CHAPTER 8

Large-value deferred net settlement systems – Three examples of "hybrid" systems in Europe, the United States and Canada

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As referred to in Chapter 6 (Payment circuits and systems), all the G20 member countries currently have RTGS systems, except for Canada.[1] In addition, in the United States and the euro area, a key feature in the landscape of large value payment systems (LVPS) is "cohabitation" between an RTGS system operated by the central bank and a deferred net settlement (DNS) system operated by a private entity, as is the case with CHIPS[2] in the United States and the EURO1[3] system in Europe.

This chapter focuses on these two systems, together with Canada's LVTS.[4] [5] Although these are all DNS rather than RTGS systems, they handle large amounts and are therefore deemed to be systemically important for the smooth functioning of the financial system. In view of this, each of the three systems has put specific solutions in place to facilitate settlement in near real-time and reduce credit risk exposure, without overly inflating the liquidity needs inherent in RTGS systems. As a result, these systems can now be qualified as "hybrid" systems (see Chapter 6).

1. The key functionalities of EURO1, CHIPS and LVTS

1.1. EURO1

EURO1 is a large-value net settlement system for payments in euro. It was developed by Europe's major credit institutions, working within the Euro Banking Association (EBA), together with EBA Clearing, which has been the operator of EURO1 since it went live on 4 January 1999 with the launch of the euro currency. The system currently counts 51 banks as direct participants (and also shareholders in EBA).

With EURO1, the aim was to develop a pan-European payment system with settlement in euro, so as to provide Europe's credit institutions with their own LVPS alongside the RTGS operated by the Eurosystem. EURO1 was designed to settle payments on a net basis, providing greater liquidity-efficiency than an RTGS system. This "dual" arrangement is similar to that in place in the United States with CHIPS and Fedwire and in France with PNS and TBF (see Chapter 6).

EURO1 operates alongside TARGET2. Banks generally prefer to use TARGET2 for their most critical payments so as to benefit from all the advantages it offers: a robust operational risk management framework, efficiency and the security provided by real-time settlement in central bank money. EURO1 is a net settlement system used for less critical large-value payments, whether domestic or transnational. Compared to TARGET2, the private system operated by EBA Clearing enjoys the liquidity efficiency afforded by netting payments.

Relative to other DNS systems (such as, at present, France's retail payment system, CORE(FR) – see Chapter 10), EURO1 – as well as CHIPS and LVTS – are specific in that payment finality is achieved on a continuous basis, without waiting for participants' net positions to be settled at the end of the day.[6] In other words, these systems provide "immediate intraday finality".[7]

This model is based on a "single obligation structure", a specific legal basis applicable to the relationship between a given participant and the community formed by all the other participants. It means that, at any given time, each participant has only one single obligation/claim to/on the system as a whole, which is adjusted automatically in real time every time a payment is processed.

Finality is achieved when transactions are allocated to the participant's single claim or single obligation vis-à-vis the rest of the community. At that point, payment orders become irrevocable and unconditional (they can no longer be cancelled, even if a participant defaults when the time comes to settle their position in TARGET2). This stage corresponds to settlement finality stage two (SF2), as described in

1 As part of the initiative to modernise Canada's payment system, the LVTS will be replaced by an RTGS system called Lynx in 2020. For further details, see the Bank of Canada's website: *https://modernisation.paiements.ca/le-plan/systeme-de-paiements-de-grande-valeur/ https://modernization.payments.ca/the-plan/high-value-payments-system/*

