzerland, that serves central banks in their pursuit of monetary and financial stability.

Central Counterparty (CCP): An entity that is the buyer to every seller and seller to every buyer of a specified set of contracts, eg those executed on a particular exchange or exchanges.

CHAPS: The sterling same-day system that is used for high-value/wholesale payments as well as for other time-critical lower-value payments.

CHAPS Co: The CHAPS Clearing Company Limited, a private sector entity which is responsible for the day-to-day management of CHAPS.

Cheque and Credit Clearing: Payment scheme providing net settlement of cheques and paper credits between financial institutions. It operates on a three-day cycle and settles net once a day in RTGS.

Clearing: A process in which two main functions may be performed: (a) the exchange of a payment instrument or relevant payment information between the payer's and the payee's financial institutions, and (b) the calculation of claims for settlement. The outcome of this process is a fully processed payment transaction from payer to payee, as well as a valid claim by the payee's institution during the clearing process.

CLS: Specialist US financial institution that provides PVP settlement services to its members in the foreign exchange market mitigating the settlement risk associated with their trades.

CREST: The United Kingdom's securities settlement system, operated by Euroclear UK & Ireland and providing real-time 'Delivery versus Payment' in central bank money for transactions in UK securities (gilts, equities and money market instruments).

Deferred Net Settlement (DNS) payment system: A payment system that settles on a net basis at the end of the settlement cycle. Settlement of DNS systems in RTGS takes place after the individual customer payments have been cleared and exchanged.

Delivery versus Payment (DvP): A mechanism in an exchange for value settlement system that ensures that the final transfer of one asset occurs if and only if the final transfer of (an) other asset(s) occur.

Enquiry Link: The system that allows RTGS account holders and certain other organisations to interrogate balance and other information and to perform certain other functions.

Euroclear UK and Ireland Ltd (EUI): The organisation that owns and operates the CREST system; part of the Euroclear group.

Financial Market Infrastructures: Payment systems, securities settlement systems and central counterparties.

Faster Payment Service: Faster Payments provides near-real time payments on a 24x7 basis, and is used for standing orders, internet and telephone banking payments. Faster Payments settles net, three times every business day in RTGS.

Geo-resilient: A system using data centres that are separated geographically and contain mutually replicated data. The data centres should be sufficiently distant from each other that a single physical event such as a fire or flood cannot render both inoperable.

Haircut: The difference between the market value of a security and its collateral value. Haircuts are taken by a lender of funds in order to protect the lender, should the need arise to liquidate the collateral, from losses owing to declines in the market value of the security.

Herstatt risk (also known as cross-currency settlement risk or foreign exchange risk): The risk that a party to a trade fails to make payment even though it has been paid by its counterparty. The term references the failure of Bankhaus Herstatt in 1974.

High-Value Payment System: A payment system designed mainly for large value, high priority, but lower volume, payments to be made between participants with immediate settlement finality.

International Monetary Fund (IMF): An international organization of 189 countries working to foster global monetary co-operation, secure financial stability, facilitate international trade, promote high employment and sustainable economic growth, and reduce poverty around the world.

Intraday liquidity: Liquidity provided to CHAPS direct participants and CREST settlement banks to help ensure they are able to make sterling payments, in addition to drawing on their reserves balances.

Level A collateral: Level A collateral is a Bank of England term used to refer to a subset of the highest rated sovereign debt, with low credit, liquidity and market risk. This is set out publically in the Bank's Red Book, as well as on the Bank's website.

Liquidity Saving Mechanism (LSM): Functionality within the RTGS processor which matches pairs or groups of CHAPS payments, settling them in batches simultaneously to offset their liquidity needs against one another. CHAPS participants use the central scheduler to manage their payment flows within the RTGS processor and the matching process employs algorithms to attempt to offset the queued payments.

LINK: The United Kingdom's ATM network which settles in 24-hour cycles. Cycles that take place over the weekend and on public holidays all settle on a net-basis on the following business day in RTGS.

Load balancing: The distribution of workload across multiple computing resources such as network links, central processing units and disk drives with the aim of improving performance and resilience.

