Committee on Payments and Market Infrastructures

Consultative report

Extending and aligning payment system operating hours for cross-border payments

November 2021



BANK FOR INTERNATIONAL SETTLEMENTS



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ISBN 978-92-9259-513-5 (online)

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Executive summary

In October 2020, the G20 endorsed a roadmap to enhance cross-border payments, developed by the Financial Stability Board (FSB) in coordination with the Bank for International Settlements Committee on Payments and Market Infrastructures (CPMI) and other relevant international organisations and standard-setting bodies. The G20 cross-border payments programme aims to address long-standing challenges in the cross-border payments market, including high costs, low speed, limited access and insufficient transparency. This programme comprises the necessary elements of a globally coordinated response in the form of a set of 19 building blocks (BBs), based on a CPMI report to the G20 (CPMI (2020a) (2020b)).

This consultative report, produced by the CPMI Cross-border Payments Expansion Workstream and developed as part of BB 12 on extending and aligning operating hours of key payment systems to allow overlapping, **focuses on the operating hours of real-time gross settlement (RTGS) systems as key payment systems to enhance cross-border payments.** RTGS systems facilitate settlement typically in central bank money and, as a result, provide the foundation on which other payment systems and arrangements involved in cross-border payments rely. **An extension of RTGS operating hours across jurisdictions can therefore help to address current points of friction in cross-border payments, resulting in increased speed of cross-border payments, as well as reduced liquidity costs and settlement risk.**¹ Enhancing the speed of cross-border payments is an important ambition of the G20 cross-border payments programme, and targets have been developed by the FSB in this regard.²

This consultative report aims to solicit views from payment system operators, participants and other interested parties on three potential scenarios for extending RTGS system operating hours ("end states") and associated operational, risk and policy considerations. The three scenarios outlined here range from an incremental increase in operating hours on current operating days (eg standard working days), to an increase to include current non-operating days (eg weekends and holidays), and finally an increase to full 24-hour and seven-day-a-week (24/7) operations. The CPMI invites comments on these end states and the benefits and challenges related to them, as well as potential solutions to address potential issues. The CPMI plans to publish in 2022 a final report on action 2 of BB 12 incorporating the inputs received from this public consultation.

The analysis presented is based on a **survey of 82 jurisdictions conducted by the CPMI**, which identified 62 RTGS systems and provided information about their current operating hours. The key findings are the following:

- Operating hours vary significantly across RTGS systems in different jurisdictions, and there are sizeable gaps in their daily operating hours that at least partially explain the delays in the processing of cross-border payments. When the operating hours of RTGS systems in different jurisdictions do not overlap, the processing of cross-border payments suffers delays, increasing liquidity costs and settlement risk.
- On a daily basis, gaps in operating hours exist across nearly all jurisdictions, affecting both CPMI and non-CPMI jurisdictions, irrespective of whether they are advanced economies (AEs) or emerging market and developing economies (EMDEs), although gaps tend to be

¹ Increasing operating hours of key payment system to allow for overlapping may yield other benefits such as increased opportunities for payment-versus-payment (PvP) settlement of foreign exchange (FX) transactions including same-day PvP, the establishment of liquidity bridges and the ability to perform additional settlement cycles for ancillary payment systems involved in cross-border payments. These benefits can support reduced transaction costs for cross-border payments, and tie in with other BBs in the G20 cross-border payments programme (FSB (2020b)).

² By the end of 2027, 75% of cross-border payments are to be credited/to provide availability of funds for the recipient within one hour of payment initiation, and the remainder should be credited within one business day of payment initiation (FSB (2021a)).

larger for non-CPMI jurisdictions and EMDEs. Gaps are particularly pronounced across regions, exceeding 20 hours per day for some jurisdiction pairs and sometimes approaching (or even reaching) the entire day. Daily gaps are less sizeable but still noticeable for jurisdictions within the same region due to smaller time zone differences.

- Gaps in operating hours are even greater when considering weekly availability, as only a limited number of RTGS systems are available on weekends.³ At present, average operating hours on a weekly basis are nearly 25% less than would result if current average weekday operating hours were to apply throughout the entire week. If the effect of public holidays were to be added, those gaps would be even bigger because few RTGS systems are open on public holidays.
- To improve the status quo and help facilitate further overlap, this report suggests **three potential** end states for central banks to consider as they assess their current operating hours and plan for the future. These end state scenarios are not intended to be prescriptive, but provide high-level approaches outlining the outcomes an individual central bank could consider.
- The report proposes the "global settlement window" a new concept reflecting the time period during which the largest number of RTGS systems are simultaneously operating as a key consideration for central banks assessing potential end states for RTGS operating hours. At present, the global settlement window is best characterised as the time period from 06:00 to 11:00 Greenwich Mean Time (GMT) on working days. This is broadly the five-hour period when, on average, the highest number of CPMI and non-CPMI systems are concurrently operating across all jurisdictions covered in this report.
- The global settlement window is not intended to be a target in and of itself, but rather a key consideration in each jurisdiction's decision-making process. When evaluating an extension of RTGS operating hours, in addition to domestic considerations, individual jurisdictions may consider the resulting aggregate outcome in terms of the overall global overlap as reflected in the global settlement window. While each end state represents a potential extension of an individual jurisdiction's RTGS operating hours, a key objective for an extension of RTGS operating hours to support enhanced cross-border payments could be to consider an end state that meaningfully improves the status quo by adding to the current global settlement window in terms of the number of hours and days for that window and the number of jurisdictions with operating hours in that window.
- Depending on each jurisdiction's present circumstances, needs and challenges, each end state will likely require differing levels of effort and paths of implementation. Individual jurisdictions have discretion over which precise operating hours they choose to extend, the overall extent of changes and the pace of changes, while being mindful of the impact of their actions both in support of the global settlement window and on domestic considerations. End states could be achieved incrementally over time or through a "big bang" approach in which an end state is reached in a single step. Timelines should be flexible to account for different circumstances across jurisdictions. The appropriate time frame to reach an end state will depend on individual factors such as near-term demand, industry readiness, infrastructure choices, and cost and risk management considerations, among others.
- Transitioning into a new reality of RTGS operating hours implies a number of considerations and changes, which include operational adjustments by both payment system operators and participants, as well as the adaptation of certain market practices and conventions. As

³ In addition, the weekend days vary between jurisdictions. In some Middle Eastern and African countries, weekends are observed on Thursday and Friday, or Friday and Saturday, while in most other parts of the world they are observed on Saturday and Sunday.

regards the former, an extension of RTGS operating hours is likely to require technical changes to existing systems, platforms and infrastructures that will need to be carefully planned and deployed. Staffing needs could also increase in order to cover extended operating hours, and many of the associated costs may persist over time. Other issues with operational implications may also arise. In particular, market conventions and practices may need to be reviewed in order to accommodate the new operating hours.

- The extension of operating hours will generally not introduce new risks but will extend the times during which certain risks can materialise. As such, parties involved in RTGS systems may need to review and/or enhance existing operational procedures, risk monitoring tools and mitigation measures to accommodate longer operating hours. In particular, operators need to ensure that the extended hours do not jeopardise current levels of operational resilience and risk management, including against cyber attacks and payment fraud. Furthermore, participants need to ensure that they have sufficient liquidity to support their activities at all times, which will partially depend on the availability of current sources of liquidity during the extended hours.
- The extent of these adjustments will be contingent on the end state that is pursued and necessarily involve costs which must be evaluated and managed by the parties that would incur them. Central banks, payment system participants and other industry stakeholders would need to assess the nature and magnitude of such operational costs when assessing the different end states and the potential impact on end users. In doing so, it is important for these operational changes and associated costs to be viewed by all affected parties in a strategic light since resulting benefits could be far-reaching and long-standing, notwithstanding the immediate cost burden.
- Finally, an extension of RTGS operating hours also raises certain policy considerations relevant for central banks and/or other authorities, such as issues related to monetary policy, financial stability and resolution policy for troubled institutions. The relevance and impact of these issues will depend on the degree of the change and, to some extent, on the actual usage of the extended operating hours as it materialises over time. In view of this, changes may be required on the side of central banks and/or other authorities.

Box 1

Questions for consultation

The CPMI is inviting comments on this consultative report and the questions set out below. Comments should be sent to the CPMI secretariat (cpmi@bis.org) by 14 January 2022. All responses will be published on the website of the CPMI. Commercial or other sensitive information should not be included in the submissions, or may be included, with redactions for publication clearly noted.

- 1. Can the extension of real-time gross settlement (RTGS) systems' operating hours materially contribute to achieving the <u>cross-border payments targets</u> endorsed by the G20, especially in terms of speed? Please explain.
- 2. What additional actions would be needed by the public sector and/or private sector entities, beyond those described in the G20 roadmap (see Annex 3 of the current report), to facilitate the extension of RTGS operating hours and realise the benefits that could result from extended RTGS operating hours?
- 3. What benefits for cross-border payments other than speed do you perceive would accrue from an extension of RTGS operating hours? What additional domestic benefits for a jurisdiction do you perceive?

- 4. How well do the three identified end states capture key scenarios that individual central banks/RTGS system operators should consider as they assess current RTGS operating hours and plan for the future? What additional end states or refinements to the end states would you suggest?
- 5. Which end state, out of the three identified or another one you may want to consider, do you believe strikes the best balance between improving cross-border payments and managing the associated challenges?
- 6. If the RTGS system in your jurisdiction has not yet reached the end state signalled in the previous question, what time horizon (number of years from now) would you envision for reaching it?
- 7. As a result of end state 3, which involves 24/7 RTGS operating hours, do you anticipate demand for 24/7 operations of RTGS systems in the future? If so, what do you expect to be the main drivers and over what time horizon do you expect this to happen?
- 8. Would your organisation make use of and/or benefit from extended RTGS operating hours?
- 9. How useful do you view the global settlement window as a concept for considering the aggregate implications of extensions to RTGS operating hours in individual jurisdictions? What alternatives or refinements, if any, would you propose in order to consider the aggregate implications of extensions to RTGS operating hours in individual jurisdictions?
- 10. To what extent have the operational and risk considerations related to an extension of RTGS operating hours been adequately identified? What additional considerations would you consider relevant?
- 11. What would you identify as the top five considerations related to an extension of RTGS operating hours in your preferred scenario (Q5)?
- 12. To what extent do the relevant considerations differ substantially depending on the end state being considered?
- 13. For the top five considerations that you identified in Q11, what mitigation measures could be taken to address them?
- 14. In your view, to what extent will the above measures require coordinated action by industry participants and/or support/guidance from authorities, such as central banks, standard-setting bodies and supervisors (as opposed to actions by individual stakeholders)?
- 15. If you are a stakeholder of an RTGS system that has extended its operating hours in the recent past, what were the key lessons learnt?

1. Introduction

In 2019, the G20 finance ministers and central bank governors tasked the Financial Stability Board (FSB), together with the Committee on Payments and Market Infrastructures (CPMI) and other international standard-setting bodies, to develop a roadmap to address challenges with cross-border payments: high costs, low speed, limited access and limited transparency. Through a three-stage process, 19 building blocks (BBs) were identified to tackle these challenges and ultimately enhance cross-border payments. The CPMI has formed the Cross-Border Payments Expansion Workstream to work on BB 12 on extending and aligning operating hours of key payment systems to allow overlapping of hours across them.⁴

Limited operating hours for key infrastructures that facilitate cross-border payments constrain the times when payments can be initiated, cleared and settled, ultimately causing them to be delayed, thereby increasing liquidity costs and settlement risk. This effect is often exacerbated in an international setting due to a lack of overlap in operating hours across jurisdictions, particularly those located in different time zones.

