



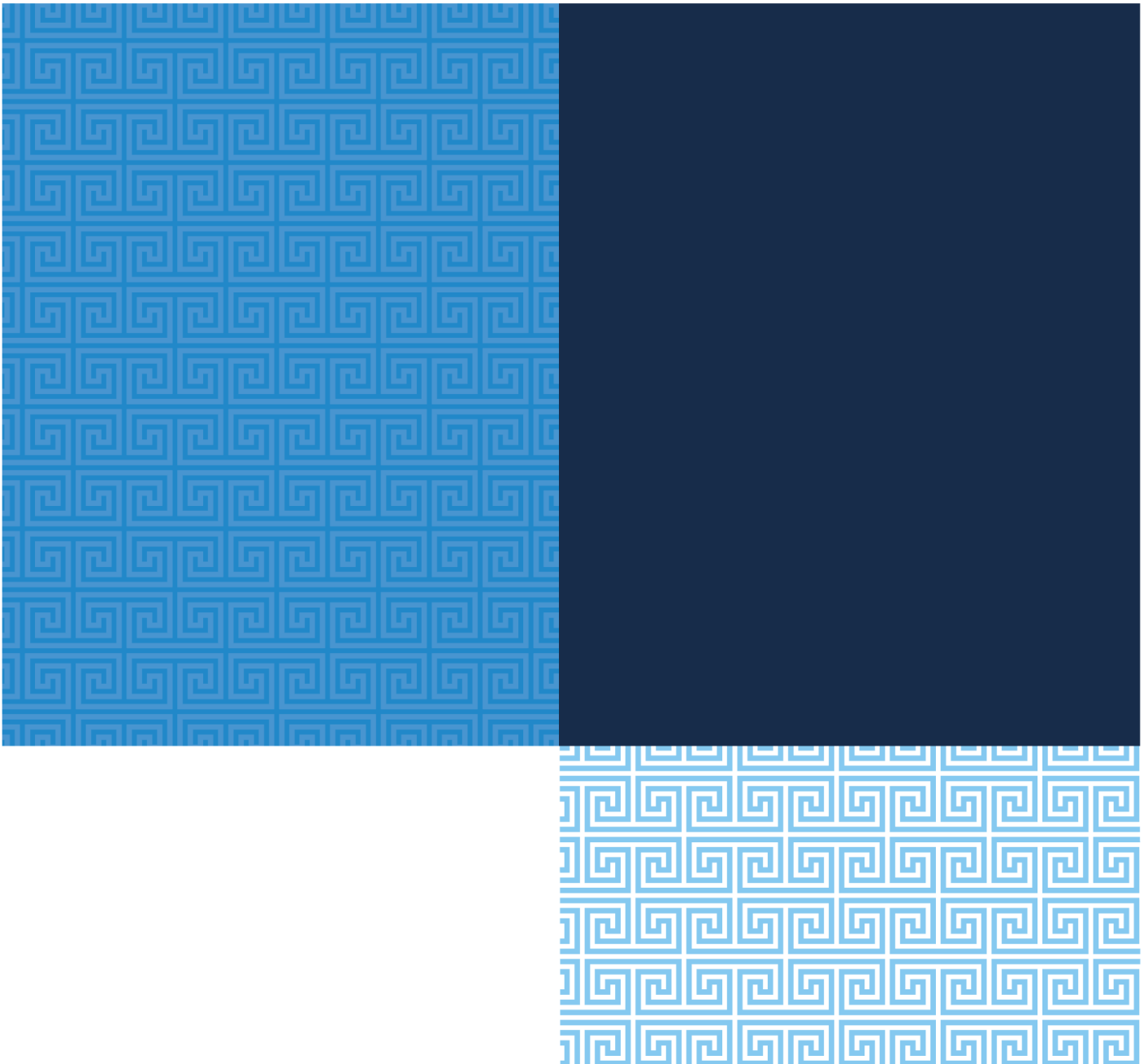
BANK OF ENGLAND

CHAPS



# Liquidity Saving Mechanism User Guide

February 2021



**Disclaimer**

This guide is issued pursuant to the CHAPS Reference Manual (*Guidance Documents*), and its sole purpose is to provide guidance and additional support to the users of the CHAPS Liquidity Saving Mechanism (LSM). It is not intended to impose legal obligations and/or form part and/or supersede or replace the CHAPS Reference Manual or any other legal agreements that CHAPS Participants have entered into with the Bank. It is designed to facilitate a broader understanding of the CHAPS LSM. If there is any conflict or inconsistency between any provisions in this guide and the CHAPS Reference Manual or any other legal agreements that CHAPS Participants have entered into with the Bank, those agreements shall prevail. Each CHAPS Participant acknowledges that it would be solely responsible for acting pursuant to the information in this guide and that the Bank would under no circumstances incur any liability for such actions. Users of this Guide should note that the provisions within this Guide are subject to change from time to time.

