

Foundations of FinTech

Payments



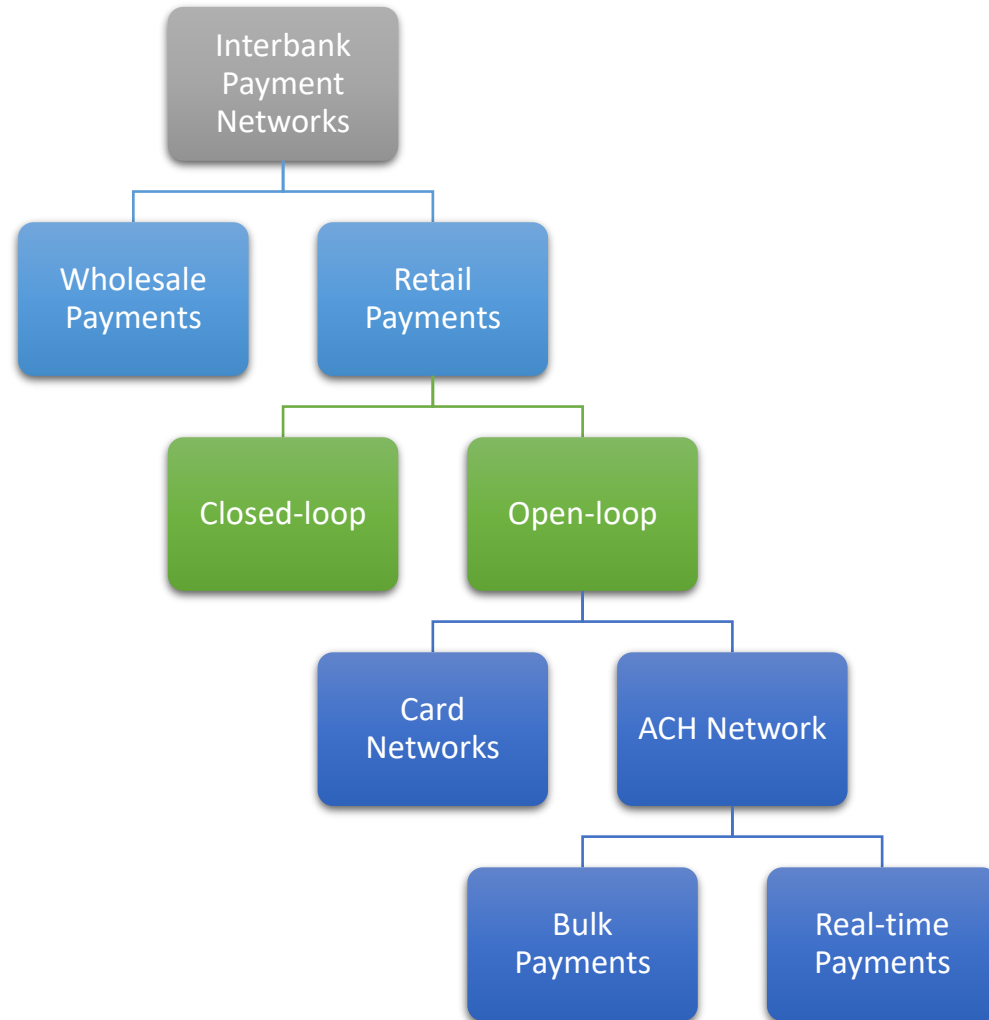
Eshwar Venugopal



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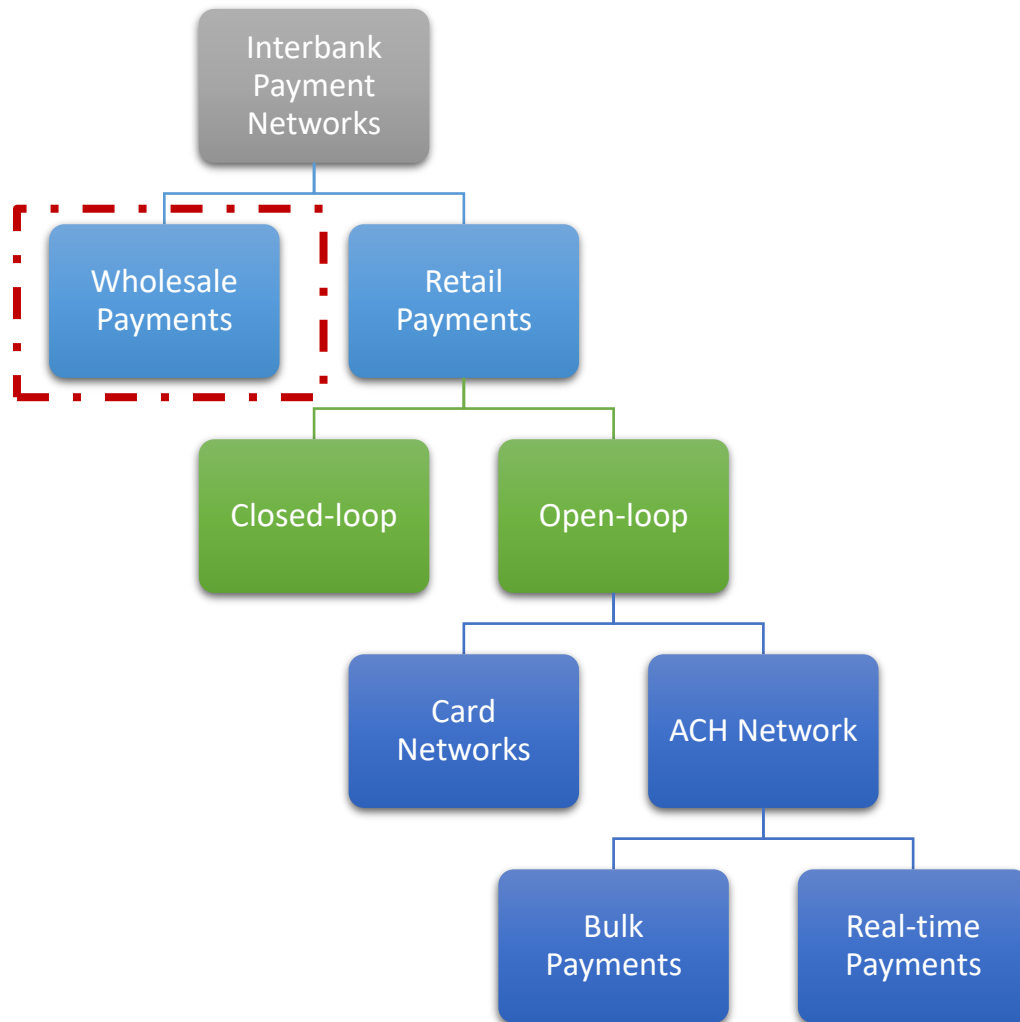
Overview of Payment Systems

Payment Systems



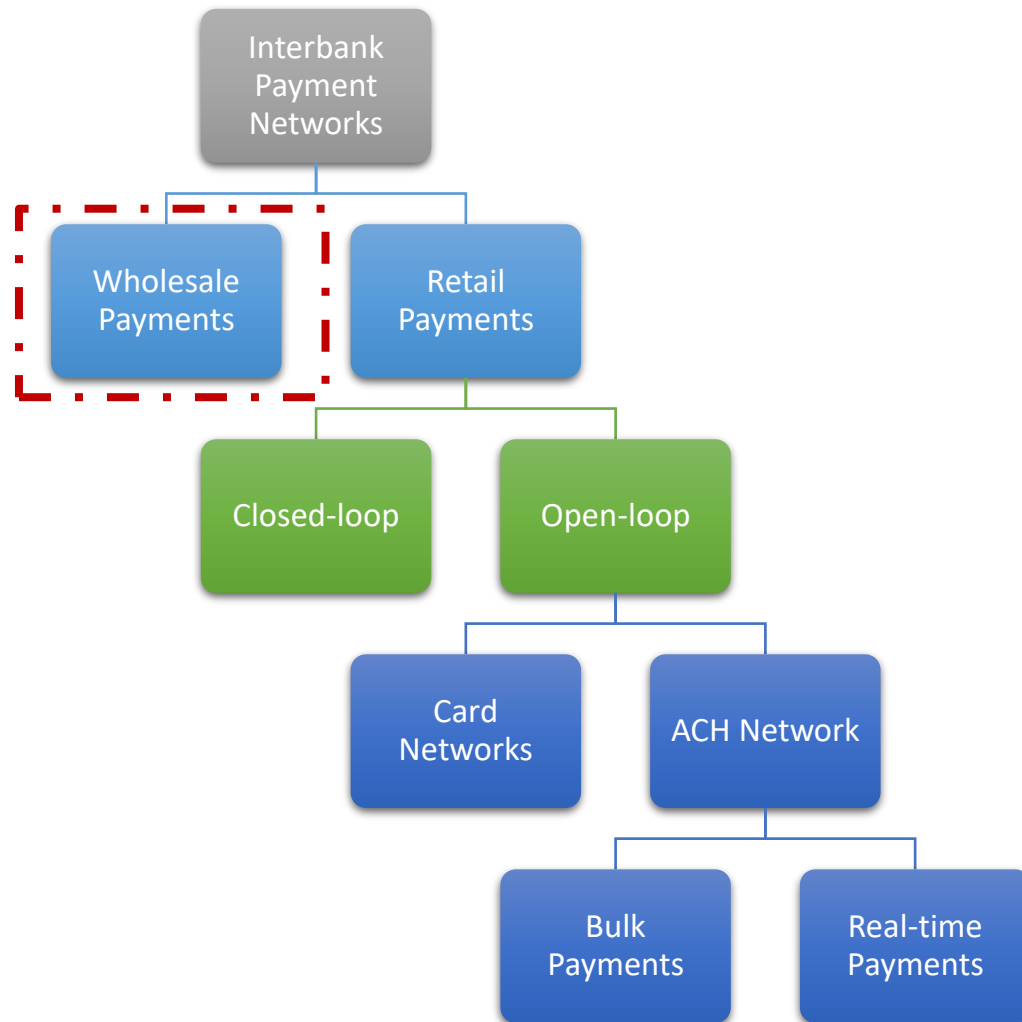
- Payment systems vary widely across countries.
- But they all share basic characteristics that help in making them moderately interoperable.
- Domestic interbank payment systems can be classified as: wholesale or retail

Payment Systems: Wholesale payments



- Wholesale payment systems, which **handle high value low volume transactions**. Hence the name *large-value payment systems*
- They are generally operated by central banks.
- They can be classified as:
 - **Real-Time Gross Settlement (RTGS)** system is used for settling funds between accounts on a per transaction basis in real-time.
 - **Deferred Net Settlement system** is used for settling funds between accounts at designated times of the day on a net basis.
 - Done by consolidating batch of transactions between accounts and instead of settling them individually, only the net positions are settled after offsetting the batches.

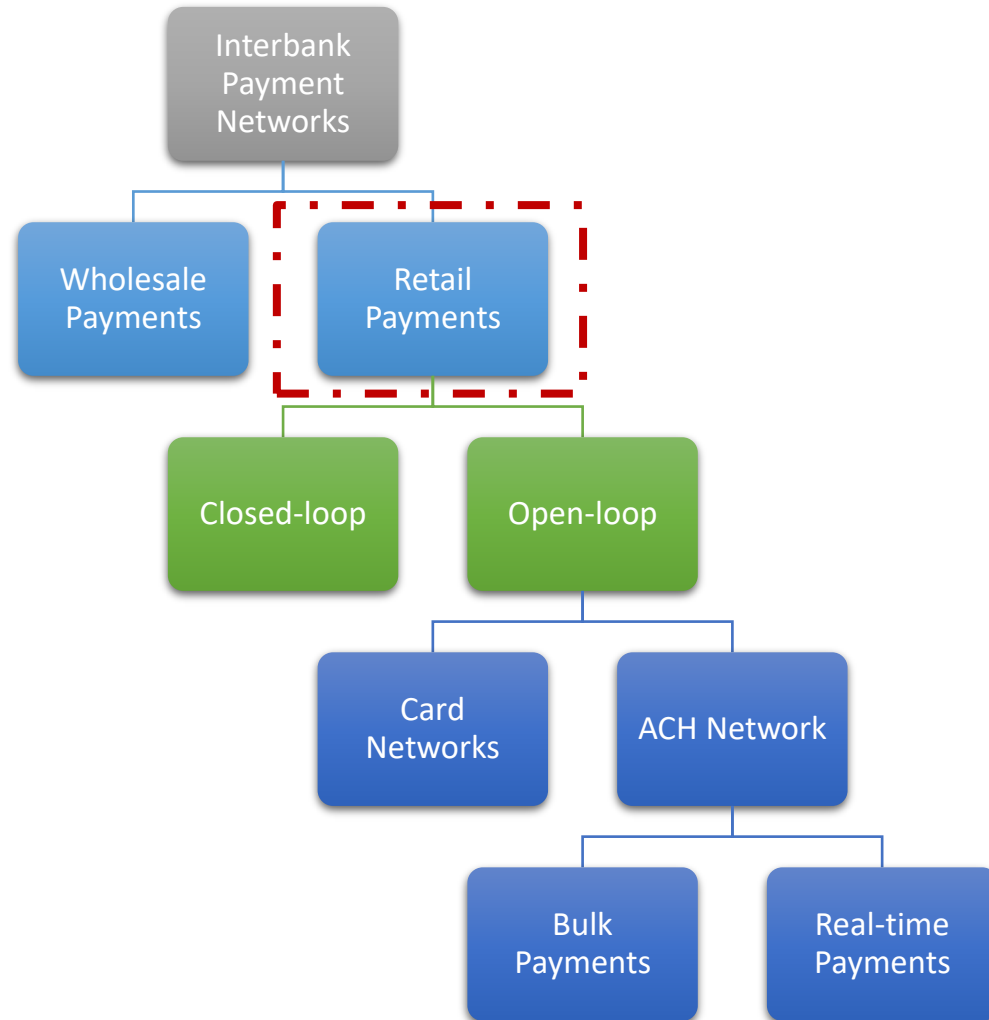
Payment Systems: Wholesale payments



- Wholesale payment systems are classified as **Systemically Important Payment Systems (SIPS)**, due to the large value of funds being routed through this network.
- Many countries maintain networks and infrastructure that are separate from the retail payment systems.
- Failure of this system can have serious implications for a country's real economy.
 - UK's RTGS called CHAPS processed 3.3 million payments worth 6.6 trillion GBP over 22 settlement processing days in September 2016 (CHAPS, 2016).
 - An average CHAPS transaction value is around 2.11 million GBP based on 2012 statistics.
 - When CHAPS suffered an outage in 2014 that impacted the processing of 142,759 transactions totaling 276 billion GBP (Deloitte, 2015).
 - The outage delayed 82% of housing transactions for the day and created downstream impact to international cross-currency settlements even though it lasted only 9 hours.