This consultative report presents the findings of a survey of 82 jurisdictions identifying the gaps and overlaps in operating hours of 62 real-time gross settlement (RTGS) systems around the world, potential end states for extending key payment systems' operating hours and the associated operational, risk and policy considerations. To that end, this report is structured as follows. After this introduction, Section 2 presents the scope of the analysis and discusses the relevance of RTGS operating hours for crossborder payments, including the potential benefits of their extension. Section 3 summarises the results of a global stocktake conducted by the CPMI in the first quarter of 2021 to survey the operating hours of key payment systems and identify current gaps in overlap, with the concept of a global settlement window introduced as a key construct related to overlap in operating hours. Section 4 describes a set of potential end states that individual jurisdictions could consider for extending key payment systems' operating hours, and how such extensions could support a global settlement window. Section 5 discusses the operational, risk and policy considerations related to those end states, underscoring the extent of changes both operators and participants may need to undergo when implementing extensions of operating hours. The report concludes by summarising the key takeaways from this exercise and inviting feedback, with Box 1 presenting specific questions on which input is sought.

⁴ In addition to its contribution to addressing the challenges around speed and cost, BB 12 supports a variety of other BBs. Some of these include facilitating increased adoption of payment versus payment (PvP) mechanisms (BB 9), liquidity bridges (BB 11), interlinking of payment systems (BB 13) and new multilateral platforms or arrangements for cross-border payments (BB 17).

2. Scope of the analysis

2.1 RTGS systems as key payment systems for cross-border payments

This report focuses its analysis on RTGS systems that settle in central bank money⁵ (hereafter, RTGS systems) as key payment systems for cross-border payments. As is the case for domestic payments, RTGS systems are a core, foundational component of current arrangements for cross-border payments as final settlement in central bank money only occurs within the operating hours of a jurisdiction's RTGS system.⁶

Beyond RTGS systems, other payment systems and critical services are also relevant for crossborder payments. However, although extensions could be made to the operating hours of some of these payment systems and critical services, without an extension of the operating hours of the underlying RTGS infrastructure, final settlement in central bank money during certain times may be unavailable.

While a focus on RTGS systems is appropriate given their key role in supporting cross-border payments, some systems, in particular fast payment systems (FPSs), exhibit operating hours and speed that have the potential to alleviate certain frictions in the payer's jurisdiction, the payee's jurisdiction, or both, even without an extension of RTGS operating hours. Box 2 focuses on this type of system due to the recent deployment of FPSs in a growing number of jurisdictions and the novel features that they display.

⁵ RTGS systems are funds transfer systems that allow the real-time gross settlement of money and/or securities. RTGS is the continuous process of settling payments on an individual order basis, without netting debits with credits. Central bank money means a liability of a central bank, which can be used for settlement purposes. Final settlement constitutes the irrevocable and unconditional transfer of funds.

⁶ There might be some exceptions to this, as in certain jurisdictions (eg Australia, euro area, United States) fast payment systems (FPSs) have been developed (or are being developed) that allow for central bank money settlement for fast payments, potentially settling those payments in real-time, even when the main RTGS system is closed. In these cases, and depending on the configuration of the FPS in individual jurisdictions and the type of cross-border payment to be processed, the use of FPS could be considered for processing cross-border retail payments, including final settlement in central bank money outside RTGS operating hours. See Box 2 for further details.

Box 2

Fast payment systems (FPS) and cross-border payments

Fast payments are characterised by both the speed of the payment for end users (ie real-time or near real-time receipt of final funds by the payee) and the availability of systems over time to conduct such payments (ie 24/7 or as close to 24/7 as possible). D Potentially, FPSs could be used to enhance the speed of a cross-border payment, without extending real-time gross settlement (RTGS) operating hours, in the following ways:

- an FPS could be used by an end user to fund a cross-border payment that is ultimately conducted through another service, such as a money transmitter service, thereby using the FPS for the domestic leg of a payment rather than being a cross-border payment that is conducted directly using the FPS;
- an FPS could be used for one or more interbank legs of a cross-border payment based on correspondent banking arrangements;² or
- two or more FPSs could be interlinked across jurisdictions. ③

However, some FPSs have not yet gained critical mass of volume and participants in those jurisdictions in which they have been deployed. In addition, many have been designed with the aim of covering certain types of transaction in a domestic context, not with the specific aim of being used for cross-border payments. As a result, the business rules and message formats might not be suited in all cases for an easy integration in the existing cross-border network. For example, there might be caps on the maximum amount that can be transferred or shortcomings in the information fields that might not allow the inclusion of detailed information on sender and beneficiary that might be required for cross-border payments. As these propositions grow, there may also be some services (eg liquidity pools in central bank money) needed in case these systems are used intensively for cross-border payments or for certain types of cross-border transaction that might not be accessible if the RTGS system is not open.

As a result, there seems to be potential for FPSs to improve cross-border payments but, depending on the FPS configuration, there might also be limitations to its broad use for all kinds of cross-border transactions. This suggests that the potential use of FPSs in the area of cross-border payments should continue to be investigated while also considering the extension of operating hours for RTGS systems as key payment systems in the existing cross-border payment network.

① As described in CPMI (2016), fast payments are defined as payments in which the transmission of the payment message and the availability of final funds to the payee occur in real-time or near real-time and as near to a 24-hour and seven-day-a-week basis (24/7) as possible. Previous work by the CPMI has documented the deployment of FPSs in jurisdictions around the world (CPMI – World Bank (2020)). ② To help improve the speed of cross-border payments, SWIFT has recently launched a new service – "SWIFT gpi instant". This service connects payments from members of the SWIFT gpi network with domestic FPSs, thus improving the speed with which cross-border payments can be processed. See <u>www.swift.com/news-events/press-releases/swift-enables-payments-to-be-executed-in-seconds</u>. ③ Issues associated with interlinking of payment systems and the implications for cross-border payments are being considered in the separate workstream on pursuing interlinking of payment systems for cross-border payments (BB 13) (CPMI (2020a), (2020b)).

2.2 RTGS operating hours and cross-border payments

For the purposes of this report, an RTGS system's **operating hours are defined as the hours of the day and days of the year when its participants can perform final settlement of funds in the system**. Operating hours determine when participants in a payment system can settle transactions, but equally importantly, establish when a participant <u>cannot</u> do so. Indeed, faced with such a constraint, participants typically must either wait for the RTGS system to reopen or must proceed with the payment by deferring settlement (or some other activity) until a later time when the system has reopened, causing delays and taking on risks and costs in the process.⁷

⁷ For example, if the settlement infrastructure being used for a payment is not open, the payee's bank may credit the payee before settlement with the payer's bank has occurred. In such a situation, the payee's bank would be exposed to credit and liquidity risk with respect to the payer's bank.

While these implications of operating hours apply to domestic payments, in the case of crossborder payments, not only are the operating hours of a particular domestic payment system relevant, but so too are the relationship and potential overlap of that system's operating hours with the operating hours of payment systems in other jurisdictions. To the extent that certain events must occur in succession across the two legs of a cross-border payment, overlap in operating hours is a precondition to prevent delays that could arise, for instance, when the funds associated with a payment must be settled for an intermediary payment service provider (PSP) before moving to another PSP in the chain. Moreover, if risk considerations suggest that certain activities should occur concurrently, such as payment-versus-payment (PvP) settlement⁸ for foreign exchange transactions, then overlap in operating hours can support such concurrent activities.

The remainder of this subsection illustrates how the speed of a cross-border payment can be affected by the operating hours of the local payment systems through a stylised example leveraging correspondent banking and the use of RTGS systems (Box 3). The example highlights some benefits that can be drawn from extending the operating hours by the delaying the closure of the main RTGS systems, both unilaterally and together, where the outcome is further overlap and alignment between the systems' hours. A similar effect can be achieved by reopening the payment system with next day value date soon after closure.

Box 3

An illustrative case study of a cross-border payment from the euro area to Indonesia

While various arrangements can be used to conduct a cross-border payment, the correspondent banking model represents a material part of cross-border payments today. Given this model's reliance on real-time gross settlement (RTGS) systems, cross-border payments conducted through correspondent banking may particularly benefit from an extension in RTGS operating hours. In what follows, a simplified and hypothetical case study of a payment from the euro area to Indonesia is used to illustrate the implications of operating hours for the payment system participants and ultimately the end users; this case study is included for illustrative purposes only and does not consider the costs or overall benefits of an extension of operating hours of the RTGS systems mentioned.

At present, in the euro area, TARGET2 is open from 06:00 to 17:00 GMT (11 hours per day) on weekdays, while Indonesia's Bank Indonesia - Real Time Gross Settlement (BI-RTGS) is open from 23:30 to 12:00 GMT the next day (12 hours 30 minutes per day) on weekdays. Current overlap between these two systems occurs between 06:00 and 12:00 GMT (6 hours per day).

Outside the operating hours that overlap, a payment from a sender in the euro area to a receiver in Indonesia can experience a delay on the sender's side of the payment (from 17:00 to 06:00 GMT D+1), the receiver's side (from 12:00 to 23:30 GMT), or both sides (from 17:00 to 23:30 GMT, when both systems are closed).

A payment from the euro area to Indonesia under current operating hours for TARGET2 and BI-RTGS

For example, under current operating hours (see Graph 3.1), if a payment were initiated in the euro area at 20:30 GMT when TARGET2 is closed, the payment could potentially be delayed until the reopening of TARGET2 at 06:00 GMT. Once TARGET2 reopens, the payment would be sent through the correspondent banking network and would settle given BI-RTGS operating hours. The resulting delay could thus be at least 9.5 hours, resulting from limited operating hours on the sender's side.

⁸ PvP is a settlement mechanism that ensures that the final transfer of a payment in one currency occurs if and only if the final transfer of a payment in another currency or currencies takes place.



A payment from the euro area to Indonesia under a hypothetical extension of the closing time for TARGET2 given current operating hours for BI-RTGS

If the closing time of TARGET2 were hypothetically extended from 17:00 to 22:00 GMT (Graph 3.2), a payment from the euro area to Indonesia initiated at 20:30 GMT could be settled through TARGET2 when initiated. At that point, the payment would be sent through the correspondent banking network across borders but could be delayed on the Indonesian leg of the payment due to the inability to settle the payment until BI-RTGS reopens at 23:30 GMT, yielding a potential delay of at least 3 hours due to limited hours on the receiver's side. Thus, an extension of hours in one jurisdiction has the potential to increase speed by decreasing delays on that side of the payment, although delays on the other side of the payment could still persist.

Hypothetical extension of the operating hours for TARGET2

Graph 3.2



A payment from the euro area to Indonesia under a hypothetical extension of the closing time for TARGET2 and a hypothetical extension of the opening time for BI-RTGS

Finally, if the closing time of TARGET2 were extended to 22:00 GMT, and the opening time of BI-RTGS were hypothetically extended to 20:00 GMT (Graph 3.3), the operating hours of TARGET2 and BI-RTGS would also overlap from 20:00 to 22:00 GMT. Given that overlap, a payment initiated in the euro area at 20:30 GMT could potentially be settled through TARGET2 and transferred through the correspondent banking network for settlement in BI-RTGS with minimal delays.