Whilst we endeavour to publish the most up to date documents on our website, we would encourage all those wishing to review any published documents to contact the Bank of England in order to ensure they receive the most up to date versions.

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## Executive Summary

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This user guide provides background information and a description of the key features of the Liquidity Saving Mechanism (LSM) in CHAPS. It is intended to be used by CHAPS Direct Participants (DPs) and those seeking an understanding of the LSM and how it can be used to manage intraday liquidity in CHAPS.

This guide is split into two sections:

- **Section 1: What is the Liquidity Saving Mechanism?**

This section provides a high-level overview of the LSM including why it was introduced, how it works and its key benefits.

- **Section 2: Liquidity Saving Mechanism controls available to DPs**

This section outlines how the LSM can help DPs manage payment flows and intraday liquidity in CHAPS. It provides a description of key operational controls available in the LSM to support management of payment flows and liquidity data available in RTGS Business Intelligence (RTBI).

The guide does not presume any prior knowledge of LSM and is intended to provide an overview targeted at those seeking a high-level understanding.

## Section 1: What is the Liquidity Saving Mechanism?

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1. This section explains why the CHAPS Liquidity Saving Mechanism (LSM) is important, provides a high-level summary of how it works and sets out its key benefits. This is a non-technical section that can be read in isolation to gain a general overview of the LSM for those not involved in the day-to-day management of payment flows and liquidity in CHAPS. This section does not assume any prior knowledge of LSM. A broader introduction to RTGS and CHAPS is available on the Bank's website.<sup>1</sup>

### What is the LSM?

2. The LSM is designed to help CHAPS Direct Participants (DPs) reduce their intraday liquidity requirements. It does so by enabling CHAPS payments to 'queue' temporarily in the RTGS infrastructure. Matching algorithms periodically match up groups of queued, broadly offsetting payments between the different DPs and settles these groups of matched payments simultaneously on a gross basis. This 'gross simultaneous settlement' is legally different to net settlement, but the liquidity requirement is the same as if netting of the transactions had taken place. The LSM also provides a range of wider functionality for DPs to monitor liquidity usage in CHAPS and set operational controls.

### Why is the LSM needed?

3. CHAPS payments are settled on a gross, real-time basis, as and when the DP submits them into the RTGS infrastructure, subject to the DP having sufficient funds in their account at the Bank. The value of payments settled in CHAPS is large compared with other sterling payment systems; in 2020 this was typically between £325bn and £475bn per day. Each DP has a different business model – and therefore the pattern and value of CHAPS payments that they submit and receive at different points of the day varies between them. Each CHAPS DP therefore faces the possibility that at certain points during the settlement day, they will be in a position of having received significantly fewer funds than they have sent. In this situation, they have to use own funds (termed '**intraday liquidity**') to settle payments rather than being able to recycle liquidity from incoming payments. DPs can generate additional intraday liquidity from a number of sources.<sup>2</sup>
4. **Intraday liquidity can be costly, especially since it can be difficult to predict how much liquidity will be needed each day.** DPs do not have control over when they will receive funds and therefore have a financial incentive to delay payments and wait for incoming payments before they send their own. If all DPs delay their payments (for example, adopt 'receipt-reactive' behaviour), this could create gridlock and no DP would receive payments early in the day or benefit from reduced intraday liquidity requirements. Whichever DP chooses to send payments first would have a disadvantage. Delaying payments may also result in further negative knock-on impacts to system-wide liquidity, each DP's ability to meet CHAPS Throughput criteria and could also adversely impact end customers.
5. **The LSM reduces the need for a DP to "move first".** Payments are submitted to CHAPS by DPs. The LSM enables submitted payments to 'queue' temporarily in the RTGS infrastructure to make use of the matching

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<sup>1</sup> See <https://www.bankofengland.co.uk/-/media/boe/files/payments/rtgs-chaps-brief-intro.pdf>

