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## Interoperability between payment systems across borders

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## Interoperability between payment systems across borders

### *Key takeaways*

- Interoperability among payment systems – as the foundation for enhancing cross-border payments – requires technical, semantic and business system compatibility so that end users can seamlessly transact with each other across systems.
- Public and private sector options in pursuing cross-border payment system interoperability can be illustrated using four stylised models, ordered in increasing complexity and cost but also greater efficiency – a single access point, bilateral link, hub and spoke or a common platform.
- The BIS Innovation Hub is putting theory into practice with several innovative projects to foster interoperability across the four stylised models.
- An ambitious, multi-year G20 programme to enhance cross-border payments is under way.

### Introduction

Cross-border payments, both wholesale and retail, must become faster, cheaper, more transparent and more accessible, while maintaining their safety and security. If these goals are to be realised, it is necessary to achieve interoperability between payment systems across borders. Payment system interoperability allows participants – banks and other payment service providers (PSPs) – from different systems or jurisdictions to conduct, clear and settle payments across systems without participating in multiple systems. Interoperability is a means, not an end; the aim is to allow banks and other PSPs from different systems or jurisdictions to transfer payments, so that end users can seamlessly transact with each other regardless of their geographic location or choice of PSP.

### Benefits and attributes of interoperability

Greater interoperability would yield a range of benefits to participants and end users. It trims the one-off, initial costs and complexity involved in establishing a link between systems and reduces the need for participants to connect to multiple systems. It lowers the barriers between traditional and new infrastructures and systems, in particular by offering alternatives to traditional correspondent banking chains. It invigorates competition by reducing switching costs and avoiding lock-in effects and allows for more integrated (“one-stop”) solutions. It cuts processing times for end users and enhances payments transparency. In these ways, greater interoperability raises efficiency and lowers costs, benefiting end users and boosting access and inclusion. From a broader perspective, greater interoperability could encourage international economic and financial integration.

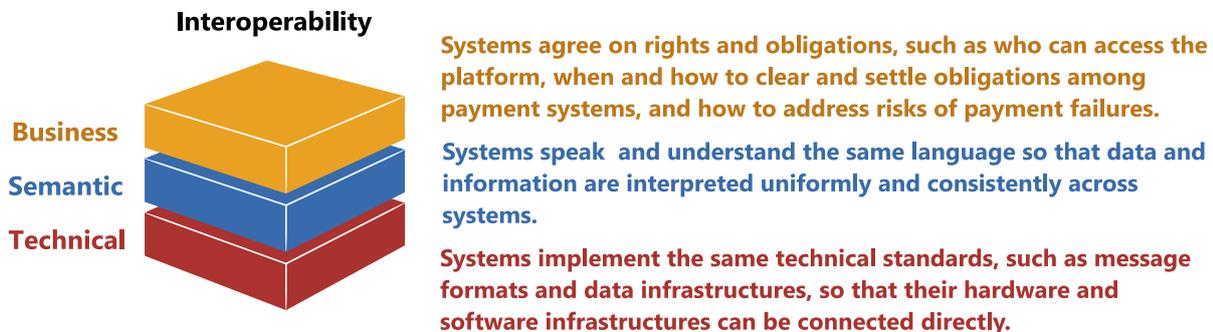
Payment system interoperability involves many attributes, which can be combined in various ways. These attributes fall into three broad dimensions: technical, semantic and business (Graph 1). Technical operability is fundamental because, for data to be interpreted and acted upon consistently (semantic interoperability), it first needs to be exchanged. And semantic interoperability, the second layer, is

necessary to establish business interoperability. Essentially, interoperability increases as the attributes are stacked together.

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## Attributes of interoperability

Graph 1



Source: Authors' elaboration.

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To illustrate the attributes and their complementarities, we can use the analogy of a video conference. All the participants have invested in the necessary technology (ie computers or mobile devices connected to the internet, with the same or compatible software). This is technical interoperability. English is chosen as the conference language, as participants understand and speak English (or have a translation function); this is semantic interoperability. Finally, all have agreed to some common business rules (eg participants are muted when not speaking, and raise their hands or use the chat function to ask questions). This is business interoperability. Together, this achieves full interoperability.

Interoperable payment systems can be located in a single jurisdiction (domestic interoperability) or can work across borders (international interoperability). Interoperability can be achieved using the same technology, or by ensuring compatibility between different technologies (eg compatibility between new and old). Payment systems of the same type (eg two or more fast payment systems (FPS)) can be made interoperable. The same is true for payment systems of different types (eg a real-time gross settlement system (RTGS) and a central bank digital currency (CBDC) system).