Hypothetical extension of the operating hours for TARGET2 and BI-RTGS Graph 3.3



2.3 Jurisdictions and RTGS systems covered in the analysis

The survey, which forms the basis of the analysis in this report, was conducted in the first quarter of 2021 and covered 82 jurisdictions, including all 27 CPMI jurisdictions and 55 non-CPMI jurisdictions. Given the scope described in Section 2.1, RTGS systems were identified as those that meet the following criteria: (1) the system is a large-value payment system (LVPS), often referred to as wholesale payment system; (2) the system's settlement method is RTGS or RTGS-hybrid, where an RTGS-hybrid system combines an RTGS mechanism with a mechanism for offsetting or netting payments; and (3) the central bank operates and/or acts as manager/settlement agent for the system. The stocktake yielded responses from 62 RTGS systems, which are listed in Annex 2. Of these 62 systems, 21 are located in CPMI jurisdictions and 41 are located in non-CPMI jurisdictions across three regions, which broadly align with different time zones: Americas (AM); Europe, Middle East and Africa (EMEA); and Asia-Pacific (APAC). In addition, the jurisdictions can also be categorised in terms of AEs or EMDEs (see Annex 2).

3. Stocktake findings on RTGS operating hours

3.1 Current RTGS operating hours

On a daily basis, RTGS systems in the stocktake are currently open for almost 11 hours per day on average (Annex 1, Table A1), although there is substantial variation across jurisdictions in daily operating hours on working days (ie non-holiday workdays or "standard business days").⁹ At present, 40 jurisdictions have below average operating hours on working days, with 21 featuring eight operating hours or less per day. Nearly all of these are non-CPMI jurisdictions and EMDEs. At the other end of the spectrum, of the 22 jurisdictions with above average operating hours, eight feature more than 16 hours per day. Of these, four jurisdictions (India, Mexico, South Africa and Switzerland)¹⁰ have operating hours of 24 hours or nearly 24 hours per day on working days.

On a weekly basis, there are relatively few jurisdictions with weekend operating hours for their RTGS systems with only eight having any weekend hours¹¹ and only five operating seven days per week (Annex 1, Table A3).¹² Of these, three systems have weekend hours aligned with operating hours of 20 or more hours per day on working days, indicating that having weekend hours is closely related to having extensive daily hours overall.¹³ The rarity of weekend operating hours implies that, at present, average operating hours on a weekly basis are nearly 25% less than would result if current average weekday operating hours were to apply throughout the entire week (Annex 1, Table A2).¹⁴

3.2 Current gaps in RTGS operating hours

The extent to which daily and weekly RTGS operating hours' overlap across jurisdictions can have important effects on the speed and cost of cross-border payments between them. Gaps in operating hours between jurisdictions can also be analysed on a daily or weekly basis. In each case, **the gap in operating hours between two jurisdictions can be defined as the time lapse when both jurisdictions' RTGS systems are not operating simultaneously**. Such gaps can arise either because both payment systems are closed at certain times or one payment system is open while the other is not.¹⁵ Evaluation of gaps in operating hours can be considered bilaterally between jurisdictions (eg between specific country corridors where there may be a high value/volume of cross-border payments), regionally (eg where there may be close trade ties) or globally.

- ⁹ Working days generally correspond to Monday to Friday, except for certain jurisdictions, such as those in the Middle East, where they correspond to Sunday to Thursday.
- ¹⁰ All of these are CPMI jurisdictions, and three are EMDEs.
- ¹¹ Weekends involve non-working days, according to the convention that applies for working days in a particular jurisdiction. In certain jurisdictions, such as those in the Middle East, the weekend comprises Friday and Saturday. In other jurisdictions, the weekend comprises Saturday and Sunday, except some exceptions such as Nepal where it only comprises Saturday.
- ¹² On an annual basis, total annual operating hours would depend on the extent of both weekend and holiday operating hours. As is the case for weekends, a large majority of RTGS systems in the survey do not operate on public/bank holidays. Indeed, only six systems, largely corresponding to those that also operate throughout the weekend, reported operating on holidays.
- ¹³ In particular, India, Mexico and South Africa all have weekend hours of (nearly) 24 hours per day, reflecting these systems' round-the-clock operations.
- ¹⁴ Current weekly hours average 57.9 hours, corresponding to 8.3 hours per day. If the current daily average of 10.9 hours on working days were to apply throughout the week, weekly hours would average 76.3 hours.
- ¹⁵ Gaps in operating hours will also depend on the application of daylight savings time in individual jurisdictions. Jurisdictions differ in whether, when and how they implement time changes over the course of a year. Such time changes can affect gaps in operating hours on daily, weekly and annual bases.

On a daily basis, the vast majority of jurisdiction pairs have relatively large daily gaps in operating hours, often exceeding half of the day (Graph 1).¹⁶ These sizeable gaps exist within regions, primarily due to limited operating hours of individual payment systems in each region. Gaps are particularly pronounced across regions due to the frequent lack of alignment in current operating hours across jurisdictions in different regions, especially where time zone differences are large. Indeed, gaps for certain jurisdiction pairs in different regions sometimes exceed 20 hours per working day, with some approaching (or even reaching) the entire day.

					AP	AC				1			EM	IEA						АМ		
		AU	JP	KR	CN	ΗК	SG	ID	IN	RU	TR	SA	ZA	СН	EA	SE	GB	BR	AR	US	CA	MX
	ΔΠ	10	13	16	11	14	14	13	10	11	19	19	10	10	19	19	19	22	22	12	15	10
	JP		12	16	14	14	14	12	12	12	18	18	12	12	18	18	18	22	23	13	17	12
	KR			16	16	16	17	16	16	16	21	22	16	16	22	22	22	24	24	17	20	16
AC	CN				3	15	16	14	4	7	18	20	3	4	16	16	15	15	14	5	9	3
AP	ΗК					14	15	14	14	14	19	20	14	14	20	20	20	23	24	15	18	14
	SG						14	14	14	14	19	19	14	14	19	19	19	23	24	14	18	14
	ID							12	12	12	18	18	12	12	18	18	18	22	23	13	17	12
	IN								1	4	15	17	1	1	13	13	12	13	13	3	6	1
	RU									4	15	17	4	5	13	13	12	16	16	6	10	4
	TR										15	17	15	15	16	16	16	19	21	15	15	15
	SA											17	17	17	17	17	17	20	22	17	17	17
ME/	ZA												0	1	13	13	12	12	12	2	6	0
Ē	CH													1	13	13	13	13	13	3	6	1
	EA														13	13	13	17	18	13	13	13
	GB															15	12	16	10	12	12	12
-	BR												_				12	12	14	12	12	12
	AR																	12	12	12	12	12
Σ	US																		. 2	2	6	2
A	CA																			-	6	6
	MX																					0
	0	6	12	18	24	Pa	irwise	gap	betw	een tł	ne two	o syst	ems o	consid	dered	(in h	ours)					
	0	6	12	18	24	Da	ily no	n-op	eratir	ng hoi	urs fo	r a gi	ven s	ystem	ín h	ours)						

Pairwise total gaps in daily real-time gross settlement operating hours on working days (GMT) for Committee on Payments and Market Infrastructures jurisdictions

Graph 1

AM = Americas; APAC = Asia-Pacific; AR = Argentina; AU = Australia; BR = Brazil; CA = Canada; CH = Switzerland; CN = China; EA = Euro área; EMEA = Europe, Middle East and Africa; GB = United Kingdom; HK = Hong Kong SAR; ID = Indonesia; IN = India; JP = Japan; KR = Korea; MX = Mexico; RU = Russia; SA = Saudi Arabia; SE = Sweden; SG = Singapore; TR = Turkey; US = United States; ZA = South Africa. Source: CPMI survey.

¹⁶ Some graphs in this section are only depicted for CPMI jurisdictions (Annex 1 provides analysis for the full set of jurisdictions). The analysis here focuses on the total gap in operating hours between two jurisdictions (ie the total number of hours from both systems being closed simultaneously and from one system being open while the other is closed). Graph 2 is symmetric because the gap in operating hours for jurisdiction A with respect to jurisdiction B is the same as the gap in operating hours for jurisdiction B with respect to jurisdiction A. In addition, the diagonal elements in Graph 2 represent the number of hours during a working day when a particular jurisdiction's RTGS system is closed. On a weekly basis, the overall relative patterns in gaps are similar to those for working days (Graph 2). In particular, **the same jurisdictions that exhibit relatively large daily gaps also tend to exhibit relatively large weekly gaps.** However, even those jurisdictions with relatively extensive weekly operating hours can face weekly gaps of up to 48 hours because of the absence of weekend operations in other jurisdictions, which is disproportionate to their daily gaps on working days.¹⁷ While alignment in operating hours to regional business hours tends to mitigate daily gaps within regions during working days relative to daily gaps across regions, **the general lack of weekend operating hours generates incremental increases in weekly gaps**, irrespective of whether two jurisdictions fall within the same region. As in the case of daily gaps, the average size of weekly gaps increases when non-CPMI jurisdictions are taken into account, reflecting their generally less extensive operating hours (Annex 1, Table A6).

Pairwise total gaps in weekly real-time gross settlement operating hours (GMT)



AM = Americas; APAC = Asia-Pacific; AR = Argentina; AU = Australia; BR = Brazil; CA = Canada; CH = Switzerland; CN = China; EA = Euro area; EMEA = Europe, Middle East and Africa; GB = United Kingdom; HK = Hong Kong SAR; ID = Indonesia; IN = India; JP = Japan; KR = Korea; MX = Mexico; RU = Russia; SA = Saudi Arabia; SE = Sweden; SG = Singapore; TR = Turkey; US = United States; ZA = South Africa. Source: CPMI survey.

¹⁷ For example, Mexico and South Africa both exhibit weekly gaps that are disproportionate to their daily gaps on working days because of the absence of weekend operations in other jurisdictions.

3.3 Current overlaps in RTGS operating hours and defining the global settlement window

The importance of improving cross-border payments worldwide calls for an aggregate perspective for overlap in RTGS operating hours. The introduction of a new concept, namely the "global settlement window", is useful in this regard.

For the purposes of this report, **the global settlement window is the time frame during which the highest number of RTGS systems across jurisdictions are concurrently open**, allowing crossborder transactions to settle across those jurisdictions without delays being incurred, ceteris paribus. While the concept of a settlement window can be applied on a regional basis (ie a "regional settlement window" based on the operating hours of jurisdictions in the same region) or even a pairwise basis (ie a bilateral "corridor settlement window" based on operating hours for two specific jurisdictions), a focus on the settlement window on a global basis (ie the global settlement window) provides a useful construct for considering the aggregate implications of individual RTGS operating hours' extension as discussed further in Section 4.

Focusing on working days for CPMI jurisdictions, distinct patterns in overlap of RTGS operating hours are evident across regions, reflecting the daytime "business hours" in each region (Graph 3).¹⁸ In particular, given the time zones, **APAC jurisdictions have operating hours that fall earlier in the day (in GMT), while EMEA jurisdictions have operating hours that are more heavily concentrated in the middle of the day, and AM jurisdictions have operating hours slightly more concentrated in the second half of the day.** In each region, certain jurisdictions have extensive operating hours throughout the day. However, gaps in operating hours related to those jurisdictions exist to the extent that other jurisdictions do not have similarly extensive operating hours.