Market Infrastructure Resiliency Service (MIRS): A contingency payment settlement service provided by SWIFT that offers a market infrastructure operational resilience in the event of unavailability of its RTGS system. Once activated, MIRS calculates accurate balances for all RTGS accounts and provides final settlement in central bank money.

Microservices: A microservices architecture is a method of developing software applications as a set of small, modular services which each run as independent processes and communicate through well-defined mechanisms to deliver business functions.

Payment Settlement Account/Settlement Account: Prime account in the Payments Minimum Balance Group(s) denominated in sterling maintained by an account holder in the RTGS System over which CHAPS payments are settled.

Prefunding: A model for collateralising Deferred Net Settlement payment systems that uses reserves account cash balances. Each participant always has the necessary resources set aside in a Reserves Collateralisation Account to meet their maximum possible settlement obligation in central bank money. Prefunding is used by Bacs and Faster Payments.

Non-bank Payment Service Providers (PSPs): Two regulatory categories of institutions that are not banks but instead specialise in providing payment services: E-Money Institutions and Payment Institutions. Many of these institutions are emerging payment fintech firms.

Payment Systems Regulator (PSR): The economic regulator of payment systems in the United Kingdom. The PSR aims to promote competition, innovation and the interests of end-users of payment systems.

Payments Strategy Forum (PSF): An forum made up of payment industry and end-user representatives with the aim to develop a strategy for payment systems in the United Kingdom. The PSR, the Financial Conduct Authority and the Bank attend the forum as observers.

Principles for Financial Market Infrastructures (PFMIs): International standards for systemically important FMIs set in 2012 by the Committee on Payment and Settlement Systems (now the Committee on Payments and Market Infrastructures, or CPMI) and the Technical Committee of the International Organization of Securities Commissions (IOSCO).

Payment versus Payment (PvP): A mechanism in a foreign exchange settlement system such as CLS which ensures that a final transfer of one currency occurs if and only if a final transfer of the other currency or currencies takes place.

Real-Time Gross Settlement (RTGS): The accounting arrangements established for the settlement in real time of sterling payments across settlement accounts maintained in the RTGS System.

Reserves account: An account held at the Bank of England for the purpose of the Bank's reserves account facility as described in the 'Documentation for the Bank of England's Sterling Money Market Operations'. CHAPS direct participants and CREST settlement banks are automatically members of the reserves scheme, and their reserves accounts are the same as their payment settlement accounts (or, for CREST-only banks, their sterling ordinary accounts).

Reserves Collateralisation Account (RCA): An account held at the Bank of England used for prefunding. Each participant in a DNS payment system that uses prefunding has a separate RCA for each payment system. The minimum balance on the RCA is maintained by the operator of the relevant DNS payment system to correspond to the net-debit cap of the payment system, and a balance equal to or in excess of the net-debit cap will need to remain in place at all times. The balance on the RCA forms part of an institution's total reserves account balance and will be remunerated at the same rate as the primary reserves account.

Settlement: The process by which a valid claim from the payee's institution is discharged by means of a payment from the payer's institution to the payee's institution. Specifically, the steps in the settlement process are: (a) collection and integrity check of the claims to be settled, (b) ensuring the availability of funds for settlement, (c) settling the claims between the financial institutions, and (d) logging and communication of settlement to the parties concerned.

Settlement Finality Directive (SFD): Directive 98/26/EC of 19 May 1998 on settlement finality in payment and securities settlement systems, implemented in UK law by the Financial Markets and Insolvency (Settlement Finality) Regulations 1999 (SI 1999/2979). The Directive and Regulations provide the rules, default arrangements, payment transfer orders and collateral security of designated payment and settlement systems with some protections against the normal operation of insolvency law, in order to reduce the likelihood risk of disruption to financial stability.

Sterling Monetary Framework (SMF): The Bank of England's operations in the sterling money markets, as set out in the 'Red Book' (www.bankofengland.co.uk/markets/Documents/money/publications/redbook.pdf).