Interoperability comes with varying degrees of complexity. It is relatively straightforward to link payment systems based on the same technology and operated within the same jurisdiction. Achieving interoperability between different types of payment system, based on different technologies in the same jurisdiction or across borders is more complex as it requires joining or linking separate infrastructures. Each may have its own technical, semantic and business attributes, such as differing message formats, communication protocols, payments processing rules and access regimes.

## How to pursue interoperability in cross-border payments and balance trade-offs

Payment systems are becoming more standardised worldwide and many innovative private sector initiatives are under way. While these developments may work towards greater interoperability, they will not achieve it on their own. For example, payment systems have adopted or are adopting the International Standards Organisation (ISO) 20022 standard as their financial messaging format. This standard allows a PSP in one jurisdiction to send payment messages (or instructions) to a PSP in another jurisdiction with little or no manual processing. However, the ISO 20022 message formats and data components must be harmonised between sending and receiving entities. Despite its global nature, individual jurisdictions may

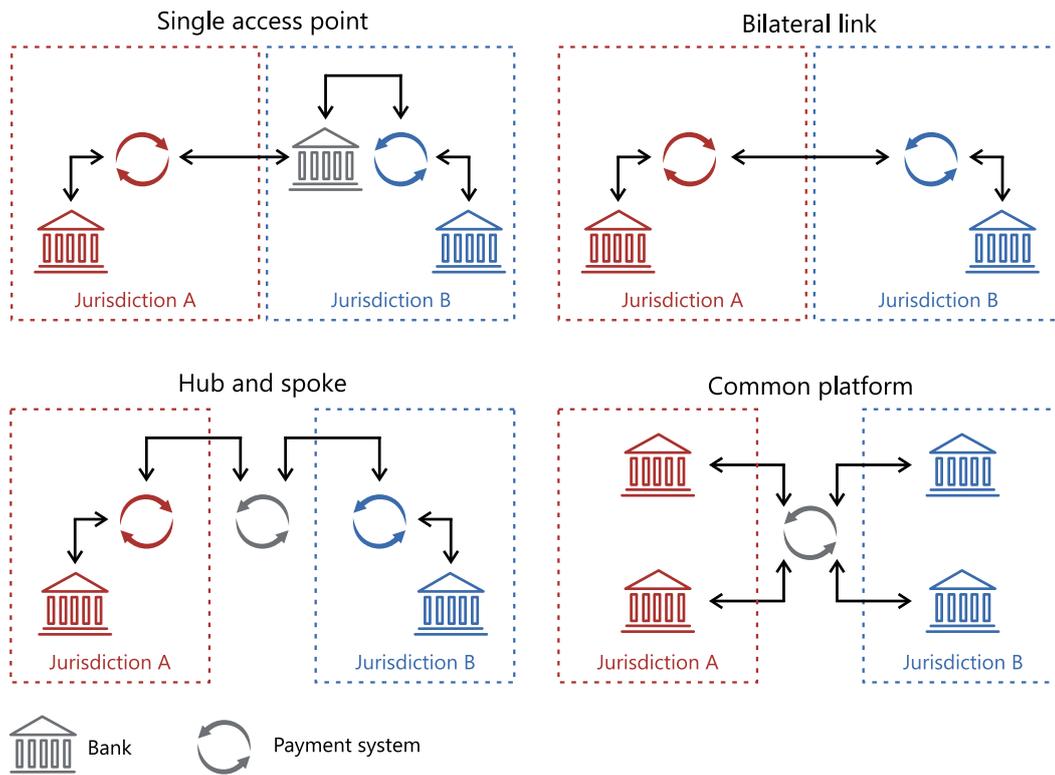
implement the ISO 20022 standard in different ways. Thus, coordinated efforts are needed, if variability in the implementation of standards is to be kept to a minimum.<sup>1</sup>

This example shows how full interoperability may not always be achieved without public intervention. Payments are conducted in complex (“multi-sided”) markets with various types of interaction between participants, many of which give rise to network effects (BIS (2020)). Providers may actively seek to stifle competition by preventing interoperability and supporting proprietary solutions instead (ITU (2016)). These difficulties imply an important role for central banks.

As operators, overseers and catalysers of payment systems, central banks have many options for fostering domestic and international interoperability, by aligning business rules and regulatory frameworks among other measures. By supporting interoperability, central banks can play a critical catalytic role in fostering competition. In addition, by operating the core of the payment system, central banks control a vital part of the payment chain and can help to define the standards needed for interoperability. Central banks’ choices and related trade-offs in pursuing interoperability can be illustrated using four stylised models, listed in increasing order of complexity and cost, but also of increasing efficiency (Graph 2).<sup>2</sup>

Stylised models for interlinking cross-border payment systems<sup>1</sup>

Graph 2



<sup>1</sup> Examples include *Single access model*: euroSIC; *Bilateral link*: Directo a México; *Hub and spoke*: Regional Payment and Settlement System (REPS) of the Common Market for Eastern and Southern Africa; *Common platform*: Southern African Development Community (SADC)-RTGS.