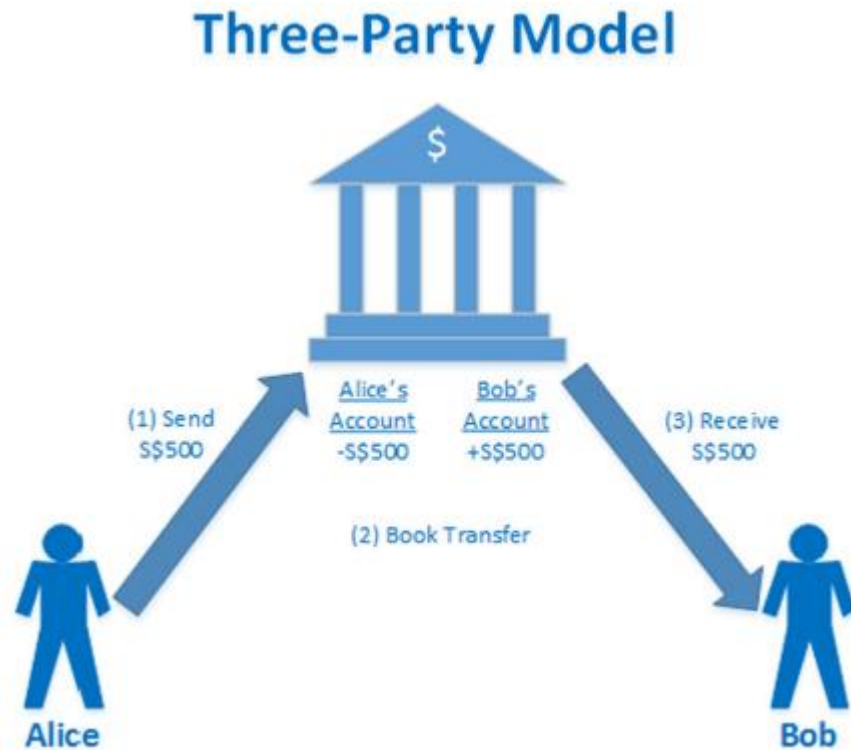
Source: Based on Bank of International Settlements Website

Payment Systems: Retail payments



- Retail payment or *low-value payment system* is a **low-value high volume system**.
- They are normally used for consumer payments
- They can be operated in a closed or open-loop

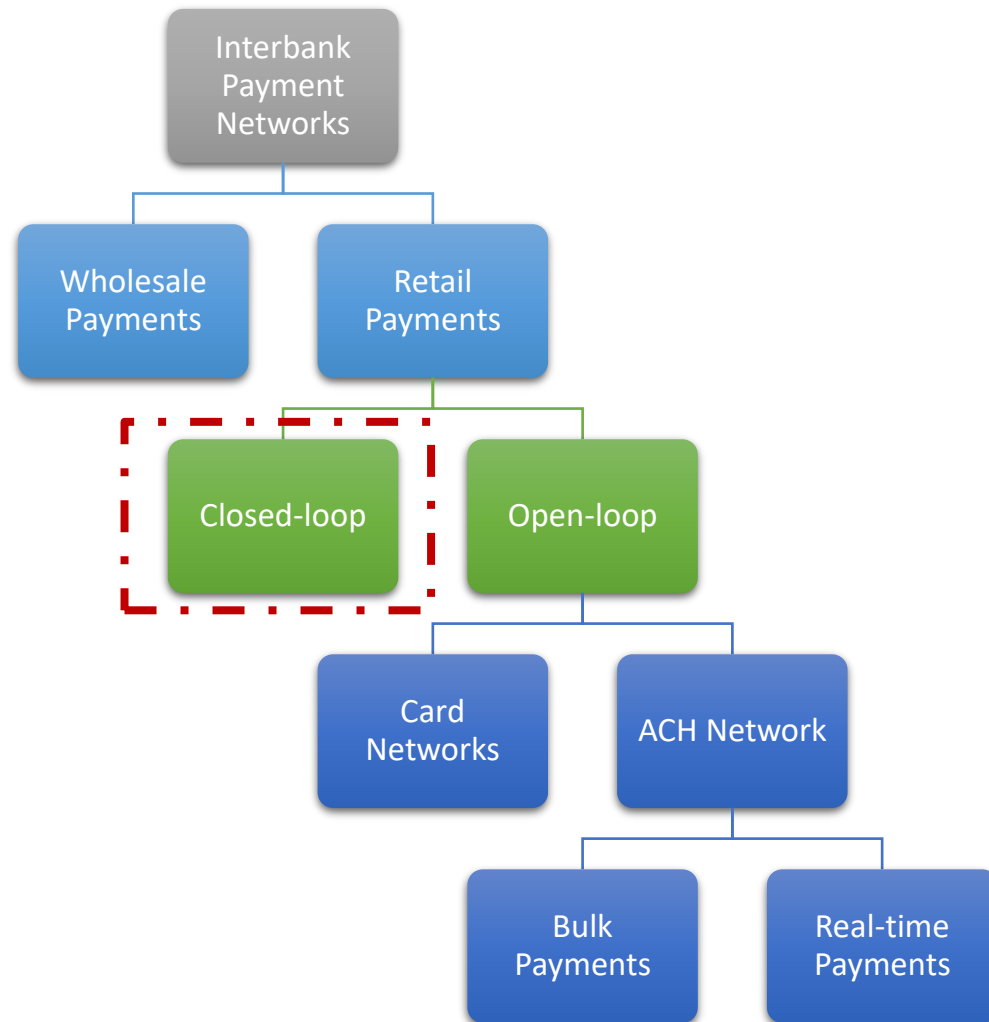
Payment Systems: Closed-loop



Source: Handbook of Blockchain, Digital Finance, and Inclusion, Volume 1

- A closed-loop system *requires both payer and payee to be on the same platform*, therefore it is also known as a **three-party payment system**.
- Settlement is achieved in one step via internal book-transfer as transactions are managed by one entity.
- Most closed-loop systems are operated end-to-end by non-bank entities.
 - However, non-bank entities are fast becoming open-loop systems integrating with bank's payment processes in the back-end.
- E.g., loyalty points, gift card and account balances on platforms.

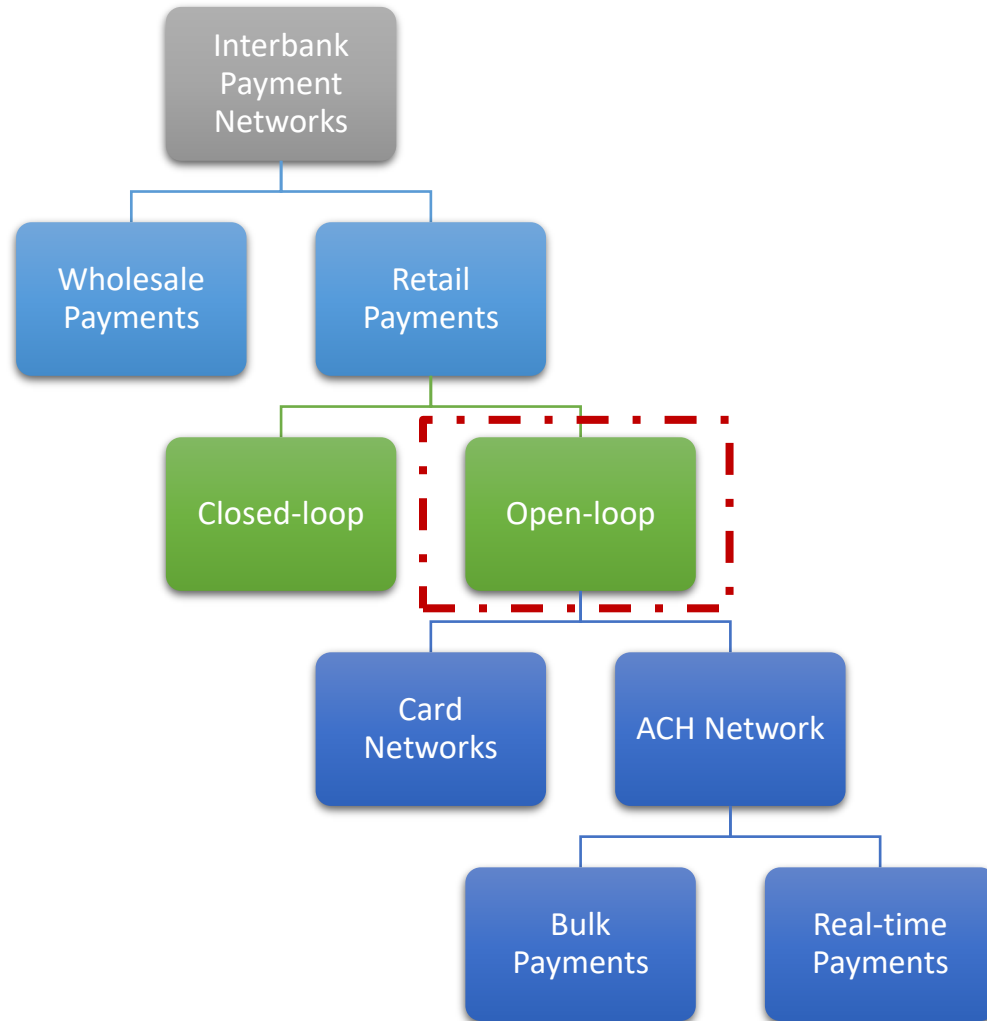
Payment Systems: Closed-loop



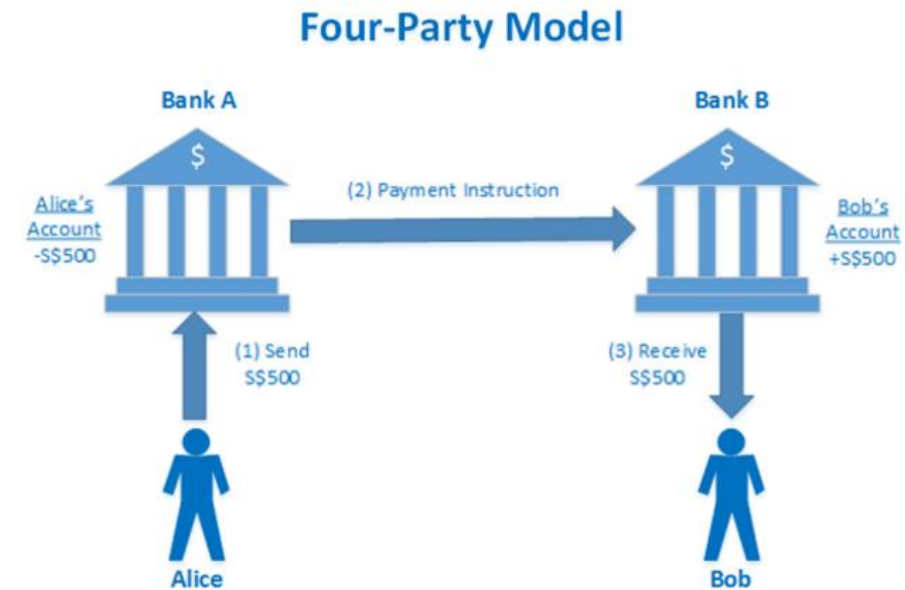
- Closed-loop system is a single vendor system that requires customers to deposit funds as a pre-payment for the goods and services offered by the vendor.
- The funds that are deposited usually exist in the form of electronic money that cannot be withdrawn as cash but can be transferred to customers of the same vendor.
- Such systems, *though cost-effective, are usually designed for a single purpose and in many cases unable to facilitate cross-platform purchases.*
- Octopus card in Hong Kong for example was originally created in 1997 for public transportation. It has since evolved into multi-purpose cash card with 24 million in circulation that can be used in convenient stores, restaurants and supermarkets supporting over 13 million transactions per day.
- In China, Tencent has successfully turned its messaging app “WeChat” into a multi-purpose mobile wallet. With 700 million active monthly users, WeChat Payment has the advantage of economy of scale and is estimated by Reuters to support \$556 billion transactions from P2P payments alone in 2016.
- M-PESA is a good example where cash is substituted with airtime transferred between mobile phones to facilitate remittance and mobile payments in Kenya.

Source: Based on Bank of International Settlements Website

Payment Systems: Open-loop

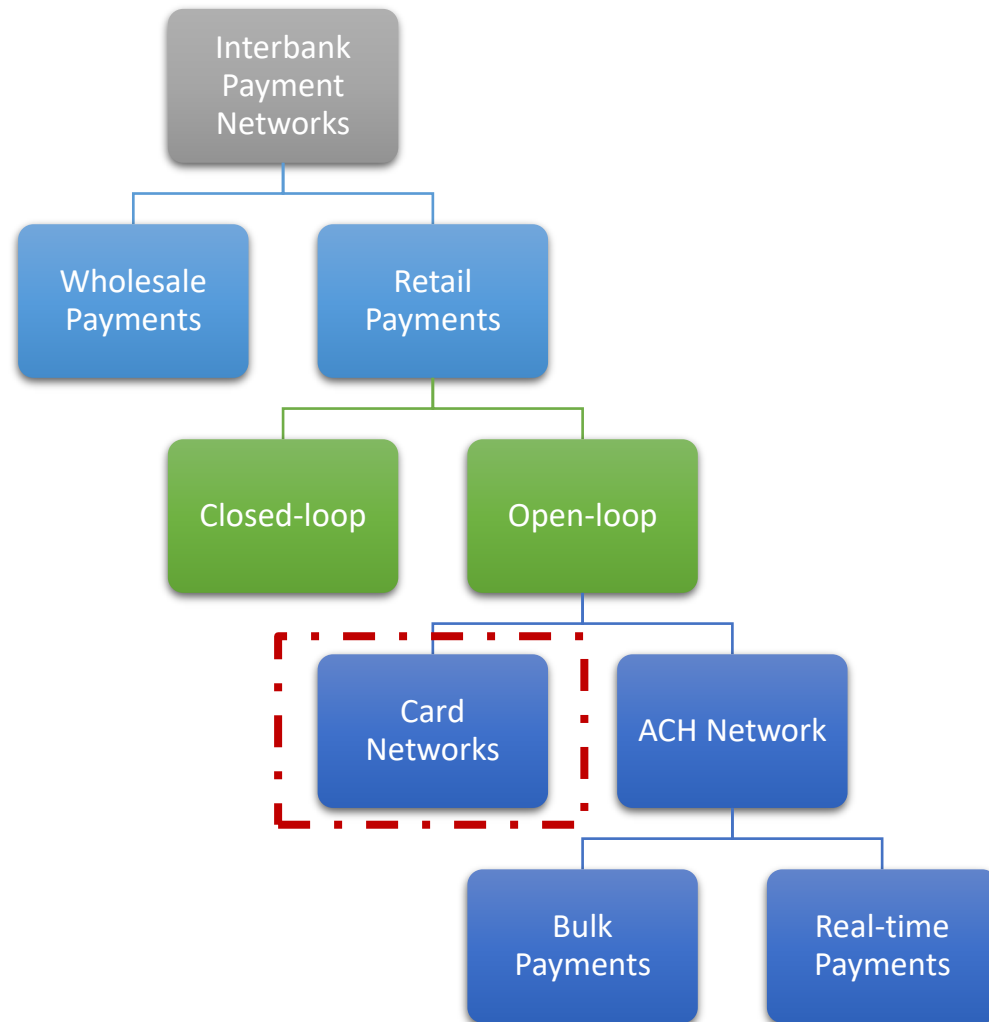


- Facilitates the transfer of funds *between a payer and payee belonging to different banks.* (Four party model)
- A trusted centralized third party is appointed by the banks and regulated by the financial authorities to be responsible for processing and coordinating the transactions.