2 The Clearing House Interbank Payments System, see: *https://www.theclearinghouse.org/payments/chips*

3 For further information, see: *https://www.ebaclearing.eu/services/euro1/overview/*

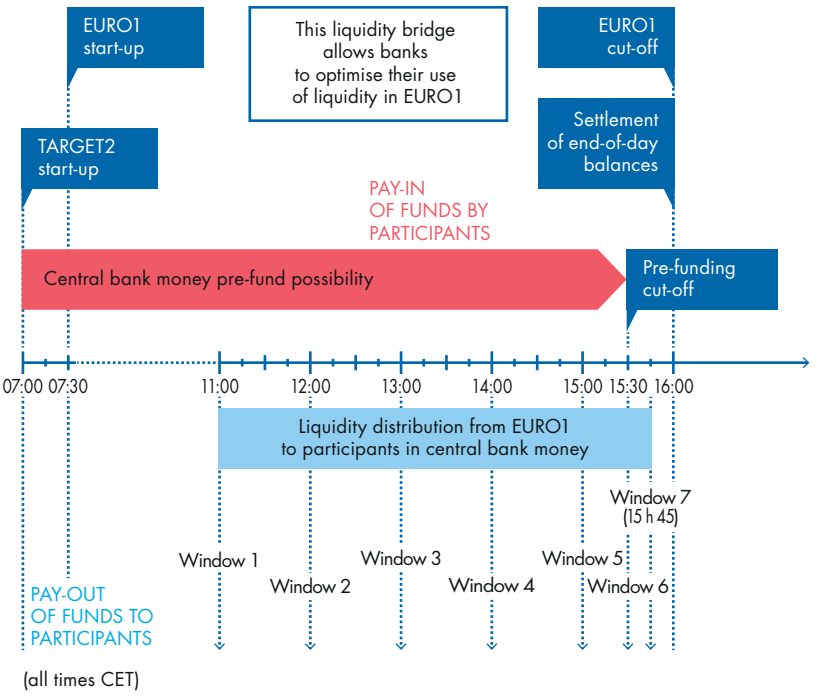
4 Large Value Transfer System, see: *http://www.bankofcanada.ca/core-functions/financial-system/canadas-major-payments-systems/*

5 See the report published in May 2005 by the CPMI, New developments in large value payment systems, *http://www.bis.org/cpmi/publ/d67.pdf*

6 Positions are settled in TARGET2 at EURO1's cut-off time.

7 Committee on Payment and Settlement Systems Payment, Clearing and settlement systems in the CPSS countries, BIS, 2012, pp. 99 – 101: *https://www.bis.org/cpmi/publ/d105.pdf99 – 101*: *https://www.bis.org/cpmi/publ/d105.pdf*

Box 1: Liquidity optimisation in EURO1 and settlement of EURO1 net balances in TARGET2[8]



Source: EBA clearing (*https://www.ebaclearing.eu/services/euro1/liquidity-efficiency/*)

Chapter 5, when neither of the two parties to a transaction is permitted to modify it. This arrangement works using a specific mechanism combining a liquidity pool with a loss-sharing agreement. The liquidity pool is set so that the system is able to complete settlement in the event of a default, or even a "dual failure".[9] If the losses incurred by a failure exceed that level, the portion not covered by the liquidity pool is distributed jointly among the surviving participants.

Although payments are processed in real time in EURO1, until final settlement is completed at the end of the day (in central bank money in TARGET2), participants that have a claim on the community are exposed to a very low degree of settlement risk.[10] This type of risk is by nature absent from a gross settlement system such as TARGET2. However, the settlement risk involved in EURO1 is highly theoretical: it would only materialise if a failure resulted in losses exceeding the "dual failure" level, the liquidity pool was insufficient and the surviving participants were unable to pay their share without defaulting themselves. Moreover, admission criteria and risk management procedures have been established to mitigate this risk (see Section 2). Apart from settlement risk, the main constraint facing EURO1 participants is that the funds they receive cannot be reused immediately outside EURO1. The funds only become available for use outside the system following the end-of-day settlement procedure in TARGET2.

1.2. Clearing House Interbank Payment System (CHIPS)[11]

CHIPS is a net settlement system for large-value payments in US dollars, which is owned by the main US commercial banks and operates alongside the Fedwire system.

8 The concepts in this chart are explained in Section 2.2.

9 Default by the two largest participants in the system.

10 In practice, payments are processed one by one and when a payment has been processed by the system it can no longer be cancelled: this is the immediate intraday finality provided by EURO1 for each payment processed. A payment becomes irrevocable when the asset for settlement is transferred to the TARGET2 account, i.e. at the end of the day. This arrangement is based on a German legal principle known as the "single obligation structure", whereby each participant has a single obligation towards the system as a whole and this obligation is updated each time the participant sends or receives a new payment.

11 See also the May 2005 CPSS report "LVPS report", Box 5: *http://www.bis.org/cpmi/publ/d67.pdf*

Fedwire is used to settle urgent large-value payments such as interbank settlements and clearing operations, as well as for tax payments. CHIPS, with its liquidity-saving mechanisms, is used for large-value commercial transactions.

CHIPS provides real-time payment finality throughout the day as payments are settled, using a centralised queuing arrangement. In contrast with EURO1, this real-time finality is not achieved on the basis of a legal (guarantee) structure, but thanks to the use of a pre-funding mechanism: as a precaution against risk, CHIPS requires participants to deposit a pre-established funding amount [12] in the system each day before operations commence.