Source: CPMI.

<sup>1</sup> To this end, work is under way to develop a common set of fields that are standard for cross-border payments messages. Building block 14 of the G20 cross-border payments programme seeks to remedy fragmented and truncated data standards and to increase the adoption of a harmonised version of ISO 20022 for cross-border payments (FSB (2020), CPMI (2020b)).

<sup>2</sup> Cross-border payments also require liquidity arrangements as a precondition for effective interoperability. In particular, cross-currency interoperability is not feasible without built-in or supporting FX pools or FX providers. These are not shown.

- **Single access point:** participants in one (domestic) system have access to a foreign system through a single “gateway” entity, such as a PSP that operates in both systems. As the simplest model, a participant in one system directly participates in the foreign system. In this arrangement, only the single “gateway” entity must implement the technical and semantic elements necessary to participate in both systems, although all participants need to address the business interoperability elements required to conduct transfers through the single gateway entity. Despite simplicity and low cost, the single access point has scalability limitations.
- **Bilateral link:** participants in one system can directly reach all participants in a foreign system. Transactions between linked systems are typically settled through accounts that PSPs in each system hold with their counterparts in the other system. In this setup, both systems must address the three interoperability attributes. For example, if the anti-money laundering/combating the financing of terrorism (AML/CFT) rules and procedures of the linked systems are misaligned, one (or both) systems must either change its rules or find a technical solution. Establishing a bilateral link can be relatively cost-effective and serve as an interim step towards a more centralised approach. However, a multitude of bilateral links results in complex processes, as multiple interoperability arrangements must be maintained.
- **Hub and spoke (or multilateral link):** using a common settlement agent (the hub), participants in one system can directly reach all participants in *two or more* foreign systems (the spokes). The intersystem accounting, clearing and settlement are carried out by the common settlement agent (the hub) with which participants in each system hold their settlement account. The attributes relevant for interoperability in this model are the same as for bilateral links, except for the added complexity of applying to three or more jurisdictions, including defining standardised and harmonised structures. In this model, a hub would need to be set up from scratch, with the costs varying according to the functions offered.
- **Common platform:** participants from one jurisdiction can directly reach participants in other jurisdictions through one common payment system, which runs on a single, integrated technical platform. As a common platform requires the harmonisation of many attributes, it is technically the most complex model, since it does not interlink existing systems but requires a new fully fledged payment system to be set up. The only interoperability issue concerns the participants who need to establish a link to the new central entity. This model is the costliest up-front because of the initial investment, as well as the need to ensure operational resilience and to address the “single point of failure” risk. At the same time, it offers extensive scalability options and the greatest long-run efficiency.

The benefits of interoperability in enhancing cross-border payments and reducing costs differ across the four models and across pairs or groups of participating jurisdictions. Additionally, policymakers must decide whether to pursue (i) an incremental or a “big bang” approach; and (ii) a regional or global approach. A “big bang” approach may be costlier but more successful in achieving critical mass. Similarly, increasing interoperability within a region may be achievable relatively quickly but may inadvertently slow down global interoperability. The terms of the trade-offs for each of the four models can be organised along the dimensions outlined in Table 1. Final choices will depend on an individual jurisdiction’s circumstances and policy preferences, as well as technological developments.

## Innovations in cross-border interoperability

Projects under way in the BIS Innovation Hub (BISIH) in conjunction with BIS member central banks show how innovation can speed progress towards cross-border interoperability. Several projects that link FPS or use multi-CBDC arrangements (Box 1) can be categorised according to the four stylised models. [Project Nexus](#) (hub and spoke model) explores interoperability between three or more domestic FPS. For cross-border interoperability involving CBDCs, projects [mBridge](#), [Dunbar](#) and [Jura](#) explore use cases for wholesale CBDCs in a cross-border context using a common platform model. While both the mBridge and

Dunbar projects address interoperability challenges through a common CBDC platform, the prototypes are executed using different distributed ledger technologies. They also have different governance, control and access frameworks: Dunbar proposes a hybrid model with the use of “sponsor banks” to allow banks to hold CBDC from jurisdictions where they do not have a presence; in the case of mBridge, the platform allows for direct access. To preserve diversity in its solutions, BISIH projects will further explore the benefits, costs and trade-offs across these and other models.