Source: Based on Bank of International Settlements Website

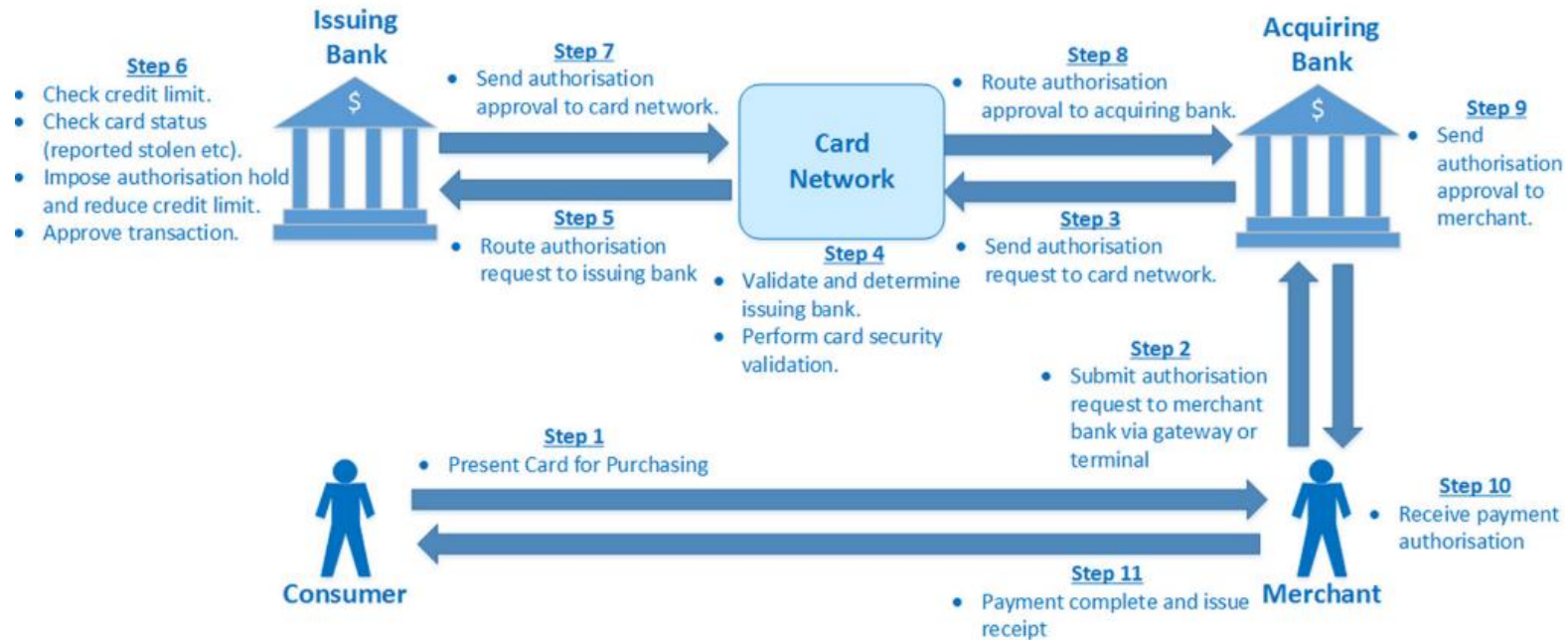
Payment Systems: Card Network



- Utilized for electronic fund transfer point-of-sale systems (EFTPOS) internationally.
- Originally designed for physical transactions where the card signature can be visually verified, or a PIN verification can be done
- A card payment involves three distinct steps:
 - Authorization
 - Clearing
 - Settlement

Source: Based on Bank of International Settlements Website

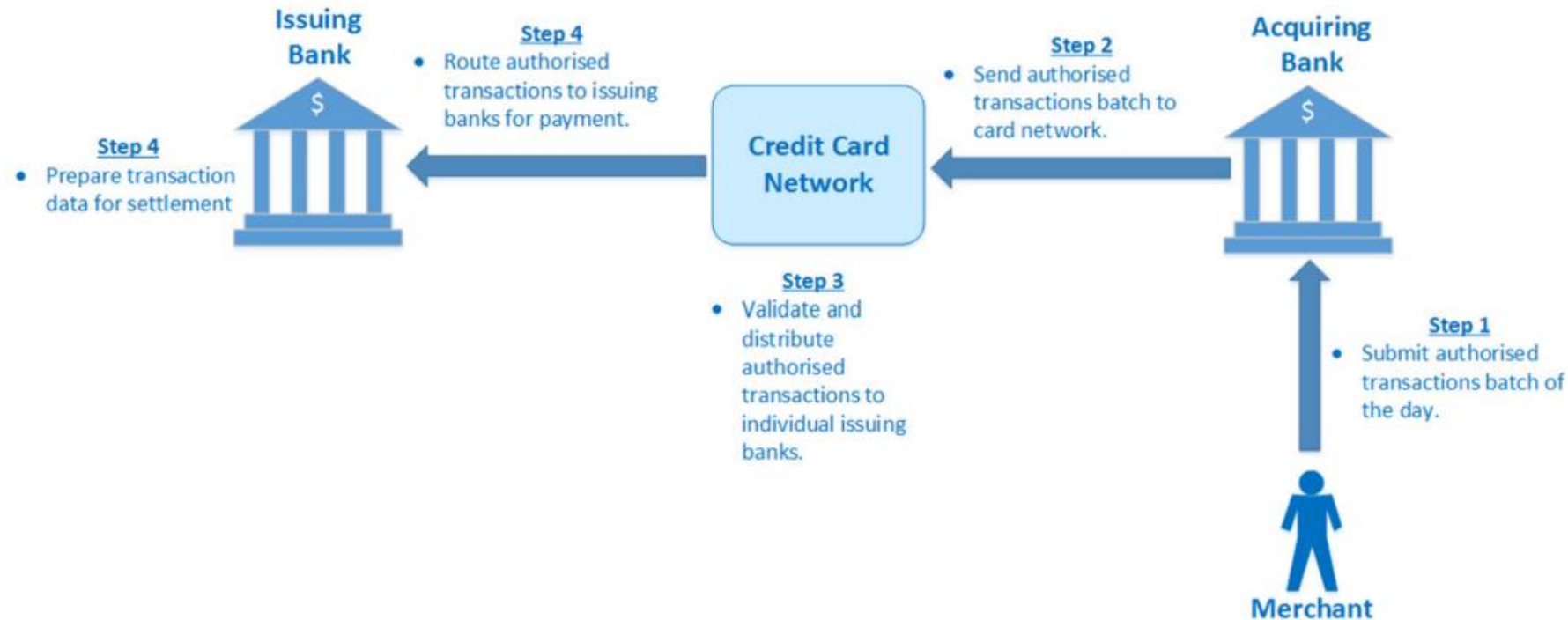
Payment Systems: Card Network



Source: Handbook of Blockchain, Digital Finance, and Inclusion, Volume 1

- **Card Payment Authorization** is the process whereby merchant is authorized by the card's issuing bank to accept payment using the card presented by consumer. This happens at the point of purchasing when the cardholder's card is swiped.
- Upon authorization approval, the payment amount is deducted from the card's credit limit (or bank account funds put on hold in debit card transaction) until clearing happens.
- This process may give the impression of payment being immediate but, in reality, fund is not transferred to the merchant yet

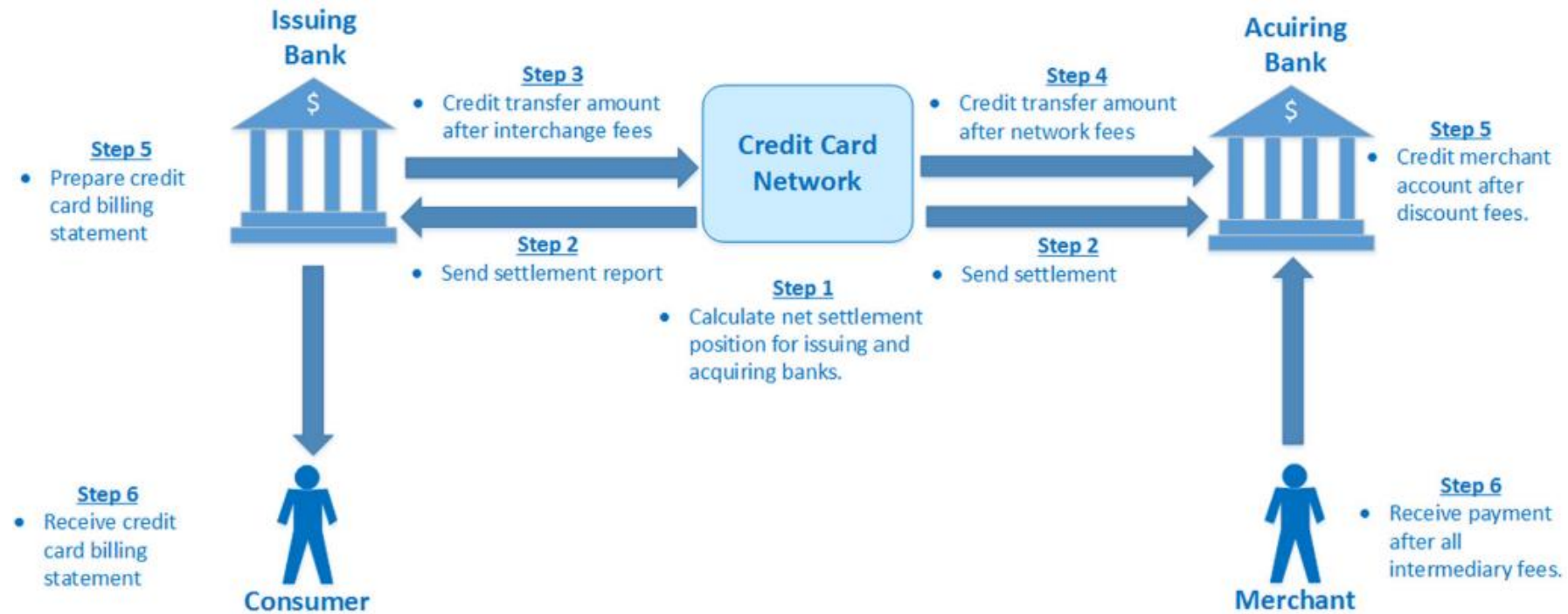
Payment Systems: Card Network



Source: Handbook of Blockchain, Digital Finance, and Inclusion, Volume 1

- **Card Clearing** is the process by which acquiring bank and issuing bank exchange transaction information, but funds are not actually transferred yet.
- This process works by all acquiring banks sending payment instructions to the credit card network in a batch and the credit card network distributing each transaction to each issuing banks for collection.

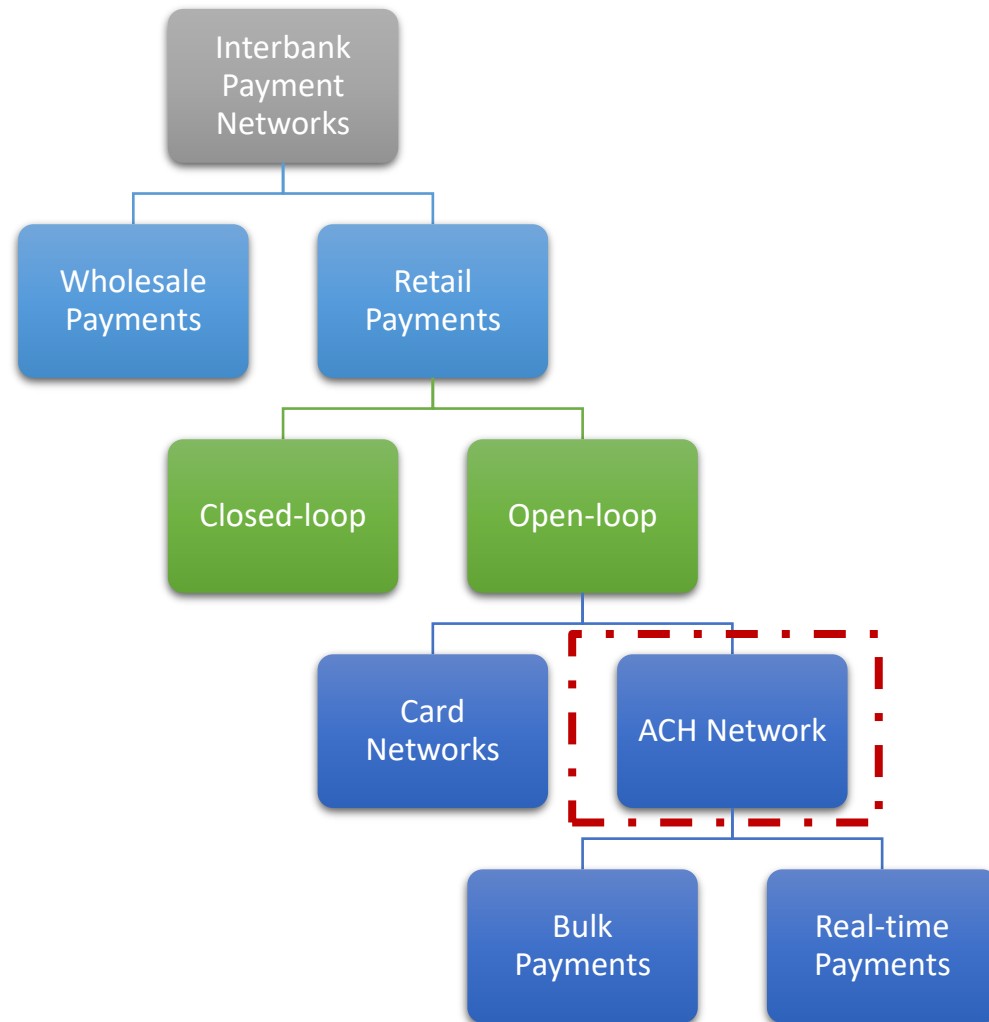
Payment Systems: Card Network



Source: Handbook of Blockchain, Digital Finance, and Inclusion, Volume 1

- **Card Settlement** is the process by which funds are actually transferred from the card issuing bank to the acquiring bank based on the net settlement position advised by the credit card network.
- Issuing bank will transfer the net settlement amount to the acquiring bank after deducting the interchange fees.
- Acquiring bank will then credit the received amount to the merchant's bank account after deducting the discount fee
- *Every intermediary from acquiring bank, to credit card network, to issuing bank takes a cut out of the merchant revenue which makes card transactions not suitable for use by merchants offering low margin purchases.*