The 45 members of CHIPS (US commercial banks and foreign banks – see eligibility criteria below) are thus required to transfer this prefunding amount or "opening position requirement" to a specific deposit account held at the Federal Reserve Bank of New York for the joint benefit of all participants who contribute to the pre-funded balance ("Funding Participants"). The opening position requirement (pre-funding) is calculated by the system on the basis of a participant's previous activity. It can be transferred any time between the opening of CHIPS and Fedwire at 21:00 ET and 09:00 ET the following day. It then remains blocked in the system until the end-of-day closing procedure takes place. Until their opening position has been transferred, participants cannot make a payment via CHIPS. During the day, participants can transfer supplemental funds to their CHIPS account as and when necessary.

Throughout the day, payment orders are placed in a queue. An optimisation algorithm regularly searches the queue for payments that can be settled by offsetting them against other payments. A participant may at no time hold a debit position that exceeds the amount of their security deposit. Payments accepted by CHIPS are therefore irrevocable and unconditional. Finality is achieved at the end of the day.

At 17:00, after a final attempt to optimise the queued payments, the system uses the deposited funds to clear all the remaining payments on a multilateral net basis. The resulting multilateral net balance for each participant is combined with their current position to calculate their closing position. After clearing, the final payments are settled and CHIPS sends each participant that has a credit position a Fedwire payment order in the amount of their balance from its prefunding account. The sum total of all the payment orders issued is equal to the balance of the CHIPS prefunded account.

1.3. Large Value Transfer System (LVTS)

Canada's LVTS system (launched in 1999, owned and operated by the Canadian Payments Association – an association of Canadian banks and the Bank of Canada[13]) is also a net settlement system providing real-time payment finality. In this system, once a payment successfully passes the real-time risk controls for the appropriate tranche (see below for details on the "tranche" concept), the original payment obligation between the issuing and receiving participants is extinguished and replaced by an obligation of the issuing participant to the system and an obligation of the system to the receiving participant. This mechanism ("netting by novation") combines a novation arrangement with a transaction netting process. Under LVTS rules, the final beneficiary receives funds on a final and irrevocable basis within a pre-defined timeframe.

A feature specific to LVTS is that participants can opt to make payments using one of two procedures:

- **Tranche 1 payments:** These payments (the net balance of payments sent and received) are fully secured by assets held by the participants at the Bank of Canada. In other words, with tranche 1 payments, participants pledge collateral to limit the risk that they pose to the community.

12 The prefunding amount is determined using a formula "reasonably designed to facilitate the [CHIPS payment message] release methodology", see p6: *https://www.theclearinghouse.org/-/media/files/payco%20files/standards%20self%20assessment%202016.pdf?la=en*

13 Payments Canada is the business name of this association, which is established under the Federal Canadian Payment Act.

- **Tranche 2 payments:** At the start of each day, each participant determines the bilateral credit limit that it is willing to grant to each of the other participants during the day's processing cycle (the amount can be set at zero).

To guarantee settlement of the multilateral net position resulting from tranche 2 payments, each participant pledges assets to the system's operator as collateral, in proportion to the highest bilateral limit that it has granted. Participants' net debit positions cannot be higher than a specified percentage (30%) of the total bilateral limits granted to them.

If a participant defaults, the system first uses that participant's collateral (tranche 1) then the tranche 2 collateral pledged by other participants, in accordance with the bilateral limit that they granted to the defaulting participant. The collateral amounts required are calculated to ensure that the collateral pool will always cover a default by the largest participant (minus the bilateral limits granted to it).[14] With tranche 2 payments, participants therefore pledge collateral to limit the risk of another participant failing.

In the event of a default, the surviving participants must absorb the associated losses (after the defaulting participant's collateral has been used to fulfil its obligation, at least partially). This arrangement distributes default risk among the system's participants.

Participants can therefore use either one of the two payment tranches in the system. The tranches are processed in the same way, but participants are not subject to the same limits. For tranche 1 payments, participants cannot have a multilateral net debit position higher than their tranche 1 net debit cap, while with tranche 2 payments, both bilateral and multilateral debit caps apply.