¹⁸ The current overlap in hours including non-CPMI jurisdictions on working days is presented in Annex 1, Graph A2. Graph A3 shows the weekend operating hours in all surveyed jurisdictions.



Real-time gross settlement operating hours on working days (GMT) for Committee on Payments and Market Infrastructures jurisdictions per region

Source: CPMI survey.

Considering all CPMI and non-CPMI jurisdictions, at present, **the best characterisation of what currently constitutes the global settlement window is the interval from 06:00 to 11:00 GMT on working days.** ¹⁹ This is broadly the five-hour period when, on average, the highest number of CPMI and non-CPMI systems are concurrently operating across all jurisdictions covered in this report (Graph 4). This window also largely coincides with the core hours for PvP settlement through CLS Bank (ie 05:00 to 10:00 GMT), which relies on the overlapping hours of RTGS systems across jurisdictions to eliminate settlement risk for wholesale foreign exchange (FX) transactions of eligible currencies.²⁰

In addition to its conceptual usefulness, the global settlement window is important for a number of reasons. First, it can support arrangements, such as liquidity bridges and PvP settlement for FX transactions, that reduce risks associated with cross-border payments and can therefore support reduced transaction costs. Second, it reflects the time period during which speed-related frictions are minimised across a wide range of jurisdictions. In light of these implications of the global settlement window, the

AM = Americas; APAC = Asia-Pacific; AR = Argentina; AU = Australia; BR = Brazil; CA = Canada; CH = Switzerland; CLS = CLS Bank; CN = China; EA = Euro area; EMEA = Europe, Middle East and Africa; GB = United Kingdom; HK = Hong Kong SAR; ID = Indonesia; IN = India; JP = Japan; KR = Korea; MX = Mexico; RU = Russia; SA = Saudi Arabia; SE = Sweden; SG = Singapore; TR = Turkey; US = United States; ZA = South Africa.

¹⁹ For purposes of this report, the global settlement window has been determined by (i) considering various time intervals (eg one hour, two hours), (ii) determining the peak time period for each interval that has, on average, the largest number of RTGS systems open for (1) CPMI jurisdictions, (2) non-CPMI jurisdictions and (3) all CPMI and non-CPMI jurisdictions, and (iii) selecting the largest interval and associated hours that involves the smallest difference in the peak time period across the three groupings of jurisdictions. This analysis identifies the five-hour period from 06:00 to 11:00 as the global settlement window with approximately 43 RTGS systems, on average, operating during that window. Alternative definitions could be used for the global settlement window.

²⁰ RTGS operating hours of several APAC jurisdictions were extended to facilitate the launch of CLS in 2002.

next section discusses the importance of this concept as a consideration for individual jurisdictions assessing potential changes in their RTGS operating hours.



Number of real-time gross settlement systems operating simultaneously on a standard working day¹

Source: CPMI survey.

4. Potential end states for RTGS operating hours in support of crossborder payments

This section presents potential future end states for the operating hours of individual RTGS systems. These end states are intended to provide different high-level scenarios that an individual central bank could consider, and do not necessarily imply a stage-based approach. Depending on a jurisdiction's current operating hours, each end state is likely to require differing levels of effort to implement, bringing with it a number of the implications further discussed in Section 5. These end states, when viewed through the lens of the global settlement window, provide analytical tools to help central banks decide which extension of hours would be appropriate for them with respect to cross-border payments.

Overview of possible extension end states Table 1						
End state 1: extended hours on current operating days	Extend operating hours on days with current operations (usually "standard working days").					
End state 2: expanded hours into current non-operating days	Expand operating hours into days without current operations (eg weekends and public holidays, as applicable). ²¹					
End state 3: 24/7 operations	Extend operating hours to 24/7.					

End state 1 involves the most incremental extension in operating hours for an RTGS system. This end state holds current operating days as fixed and envisions an extension achieved through increased operating hours on those days. If undertaken by multiple jurisdictions, this end state would help to close daily gaps in RTGS operating hours, primarily on standard working days given that the majority of jurisdictions' RTGS systems currently do not operate on weekends and public holidays. As such, this end state could help to alleviate frictions for cross-border payments on those days, but would not address frictions that arise on other days. Of the three end states, this may be the most straightforward to achieve in the short run because it may involve relatively moderate changes to the existing operations of a jurisdiction's RTGS system.

End state 2 involves an expansion of operations into additional days on which a jurisdiction's RTGS system is not currently operating. As documented in Section 3, limited operations on weekends for RTGS systems give rise to substantial gaps in RTGS operating hours over the course of a week. A lack of operations on holidays in many jurisdictions also gives rise to substantial gaps in operating hours over the course of a year, as well as gaps during certain weeks that involve holidays. If undertaken by multiple jurisdictions, this end state would help to close those gaps. For a jurisdiction that does not currently operate on weekends and holidays, an expansion could involve applying current operating hours on working days to weekends and holidays. An alternative expansion could involve weekend and holiday hours that are focused more directly on achieving a specific period of overlap on those days. This end state may, however, require more substantial changes to existing operations for a larger number of jurisdictions when compared to end state 1.²²

²¹ As described in Section 3, RTGS systems in some jurisdictions already operate on some weekend days and holidays. In this end state, those that do so could consider expansion to additional weekend days or holidays.

²² A further end state involves a combination of end states 1 and 2. In particular, a potential end state could involve an extension of operating hours on current working days <u>and</u> an expansion of operating hours to weekends and holidays. The report treats these end states as distinct to focus on the different actions needed to support them and their different implications.

End state 3 involves the boundary scenario of a jurisdiction extending its operating hours to 24/7. This end state reflects the most extensive versions of end state 1 and end state 2 combined (ie extending operating hours to 24 hours per day on working days, as well as weekends and holidays). At present, only a small number of jurisdictions already have RTGS systems that operate 24/7 or near 24/7. Achieving 24/7 operations may require substantial operational changes and other adjustments for many jurisdictions. At the same time, this end state would, if broadly adopted across jurisdictions, largely remove frictions for cross-border payments arising from gaps in RTGS operating hours and would also be consistent with the broader trend towards 24/7 commerce and economic activity.

4.1 Assessing end states through the lens of the global settlement window

While each end state represents a potential extension of an individual jurisdiction's RTGS operating hours, a key consideration from the perspective of improving cross-border payments, would be to envision an end state that meaningfully adds to the current global settlement window which, as indicated in Section 3.3, is best characterised as 06:00 to 11:00 GMT on working days. In particular, end state 1 would contribute to an extension of the current global settlement window on working days; end state 2 would support the creation of a meaningful global settlement window on weekends; and end state 3 would support a round-the-clock global settlement window. If each RTGS operator were to take these effects into account when evaluating potential end states, the global settlement window could be extended in terms of the number of hours and days, on the one hand, and the number of jurisdictions with operating hours in that window, on the other.

Extending the settlement window on a global basis to maximise the number of RTGS systems that are open concurrently across a broad range of jurisdictions and regions yields the most advantages with respect to cross-border payments. It maximises overlaps between a wide range of jurisdictions and regions, and thus enables the broadest range of payments to be settled without delays being incurred due to RTGS systems being closed. As a result, the speed and efficiency with which cross-border payments are processed could be increased as payments would not need to be queued while the respective systems are closed.

The nature and extent of these changes will depend on a jurisdiction's current RTGS operating hours and the end state under consideration. For example, a jurisdiction may already have extensive operating hours on standard working days, such that end state 1 brings little or no gains in terms of expanding the global settlement window. Another jurisdiction may have more limited current operating hours that are not well-aligned with the current global settlement window. Such a jurisdiction would need to make more substantial changes to its operating hours to align with the global settlement window and to support the expansion of that window. Both jurisdictions may consider expanding operations to weekends and holidays to support this objective.

The approach set out in these end states provides guidance to individual jurisdictions on the ways in which they could extend their RTGS operating hours in support of expanding the global settlement window to enhance cross-border payments, both in terms of the number of jurisdictions operating in that window and the size of the window itself. It is not intended to be prescriptive, and individual jurisdictions have discretion over which precise operating hours they might choose to extend, the overall extent of changes, and the pace of changes while being mindful of the impact of their actions both in support of the global settlement window and on domestic considerations.

A central bank may have other motives to promote extended RTGS operating hours, such as improvements in the safety and efficiency of domestic payments. This report does not look to enumerate or evaluate these considerations; instead, it focuses on enhancing cross-border payments as a key consideration for such an extension. Importantly, however, an extension in operating hours that yields benefits for cross-border payments may also generate benefits domestically, and vice versa.

4.2 A complementary regional or corridor perspective

While individual jurisdictions may examine their RTGS operating hours relative to the global settlement window, it may also be useful for jurisdictions to consider end states that affect settlement windows on a corridor (ie pairwise) or regional basis, as suggested in Section 3. A corridor or regional perspective may identify extensions of operating hours that would be particularly impactful for an individual jurisdiction or a combination of jurisdictions. At the same time, expansions based on a regional or corridor perspective may serve as vehicles for expanding the global settlement window.

Similar to the concept of the global settlement window, the "regional settlement window" can be viewed as the time frame during which the largest number of RTGS systems within a region are open simultaneously and, thus, cross-border payments within that region can be processed without delay stemming from limits to RTGS operating hours. By expanding regional settlement windows, overlaps in operating hours between jurisdictions within the same region would be extended, which would also support more overlaps in operating hours globally, further enhancing the efficiency of cross-border payments and supporting marginal gains in ultimately achieving a global outcome (Box 4).

Box 4

An illustrative example of the impact of an expansion in operating hours in regional settlement windows in support of the global settlement window⁰

This example shows how a change in the operating hours of countries within a region can increase the extent of overlap in operating hours between these countries (intra-regional overlap) thus extending the regional settlement window. This extension of the regional settlement window also increases the extent of overlap between countries across different regions (inter-regional overlap), thus supporting expansion of the global settlement window.

The two scenarios in this analysis are as follows:

- "Partial expansion". The scenario assesses the impact on the global settlement window if countries within a region whose operating hours do not currently overlap completely with the global settlement window collectively extended their operating hours **by up to an hour**, either to increase their overlap with the global settlement window or to operate closer to the global settlement window.
- "Full expansion". The scenario assesses the impact on the global settlement window if countries within a region collectively extended their operating hours so that their regional settlement window **fully overlaps** with the global settlement window.

Looking at the impact of the above two scenarios for the Americas (AM) region, currently, most country pairs within the AM region already share an overlap of at least 5 hours (Graph 4.1). Conversely, the overlaps in operating hours between AM region countries and countries in the other regions – Europe, Middle East and Africa (EMEA) and Asia-Pacific (APAC) – are more modest. In particular where there are large time zone differences, such as between the AM and APAC regions, over half of the inter-regional country pairs have an overlap of less than two hours (Graphs 4.2 and 4.3).