<sup>2</sup> On-supply intraday liquidity secured against high quality collateral; against euro cash provided to the Bank through the euro liquidity bridge; and use of Cash Ratio Deposits.

algorithms. Therefore, the key benefit of LSM is that it reduces DP incentives to delay submission of payments into RTGS, which could ultimately result in delays across the CHAPS system as a whole. Instead, the LSM provides a means for payments to offset efficiently, taking into account each DP's preferences. The earlier payments are submitted, the more likely they are to offset against matching payments. Given the importance of early submission, the CHAPS rulebook prohibits the use of local schedulers<sup>3</sup> and encourages timely submission of payments into CHAPS.

### **Introduction of the LSM**

The LSM was introduced in April 2013 following new regulations for intraday liquidity, requiring a dedicated pool of liquidity to meet payment obligations. Prior to the 2007-08 financial crisis, there was a sole requirement for banks to hold enough liquidity to fund outflows in times of balance sheet stress. The banks also used these buffers to fund payment activity during the day, a practice known as '**double duty**'. The regulatory reforms increased the cost of holding liquidity, as banks were now required to hold two separate pools of liquidity; one for funding their (business as usual) payment obligations, and another to fund any exceptional balance sheet stress events. This increased cost gave financial institutions an incentive to try to reduce the size of the liquidity pool required to meet payment obligations, and was a key driver behind the development of the LSM.

6. **As part of our work to renew the RTGS service as outlined in the Blueprint<sup>4</sup>**, the Bank consulted DPs in November 2018 on options to improve the LSM. There was broad support for the Bank's proposals in the renewed RTGS service which included incremental improvements to LSM functionality. More specifically, the proposals included forward-dated payments, an improved offsetting algorithm, simplified urgency categories, improved access to real-time data and a new trialling environment to allow participants to test how different settings will affect their liquidity parameters using representative historical data. More information on these features will be provided closer to the time when they will go live in the renewed RTGS service (expected in late 2023).

### **How does the LSM work?**

7. **With the LSM in place, CHAPS payments now settle in two distinct streams – urgent and non-urgent.** DPs can settle urgent payments immediately, subject to not breaching any limits or controls set by them in the central scheduler.<sup>5</sup> DPs can choose to send other, non-urgent payments, to the non-urgent stream where they queue temporarily and can be matched with incoming payments to reduce liquidity requirements. DPs can distinguish between urgent and non-urgent payments using a priority code in the CHAPS payment message. The key facts about each settlement stream are summarised in Table 1 below.

Urgent stream	Non-urgent stream
Payments specified by DPs as urgent	Payments specified by DPs as non-urgent

<sup>3</sup> Local schedulers are permitted in contingency scenarios only. The Bank must be informed of any use in this scenario.

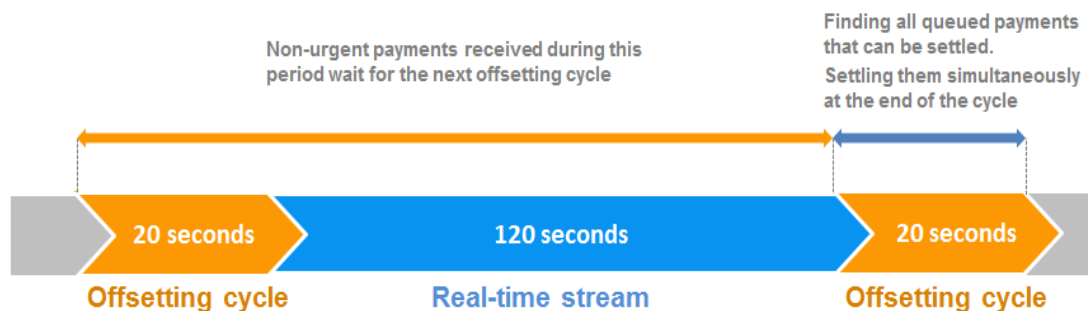
<sup>4</sup> <https://www.bankofengland.co.uk/-/media/boe/files/payments/a-blueprint-for-a-new-rtgs-service-for-the-uk.pdf>

<sup>5</sup> The central scheduler is the interface used by DPs to set LSM parameters and manage payment queues.