A key distinction between the two tranches is the way in which their exposure to intraday credit risk is controlled. While debit caps apply in both tranches, in tranche 1 the multilateral net debit cap is fully collateralised by the issuing participant, but in tranche 2 the overall exposure to credit risk is partly covered by a collateral pool provided by the surviving participants, with the remainder being covered by the central bank's guarantee to settle the positions.

During the daily payments cycle, between midnight and 19:30, payments are charged to participants' accounts on a net basis.[15] At the 18:30 payment cut-off time, and by 19:30 at latest, the Bank of Canada books each participant's multilateral net position in their settlement account at the central bank. So in practice, it is only at the end of the day that participants' net balances (whether positive or negative) resulting from the day's transactions are entered in their accounts at the central bank.

2. Risk management in these three systems

Every day EURO1 processes transactions totalling around EUR 200 billion. The figure is around USD 1,560 billion[16] for CHIPS and CAD 140 billion for LVTS. Given the huge amounts handled by these systems and the fact that financial risk cannot be completely eliminated in the environments in which they operate. All three payment systems have therefore adopted solutions to enable them to achieve real-time payment finality while controlling their settlement risk using ad hoc mechanisms. This gives them some of the advantages offered by RTGS systems at a lower cost, particularly in terms of liquidity. It should be noted, however, that while the settlement risk associated with these systems is reduced by their specific mechanisms, none of the systems considered have zero settlement risk (in RTGS systems, which settle payments one by one in real time, settlement risk is effectively zero). As explained above, risk management tools have been put in place.

14 In the event that limits are set to zero by all participants, no tranche 2 payments can be made. Only tranche 1 payments can be made and these are fully secured by the collateral pledged by each participant.

15 When a payment is submitted, the system calculates the net position of each participant in real time (payment inflows minus outflows). The net positions of tranches 1 and 2 are combined to produce a single multilateral net LVTS position for settlement.

2.1. Participant selection criteria

In general, net settlement systems have fewer participants than RTGS systems. This is the case for CHIPS, which has 45 participants versus 7,500 for Fedwire, and for EURO1, which has 51 participants versus over 1,000 for TARGET2. As for LVTS, it has only 17 participants.

2.1.1. Eligibility criteria for EURO1

In order to be eligible to participate in EURO1, a bank must satisfy certain legal, financial and operational criteria.

- **Legally**, a bank must be authorised to conduct banking business, be a member of the EBA (Euro Banking Association), have its registered office or a branch in a Member State of the EU and provide a capacity opinion (a legal opinion on its ability to meet its obligations). Each banking group can have only one participant authorised to use the system.
- **Financially**, a bank must have own funds of at least EUR 1.25 billion and a short-term credit rating of at least P2 (Moody's) or A2 (S&P) or equivalent.
- Lastly, to satisfy the **operational criteria**, a bank must have direct access to TARGET2 (and hence an account at the central bank) and adequate technical and operational facilities, including back-up facilities, and staffing for the purposes of participation in the system.

2.1.2. Eligibility criteria for CHIPS

In order to be admitted as participants, "depository institutions" and foreign banks must: (i) have an office located in the United States that is subject to regulation by a federal or state regulator,[16] (ii) be a "financial institution" governed by the Federal Deposit Insurance Corporation Improvement Act, (iii) be able to send and receive messages via a "connection" to CHIPS that complies with the CHIPS Rules and (iv) maintain primary and back-up computer facilities as required by the CHIPS Rules.

Pre-funding participants must also satisfy pre-funding criteria: they must be a foreign bank or depository institution, hold an account on the books of a Federal Reserve Bank and be able to send and receive fund transfers via Fedwire.[17]

2.1.3. Eligibility criteria for LVTS

The CPA (Canadian Payments Association) admission criteria for direct participants in LVTS require that a bank must:

- be a member of the CPA;
- use the SWIFT messaging network;
- have appropriate back-up facilities for their LVTS operations;
- hold a settlement account at the Bank of Canada;
- enter into agreements to take loans from the Bank of Canada and pledge eligible collateral.

2.2. Risk management: pre-funding, limits and liquidity pools

The systems considered use the following tools for the purpose of risk management (pre-funding, bilateral and multilateral limits) and risk reduction (liquidity pools).

2.2.1. Risk management mechanisms for EURO1

All EURO1 participants are exposed to credit risk arising from a default by another EURO1 participant. To contain this risk, a framework of bilateral and multilateral limits on payments processed in the system has been established. Payments entered in the system can only be considered final if they do not increase the participant's bilateral position above the set limit.