Under the **partial expansion scenario**, the scale of overlap both intra-regionally and inter-regionally is increased more marginally than under the full expansion scenario. On an intra-regional basis (Graph 4.1), the scale of overlap is increased such that all country pairs in the AM region have at least a five-hour overlap. On an inter-regional basis, a partial extension of operating hours has a greater impact on the scale of overlap between country pairs in the AM and EMEA regions (Graph 4.2) – increasing the number of country pairs with more than 5 hours overlap by around one third. The scale of overlap between AM and APAC countries (Graph 4.3), on the other hand, is much more modest given the degree of time zone divergence.

Under the **full expansion scenario**, the extension of operating hours ensures all country pairs within the AM region have at least 12 hours of overlap on an intra-regional basis (Graph 4.1). At the inter-regional level, the overlaps in operating hours for country pairs between the AM and the EMEA region (Graph 4.2), and between the AM and APAC region (Graph 4.3), are increased up to a minimum of five hours for all country pairs.



Inter-regional overlap between AM and EMEA real-time gross settlement systems





Individual jurisdictions may also choose to increase overlaps in operating hours between specific country corridors. For example, individual jurisdictions may choose to prioritise an extension of RTGS operating hours for specific country corridors where there may be a high value/volume of cross-border transactions and currently limited overlap in RTGS operating hours. This in turn increases the scale of overlaps in RTGS operating hours between individual jurisdictions, potentially contributing to an expansion in their respective regional settlement windows and, ultimately, the global settlement window (Box 5).

Table 5.1

An illustrative example of the impact of an expansion in operating hours on bilateral corridors in support of the global settlement window

This example shows the impact of individual jurisdictions extending their operating hours between specific corridors. For example, Brazil's RTGS system currently operates from 09:30 to 21:30 GMT from Monday through Friday. As shown in Table 5.1, given time zone differences, the overlap in operating hours between Brazil's real-time gross settlement (RTGS) system and the other Committee on Payments and Market Infrastructures (CPMI) jurisdictions' RTGS systems varies between no overlap with South Korea to a 12-hour overlap with Canada, the United States, Mexico and South Africa.

Bringing forward the opening time of Brazil's RTGS system by one hour (to 08:30 rather than 09:30 GMT) would extend the degree of overlap it has with 18 CPMI jurisdictions' RTGS systems on a bilateral basis. It would increase the overlap, in particular, with jurisdictions with which it currently has relatively less overlap, namely eastern time zone RTGS systems in the Asia-Pacific region. It would also extend the scale of overlap for Brazil's RTGS system with the global settlement window (06:00 to 11:00 GMT on working days) by one hour.

If Brazil's RTGS system opened three and a half hours earlier, it would significantly increase its overlap with other CPMI jurisdictions, including with those in the APAC region. For example, such a change would result in the number of hours that Brazil's RTGS system overlaps with Hong Kong's RTGS system increasing from one hour currently (09:30 to 10:30 GMT) to four and a half hours (06:00 to 10:30 GMT). It would then also have a 100% overlap with the global settlement window.

					Brazil	RTGS		
		Total	Overlap g ho	iven current operating urs (09:30-21:30)	Overlap afte	er extending the Br	razil RTGS operati	ng hours
		time	In hours	Per cent of total operating time	Opening (08:30-21: global settle	1 1h earlier 30) towards ment window	Opening 3h (06:00-21: global settle	30mins earlier 30) towards ment window
	AU	14:30	02:30	17%	03:30	+40%	06:00	+140%
	JP	12:30	02:30	20%	03:30	+40%	06:00	+140%
	KR	08:30	00:00	0%	00:00	-	02:30	
ADAC	CN	20:45	09:00	43%	09:45	+8%	12:15	+36%
APAC	нк	10:00	01:00	10%	02:00	+100%	04:30	+350%
	SG	10:00	01:30	15%	02:30	+67%	05:00	+233%
	ID	12:30	02:30	20%	03:30	+40%	06:00	+140%
	IN	23:30	11:30	49%	12:30	+9%	15:00	+30%
	RU	20:00	08:30	43%	09:30	+12%	12:00	+41%
	SA	07:30	04:00	53%	05:00	+25%	07:30	+88%
	TR	09:00	05:00	56%	06:00	+20%	08:30	+70%
ENAEA	ZA	24:00	12:00	50%	13:00	+8%	15:30	+29%
EMICA	EA	11:00	07:30	68%	08:30	+13%	11:00	+47%
	SE	11:00	07:30	68%	08:30	+13%	11:00	+47%
	СН	23:30	11:30	49%	12:30	+9%	15:00	+30%
	GB	12:00	08:30	71%	09:30	+12%	12:00	+41%
	AR	12:00	10:30	88%	10:30	-	10:30	-
	BR	12:00						
AM	CA	18:30	12:00	65%	13:00	+8%	15:30	+29%
	US	22:00	12:00	55%	13:00	+8%	15:30	+29%
	MX	24:00	12:00	50%	13:00	+8%	15:30	+29%
	CLS	05:00	00:30	10%	01:30	+200%	04:00	+700%
	Total	306.45	141.30	44%	159.15	+13%	206.45	+46%

Operating hours overlap

AM = Americas; APAC = Asia-Pacific; AR = Argentina; AU = Australia; BR = Brazil; CA = Canada; CH = Switzerland; CLS = CLS Bank; CN = China; EA = Euro area; EMEA = Europe, Middle East and Africa; GB = United Kingdom; HK = Hong Kong SAR; ID = Indonesia; IN = India; JP = Japan; KR = Korea; MX = Mexico; RU = Russia; SA = Saudi Arabia; SE = Sweden; SG = Singapore; TR = Turkey; US = United States; ZA = South Africa.

Source: CPMI survey.

5. Operational, risk and policy considerations of the end states

While moving towards any of the potential end states identified in Section 4 could enhance the speed and reduce costs of cross-border payments, extending RTGS operating hours also raises a number of considerations and costs relevant for central banks and industry stakeholders.²³ These issues include operational adjustments by both payment system operators and participants, as well as changes to certain market practices and conventions, the impact of which will be borne across the entire payment ecosystem. At the same time, it is important for these operational changes and associated costs to be viewed by all affected parties in a strategic light since resulting benefits could be far-reaching and long-standing notwithstanding the immediate cost burden. Moreover, operational changes to extend RTGS operating hours can be part of a broader programme to enhance a jurisdiction's RTGS system, in support of cross-border payments and for other purposes (eq to foster improvements in the domestic payments market).

While an extension of operating hours will not generally introduce new risks beyond those the CPMI and IOSCO have previously identified for payment systems, it will extend the times during which certain risks can materialise.²⁴ Furthermore, while all risks and considerations need to be treated in parallel, the materiality of certain risks may vary across scenarios for extending operating hours (ie at which time of the day the operating hours are extended) and may also depend on the degree of utilisation of the extended operating hours (ie the actual level of activity during these hours). As such, parties involved in RTGS systems may need to review and/or enhance existing mitigation measures to accommodate longer operating hours while maintaining at least current levels of operational resilience and risk management, including against service disruptions and payment fraud.

An extension of RTGS operating hours also raises certain policy considerations relevant for central banks and/or other authorities. These include issues related to monetary policy, financial stability and resolution policy for troubled institutions.

This section presents risks and policy considerations from extending RTGS operating hours and some potential mitigants, distinguishing between the parties for which they are relevant, where appropriate. The considerations may also differ depending on whether the focus is placed on the transition process to an end state or a longer-term outcome where an end state has been reached. The end state that an individual RTGS system pursues – whether one of those presented in Section 4, a combination of them, or an alternative – may be particularly important. Where relevant, this section draws these distinctions between the end states.

For example, a more ambitious extension in operating hours, as would be consistent with end state 3 (ie 24/7 operations), may specifically raise different or more significant issues than a more modest extension. The fact that some jurisdictions have already successfully moved into a 24/7 scenario demonstrates, however, that the issues associated with that end state are manageable in practice, at least in certain cases. Both central banks and industry stakeholders can leverage existing experiences to learn from each other as part of their decision-making process in extending RTGS operating hours.

A final set of considerations concerns the path and timeline to reach an end state. Consistent with the non-prescriptive approach taken in Section 4, this report does not envision a specific implementation path or timeline for a RTGS system to extend its operating hours.

²³ The analysis in this section has been informed by input previously received from the industry, in the context of the CPMI conference "Pushing the frontiers of payments: towards a global payments area" (held in March 2021), including a questionnaire and responses to questions related to extended operating hours for the 62 RTGS systems included in this report.

²⁴ The *Principles for financial market infrastructures* provide a description of risks in financial market infrastructures, including payment infrastructures (see, in particular, CPSS-IOSCO (2012), Section 2).

5.1 Operational considerations: technical, staffing and other adjustments

Operational changes needed to support an extension to RTGS operating hours can apply to the system operator itself (often, the central bank), as well as direct system participants, critical service providers and other industry stakeholders, including other payment infrastructures that rely on the RTGS system for settlement, PSPs that indirectly access it, and end users that utilise it through PSPs. The diversity of parties that may need to make operational changes points to the importance of broad engagement when planning an extension of RTGS operating hours. The significance of operational changes will depend on the extent of current operating hours for the RTGS system and the end state of choice.

The operational changes associated with the different end states necessarily involve costs, which must be evaluated and managed by the parties that would incur them. Some of these costs, such as those associated with technical accommodation of a particular end state, may be particularly relevant in the transition to that end state. Others, such as staffing costs, may be ongoing costs that would be incurred permanently in any end state, although the degree of these costs will vary depending on the extensiveness of the extension in operating hours. Payment system operators, participants and other industry stakeholders would need to assess the nature and magnitude of such operational costs when assessing the different end states and the potential impact on end users.

5.1.1 Technical considerations

An extension of RTGS operating hours is likely to require changes to existing systems, platforms and infrastructures. These changes will broadly involve modifications, upgrades and potential replacement of software and hardware. Such changes will need to be carefully planned and deployed by the payment system operator so as to ensure that the infrastructure can successfully process payments during its operating hours.

On account of the above, some potential technical considerations by the payment system operator may include assessing which activities that require settlement to be stopped can be taken offline such as end of day processing. Payment system operators may also consider how settlement can be kept running while some tasks such as maintenance take place, for example by operating two payment systems in parallel and then transferring between the two while each is being upgraded (see Section 5.1.2). Along the same lines, payment system operators may also have to secure adequate rollback capabilities between these separate environments to be able to unwind a failed change, in case of need.

Payment system participants and other parties may be further required to make changes to their internal systems to accommodate additional hours for the RTGS system. For the payment system operator, participants and other industry stakeholders, these changes are likely to have downstream impacts and may extend beyond those specific to the RTGS system itself to include changes to related systems. For example, the operator (especially a central bank) may need to adjust systems that monitor certain risks, such as credit exposures, in the event that intraday credit is provided during new operating hours. Participants may similarly have to make changes to systems that support client services, treasury, fraud prevention, sanctions screening and other functions.

The necessary technical changes are likely to vary across the potential end states. An extension of operating hours on current operating days, as in end state 1, may require relatively minor technical changes. By contrast, a move to 24/7 operations under end state 3 may require a complete system renewal if the legacy platform is not able to accommodate round-the-clock operations. Such a system renewal would be likely to necessitate substantial upfront adjustments, but could also have longer-term implications if new technologies or capabilities are included as part of a renewed RTGS system.