Settles in real-time, subject to not breaching DP controls	Settles in a 'offsetting cycle', which runs every 2 minutes
Urgent payments that breach any DP controls remain top of the queue and can settle swiftly in cycles	In each cycle, system identifies 'offsetting' payments within set controls and settles them simultaneously
Can use the whole RTGS settlement account balance	Can only use a part of the RTGS settlement account balance ('non-urgent balance') to settle
Operates throughout the CHAPS opening hours	Operates until 30 minutes before the end of the CHAPS day; all payments received in the last 30 minutes are auto-promoted by RTGS to 'urgent', subject to not breaching DP controls

**Table 1.** Summary of two settlement streams in CHAPS

8. **CHAPS settlement continuously switches between the two settlement streams.** During the majority of the settlement day, RTGS only settles urgent CHAPS payments. Every two minutes, RTGS briefly (for 20 seconds on average) pauses the immediate settlement of urgent CHAPS payments to settle payments that are queued. **These payments are settled via an 'offsetting cycle'** (illustrated in *Figure 1*):



**Figure 1:** Offsetting cycles in the LSM

9. Matching algorithms are used to find a set of offsetting payments made by different DPs, which do not breach the individual parameters set by any DP. All payments identified then settle simultaneously at the end of the offsetting cycle. Offsetting cycles also pick up any 'urgent' payments that did not settle in the urgent stream (for example, due to an insufficient balance). Payments that are submitted during the offsetting cycle are queued and do not enter the current offsetting cycle. These payments enter the next offsetting cycle.

### Key benefits of the LSM

10. **The LSM encourages DPs to send payments earlier during the CHAPS settlement day.** This reduces delays caused by receipt-reactive behaviour and supports compliance with the CHAPS Throughput criteria. A smooth flow of payments throughout the day increases liquidity recycling and therefore lowers system-wide liquidity needs.
11. **Economise on intraday liquidity.** The LSM has reduced intraday liquidity requirements in CHAPS. In 2019, the LSM helped save approximately 20-30% of intraday liquidity across all CHAPS DPs. DPs can use saved liquidity elsewhere.