16 "Subject to regulation by a federal or state depository-institution regulatory authority."

17 Extract from the CHIPS "Core principle self assessment", *https://www.theclearinghouse.org/payments/chips* "Participation in CHIPS is available to any depository institution or foreign bank that meets the requirements detailed in the CHIPS Rules, which are publicly available. Pursuant to CHIPS Rule 19, a participant must (i) have an office located in the United States that is subject to regulation by a federal or state regulator, (ii) be a "financial institution" covered by the Federal Deposit Insurance Corporation Improvement Act, (iii) establish a "connection" to CHIPS that meets the requirements of the CHIPS Rules, and (iv) maintain primary and back-up computer facilities as required by the CHIPS Rules. In addition, each participant must have access to sources of credit and liquidity sufficient to enable it to pay its opening position requirement and its closing position requirement promptly, and it must be able to manage its operations in a way that will not delay or complicate the operations of CHIPS. CHIPS participants that are foreign banks must agree that the obligations that they incur on CHIPS are obligations of the entire bank, not just its branch or agency in the United States."

Each participant grants bilateral limits to each of its counterparties. These limits comprise a mandatory limit and a discretionary limit. The mandatory limit is equal to the participant's liquidity pool deposit divided by the number of participants in the system, minus one. Participants can set the discretionary limit at any level between zero and EUR 50 million. Participants can adjust these limits each day before the system opens for processing. The discretionary limit can be said to represent the level of credit risk that a participant is willing to assume vis-à-vis each of the other participants. In the event of a default, discretionary limits form the basis for calculating loss allocations to the surviving participants.

Taken together, the bilateral limits granted by a given bank to each of the other participants form the multilateral net receiving limit (credit cap) of the grantor bank. Conversely, the total bilateral limits accorded to a given bank by the other participants form the multilateral net sending limit (debit cap) of the grantee bank. The bilateral limits do not restrict the bilateral payment flows between individual participants. Banks can send payments to any other participant within the limit of the total amount of their debit cap.

Unlike bilateral limits, which vary over time and differ from one participant to another, the upper multilateral debit limit, or maximum debit cap, is a single limit that applies system-wide to all participants.[18] The current maximum debit cap is EUR 500 million. The liquidity pool amounts to twice the maximum possible exposure in the system/maximum debit cap (EUR 1 billion). In the event of a failure, any losses over and above the cap are distributed among the surviving participants in accordance with the discretionary limits set by each participant.

The framework of bilateral and multilateral limits therefore makes participants accountable and limits the system's exposure to financial risks.

If the liquidity pool has to be used for reasons other than a participant's bankruptcy, then the participant that made such use necessary (because it experienced technical problems, for example) is responsible for topping up the liquidity pool.

2.2.2. Risk management mechanisms for CHIPS

As a precaution against risk, every day before operations commence CHIPS requires participants to deposit a pre-established funding amount in a specific deposit account held at the Federal Reserve Bank of New York for the joint benefit of all CHIPS participants. This arrangement is referred to as pre-funding. During its daily processing hours, CHIPS keeps all the payment orders that it has been unable to debit to the participant's account in a queue. A participant's net balance can never be in debit. Payment orders are final at the point when they are released from the queue. All CHIPS participants must have access to Fedwire to open their positions and close them at the end of the day. Participants must be subject to regulation by a US state, the Federal Reserve or the Office of the Comptroller of the Currency to ensure that they are monitored regularly. PaymentsCo, the operator of the CHIPS system, ascertains whether a future participant has the necessary liquidity to participate in CHIPS by looking at credit quality reports produced by recognised rating agencies and by assessing the potential participant's financial situation. For existing participants, PaymentsCo monitors the punctuality of their funding deposits and uses credit quality reports, if necessary, to identify any changes in their financial health that could affect their ability to finance their positions in CHIPS.

2.2.3. Risk management mechanisms for LVTS

Canada's large-value transfer system LVTS provides real-time finality and calculates each participant's net position (fund inflows minus outflows) in real time as payments are entered, even though the multilateral net positions are settled only at the end

18 The sum of the bilateral limits can be lower or higher than the maximum debit cap. When payments are entered in the system, they are therefore checked against both these limits.

of the day on the Bank of Canada's books. As it provides immediate finality, LVTS can be considered as a near equivalent to an RGTS system. Moreover, it limits the amount of collateral that banks have to post, relative to a traditional RGTS system: participants' exposure to intraday credit risk is partly covered by a collateral pool pledged by survivors and the Bank of Canada guarantees settlement in the unlikely event that more than one participant defaults during the same day and the sum of their net debit balances exceeds the amount of the securities pledged as collateral to the Bank of Canada.