5.1.2 Staffing considerations

Both the RTGS system operator, participants and, potentially, some other industry stakeholders would need to increase staffing levels in order to cover extended operating hours. While some initial adjustments may be required to ensure that, at all times, available staff have appropriate skillsets to manage extended operating hours, many staffing adjustments and associated costs would persist over time. Such changes are likely to extend beyond core operational functions to include additional staffing adjustments in related areas, such as technology and customer support, for both the payment system operator and other parties.

As with technical changes, the nature of staffing adjustments will vary across the end states. For a limited extension in operating hours (eg end state 1), it may be possible to address staffing needs with relatively small adjustments to existing resources. By contrast, an end state that involves a more substantial increase in operating hours (eg end states 2 and 3) would be likely to require more significant staffing changes, such as additional employees and shifts, especially qualified staff as a result of the potentially reduced maintenance window.²⁵ At the same time, a more ambitious end state and the associated renewal of technical systems may provide an opportunity to take advantage of new technologies in order to automate some tasks. Such changes could free up staff to then be reallocated to other, more specialised activities.

5.1.3 Industry practices and business conventions

An extension of RTGS operating hours can raise various other issues that, while not purely operational, have operational implications. In particular, certain market conventions and practices have developed over time around the operating hours of RTGS systems. In order to fully realise the benefits of an extension of RTGS operating hours, operators, system participants and other industry stakeholders would need to assess the required changes in industry rules and practices (both operational and business) to accommodate such an extension.

Payment system participants and other affected parties across the industry may specifically need to assess and adapt their end-of-day processes. These could include liquidity management activities, reconciling books and records, and refreshing and updating system applications, among other activities. Such processes are often designed to account for the closing and opening times of a jurisdiction's RTGS system. For example, parties that rely on an RTGS system that has a significant amount of end-of-day downtime may rely more heavily on manual processes to complete their end-of-day activities. As extensions of operating hours move closer to a 24/7 business day, there may be an increasing need to redesign end-of-day processes and adopt greater automation.

In an end state involving weekend operations (ie end state 2) or 24/7 operations (ie end state 3), it will also be important to consider certain date conventions. In particular, the "business day" definition for the RTGS system is a key consideration. For example, in end state 3, such a definition would involve establishing a "start of day" and "end of day" for a system that is operating continuously. A related date convention concerns the "value date" that applies to payments processed through the system. Consideration of value dates is relevant for payment system participants vis-a-vis the RTGS system, their clients and also central banks. Such date conventions are important for legal/regulatory, account, risk management (including settlement), reference, monetary policy (see also Section 5.3 below) and other purposes.

²⁵ Legal considerations (eg labour regulation) may also be relevant for staffing changes.

5.2 Risk considerations

As noted previously, an extension of RTGS operating hours would not introduce new risks beyond those that have previously been identified as relevant for payment systems, but would extend the window (potentially to a significant degree under end state 3) during which such risks can materialise. The key risks considered below are financial risks (ie credit and liquidity risk) and operational risk with attention also paid to fraud and cyber risk as subtypes of operational risk. When considering these risks, it is important to recognise that an extension of RTGS operating hours can decrease as well as increase certain risks. For example, in the case of fraud risk, reducing downtime between systems can allow for faster reaction in case fraud is detected and request a quick return of the compromised funds.

As during current operating hours, risks during extended RTGS operating hours in any end state would need to be appropriately managed. In particular, at least current levels of operational resilience would be important to maintain. Appropriate risk management is particularly important given the systemic importance of RTGS systems.

In general, risks arising during extended operating hours could be addressed through application of established mitigation measures during those hours. However, there may be a lack of existing capabilities to deploy such measures out of-hours (and particularly round-the-clock in end state 3), as well as a lack of experience doing so. As a result, the adjustments needed to apply risk mitigation measures during new operating hours may warrant particular attention, and consideration should be given to where automation can support risk mitigation during extended operating hours.

5.2.1 Financial risks

Extended RTGS operating hours will require participants to ensure they have sufficient liquidity to support their activities during new operating hours and to understand the potential implications on their broader liquidity management approaches. Support for effective liquidity management may require an expansion of central bank liquidity facilities (see also Section 5.3). The availability – or unavailability – of other interconnected financial markets that payment system participants use to source liquidity (eg securities market, FX market and interbank money markets) will also affect participants' ability to effectively manage their liquidity during extended RTGS operating hours.²⁶ All these aspects can potentially have implications in terms of financial stability (see also Section 5.3).

Liquidity shortfalls could, nevertheless, be managed by applying a range of mitigation measures. For example, payment system participants could hold additional funding to support extended RTGS operating hours, and central banks could establish liquidity bridges²⁷. Alternatively, participants could adjust their existing liquidity management practices to ensure adequate access to liquidity. Such measures may increase liquidity costs for participants. RTGS systems could also contemplate the possibility of improving the availability and effectiveness of liquidity savings mechanisms, for example, by implementing alerts and tools for monitoring liquidity needs during new extended operating hours.

5.2.2 Operational risk

On top of the necessary initial adaptations, payment system operators and participants may need to focus on a number of additional considerations related to operating over extended periods of time. In general,

²⁶ Market participants may use securities markets and central bank borrowing to monetise non-cash assets (such as government bonds) via both sale and repurchase agreements. If such markets and/or facilities are not available during extended RTGS operating hours, market participants may need to adjust their liquidity management approaches such as holding relatively higher levels of central bank reserves.

²⁷ A dedicated workstream (BB 11) is exploring reciprocal liquidity arrangements across central banks (ie liquidity bridges).

longer operating hours extend the time window during which operational issues can arise. Such operational issues could involve errors, fraud, money laundering/terrorist financing and cyber attacks.

One of the most distinctive operational risks that could increase as a result of longer operating hours relates to information technology change management, such as adding new functionalities, applying software patches, and testing the cyber resilience framework. Many RTGS systems rely on scheduled downtime to address these technical requests and to onboard new direct participants. : , Reduced or virtually non-existent closure times (as in the case of end state 3) place an additional burden on both payment system operators and participants in dealing with these fundamental issues.²⁸ As such, along the lines described in Section 5.1.1, interested parties may start by considering potential ways of redesigning how this process is executed, eventually exploring modern approaches to technology which provide greater practical flexibility and facilitate proper servicing of different financial markets by the RTGS system at the times when they are in global demand.

Extending operating hours further increases the time during which fraudulent payments can be initiated and/or cyber attacks can originate and propagate. This may, therefore, require an enhancement of existing monitoring tools and resiliency measures including the migration towards novel automated screening solutions such as those based on artificial intelligence/machine learning (AI/ML) techniques. It may also entail the definition and deployment of an appropriate awareness and learning strategy which can help to achieve a solid understanding of the new threat landscape and delineate adequate countermeasures. As a result, direct investment in hardware/software is likely to be needed, as well as staffing adjustments to best manage such risk during extended hours.

5.3 Policy considerations for central banks and other authorities

Extended RTGS operating hours have the potential to raise certain issues of particular relevance for central banks and other authorities. As is the case for many other topics discussed in this section, these issues are likely to be most pronounced under a more substantial extension of operating hours, as contemplated in end states 2 or 3. The relevance and impact of these issues will depend to a large degree on the actual usage of the extended operating hours. In the early stages after extension, changes to operating hours of money markets and business hours of financial institutions could be limited. However, these issues may gain relevance in the longer term, as the payments industry and financial markets adapt to extended RTGS operating hours.

5.3.1 Monetary policy implementation

RTGS systems are a critical component of the ecosystem through which central banks implement monetary policy. Short-term market interest rates are held close to the central bank's policy interest rate through a variety of different central bank interventions. The primary medium through which these market interest rates are controlled is commercial banks' reserves (deposits at the central bank). Central banks typically exert control over the quantity of reserves and their remuneration. Transactions in reserves by both commercial banks and the central banks are settled in RTGS systems. These transactions may also involve the purchase and sale of securities and foreign currencies.

An extension of operating hours could lead to a change in the timings of these transactions: current off-hours could see extended activity. This in turn could require central banks to extend the hours in which their open market operations take place in order to maintain control of market interest rates. For some central banks, this may require revisions to their reserves forecasting models. To the extent that

²⁸ The same considerations could apply in the case of an RTGS system relying on weekends to perform maintenance tasks and opting to extend operations over that window as a result of pursuing end state 2.

central banks extend the hours in which they undertake their policy operations, this might also have an impact on operating hours of a jurisdiction's securities settlement systems, given that these systems settle the securities leg of open market transactions.

An extension of operating hours may also affect the administration of reserve requirements and remuneration. Typically, each central bank sets a cut-off time for quantifying and (in some cases) remunerating the reserves held by each institution in their deposit account overnight. Central banks could consider how these cut-off times in different jurisdictions interact, to manage any potential new risks to the effective implementation of monetary policy. Overall, the impact of extended hours and the importance of the aforementioned considerations could vary significantly across jurisdictions as central banks implement domestic monetary policy in different ways.

5.3.2 Intraday liquidity provision and overnight lending

As noted in the discussion on risks, the extension of an RTGS system's operating hours could create liquidity needs for participants that operate during those extended hours. To address these potential liquidity needs, central banks might want to review their provision of intraday liquidity and overnight lending.²⁹ A central bank may consider providing temporary intraday liquidity during extended hours to support the smooth functioning of business-as-usual activities in the payment system. In addition, extending overnight lending tools may be particularly important for addressing liquidity needs that might arise from stress experienced by a payment system participant or in the market more broadly during periods related to newly extended RTGS operating hours. A further consideration is that the provision of liquidity by the central bank may require the availability of collateral services in order to pledge collateral as guarantee for the provided liquidity.

The nature of intraday and overnight credit tools may not change significantly across end states as central banks may be able to leverage existing policies and tools in each end state. However, the costs to central banks and their participants of extending their credit and liquidity functions (ie staff and technology) to cover extended hours would be likely to increase from end state 1 to end state 3. A unique consideration for end state 3, however, is the need to evaluate the terms of overnight credit in an environment with little or no down time (eg how to delineate between intraday and overnight credit).

5.3.3 International market operations

With respect to international market operations, an extension of operating hours is likely to provide greater flexibility to execute foreign exchange transactions or swap transactions with foreign central banks. An increase in the overlap of operating hours across jurisdictions would, thus, create a longer window across corridors for central banks to potentially execute these transactions. This could offer the potential to promote same-day FX settlement for the benefit of both risk reduction and speed. In addition, multiple expansions into weekends and holidays could open up new days for these activities. Such flexibility could promote enhanced liquidity arrangements between central banks, a goal of the work on exploring liquidity bridges across central banks (BB 11).

5.3.4 Financial stability

Another consideration in the extension of the operating hours of RTGS systems concerns the potential impact on financial stability. By design, RTGS systems limit systemic risk by settling transactions on a gross basis and in real time. Nevertheless, in a cross-border payment where multiple intermediaries may be

²⁹ An additional angle to bear in mind is how these increased liquidity needs may not only arise in relation to the domestic currency but also to foreign one, in particular, in times of stress.

involved, disruptions may happen along the chain that could result in a failed transaction and have spillover effects throughout the financial system.