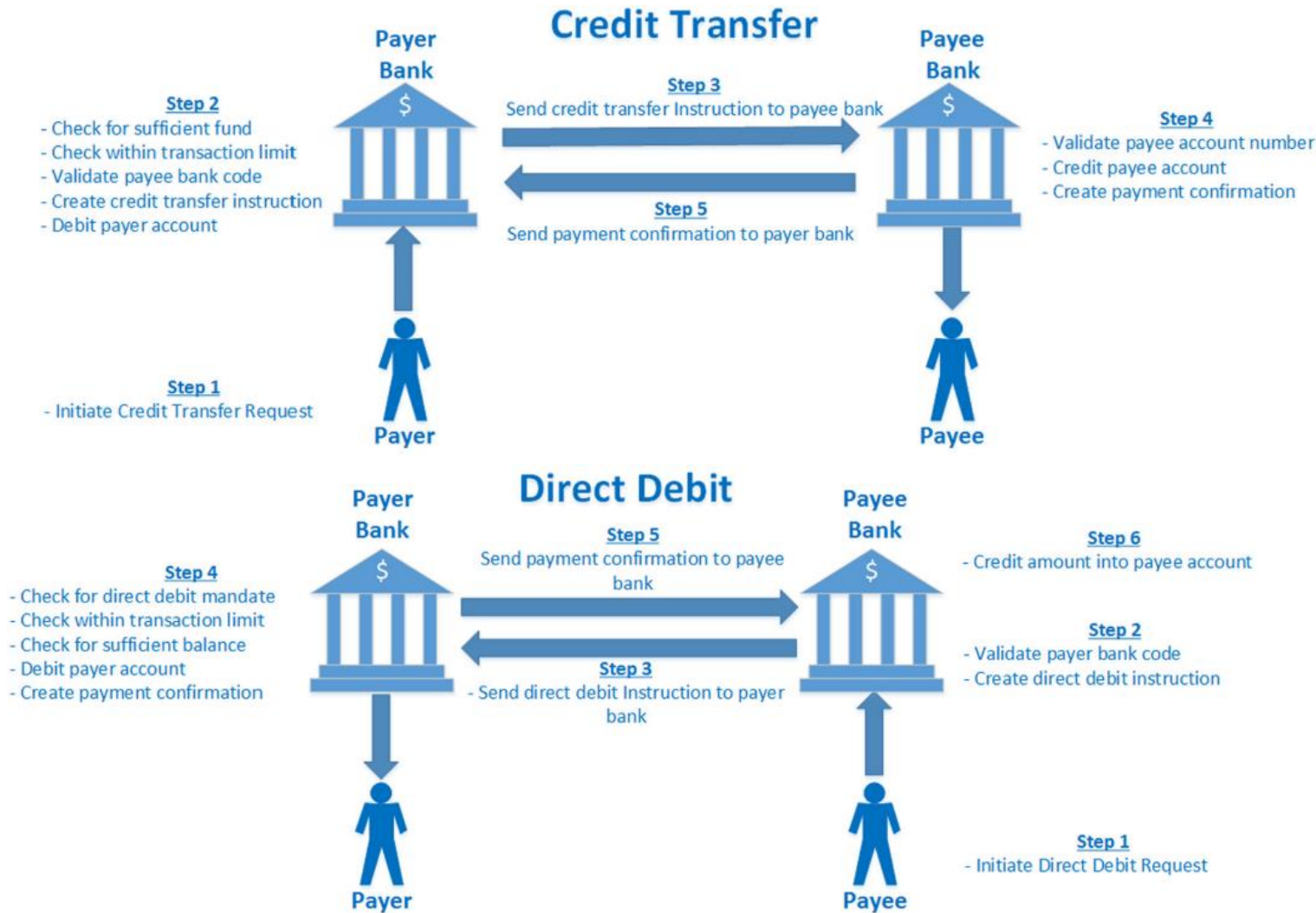
Payment Systems: Automated Clearing House (ACH)



- Facilitates domestic fund transfer directly between banks. Also called **Account-to-Account** or **A2A transfer**
- The original purpose of clearing houses is to *provide clearing services for paper checks between banks.*
- With the increasing use of paperless transactions, clearing houses have taken on the role of processing electronic payment instruments in general hence the term “automated.”
- **ACH payment networks are designed for batch processing only and are cheaper than card networks.**
- Like wholesale payments ACHs operate only during normal working days and since they process transactions in batches, payments can take days to settle, especially over weekends and public holidays.
- They can cater very well to scheduled batch payments use cases such as payrolls and bill payments.

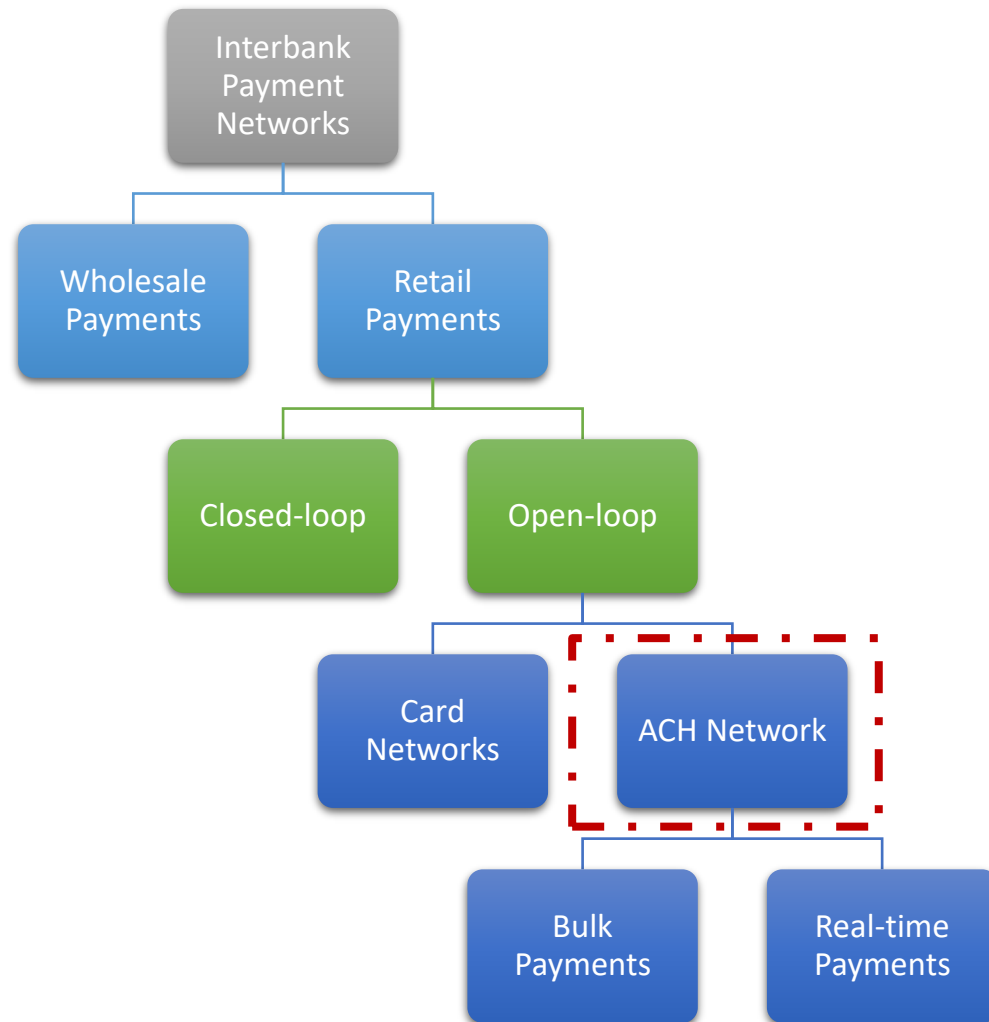
Source: Based on Bank of International Settlements Website

Payment Systems: Automated Clearing House (ACH)



- There are two types of payment instruments that are supported by ACH:
 - Credit transfer
 - Direct debit
- **Credit transfer** is a payment service that is originated by the payer of one bank to send money to a payee of a different bank
- **Direct debit** is a payment service that is originated by the payee of one bank to collect money from a payer of another bank

Payment Systems: Automated Clearing House (ACH)

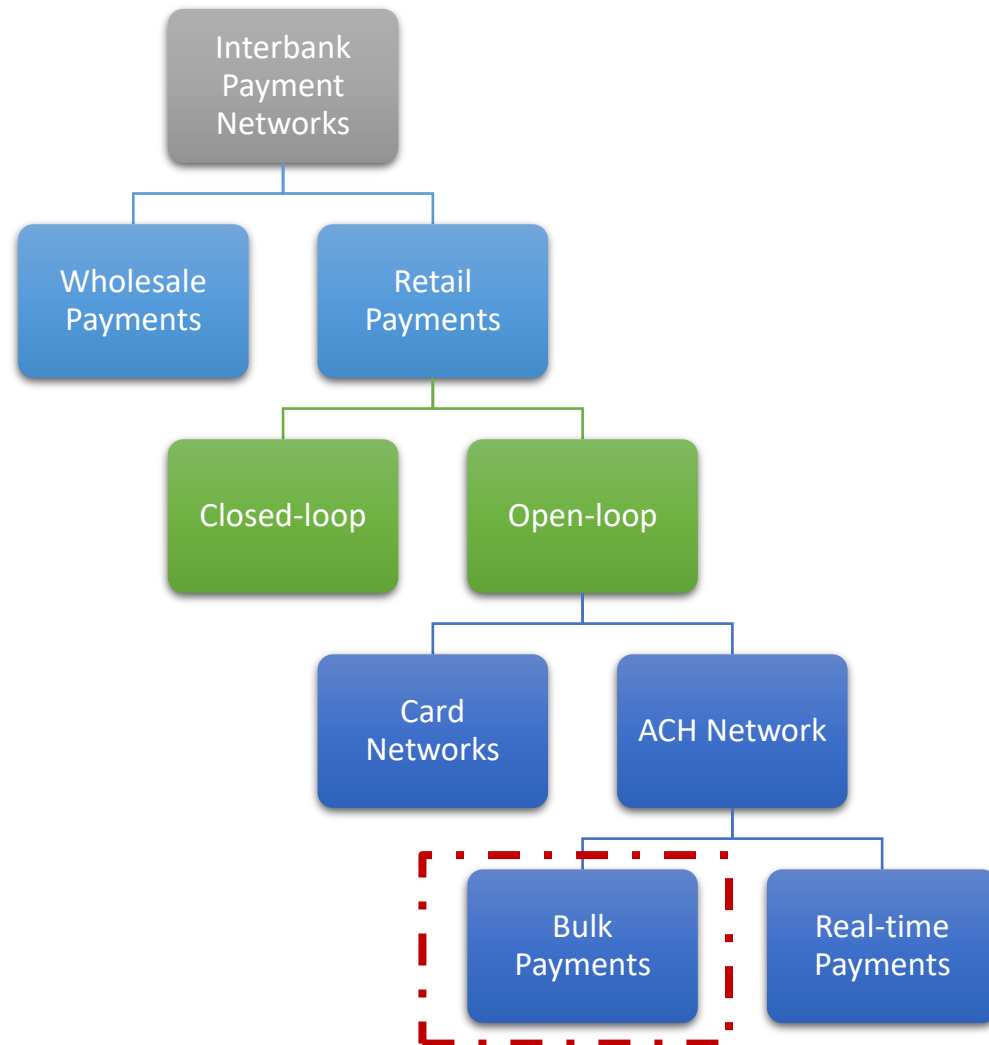


ACH Clearing

- ACH batch payment systems operate only during normal working day.
- A specific clearing window of the day known as the **outward clearing window** is open for banks to submit payment instructions from their account holders to the ACH for validation and processing.
- A different clearing window known as the **inward clearing window** is used by the clearing house to distribute the payment instructions to the receiving banks for processing payments to their account holders.

Source: Based on Bank of International Settlements Website

Payment Systems: Automated Clearing House (ACH)



Source: Based on Bank of International Settlements Website

Deferred Net Settlement (Bulk Payments):

- Settlement usually takes place *immediately after the outward clearing window* by submitting a batch settlement file to the central bank.
- Because the central bank also operates only during normal working days, file submission must take place before a cut-off time.
- Due to the high volume of transactions involved, settlement processing is usually performed on a deferred net settlement basis.
- The inward clearing window usually happens after the settlement for the following day.
- *That is why it can take more than one day for funds to be settled and sometime even longer over weekends and public holidays.*

ACH in the U.S.

- An *Originator*—an individual, a corporation, or another entity—initiates either a Direct Deposit or Direct Payment transaction using the ACH Network.
- The *Originating Depository Financial Institution* (ODFI) transmits an electronic ACH entry at the request of the Originator.
- The ODFI aggregates payments from customers and transmits them in batches at regular, predetermined intervals to an ACH Operator.
- ACH Operators (*two central clearing facilities: The Federal Reserve or The Clearing House*) receive batches of ACH entries from the ODFI.
- The transactions are sorted and made available to the *Receiving Depository Financial Institution* (RDFI). The Receiver's account is debited or credited by the RDFI. Individuals, businesses, and other entities can all be Receivers.
- *In September 2016, ACH committed to increasing batch processing frequency to twice and later to three times daily, accelerating a move towards same day settlement for many transactions.*
- Some of the lag can be attributed to the volume of transactions processed as well as the need for anti money laundering (AML), antifraud, fat-finger, and other risk checks to be performed. But some of the lag also is due to legacy systems and therein lies an opportunity for Fintech disruption to provide a more efficient solution.

PREPARING FOR SAME DAY ACH Phase 2 - ACH Debits

An RDFI Call to Action

Same Day ACH builds upon the ACH Network's existing next-day settlement functionality and provides a new option for same-day processing and settlement of ACH transactions. This creates a host of new opportunities for you, as well as obligations, as a Receiving Depository Financial Institution.

Same Day ACH Use Cases

Same Day ACH has numerous potential use cases that can benefit all consumers, businesses, government entities and financial institutions that use the ACH Network. Significant use cases can enable:

Expedited Bill Payments - customers to make one-time bill payments on due dates, and provide faster crediting for late payments

Business-to-Business Payments - faster settlement of invoice payments between trading partners with remittance information

Account-to-Account Transfers - faster movement of funds for customers who transfer money among various accounts they own

Collections - the ability to collect funds as soon as possible upon the customer's commitment to pay

For RDFIs, Same Day ACH can enable faster returns and Notifications of Change (NOCs), as well as the faster delivery of payment remittance information.

Same Day ACH Specifics

All RDFIs are required to receive Same Day ACH payments. Only International ACH Transactions (IATs) and single transactions over \$25,000 are excluded. Additionally, Corporate Receivers are obligated to post same-day entries and make funds available, as required.

Same-day returns are optional with Same Day ACH. RDFIs can choose to send returns same day, whether the forward entry was same day or not. Same-day returns can be sent up to 4 pm ET for settlement that afternoon.

	Phase 1 Sept. 2016	Phase 2 Sept. 2017	Phase 3 March 2018
Eligible Transaction Type	ACH Credits	ACH Credits and Debits	ACH Credits and Debits
Processing Deadline	10:30 am and 2:45 pm ET (4 pm for returns)	10:30 am and 2:45 pm ET (4 pm for returns)	10:30 am and 2:45 pm ET (4 pm for returns)
Settlement Time	1 pm and 5 pm ET	1 pm and 5 pm ET	1 pm and 5 pm ET
Funds Availability	End of RDFI processing day	End of RDFI processing day	5 pm RDFI local time



Learn more at www.nacha.org/same-day-ach

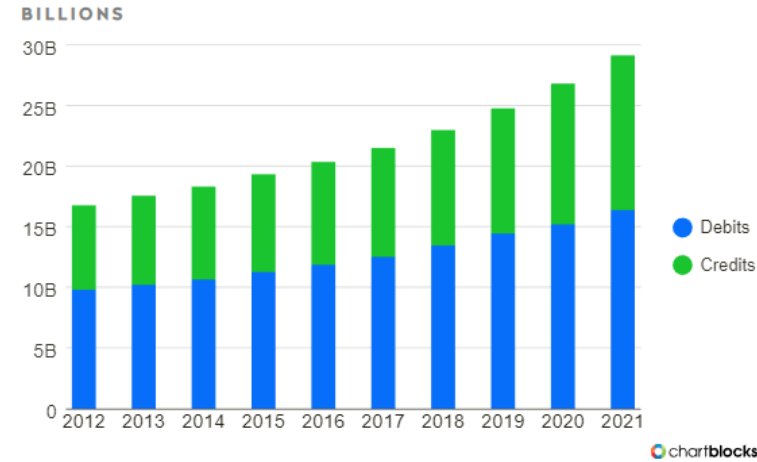
- 1 UNDERSTAND**
 schedules for mandatory receipt of same-day transactions
- 2 DETERMINE**
 how and when to post received same-day transactions and make funds available
- 3 REVIEW**
 corporate reports, treasury management, and online banking systems for Same Day ACH integration
 • Talk with corporates about requirement to post received same-day transactions to internal accounts effective with the same-day Settlement Date
- 4 CONSIDER**
 opportunities to accelerate returns
- 5 REQUEST SUPPORT**
 from operators, vendors and processors

ACH in the U.S.