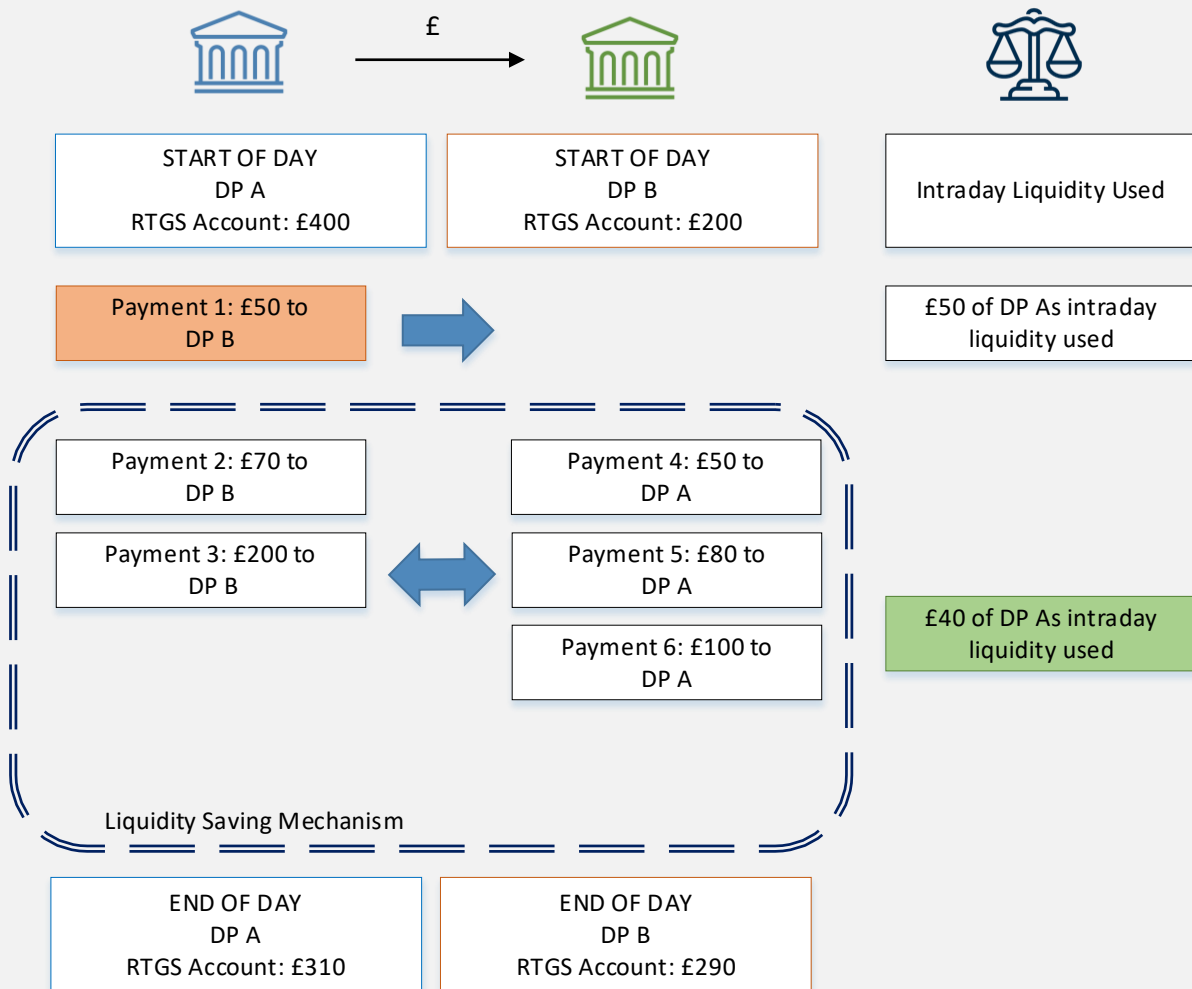
12. **Supports effective management of liquidity risk in CHAPS.** The LSM lowers the risk that a DP fails to manage its intraday liquidity effectively and is unable to meet a payment obligation at the time expected. There is a risk that if other firms detect that a DP has stopped sending payments not realising it is a result of poor liquidity management, this could lead to perceptions that the DP has a more serious problem such as a lack of liquidity or major operational issues. This could have a knock-on impact to market confidence and financial stability, both directly and indirectly, if other DPs seek to delay payments as a defensive measure to conserve their own liquidity.
13. **The LSM has systemic benefits beyond the ability to limit the need to use liquidity.** The LSM removes the case for DPs to inefficiently queue payments in their own internal schedulers as payment flows can be managed in the LSM. The CHAPS Reference Manual explicitly states that DPs should only use internal schedulers in contingency scenarios.<sup>6</sup> It therefore leads to more efficient, system-wide settlement.

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<sup>6</sup> CHAPS reference manual - <https://www.bankofengland.co.uk/-/media/boe/files/payments/chaps/chaps-reference-manual.pdf>, section 3.2.4.



**BOX A: HOW DOES THE LSM REDUCE INTRADAY LIQUIDITY REQUIREMENTS?**



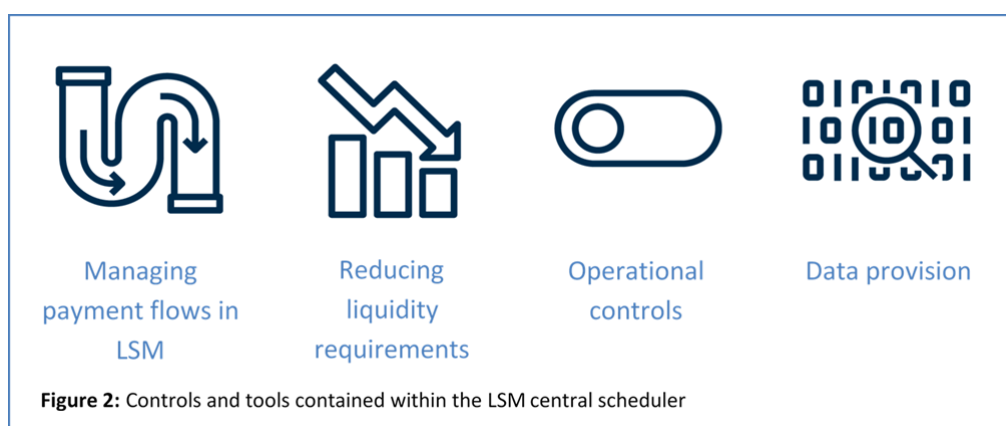
DP A has an account balance of £400 and a total of £320 payments due to DP B. DP B has an account balance of £200 and a total of £230 payments due to DP A.