Trade-offs for each of the four models

Table 1

	Single access point	Bilateral link	Hub and spoke	Common platform
Initial investment cost	Relatively low cost, but only an interim step	Relatively low cost, but only an interim step	Costs vary depending on functions offered	Costliest up-front and requires a full-fledged system
Scalability	Limited; would require multitude of links	Limited; would require multitude of links	Extensive	Extensive
Legacy systems	Older systems were often designed with a purely domestic focus, using proprietary technologies, and without international interoperability in mind. Newer systems can overcome limitations if interoperability is considered during the design phase.			
Heterogeneity across systems and PSPs	Depending on the openness of the economy and the concentration of the market for payment services, a specific model may be preferred.			

Source: Authors' elaboration.

## BIS Innovation Hub projects exploring interoperability

The BIS Innovation Hub (BISIH) is leading several projects that explore both domestic and cross-border interoperability.

- **Project Nexus** in the Singapore Centre (*hub and spoke model*) explores interoperability between three or more domestic FPS. Nexus seeks to overcome the limitations of bilateral links by standardising the way that FPS connect to each other, supporting faster growth and scalability of a multilateral cross-border payments network. It addresses technical interoperability through a standardised application programming interface (API); semantic interoperability by using different yet compatible message formats; and business interoperability in such areas as AML/CFT, where compliance checks can be performed in seconds without human intervention or review.

In the area of CBDC, Projects mBridge (Hong Kong), Dunbar (Singapore) and Jura (Switzerland) each explore use cases for wholesale CBDC in a cross-border context using a *common platform model*.

- **Project mBridge** seeks to enhance cross-border payments through the development of a common platform for the issuance and exchange of wholesale CBDCs issued by multiple central banks. The customisable platform supports jurisdictional compliance, privacy, liquidity and monetary policy transmission tools. The most recent prototype reduced cross-border transfer speeds from days to seconds.
- **Project Dunbar** also features a common platform for the issuance and exchange of CBDCs that can be cooperatively managed by multiple central banks and used by private financial institutions. It solves the technical and semantic challenges of interoperability by enforcing common technical standards, data architectures and terminology. However, standardising jurisdiction-specific business rules poses difficulties. Project Dunbar addresses this issue by giving each central bank the autonomy to apply specific business rules at the level of an individual CBDC, within the parameters of a common framework.
- **Project Jura** explores interoperability on a privately-operated common platform with separate subnetworks in which a euro and a Swiss franc wholesale CBDC, and tokenised French commercial paper are issued. Swiss and French commercial banks participate directly on the platform to settle the commercial paper and FX transactions with wholesale CBDC. Thus, Project Jura combines the common platform model described above with interoperability between subnetworks. The subnetworks provide both central banks with individual control over their respective wholesale CBDCs.

## Conclusion

Better cross-border payments, a key G20 goal, is high on the agenda of central banks. The aim is to make cross-border payments faster, cheaper, more transparent and more accessible to all, while maintaining their safety and security. To achieve this, both the public and private sectors must make progress on the technology and infrastructure fronts as well as on the relevant policy and regulatory frameworks. The ambitious multi-year G20 cross-border payments programme (FSB (2020); CPMI (2020a) and (2020b)) reflects the multi-faceted nature of these necessary improvements.<sup>3</sup> Following stocktaking and analysis, the G20 programme is now moving into the design phase and will help to set the direction for public and private infrastructure investments.

Greater interoperability between payment systems across borders, both regionally and globally, is essential to these efforts.<sup>4</sup> Achieving interoperability with existing and new payment infrastructures requires coordination and collaboration.<sup>5</sup> Acknowledging this need, more than half the G20 programme's 19 building blocks relate to harmonising, standardising and applying common features to payment systems. In parallel, the BISIH projects show how innovation can speed progress among central banks and other participants. With a coordinated and sustained initiative supported by both private and public sectors, we can expect to see the necessary improvements and the development of a broad range of cross-border payment services to support the changing ways we live and transact. Failure to achieve these goals has material costs, carrying with it the risk of fragmenting the global financial system. The stakes are high.

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<sup>3</sup> The G20 cross-border payments programme comprises the necessary elements of a globally coordinated response in the form of a set of 19 building blocks, based on a BIS CPMI report to the G20 (CPMI (2020a), (2020b)). The 19 building blocks are arranged into five focus areas, four of which (focus areas A to D) seek to enhance the existing payments ecosystem, while focus area E is more exploratory and covers emerging payment infrastructures and arrangements.

<sup>4</sup> See also Rice (2021).

<sup>5</sup> The CPMI, BISIH, IMF and WB are working on interlinking payment systems and multilateral platforms, see FSB (2021).

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