- 2016: Same Day ACH introduced for Credit Payments.
- 2017: Same Day ACH enabled for Debit Payments.
- 2018: Faster Funds Availability for Same Day ACH Credits.
- 2019: Faster Funds Availability for certain Same Day ACH Credits and non-Same Day credits.
- 2020: The Same Day ACH Dollar Limit per Transaction increased from \$25,000 to \$100,000.
- 2021: Same Day ACH operating hours extended by 2 hours.
- 2022: Same Day Dollar Limit per Transaction increased from \$100,000 to \$1 million.

ACH Network Growth Since 2012

Payment Volume by Debits and Credits



YoY Growth:
Payments - 8.7%
Dollars - 17.4%

Total Payments:
29.11 billion

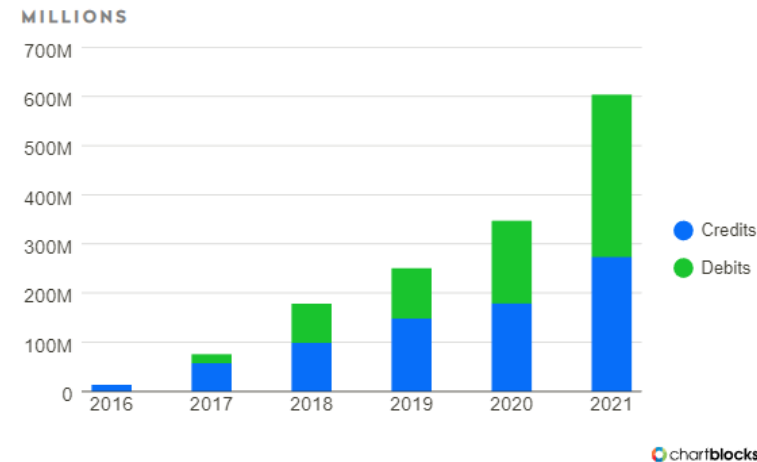
Debits:
16.37 billion

Credits:
12.74 billion

Total Dollars Transferred:
\$72.62 trillion

Rapid Growth of Same Day ACH Since Its Inception in 2016

Payment Volume of Same Day ACH



YoY Growth:
Payments - 73.9%
Dollars - 105.1%

Total Payments:
603.82 million

Debits:
330.75 million

Credits:
273.07 million

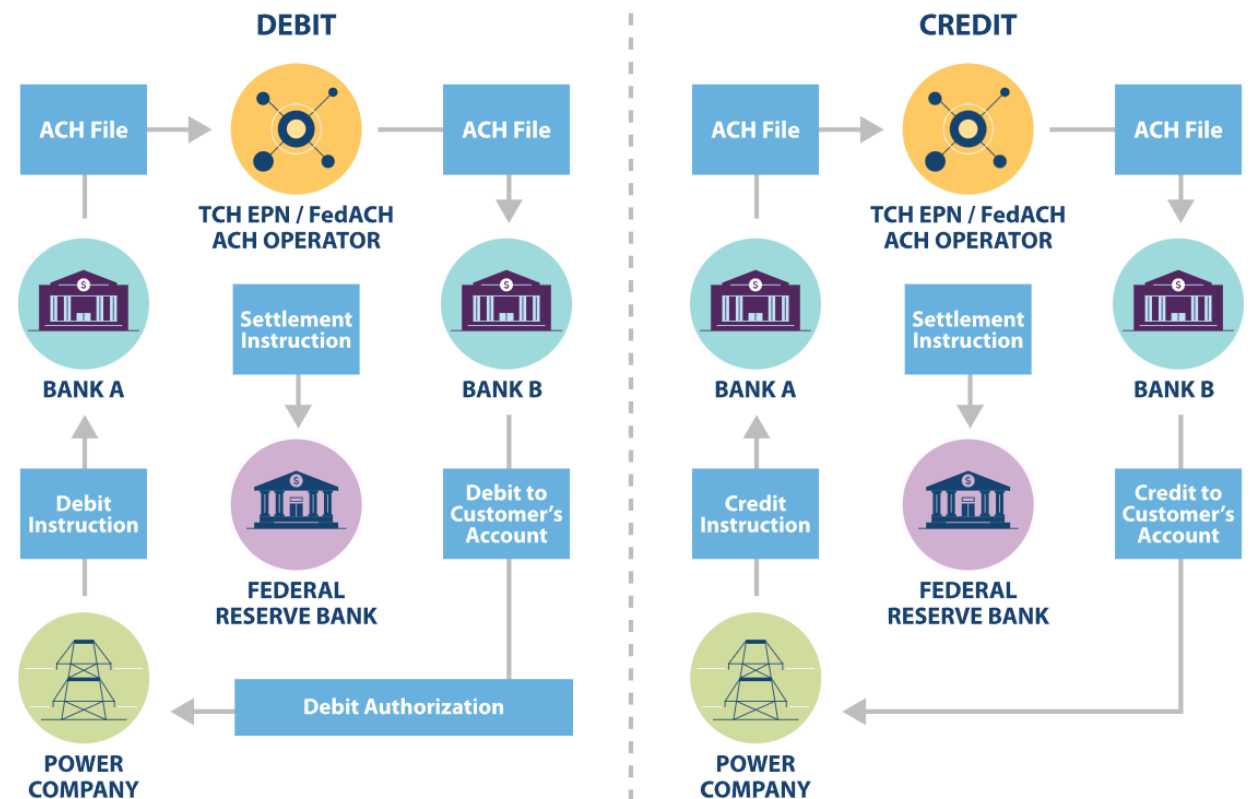
Total Dollars Transferred:
\$943.69 billion

Source: <https://www.nacha.org/content/ach-network-volume-and-value-statistics>

ACH in the U.S.

- The National Automated Clearinghouse Association (Nacha) sets the rules and regulations for ACH networks in the U.S.
- The Federal Reserve Bank's Automated Clearing House (FedACH) and The Clearing House's Electronic Payment Network (EPN) are the two national ACH operators.
 - FedACH and EPN rely on each other to process inter-operator ACH payments (settled by FedACH).

How ACH works:



Source: <https://www.theclearinghouse.org/payment-systems/ACH>

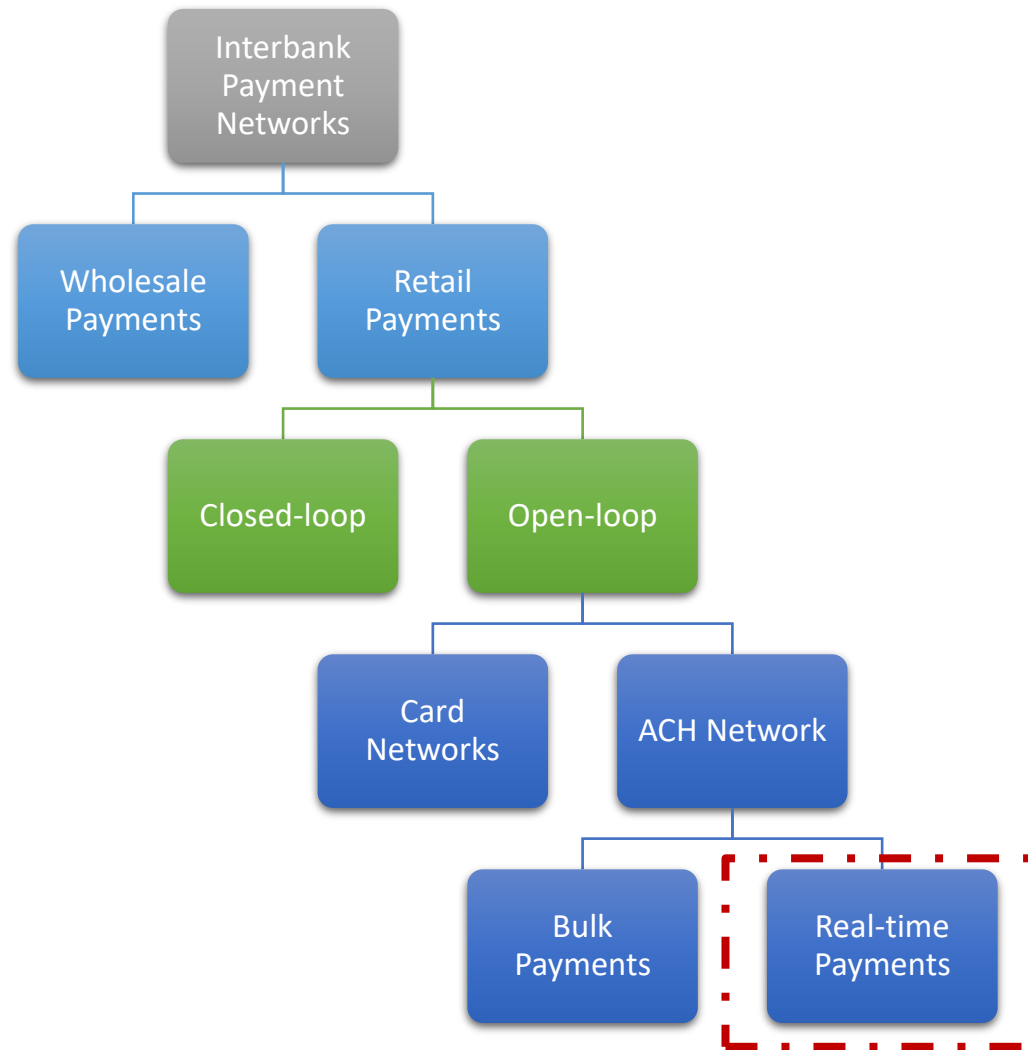
ACH in the U.S.

- ACH processing timelines as of September 2022 (Source: FedACH)

Outgoing Transaction Type	Cut-Off Time	Est. Settlement Time
Regular ACH	3:00 p.m. PST / 6:00 p.m. EST	1-2 business days
Same Day ACH	9:00 a.m. PST / 12:00 p.m. EST	Same business day
Domestic Wire	12:00 p.m. PST /	End of same business day if sent before cut-off
	3:00 p.m. EST	End of next business day if sent after cut-off
International Wire	N/A	Varies. Approximately 2-5 business days
Check sent by mail	3:00 p.m. PST / 6:00 p.m. EST	8-10 business days

See <https://www.frb services.org/resources/resource-centers/same-day-ach/fedach-services-settlement-tips.html> for more information on Same-day ACH.

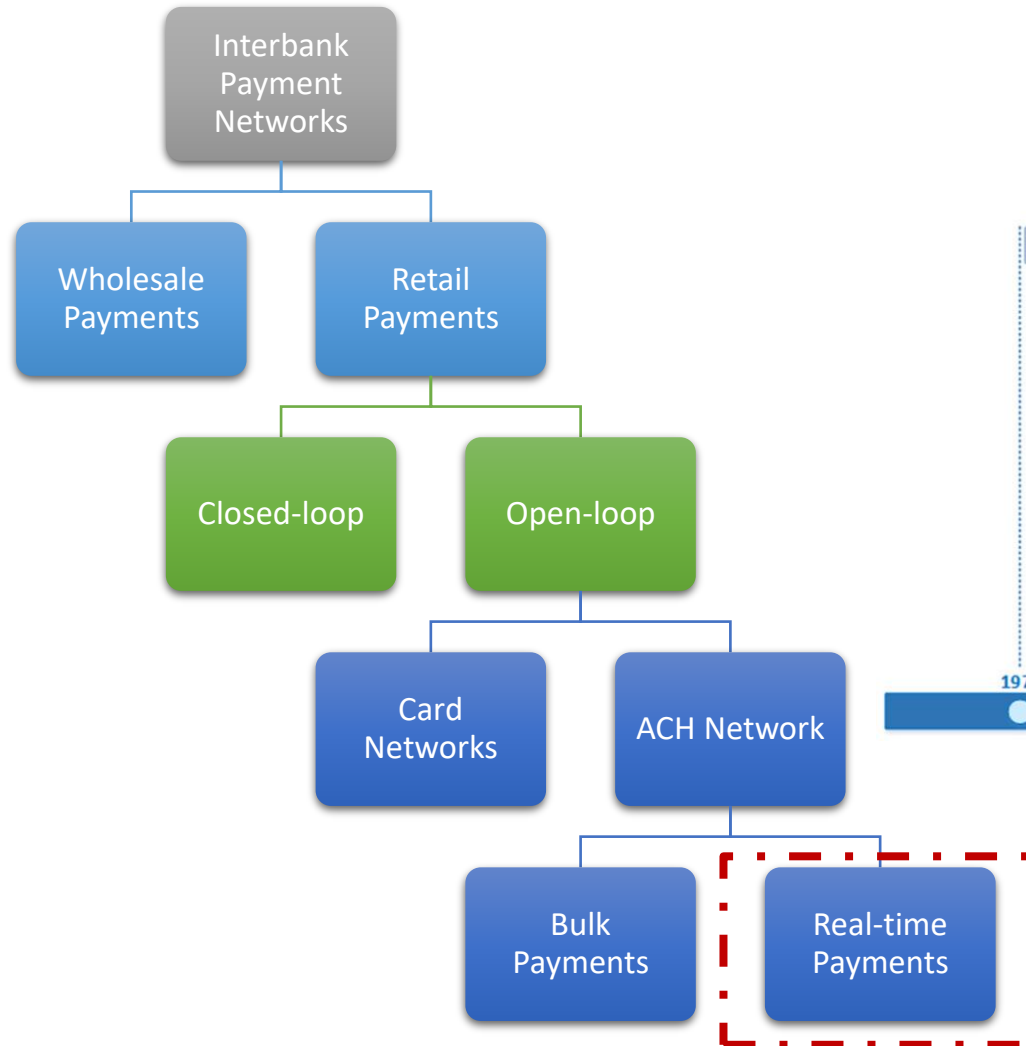
Payment Systems: Real-time Payment System (RTPS)



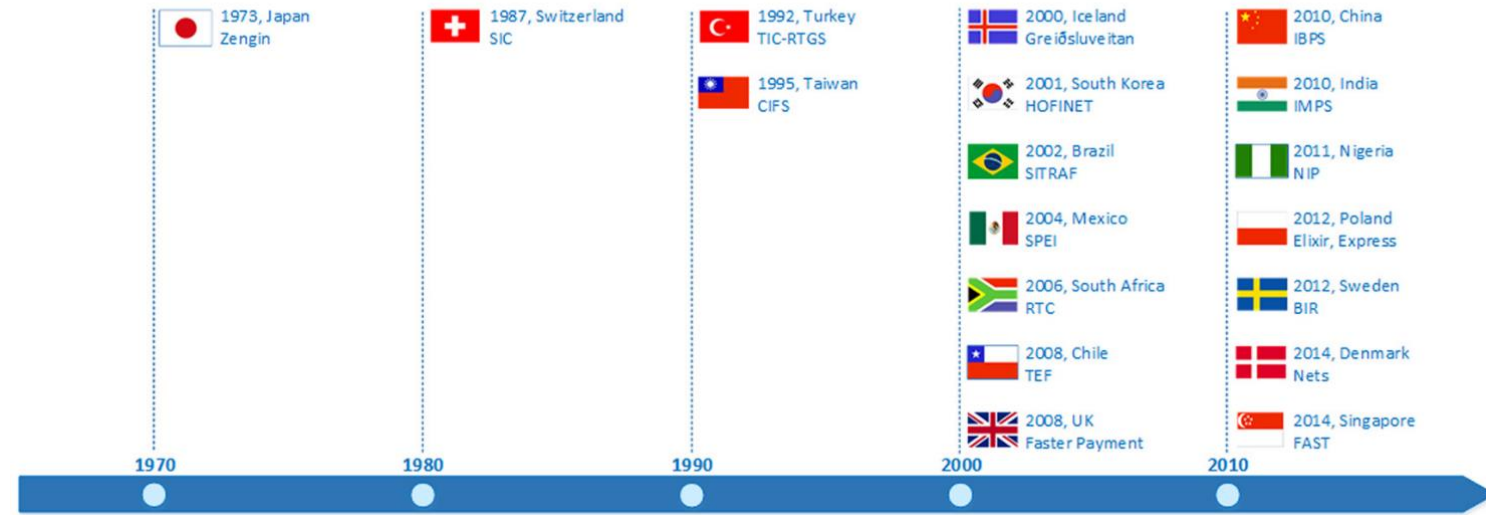
- RTPS started when Japan created the Zengin Systems in 1973.
- Recent years have seen a rise in RTPS implementations in various countries especially towards the end of 2010.
- This phenomenon is *largely attributed to consumers becoming accustomed to the high-speed and readily accessible information brought on by the mobile revolution.*
- With e-commerce and m-commerce purchases taking place in real-time, and in some countries where deliveries can be made on the same day, the expectations are for the banks and businesses to be able to provide services that can cater for faster payment needs anytime and anywhere.
- UK's Faster Payment System (FPS), established in 2008, handled more than 1 billion transactions worth over \$1 billion in 2014.