Payment 1 is sent as urgent and all other payments are sent as non-urgent. Payment 1 uses £50 of DP A’s intraday liquidity. Payments 2, 3, 4, 5 and 6 are matched by the offsetting algorithms in the LSM. The net result is that £40 of DP A’s intraday liquidity is used and none of DP B’s intraday liquidity is used.

Without the LSM, DP A would have used £320 of intraday liquidity in total if DP B adopted receipt-reactive behaviour. DP B does not have a sufficient Start of Day balance to settle all of its payment obligations to DP A. With the LSM, DP A only uses £90 of intraday liquidity in total thus saving £210 of intraday liquidity or 68%.

## Section 2: Liquidity Saving Mechanism controls available to Direct Participants

14. This section describes how CHAPS Direct Participants (DPs) can manage their payment flows and intraday liquidity usage using the controls that are available in the LSM central scheduler. It explains key features of the LSM and provides information on payments data provision. This section would be useful to liquidity managers with responsibility for calibrating controls in the central scheduler or those seeking to understand these controls.
15. **The central scheduler provides a set of functions and controls to CHAPS DPs (illustrated in Figure 2).** These enable DPs to manage their intraday liquidity requirements in line with organisational preferences and business models, rather than imposing a particular level of liquidity saving. These also allow DPs to set controls to limit operational risk, for example, of insufficient liquidity to settle payment obligations.



### Managing payment flows in LSM

16. **Submitting payments.** DPs can send CHAPS payments as 'urgent' or 'non-urgent', by setting one of 80 available priority codes (10-89) in the payment message.<sup>7</sup> Payments with priority codes of 10 to 49 are categorised as 'urgent' and enter the urgent stream.<sup>8</sup> Payments with priority code 50-89 are categorised as 'non-urgent' and enter the non-urgent stream. All outstanding payments are **automatically promoted** to urgent 30 minutes before the end of the CHAPS settlement day.
17. **DPs can redefine payments as urgent by adjusting the priority of a payment at any time while it is queuing.** DPs can also **hold / cancel** payment instructions which are queuing if required. A held payment remains in the central scheduler but cannot be settled (either urgently or in offsetting cycles) until manually released. A cancelled payment will be removed from the central scheduler and will not settle. DPs can also set a limit on the amount of time all their payments can queue before being automatically promoted to urgent – this is known as **auto-promote delay**.

<sup>7</sup> Priority codes 01-09 are reserved for system use.

<sup>8</sup> If urgency is not specified, the payment is assumed to be non-urgent. All payments to and from Continuous Linked Settlement (CLS) automatically enter the urgent stream.

18. To facilitate settlement in the urgent and non-urgent streams, each DP's RTGS settlement account balance is effectively split into two parts (see Figure 3).<sup>9</sup>

- **Headroom** – funds reserved solely for the settlement of urgent payments (and other RTGS movements like FPS and Bacs net settlement).
- **Non-urgent balance** – funds that can be used by all payments. Non-urgent payments will always settle from the non-urgent balance. Urgent payments only use it if headroom is fully depleted.

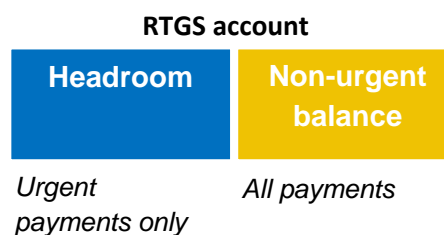


Figure 3: Split of account balance

19. This enables DPs to ensure that there are always sufficient funds to settle the urgent payments. If the non-urgent balance is relatively low such that there is not enough funds to settle non-urgent payments then settlement will only occur if there is a similar value of offsetting incoming payments.

20. There are several ways to ensure that specific payments settle on a timely basis. These include:





- Submit as **urgent**. Provided there is sufficient liquidity, urgent payments will settle immediately.
- An overall **auto-promote delay** can be set to ensure that no payment is queuing for longer than a set duration.
- Operators can be alerted to **promote** or **force settle** a payment if it is queuing after a particular length of time (for example, 15 minutes or 1 hour). Force settling a payment will override any limits or brakes that have been previously set. A sufficient overall balance is required to settle payments that have been promoted or force settled.