The extension of overlaps in operating hours, and consequently, the increased speed of transactions, could minimise the exposure to this risk, and hence have positive effects on financial stability. Nevertheless, it also results in a broader window in which shocks may propagate throughout the financial system. Again, the more extensive the changes (in particular end state 3), the larger the potential impact. Furthermore, the likelihood of these shocks could increase if proper measures are not taken to address the challenges discussed above (eg appropriate liquidity management, see Section 5.2.1). Therefore, the effects on financial stability will largely depend on the extent to which: (i) the risks discussed above are properly managed; and (ii) current monitoring tools and practices are also upgraded to cover extended operating hours.

5.3.5 Monitoring of troubled institutions and resolution policy

Extended operating hours of RTGS systems may facilitate depositors moving their funds to other financial institutions (both domestic and abroad) at times when it was previously not possible, potentially exacerbating the problems of an institution at risk. This is more likely to be the case for corporate clients, but could also happen for retail depositors if the extension of the RTGS system operating hours led to similar extensions in other payments systems that settle their positions in the RTGS accounts.

In addition, the extension of operating hours could also affect the way resolution policies are envisaged. Since the resolution of a financial institution during operating hours may introduce disruptions, generally these procedures are carried out in practice over the weekend. As a consequence, an extension of operating hours such as those foreseen in end states 2 and 3 might affect resolution policies.

5.4 Implementation considerations

As noted previously, the end states presented in this report are not intended to be prescriptive, with the decision of which, if any, end state to pursue made by individual central banks in consultation with industry stakeholders. However, in addition to determining which end state is preferable, central banks and payment system operators could consider a number of additional factors associated with how and when an end state might be reached.

5.4.1 Potential implementation paths to future end states

The possible end states in this report could be achieved incrementally over time or through a "big bang" approach in which an end state is reached in a single step.³⁰ While the best approach for each jurisdiction will depend on its particular needs and challenges, both approaches could support a collective long-term objective for expanding the global settlement window. This subsection highlights different reasons why jurisdictions might prefer one implementation path over another to reach the desired end state. In any case, decisions regarding the potential implementation path should be considered carefully, with the needs of various stakeholders (eg RTGS operators and participants, relevant authorities and end users) in mind.

One path that jurisdictions could pursue is to move to a particular end state by extending operating hours in incremental steps. This approach could bring near-term efficiency and risk-reduction

³⁰ As noted previously, a jurisdiction could also pursue an end state involving extended operating hours on current operating days (end state 1) and expanded operating days (end state 2). In doing so, a jurisdiction could consider whether and how to sequence the two elements of extended operating hours. In particular, a jurisdiction could consider achieving extended operating hours prior to expanded operating days, or vice versa. It could alternatively do the two expansions simultaneously.

benefits to cross-border payments that could not be achieved through a longer-term big bang approach. For example, an incremental extension of operating hours could allow innovative cross-border payment services to develop more quickly than they would in a big bang extension scenario if the latter took longer to achieve. Incremental extensions could also allow stakeholders in specific jurisdictions (ie all interested parties in the payment ecosystem) to gain experience with progressively longer operating hours, which could help them to prepare for the operational, staffing and risk management needs of potentially more extensive operating hours in the long term.³¹

Alternatively, some jurisdictions might prefer a big bang approach to reach an end state in order to reduce their overall time and cost to reach that end state.³² An incremental extension could increase overall costs relative to a big bang approach if the technology that supports an interim extension cannot be leveraged for further extensions. A big bang approach would allow payment system operators and their participants to focus on building infrastructure and processes to support the target end state rather than multiple interim states over time. A variation of the big bang approach is a focus on building the technical capability to extend operating hours (eg up to 24/7). Extended operating hours could then be implemented incrementally once the technical capability is achieved.

5.4.2 Potential timelines for achieving the end states

Closely related to implementation paths are the timelines associated with achieving different end states. As with implementation paths, timelines should be flexible to account for different circumstances across jurisdictions. As a result, this report does not aim to identify a specific timeline for any end state. Instead, it presents various factors that jurisdictions might consider when choosing an implementation time frame.

A jurisdiction could view each proposed end state as an outcome to be achieved in the near term or in the long term. The appropriate time frame to reach an end state will depend on individual factors such as near-term demand, industry readiness, infrastructure choices, cost, and risk management considerations, among others. A jurisdiction could also consider the extent to which potential implementation timelines would contribute to global efforts to enhance cross-border payments, such as the G20 cross-border payments programme and the associated global targets (FSB (2021)).

6. Conclusion

Slow speed is one of the four key challenges for cross-border payments, which, as this consultative report has described, is partly due to existing differences in RTGS systems' operating hours. The G20 cross-border payments proramme considers the potential extension and alignment of operating hours across key payment systems to be an important element to address frictions in this market. By increasing the availability of payment systems across jurisdictions to process transactions, potential delays in their execution can be meaningfully reduced. The analysis in this consultative report shows that, at present, the operating hours of RTGS systems vary significantly across jurisdictions, providing significant scope for extension of hours. Even within the same region, substantial gaps exist in the daily operating hours of these key infrastructures. These gaps become even greater when considering weekly availability, due to the typical lack of weekend operations, and are further exacerbated by lack of service availability on public holidays.

The extension and overlap of operating hours across jurisdictions could certainly yield lasting benefits by improving the speed and reducing ancillary transaction costs of cross-border payments. At the

³¹ Incremental expansions could allow operators and participants to reduce their reliance on end-of-day and weekend downtime.

³² A big bang approach generally applies to significant expansions of operating hours, such as moving to weekend operations or to full 24/7 operations.

same time, it is important to recognise that change does not come without adjustment costs, various risks and other issues that need to be addressed. Therefore, central banks and payment system operators could evaluate a potential change under a strategic light, consider its long-term impact and decide on the most appropriate way forward to strike the right balance between its expected payback and the potential consequences it may entail for the entire payments ecosystem, including end users.

Extending operating hours has broad implications. Its relevance is not limited to providers of RTGS services (mostly central banks), rather it also has implications for a variety of industry stakeholders. All these parties will need to consider the profound impact such changes will bring depending on the chosen strategy to increase the availability of key payment systems' operating hours. As such, this consultative report presents three potential end states for jurisdictions to consider as they assess their current operating hours and plan for the future, as well as the associated operational, risk and policy considerations related to those end states.

Looking forward, central banks can consider the applicability and desirability of each end state with differing degrees of ambition. This consultative report encourages central banks, payment system operators and the payments industry more broadly to reflect on the benefits and costs of extending operating hours while also taking into account the positive effects of overall coordination on the cross-border payments market. The CPMI welcomes feedback on the approach, analysis and questions included in this consultative report. The CPMI will assess the input received and provide guidance on the key risks and policy considerations, including potential ways to address risks and challenges, as part of a subsequent report.

Annex 1: Tables and figures

Daily real-time gross settlement systems operating hours on working days

Extent of daily operating hours

Table A1

		All	All Jurisdiction category Economic category		category ¹	Region			
		jurisdictions	CPMI	Non-CPMI	AE	EMDE	AM	EMEA	APAC
	No of jurisdictions	62	21	41	14	48	19	28	15
	Average daily hours	10.9	15.2	8.7	12.9	10.3	11.6	10.0	11.7
Low hours	No of jurisdictions	21	1	20	1	20	6	12	3
(hours/day ≤ 8)	Average daily hours	7.3	7.5	7.3	8.0	7.3	7.6	7.2	7.6
Moderate hours	No of jurisdictions	33	12	21	10	23	10	13	10
(8 < hours/day ≤ 16)	Average daily hours	10.5	11.3	10.0	10.9	10.3	11.0	9.8	10.8
High hours	No of jurisdictions	4	4	0	2	2	2	1	1
(16 < hours/day ≤ 23)	Average daily hours	20.3	20.3	-	20.3	20.4	20.3	20.0	20.8
Very high hours	No of jurisdictions	4	4	0	1	3	1	2	1
(hours/day > 23)	Average daily hours	23.8	23.8	-	23.5	23.8	24.0	23.8	23.5

AE = Advanced economies; AM = Americas; APAC = Asia-Pacific; EMDE = Emerging market and developing economies; EMEA = Europe, Middle East and Africa.

¹ Classification based on International Monetary Fund (IMF) criteria.

Source: CPMI survey.

Weekly real-time gross settlement systems operating hours for non-holiday weeks

Extent of weekly operating hours

		All	Jurisdicti	on category	Economic	category ¹	Region		
		jurisdictions	CPMI	Non-CPMI	AE	EMDE	AM	EMEA	APAC
	No of jurisdictions	62	21	41	14	48	19	28	15
	Average weekly hours	57.9	83.6	44.8	66.0	55.5	62.2	52.9	61.7
Low hours	No of jurisdictions	44	7	37	8	36	11	24	9
(hours/week ≤ 56)	Average weekly hours	42.5	47.9	41.5	48.9	41.1	41.5	42.5	43.8
Moderate hours	No of jurisdictions	14	10	4	5	9	7	2	5
(56 < hours/week ≤ 112)	Average weekly hours	77.4	78.4	74.9	79.5	76.2	79.6	80.0	73.3
High hours	No of jurisdictions	1	1	0	1	0	0	1	0
(112 < hours/week ≤ 161)	Average weekly hours	135.5	135.5	-	135.5	-	-	135.5	-
Very high hours	No of jurisdictions	3	3	0	0	3	1	1	1
(hours/week > 161)	Average weekly hours	166.8	166.8	-	-	166.8	168.0	168.0	164.5

AE = Advanced economies; AM = Americas; APAC = Asia-Pacific; EMDE = Emerging market and developing economies; EMEA = Europe, Middle East and Africa.

¹ Classification based on IMF criteria.

Source: CPMI survey.

Real-time gross settlement operating status on weekends and holidays¹

Number of jurisdictions

Table A3

Table A2

	All	Jurisdiction category		Economic category ²		Region		
	jurisdictions	CPMI	Non-CPMI	AE	EMDE	AM	EMEA	APAC
All systems	62	21	41	14	48	19	28	15
Systems operating on								
one weekend day	3	0	3	0	3	0	3	0
two weekend days	5	4	1	1	4	2	2	1
public/bank holidays	7	5	2	2	5	2	3	2
public/bank holidays and two weekend days	5	4	1	1	4	2	2	1

AE = Advanced economies; AM = Americas; APAC = Asia-Pacific; EMDE = Emerging market and developing economies; EMEA = Europe, Middle East and Africa.

¹ Weekends are defined as Friday and Saturday for the Middle East; Saturday for Nepal and Saturday and Sunday elsewhere. ² Classification based on IMF criteria.

Source: CPMI survey.

Average total gaps in real-time gross settlement operating hours per day on working days by region

Average number of hours

			Region		
		APAC	EMEA	AM	All regions
CPMI juri	sdictions	·			
Denieur	APAC	13.6	15.3	15.4	14.9
	EMEA		13.2	12.7	14.0
Region	AM			9.9	13.6
	All regions				14.0
All jurisdi	ictions (CPMI and non-CPMI)				
	APAC	15.4	18.2	21.0	18.8
Denien	EMEA		16.7	19.9	18.5
Region	AM			15.7	19.5
	All regions				17.8

AM = Americas; APAC = Asia-Pacific; EMEA = Europe, Middle East and Africa.

Source: CPMI survey.