Source: Based on Bank of International Settlements Website

Payment Systems: Real-time Payment System (RTPS)



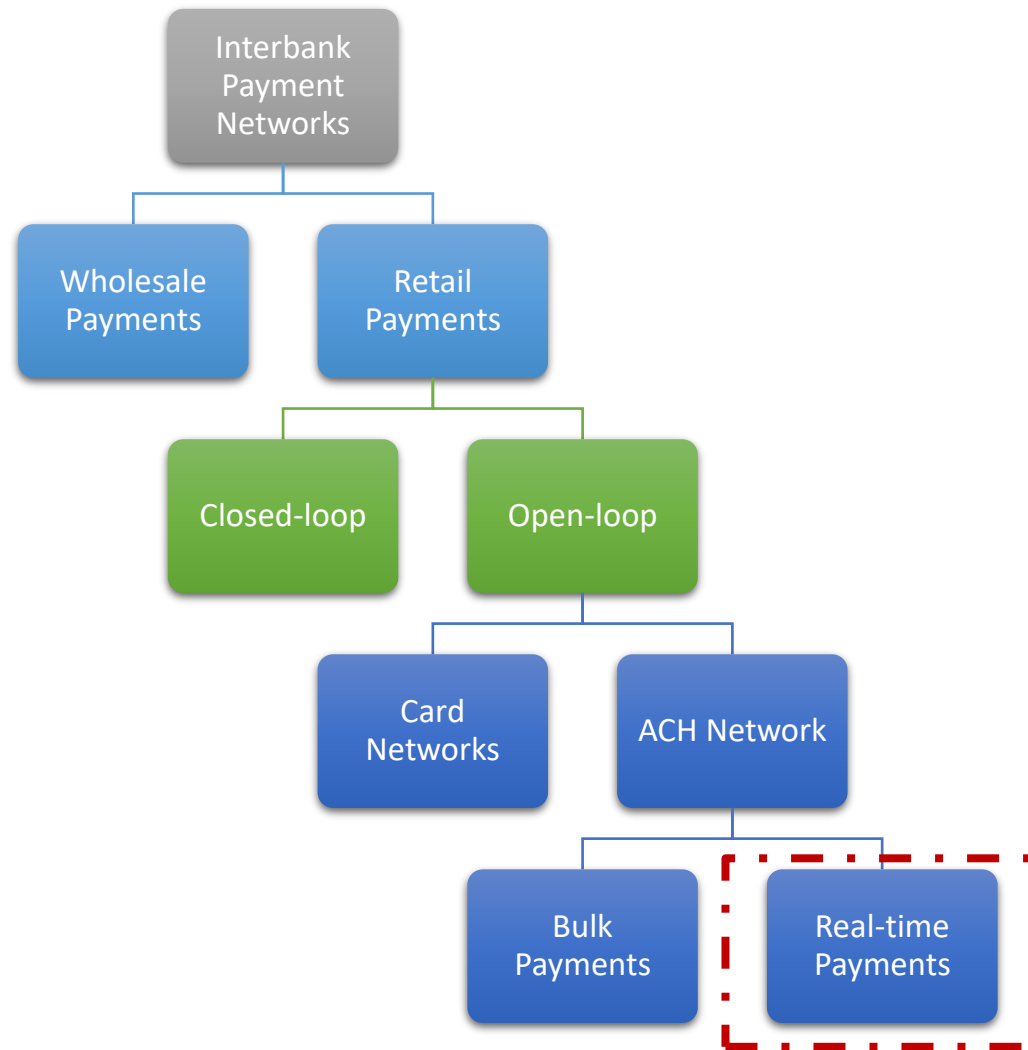
Real-Time Retail Payment Systems Timeline



- Most banks in the U.S. do not yet offer RTPS.
- Multiple batch processing in ACH became a reality only in 2018

Source: Based on Bank of International Settlements Website

Payment Systems: Real-time Payment System (RTPS)

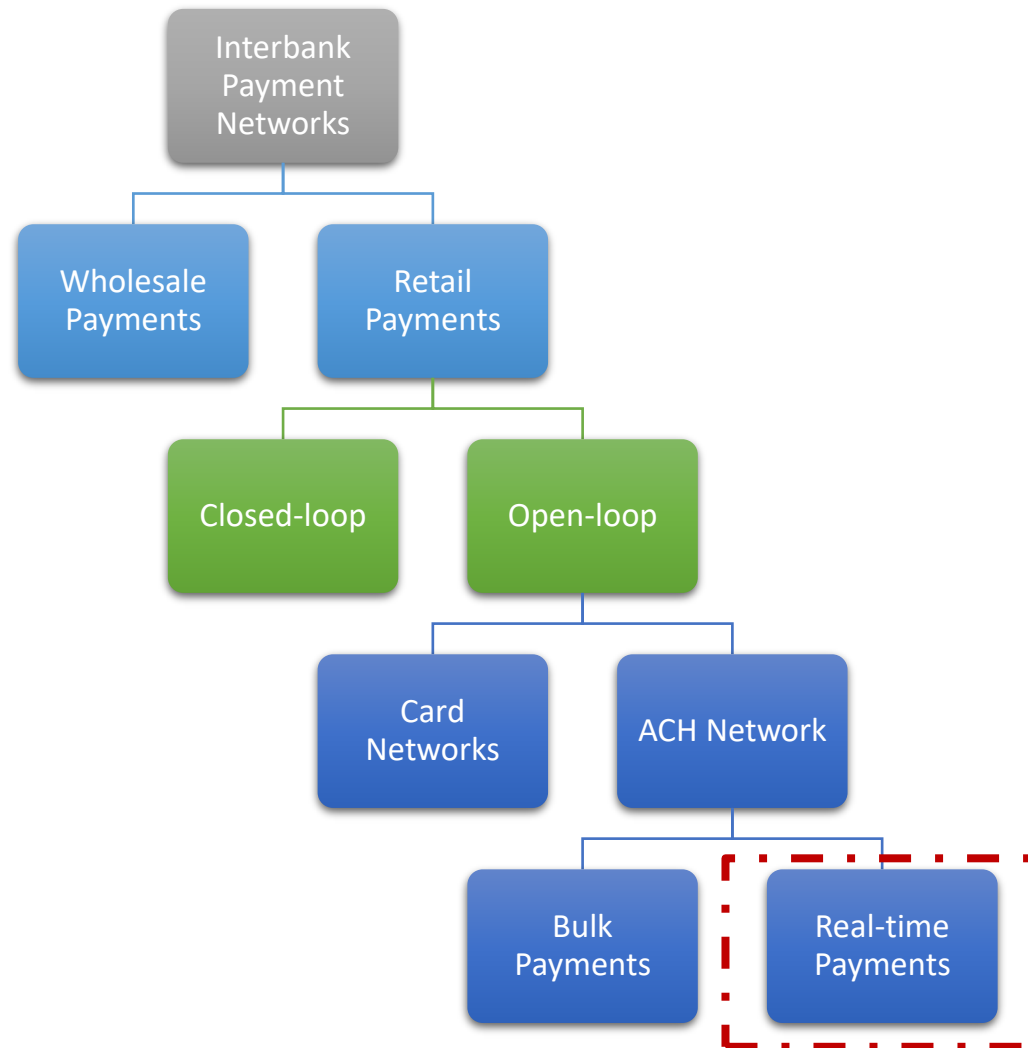


Source: Based on Bank of International Settlements Website

Regulator motivations for implementing RTPS

- **Adherence to their mandates:** Maintaining stability and efficiency of the financial system is part of the mandate given to the financial regulators and central banks. It is in the central banks' interest to foster payment innovation and competition in payment sector to improve overall payment effectiveness. In UK's Faster Payment, main driver for RTPS came from Office of Fair Trading to remove the float from regular fixed amount payments which can take as long as T + 3.
- **Financial Inclusion:** Kenya, Nigeria and India are examples of countries whose primary objective is to improve the financial inclusion situation through the use of RTPS.
- **Controlling high-inflation rate:** SITRAF was implemented by Brazil in 2002 to combat the hyperinflation problem (as high as 4000% in 1990) that has resulted in severe loss of confidence for the Brazilian Real. Implementing a real-time payment system is for the purpose of enabling payment as soon as possible avoiding the use of the slow paper check payment instrument to counter the effect of its sliding currency value.

Payment Systems: Real-time Payment System (RTPS)

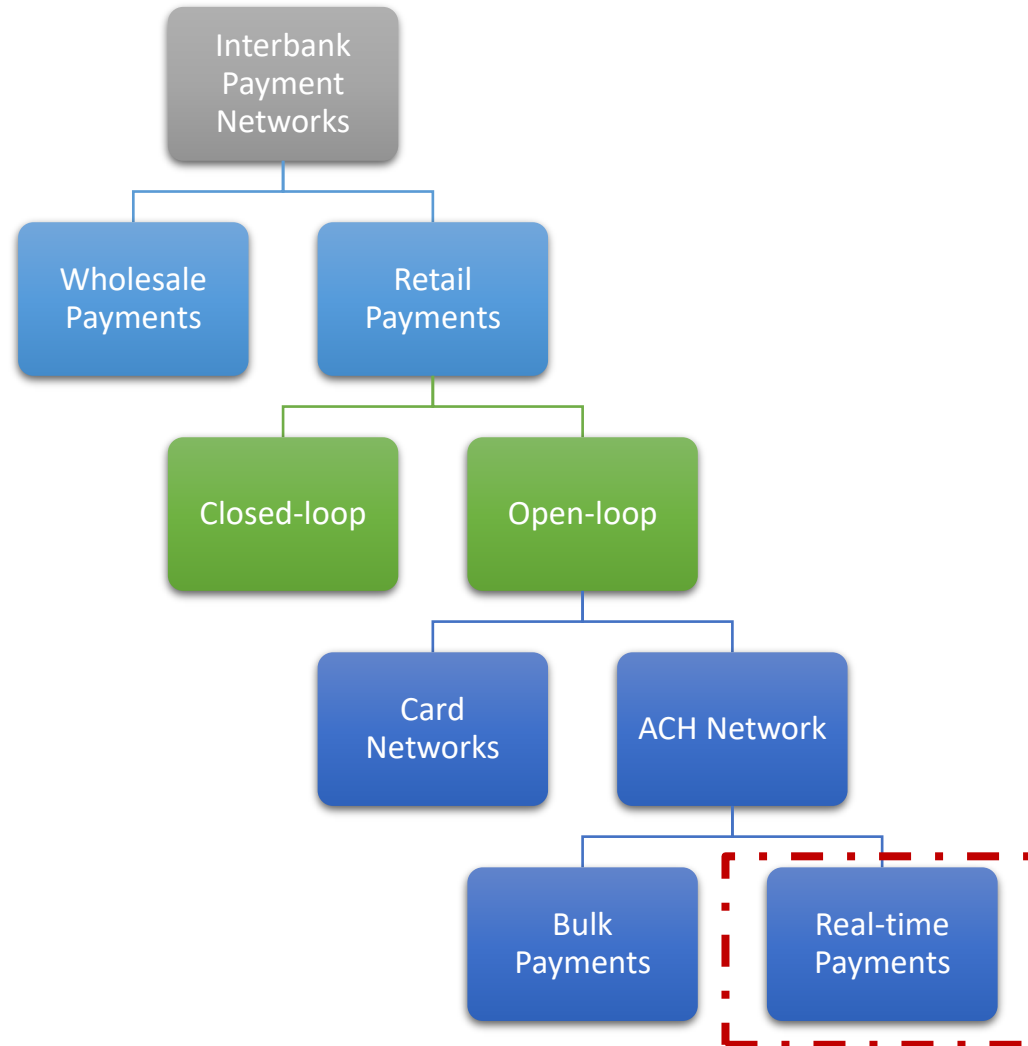


Regulator motivations for implementing RTPS

- **Improving Economy:** Faster payments can speed up cash conversion cycle, generate working capital, reduce short-term interest rate expenses. In the U.S., interest has been there since 2002 but it has only just commissioned a new RTPS in 2016 to be implemented by Vocalink, operator for UK's Faster Payment.
- **Digitization:** RTPS is also used as a motivation to drive down the use of cash and check payments which is a more costly and ineffective payment instrument. It is estimated that once a paper-based payment system is fully transitioned to electronic payment, a country can save more than 1% of its annual GDP.

Source: Based on Bank of International Settlements Website

Payment Systems: Real-time Payment System (RTPS)

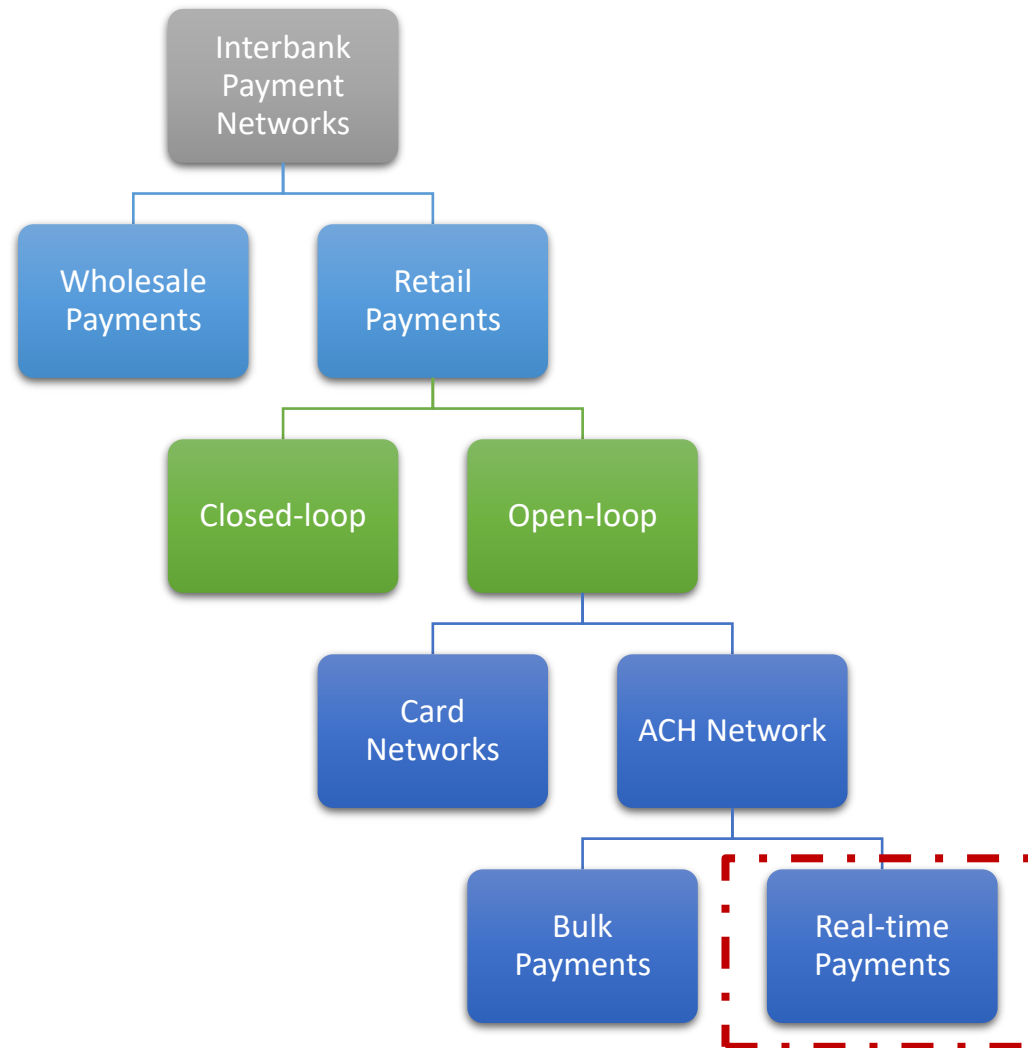


Consumer's perspective for implementing RTPS

- **Availability of funds:** Existing electronic payment methods usually imply a delay of at least one day. This becomes an issue for urgent payment needs. RTPS is available around the clock and can address urgency payment very well such as late payment of bills.
- **Proximity Person-to-Person payment:** There is no easier way to make payment to someone face-to-face apart from the use of cash. This problem can be solved electronically in consumer-to-business transactions through the use of EFTPOS.
- **Instant confirmation:** When a payment is made, payer will usually want to know if the payment is transferred successfully rather than waiting for the following day to receive a confirmation.