## Reducing liquidity requirements

21. The 'engine' of the LSM are the embedded matching algorithms. In each offsetting cycle, the algorithms look at the queuing payments and attempts to settle as many payments as possible within the constraints set by DPs. Its effectiveness is based on payments being submitted to the non-urgent stream. Queued payments are sorted into a certain order that rotates between cycles to ensure no payments get 'stuck' (by priority code and then largest first, smallest first or longest queued first). The first 500 payments at the top of each DP's sorted list are considered for settlement. The remainder are considered in the next offsetting cycle.

22. Payments which breach any of the parameters set by the DP are also identified and removed from the offsetting cycle. All remaining payments are settled simultaneously. Three broad scenarios for payments submitted to the non-urgent queue for LSM offsetting are detailed in the below table. See Box B at the end of this section for further detail on how the LSM offsetting cycle works.

<sup>9</sup> Theoretically, settlement of retail payment systems and other payment obligations (e.g., CLS) would come out of the headroom balance if headroom was set as the difference between the non-urgent balance and group account balance.

Scenario 1 – DP A submits 500 'non-urgent' payments	Scenario 2 – DP A submits 600 'non-urgent' payments	Scenario 3 – DP A submits some payments breaching controls
<p style="text-align: center;"></p> <p>All payments will be considered as part of current offsetting cycle.</p>	<p style="text-align: center;"></p> <p>Only the initial 500 payments at the top of each DP's sorted list are considered in the current offsetting cycle. The remaining 100 payments are delayed to be considered in the following offsetting cycle.</p>	<p style="text-align: center;"></p> <p>Payments flagged and removed from the LSM offsetting cycle, and remain in queue for future cycles.</p> <p style="text-align: center;"></p> <p>All other payments (up to 500) are considered as part of the offsetting cycle.</p>

**Table 2.** Summary of scenarios for payments submitted to the LSM (non-urgent stream)

23. It is also possible for a DP to settle payments in the offsetting cycle without receiving any payments if the DP has sufficient balance and none of its controls prevent the payments from settling (for example, bilateral limits). Furthermore, any urgent payments that have been unable to settle so far (for example, because of limits set by the DP) will be included in offsetting cycles and moved to the top of the queue.
24. **LSM offers three ways to limit liquidity available for offsetting** (see Figure 4 below). DPs are able to offset payments by limiting the amount of funds that the non-urgent payments can use. DPs can control this via several settings:

#### Manually adjusting the balances.



- DPs are able to adjust the split of their account balances into headroom and non-urgent balances at any time.
- The non-urgent balance limits the liquidity available for non-urgent payments, forcing them into the offsetting algorithms.
- A lower non-urgent balance should generate greater liquidity savings as non-urgent payments will be forced to offset prior to settlement.

#### Headroom refresh.



- This setting allows DPs to direct all incoming payments to the headroom balance which will top up the headroom balance only.
- It can be switched ON permanently to ensure that the headroom balance is always replenished and is at or approaching the max headroom set. Or it can be switched on temporarily to top-up the headroom balance if it was significantly depleted.
- Care should be taken when using this setting. If it is switched on and the non-urgent balance is zero, no non-urgent payments will settle. This is known as **headroom headlock**.



#### Max headroom.

- If headroom refresh is switched on, DPs are also able to set the maximum level of headroom. This ensures that headroom is topped up **only** if it dips below a specified amount.

**Figure 4:** Settings to control available liquidity for offsetting

25. **Multilateral limit.** This limits the net debit position a DP can get into. A multilateral limit of £10 million means that a DP is not able to send £10 million more in value than it has received from all other DPs. This

provides a limit on the overall amount of liquidity that can be used for CHAPS settlement. It applies to both urgent and non-urgent payments jointly and can be used to target a specific level of intraday liquidity.<sup>10</sup>

26. **Bilateral limit.** The DPs can also set limits against individual counterparties. This limits the net debit position a DP can get into against a specific DP. These can be used to limit liquidity exposure to individual DPs and can be used to target a specific level of intraday liquidity.