Average total gaps in real-time gross settlement operating hours per week by region

Average number of hours

			Region				
		APAC	EMEA	AM	All regions		
CPMI juri	sdictions						
Region	APAC	115.9	124.2	125.0	122.7		
	EMEA		114.9	110.4	118.1		
	AM			97.3	115.4		
	All regions				118.1		
All jurisdi	ictions (CPMI and non-CPMI)					
	APAC	125.4	139.6	153.4	142.6		
D	EMEA		133.4	147.7	141.3		
Region	AM			126.0	145.6		
	All regions				138.0		

AM = Americas; APAC = Asia-Pacific; EMEA = Europe, Middle East and Africa.

Source: CPMI survey.

Table A4

Table A5



Distribution of daily real-time gross settlement operating hours on working days

Real-time gross settlement operating hours on working days (GMT) for all jurisdictions per region

Graph A2



Jurisdictions ISO codes and acronyms are used. For the complete names, please refer to Annex Table A6. CLS = CLS Bank. Source: CPMI survey.

Real-time gross settlement operating hours on weekends (GMT) for all jurisdictions per region¹

Graph A3

Jurisdictions ISO codes and acronyms are used. For the complete name, please refer to Annex Table A6. CLS = CLS Bank.

¹ For Nepal, the weekend is only on Saturday, while for Algeria, Bahrain, Jordan, Kuwait and Saudi Arabia the weekend is from Friday to Saturday.

Source: CPMI survey.

Annex 2: RTGS systems in scope of this report

Real-time gross settlement systems in scope of this report					
Jurisdiction (ISO code)	Name of real-time gross settlement system				
Algeria (DZ)	Algeria Real Time Settlements System (ARTS)				
Argentina (AR)	Mercado Electronico de Pagos (MEP)				
Armenia (AM)	Electronic payment systems (EPS)				
Australia (AU)	Reserve Bank Information and Transfer System (RITS)				
Austria (AT)	ASTI				
Bahrain (BH)	Real Time Gross Settlement System (RTGS)				
Belarus (BY)	Belarus Interbank Settlement System (BISS)				
Belize (BZ)	Automated Payment and Securities Settlement System (APSSS)				
Bolivia (BO)	Sistema de Liquidación Integrada de Pagos (LIP)				
Brazil (BR)	STR – Sistema de Transferência de Reservas				
Canada (CA)	Lynx				
Chile (CL)	Sistema de Liquidación Bruta en Tiempo Real (Sistema LBTR)				
China (CN)	HVPS				
Colombia (CO)	Sistema de Cuentas de Depósito LBTR- CUD				
Croatia (HR)	Croatian Large Value Payment System – CLVPS				
Curacao (CW)	National Automated Clearing & Settlement system (NACS3)				
Czech Republic (CZ)	CERTIS				
Dominican Republic (DO)	Real Time Gross Settlement System (RTGS)				
Eastern Caribbean Currency Union (ECCU)	RTGS				
El Salvador (SV)	Sistema de Liquidación en Tiempo Real (LBR)				
Eswatini (SZ)	RTGS				
Ethiopia (ET)	Ethiopian Automated Transfer System/ RTGS system/				
Euro area (EA)	TARGET2				
Guatemala (GT)	Real Time Gross Settlement System (RTGS)				
Honduras (HN)	Sistema Banco Central de Honduras en Tiempo Real (BCH-TR)				
Hong Kong SAR (HK)	HKD CHATS				
India (IN)	Real Time Gross Settlement (RTGS)				
Indonesia (ID)	Bank Indonesia Real-Time Gross Settlement System				
Jamaica (JM)	JamClear [®] Realtime Gross Settlement System (RTGS)				
Japan (JP)	BOJ-NET Funds Transfer System (BOJ-NET FTS)				
Jordan (JO)	Real Time Gross Settlement System (RTGS-JO)				
Kuwait (KW)	Kuwait's Automated Settlement System for Inter-participant Paymer (KASSIP)	nts			
Lebanon (LB)	BDL RTGS				
Lesotho (LS)	Real Time Gross Settlement system – RTGS(LSW)				
Madagascar (MG)	RTGS				
Malaysia (MY)	Real-time Electronic Transfer of Funds and Securities System (RENTA	۹S)			
Mauritius (MN)	Mauritius Automated Clearing and Settlement System MACSS				
Mexico (MX)	Interbanking Electronic Payment System (SPEI)				
Mongolia (MN)	Banksuljee RTGS system				
Morocco (MA)	Système de Reglements Bruts du Maroc (SRBM)				
Namibia (NA)	Namibia Inter-bank Settlement System (NISS)				

Nepal (NP)	Real Time Gross Settlement
Oman (OM)	Real Time Gross Settlement (RTGS) System
Pakistan (PK)	Pakistan Real-time Interbank Settlement Mechanism (PRISM)- RTGS
Paraguay (PY)	Real Time Gross Settlement – RTGS
Poland (PL)	SORBNET2
Russia (RU)	Bank of Russia Payment System (BoR PS)
Saudi Arabia (SA)	Saudi Arabian Riyal Interbank Express (RTGS System)
Singapore (SG)	New MAS Electronic Payment and Book-Entry System (MEPS+)
South Africa (ZA)	South African Multiple Option Settlement (SAMOS)
South Korea (KR)	Bank of Korea Financial Wire Network (Bok-Wire+)
Sri Lanka (LK)	LankaSettle System
Sweden (SE)	RIX-RTGS
Switzerland (CH)	Swiss Interbank Clearing (SIC)
Chinese Taipei (TW)	CBC Interbank Funds Transfer System (CIFS)
The Bahamas (BS)	Bahamas Interbank Settlement System/Real Time Gross Settlement System (BISS/RTGS)
Trinidad and Tobago (TT)	Settlement Assured for Financial Exchange in Trinidad and Tobago (Safe-tt)
Tunisia (TN)	Tunisia's large amounts transfer system (SGMT)
Turkey (TR)	EFT- Electronic Fund Transfer System
United Kingdom (GB)	CHAPS
United States (US)	Fedwire Funds Service
Vietnam (VN)	National Interbank Payment System – IBPS
Source: CPMI survey.	

Real-time gross settlement systems by economic region

Graph A4

The use of this map does not constitute, and should not be construed as constituting, an expression of a position by the BIS regarding the legal status of, or sovereignty of any territory or its authorities, to the delimitation of international frontiers and boundaries and/or to the name and designation of any territory, city or area.

The categorisation of jurisdictions into advanced economies (AE) and emerging market and developing economies (EMDE) is based on the World Economic Outlook (WEO) International Monetary Fund (IMF) classification.

The circle in Europe represents TARGET2. The RTGS systems in the Dominican Republic, the Eastern Caribbean Currency Union (ECCU) countries, Hong Kong SAR and Singapore are also represented by circles.

Source: CPMI survey.

Time zones of the real-time gross settlement systems

Graph A5

Graph A6

The use of this map does not constitute, and should not be construed as constituting, an expression of a position by the BIS regarding the legal status of, or sovereignty of any territory or its authorities, to the delimitation of international frontiers and boundaries and/or to the name and designation of any territory, city or area.

The circle in Europe represents TARGET2. The RTGS systems in the Dominican Republic, the Eastern Caribbean Currency Union (ECCU) countries, Hong Kong SAR and Singapore are also represented by circles.

Source: CPMI survey.

Real-time gross settlement systems by CPMI membership

CPMI member Non-CPMI member

The use of this map does not constitute, and should not be construed as constituting, an expression of a position by the BIS regarding the legal status of, or sovereignty of any territory or its authorities, to the delimitation of international frontiers and boundaries and/or to the name and designation of any territory, city or area.

The circle in Europe represents TARGET2. The RTGS systems in the Dominican Republic, the Eastern Caribbean Currency Union (ECCU) countries, Hong Kong SAR and Singapore are also represented by circles.

Source: CPMI survey.

Annex 3: Actions and milestones for building block 12

The full actions and milestones for building block 12 ("Extending and aligning operating hours of key payment systems to allow overlapping") are outlined below, based on the G20 roadmap (FSB (2020b)). The dates for each milestone in the table indicate the start date and completion date for the steps described in the milestone. For all actions in 2021 and 2022, actions and dates are committed deliverables. The content of actions and dates of milestones beyond end-2022 are indicative (see FSB (2020b and 2021b)).

Actions and milestones

Action 1: Identification of payment systems relevant for (global) cross-border payments and stocktake of their operating hours.

CPMI to consolidate information on current operating hours and planned expansion efforts in order to identify potential remaining gaps in overlap/alignment of operating hours across jurisdictions and collect quantitative data to help identify which payment systems and currency corridors are most relevant.

November 2020–January 2021

Action 2: Setting out potential future operating hour "end states" to support enhanced crossborder payments, analysis of risks and policy considerations, and potential solutions to address them.

CPMI to set out potential future "end-states" of key payments systems operating hours and how these could enhance cross-border payments and to identify any risks including operational, cyber and fraud; credit and liquidity; monetary policy considerations; financial structure and financial stability considerations; and resolution policy considerations for each "end state". To identify potential solutions to mitigate or address these key risks or policy considerations via a publication.

February 2021–March 2022

Action 3: Development of technical and operational approaches on how to address key challenges.

CPMI to develop technical and operational approaches on entity-level and/or required industry-wide rule changes to support the respective end states for authorities and operators aiming to extend/align operating hours.

April 2022–September 2022

Central banks and payment system operators wishing to align/extend operating hours to work with their direct participants and other domestic stakeholders to consider each of the potential end states, along with the associated challenges, risks, and potential solutions that have been identified, with the goal of seeking consensus on if and how best to move forward.

June 2022–May 2023

Annex 4: Cross-border Payments Expansion Workstream

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The Workstream's work has also benefited from the contributions and support provided by Jérémy Cuny and Nathan Crespy (Bank of France); Pearl Malumane (South African Reserve Bank); Ana Fernández Bedoya* (Bank of Spain); Michael Pywell and Abigail Whiting [since September 2021] (Bank of England); Emilie Walgenbach and Seaira Christian-Daniels (Federal Reserve Bank of New York); Martha K Pratiwi, Jultarda Hutagalung and Franz Hansa (Bank Indonesia); Hyerim Jeong [until May 2021] (Bank of Korea); Priyanka Slattery [since June 2021] (Board of Governors of the Federal Reserve System); and Patrick Tuin [until August 2021] (Netherlands Bank).

Regis Bouther (Bank of England) and Ilaria Mattei (Bank for International Settlements) provided data support to the Workstream.

^{*} Member of the drafting team.

Annex 5: Acronyms and abbreviations

AE	advanced economies
AM	Americas
APAC	Asia-Pacific
BB	building block
BIS	Bank for International Settlements
СРМІ	Committee on Payments and Market Infrastructures
EMDE	emerging market and developing economies
EMEA	Europe, Middle East and Africa
FMI	financial market infrastructure
FPS	fast payment system
FSB	Financial Stability Board
FX	foreign exchange
GMT	Greenwich Mean Time
GPI	Global Payments Innovation
G20	Group of Twenty
IMF	International Monetary Fund
IOSCO	International Organization of Securities Commissions
LVPS	large-value payment system
PFMI	Principles for Financial Market Infrastructures
PSP	payment service provider
PvP	payment-versus-payment
RTGS	real-time gross settlement
SWIFT	Society for Worldwide Interbank Financial Telecommunication
WEO	World Economic Outlook

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³³ The Committee on Payment and Settlement Systems (CPSS) changed its name to Committee on Payments and Market Infrastructures in September 2014. References to reports published before that date use the Committee's old name.