Source: Based on Bank of International Settlements Website

Payment Systems: Real-time Payment System (RTPS)

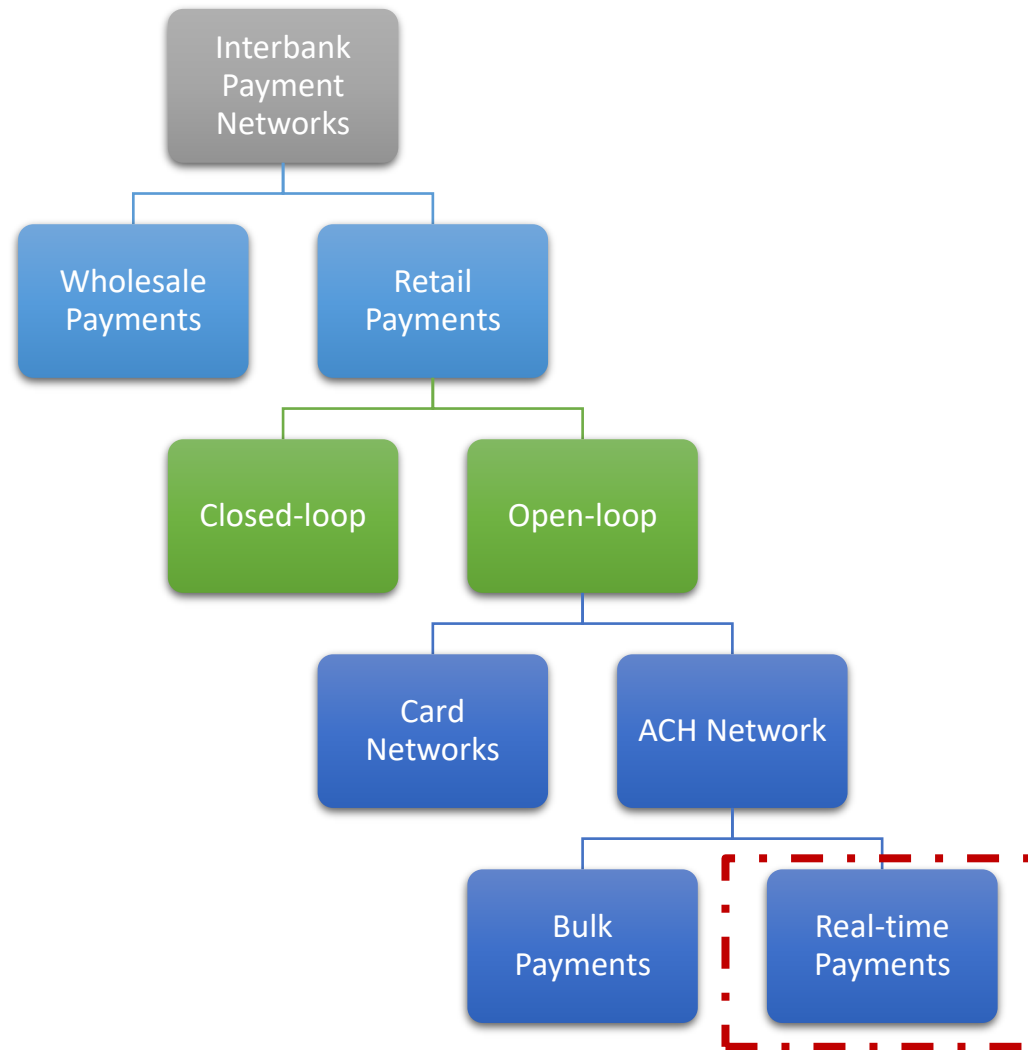


Merchant's perspective

- **Card is expensive:** The biggest issue with card payment is the card charges that merchants have to pay.
- **Availability of funds:** Being able to receive payment faster can improve the cash position of businesses and contributed to the economy overall.
- **Ability to support more payment information:** One of the advantages of paper check is the ability to carry additional payment information either as a separate attached paper document or additional account payment information written at the back of the check. This can help businesses improve payment reconciliation for handling of account receivables.

Source: Based on Bank of International Settlements Website

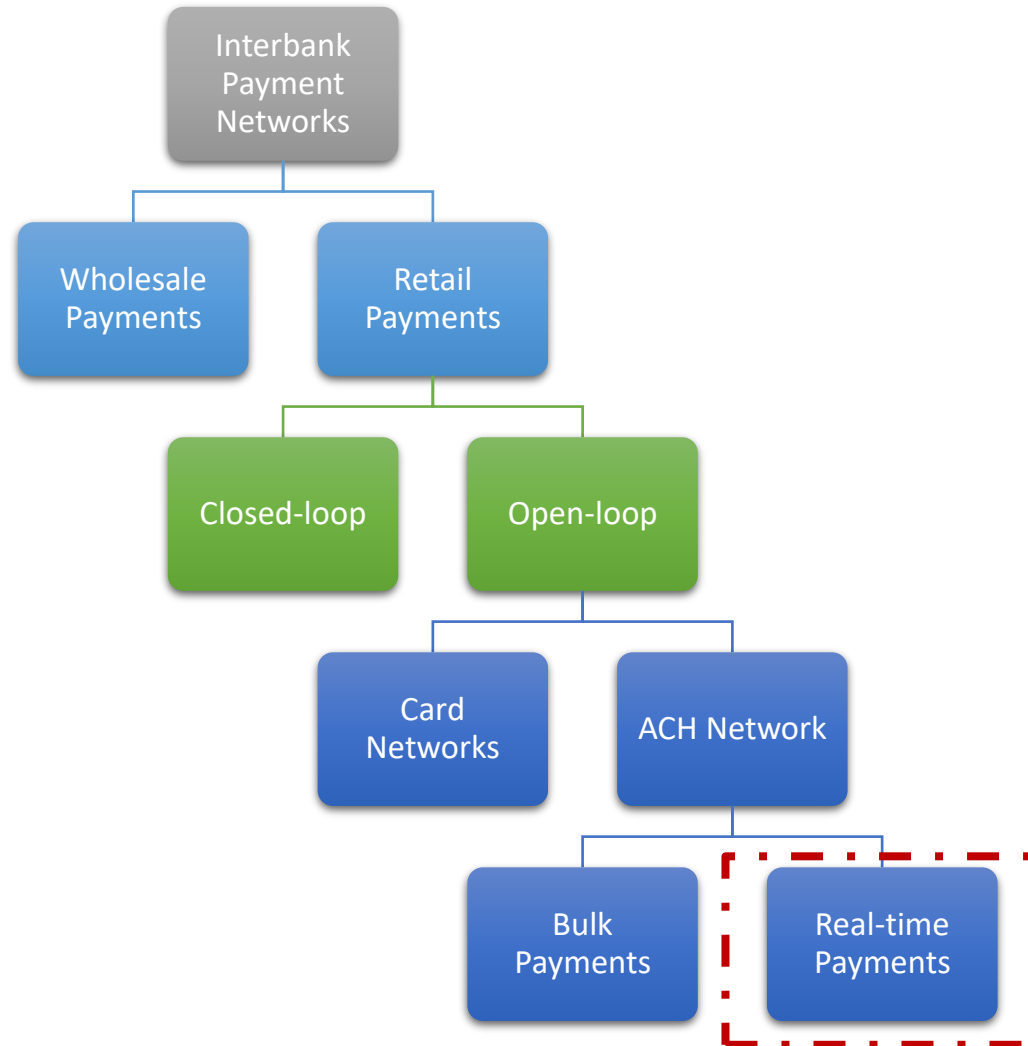
Payment Systems: Real-time Payment System (RTPS)



- The banking industry does not find RTPS a compelling business case because of its **potential to cannibalize existing revenue streams such as card and float revenue.**
- **High Implementation and Support Cost**
 - The cost depends on how entrenched and developed the countries' existing retail payment system is and therefore developed versus developing countries may face different cost issues
 - In developed markets, banks have lesser motivation to change. An established ACH network may already have been operating efficiently for some time. The whole industry including banks and ACH may have its processes and systems optimized for batch processing.
 - In emerging markets, banks may be more receptive to change. A mature payment infrastructure may not be in existence yet and banks do not have as high a sunk cost.
 - BIS has pointed out in their report (BIS, 2012), innovations in retail payments may represent only incremental improvements of established payment services whereas large leaps can occur in countries where payment infrastructure is underdeveloped.
 - According to Accenture's 2015 report, UK banks each spent close to \$300 million for Faster Payments Service access and more than \$1 billion for internal systems upgrade.
 - According to US Federal Reserve Bank and The Clearing House, implementing RTPS for US can cost about \$5 billion.

Source: Based on Bank of International Settlements Website

Payment Systems: Real-time Payment System (RTPS)

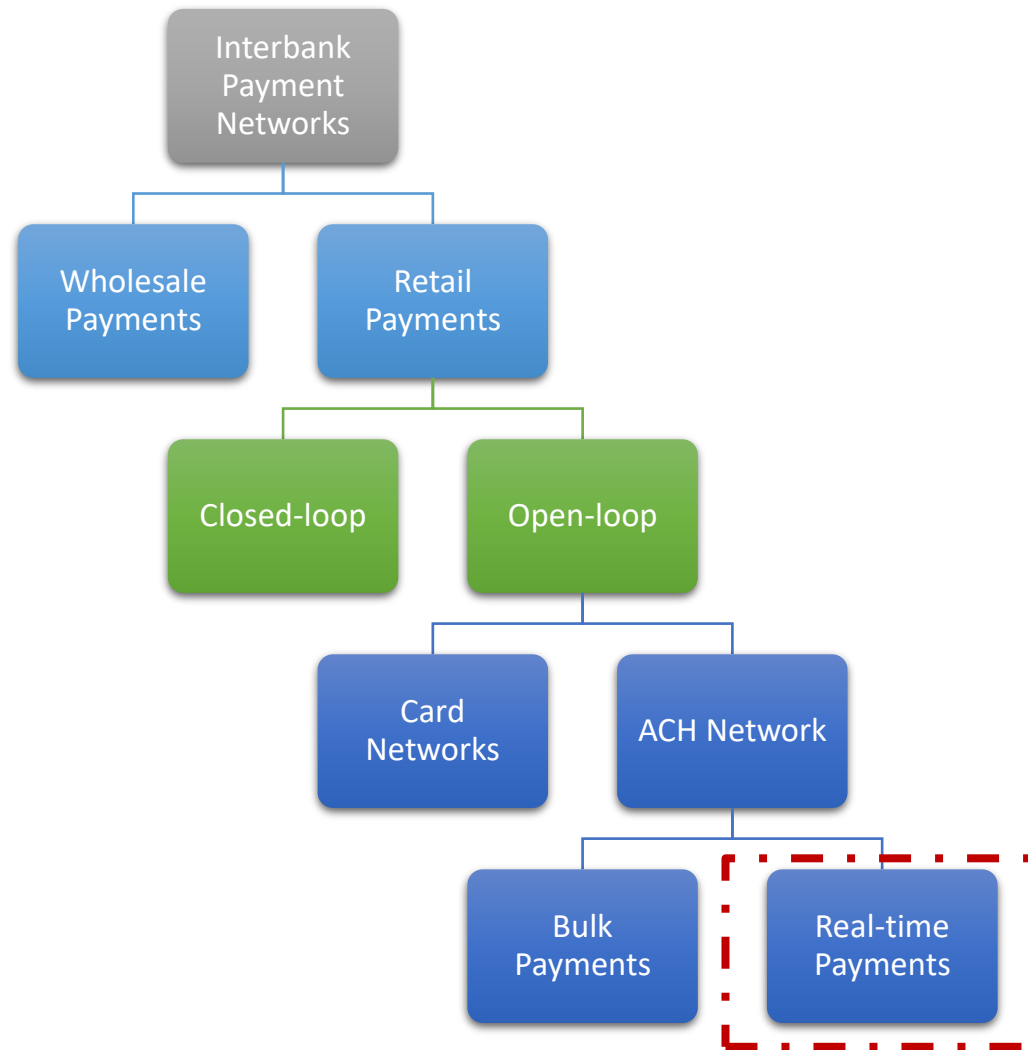


• Unclear Revenue Potential

- The upfront cost in upgrading existing bank systems combined with low margin from RTPS and potential impact to profitable revenue stream will mean longer time to achieve return on investment.
- In some of the major implementations of RTPS such as Singapore's FAST and UK's FPS, consumer transactions are free with the view that savings from paper-based payment will offset the cost of transaction, introduction of new innovative overlay services may create new revenue opportunities but this is still too early to be proven.
- **Loss of competitive advantage:** Larger banks especially those that have achieved a dominant position in the markets have more to lose in implementing RTPS as it levels the playing field for the industry and neutralizes their competitive advantage from information asymmetry (Reserve Bank of Australia).
- **Cannibalization of card revenue:** Card revenue is an important revenue source to banks performing the roles of acquirer and/or issuer. This revenue can be significantly impacted if payments by cards are overly substituted by RTPS without reasonable revenue transfer. However, regardless of RTPS implementations, the same competition will be faced when new entrants offer cheaper payment alternatives to cards. On the other hand, in developing countries where card penetrations are not high, the impact may not be as significant

Source: Based on Bank of International Settlements Website

Payment Systems: Real-time Payment System (RTPS)