LVTS thus benefits from collateral pledged to, and a guarantee provided by, the Bank of Canada:

- the net amount that a participating financial institution can owe is subject to bilateral and multilateral limits;
- participants deposit eligible collateral with the Bank of Canada, the value of which must be at least equal to the net debit cap authorised for them. The collateral pool is large enough to ensure that, should a participant default, sufficient funds could be made available for the system to settle;
- as explained above, if a participant defaults, the system first mobilises that participant's collateral (tranche 1), before using the other participants' tranche 2 collateral in accordance with the bilateral limit granted by them to the defaulting participant;
- the Bank of Canada guarantees settlement in the unlikely event that more than one participant defaults during a single LVTS processing day and the sum of their net debit balances exceeds the total amount of securities pledged as collateral to the central bank. In such cases, the Bank of Canada extends loans to the defaulting institutions to cover the portion of losses not covered by the securities pledged as collateral by the LVTS community. The Bank of Canada's guarantee is not applicable to tranche 1 payment streams, because these are fully collateralised by the issuing participants;
- the two-tier model provides protection against settlement risk for priority and systemically important payments (relating to monetary policy, securities systems, CLS, etc.). Tranche 1 is fully collateralised by participants. Moreover, within tranche 1 some payments are covered by reserved collateral transferred to the Bank of Canada. To be more specific, when using Canada's securities settlement system (CSDX), LVTS participants can make a specific type of payment (T1R) secured by reserved collateral (e.g. eligible securities purchased and pledged as collateral by the participant during the CDSX cycle).

3. The prospects for these "hybrid" payment systems

Large-value payment systems operating on a deferred net settlement (DNS) basis have remained in use despite the development of RTGS systems, which are more secure. They have addressed their lower level of security by establishing robust risk management frameworks that greatly reduce their financial risks. The longevity of these hybrid systems is linked to the specific environments in which they operate.

In the case of EURO1 and CHIPS, the fact that a large-value net settlement system for payments in a single currency using central bank money has continued to operate alongside an RTGS system can be explained by the "dual" structure of the large-value payment markets in these systems' monetary areas. The term "dual" structure refers to the co-existence of two systems in a market, where one is operated by a public institution and the other by a private entity. The environments in which EURO1 and CHIPS operate also have a number of similarities.

Banks use EURO1 rather than TARGET2 for less urgent payments to save costs. In practice, participants in these systems weigh up the costs and urgency of their payments, together with their sensitivity, in order to decide which large-value payment system to use.

Consequently, the values of payments processed are much higher in RTGS than in DNS systems. This is the case in the euro area with TARGET2 and EURO1 and in the United States with Fedwire and CHIPS (see table 1).

In the euro area, the distribution of large-value payments between TARGET2 and EURO1 in terms of volume is relatively even, with TARGET2 processing around 60% of payments and EURO1 around 40%. In terms of value, however, TARGET2 handles 90% of the total amount of payments processed, versus just 10% for EURO1. This shows that for urgent and very large-value payments,[20] participants prefer the RTGS system, which has operating procedures better suited to these large transactions, especially in terms of liquidity management.

As regards LVTS, the system is set to evolve significantly in the coming years, culminating with its replacement in 2020 by its successor, Lynx.[21] Canada's new large-value payment system will operate in real time and provide payment finality. It will be based on a "cover all" credit risk management model, whereby each participant fully collateralises all their transactions. Consequently, the residual guarantee provided by the Bank of Canada in the LVTS system will no longer be required.

According to the Bank of Canada, Lynx will be a large-value payment system that complies with its standards for systemically important payment systems, which in turn are based on the Principles for Financial Market Infrastructures (PFMI, see Chapter 18).

T1 : Daily transactions in RTGS and DNS systems

	Average daily transactions (volume)	Average daily transactions (value)
TARGET2	250,000	EUR 1,330 billion
EURO1	150,000	EUR 117 billion
Fedwire	420,000	USD 2,028 billion
CHIPS	310,000	USD 1,077billion

Source: Bank for International Settlements (CPMI statistics).

20 Payments whose value exceeds the limits set in EURO1.

21 *https://modernization.payments.ca/the-plan/high-value-payments-system/*