## Operational controls

27. **Managing payments via LSM profiles. To enable quick changes to settings and reduce manual effort, LSM allows DPs to specify 'profiles' (effectively templates) of settings that can be quickly enabled.**<sup>11</sup> Multiple profiles can be set up and applied at different times in the day. Using profiles can be a good way to reduce manual effort in common situations, for example, on known high payment flow days or in a participant or system outage scenario. All DPs are required to set a default start-of-day profile and a profile for contingency scenarios (e.g. if they lose access to the system). DPs can manually adjust settings after a profile has been applied or utilise profiles based on their own risk appetite.
28. **Operational controls include:**
- **Bilateral brakes** block all payments to a specific DP from settling and can be set at any time during the CHAPS settlement day. This could be used to manage payment flows to a DP that doesn't normally commence operations until a point after the 06:00 opening.
  - **Value caps** set a maximum value limit, after which any individual payment will require extra authorisation to settle. Value caps can be used by DPs to validate payments or apply additional own checks prior to settling via the LSM based on risk appetite. DPs will need to go into the central scheduler and manually release a payment parked behind a value cap before it can settle. Value caps can be particularly useful to check high value payments.
  - **Promote to urgent.** Payments that are queuing in the central scheduler can be promoted to urgent to settle immediately. Urgent payments will get parked behind a limit or a cap if these are breached and will not settle.
  - **Force settle** will override all limits and caps and the payment will settle provided there are sufficient funds available.
  - **Earliest Settlement Time (EST) Offset** applies to Continuous Linked Settlement (CLS) pay-ins and brings forward the settlement time by the number of set minutes specified (up to a maximum of 60). For example, an EST of 45 minutes for a CLS pay in instructed to settle at 07:00 will be available for settlement from 06:15.

**CHAPS Throughput criteria** are in place to ensure that DPs maintain a smooth flow of settled payments and do not delay excessively. Any liquidity management strategy should take these into account by closely monitoring the likely adherence with the criteria each day. **Throughput** is defined as the value of payments settled at a particular time in the day, against the total value settled for that day, expressed as a percentage.

<sup>10</sup> CREST transfers are not taken into account for the multilateral limit.

<sup>11</sup> Settings include headroom balance, max headroom or non-urgent balance (1 of the 3), multilateral limit, headroom refresh, auto-promote delay and some bi-lateral settings.

## Data provision

29. **Account information.** Timely and comprehensive information is key to ensuring that users are able to monitor and manage liquidity effectively. RTGS Enquiry Link provides real-time information on account balances and liquidity used in total and against other DPs. It also shows other information such as the total number of payments sent.
30. **Payment data and analysis.** Users are able to see their historical payment data on a t+1 basis in a convenient format via RTGS Business Intelligence (RTBI). RTBI displays a range of interactive diagrams and tables, as well as allowing DPs to download raw payments data. It has a separate section on LSM analysis, which shows the analysis on payment delays and queuing.

**BOX B: THE LSM OFFSETTING CYCLE**

Offsetting cycles attempt to offset queued payments at regular intervals. There are typically about 600 offsetting cycles per settlement day and these run approximately every 2 minutes.

The offsetting cycle finds the largest group of payments which could settle without breaching limits and the non-urgent balance. It uses multilateral and bilateral algorithms to ensure payments do not get stuck in the offsetting process.

The **multilateral algorithm** considers incoming and outgoing payments across all participants (subject to a maximum 500 payments per participant) and determines if these can settle without any participant becoming overdrawn. The algorithm de-allocates those payments that would leave any counterparty in a negative position. De-allocation results in those payments being dropped from the current offsetting cycle. Payments are always de-allocated in sort order from the bottom of the payment in the sorted list upwards. This process only stops once an overdrawn counterparty is no longer in a negative position and the updated payment set does not leave any DP in an overdrawn position. The offsetting cycle stops at this point and all payments settle subject to limits, soft earmarking and non-urgent balance checks. Soft earmarking of funds occurs when an urgent payment cannot settle due to a limit or cap breach. Soft earmarked funds will not be used for settlement of non-urgent payments.

The offsetting process will mark payments for settlement even if there are no incoming payments to offset against, provided other conditions are met, for example, it does not breach any limits and there is sufficient non-urgent balance.

The **bilateral algorithm** follows the same process but only considers two counterparties at a time, rather than a chain of payments simultaneously. Multilateral and bilateral algorithms rotate every other cycle.

**Priority code queuing**

There are three types of queuing order; oldest within priority, smallest within priority and largest within priority. The order of sorting is pre-determined ahead of each offsetting cycle.

DPs can manually alter the priority code of a payment in the central scheduler to increase its likelihood of offsetting. For example, a payment with a priority code 60 could be altered to have a priority code of 50. This would move it up in the sort queue ahead of the next offsetting cycle.