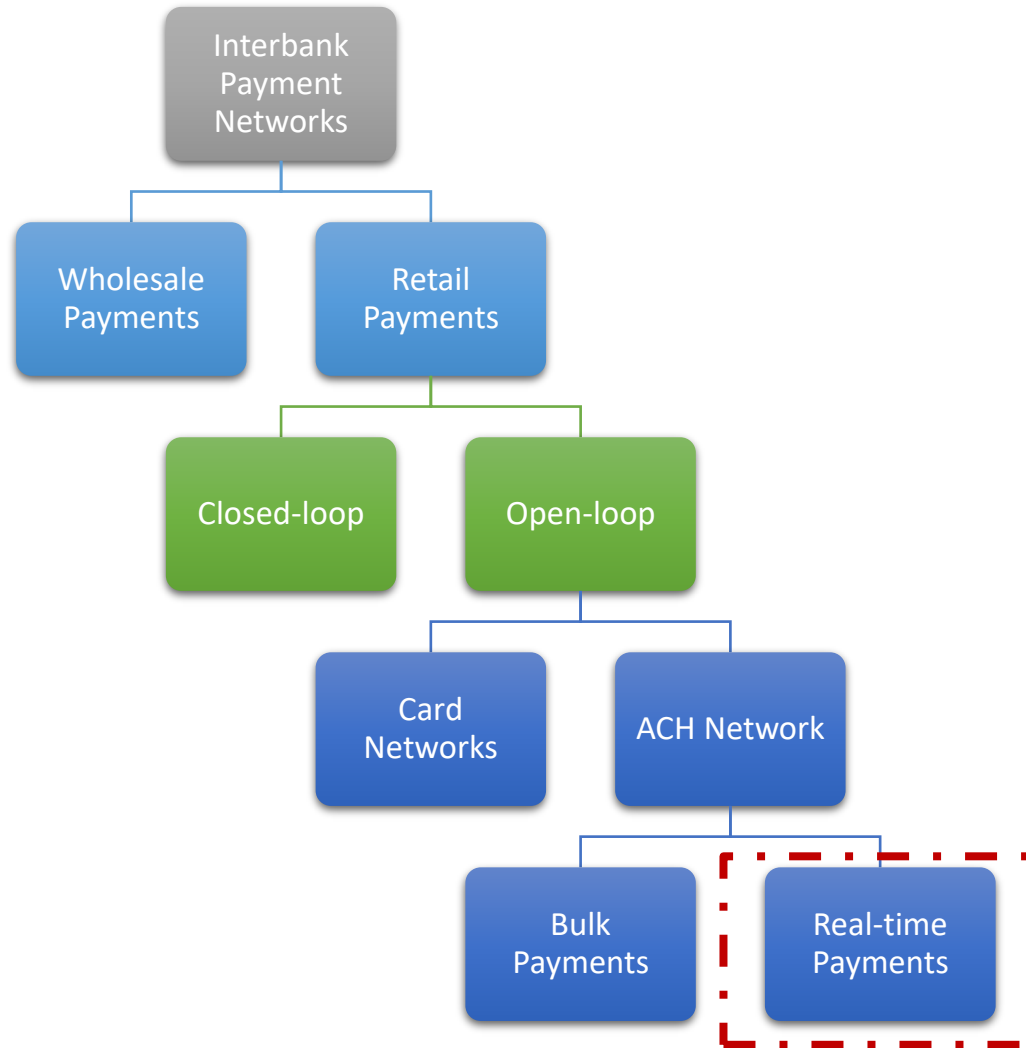


- **Unclear Revenue Potential**

- **Loss of float revenue:** RTPS will remove the time for cash to be outside of consumers' bank accounts and reduce revenue opportunities of float from the banks. Any float revenue opportunity is a constraint to what the paying bank can earn from the time between clearing and settlement. This has less implications in a low interest rate environment.
- **Fraud:** Making transactions faster and irrevocable also means making it harder to manage fraud. Banks will need to invest in better fraud detection mechanisms as well as risk management procedures.

Source: Based on Bank of International Settlements Website

Payment Systems: Real-time Payment System (RTPS)

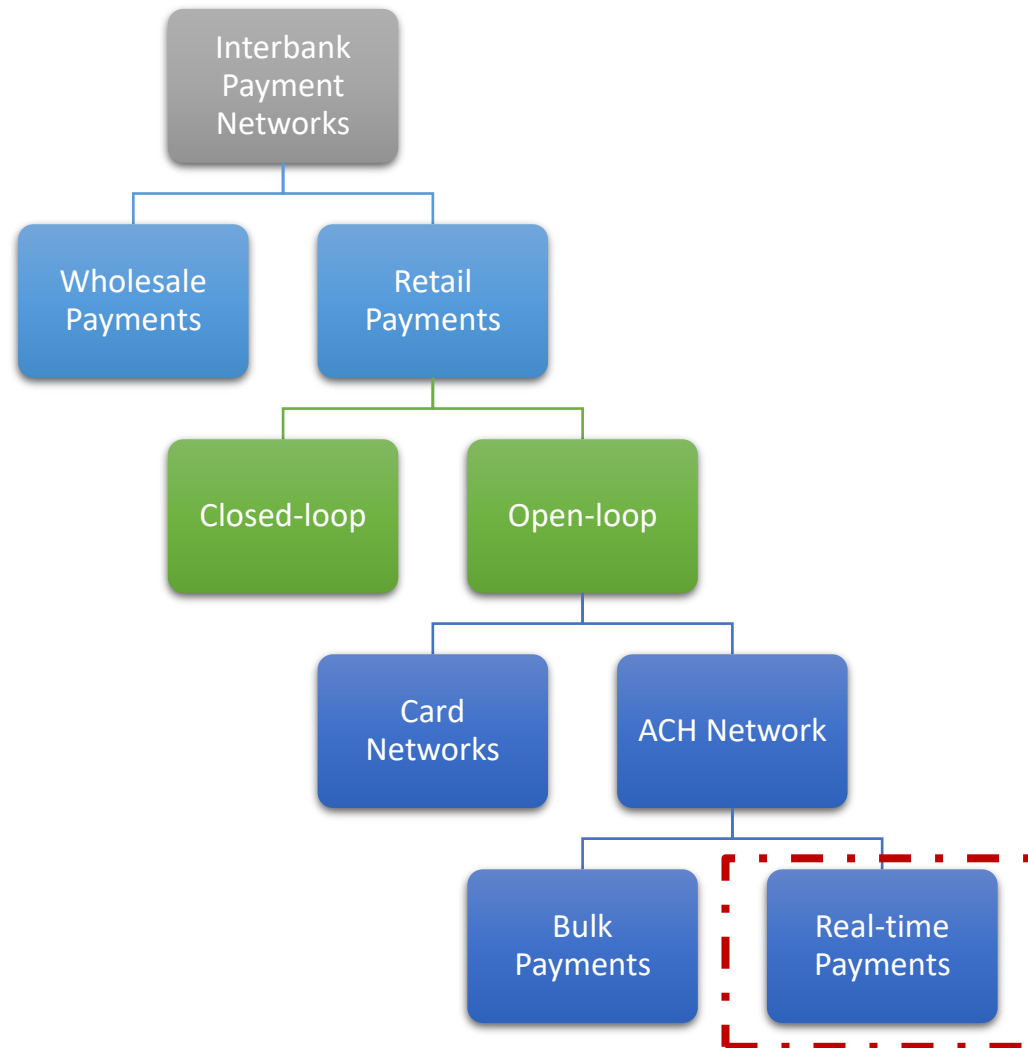


• Project Implementation Risks

- Implementations of RTPS even by some of the more successful examples are often plagued with delays including UK's FPS, Singapore's FAST and Australia's NPP.
- The Polish national clearing house, Krajowa Izba Rozliczeniowa S.A. (KIR), introduced Express ELIXIR, Poland's RTPS, in June 2012 but is not successfully adopted. This is due to the lack of central bank mandate, and as a result there are only 11 out of 49 banks participating in the network. KIR was created out of the need to compete against a strong third-party competitor, BlueCash.
- In South Africa, only 27% of the banks participated in RTC.
- In Brazil, banks are reluctant to use SITRAF because of the loss of float

Source: Based on Bank of International Settlements Website

Payment Systems: Real-time Payment System (RTPS)



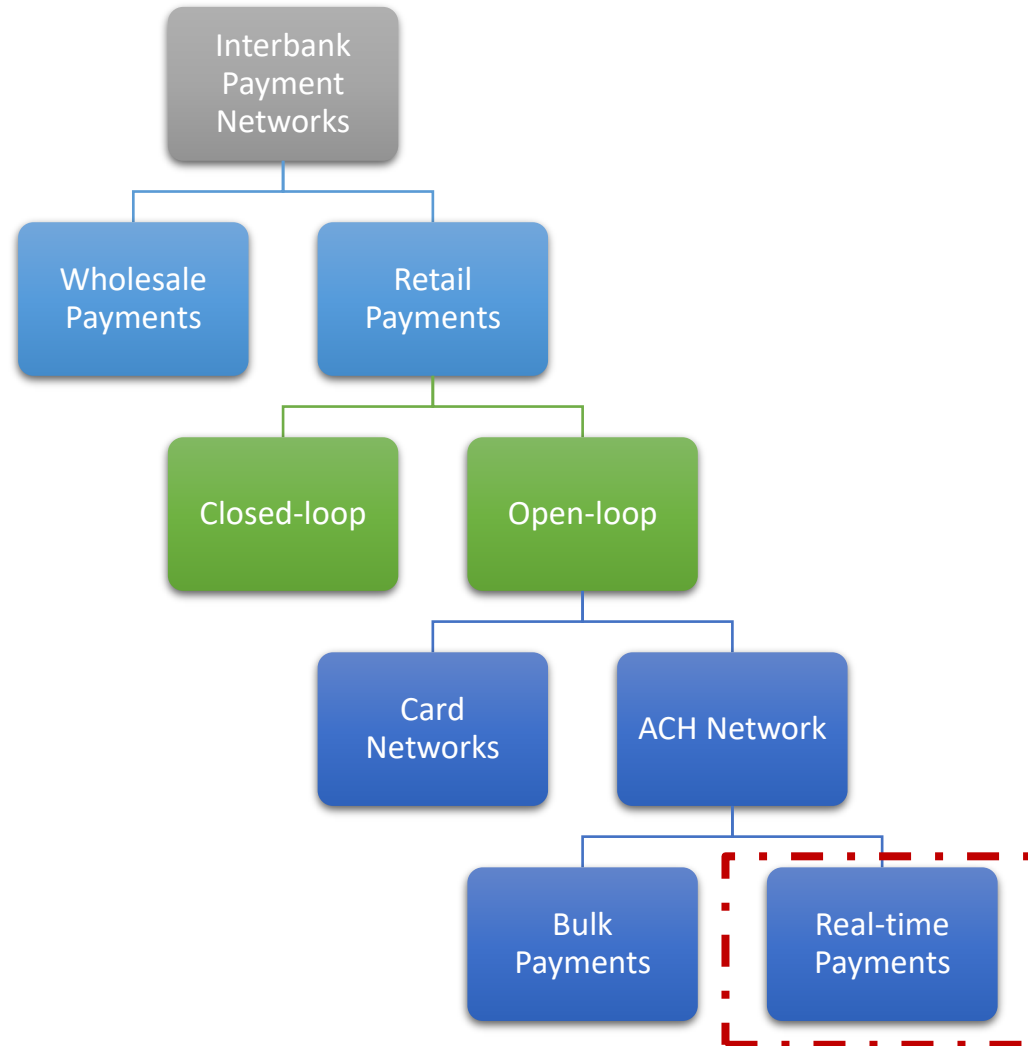
Source: Based on Bank of International Settlements Website

Characteristics of an RTPS Implementation

- A real-time payment transaction can involve processing for clearing, posting and settlement. For this to be feasible, the following parties must work in tandem.
- Payer's Bank
 - Must be able to immediately forward a payment instruction from payer to the RTPS.
 - Must be able to debit the payer's account after receiving a successful payment confirmation from RTPS.
- Payee's Bank
 - Must be able to immediately credit the payee's account after receiving the payment instruction from RTPS.
 - Must be able to respond immediately to the RTPS with a successful payment confirmation.
- ACH
 - Must be able to receive payment instruction from any originating member bank and process the instruction within a very short timeframe that is collectively agreed by all participants.
 - Must be able to route the payment instruction to the corresponding receiving member bank immediately after processing it.
 - Must be able to receive payment confirmation from any receiving member bank and process the instruction immediately.
 - Must be able to route the payment confirmation to the corresponding originating member bank immediately after processing it.
- The settling of funds between banks need not to take place in real-time and can be aggregated as a batch for settlement at a later time.

Payment Systems: Real-time Payment System (RTPS)

Characteristics of an RTPS Implementation



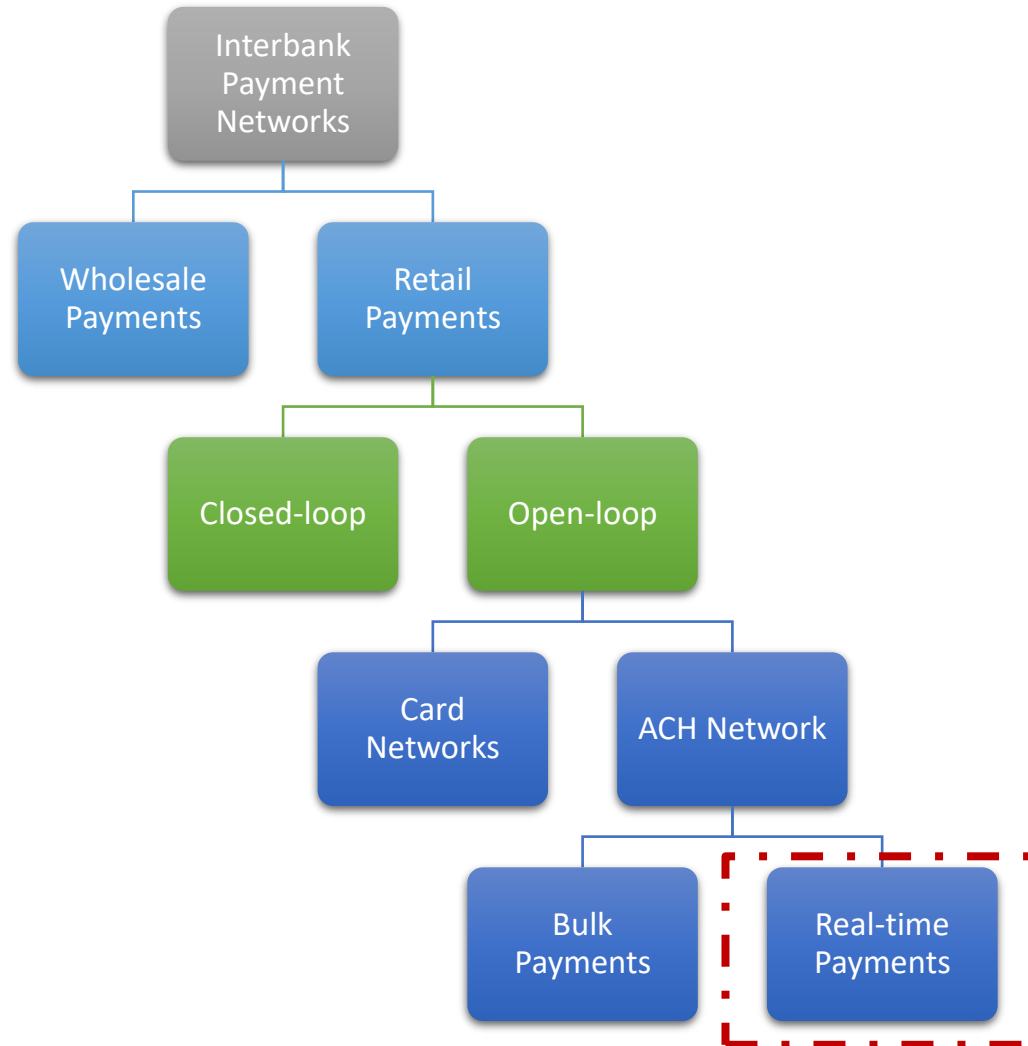
• Availability

- RTPS is primarily driven by online and mobile consumer needs and, therefore, the service must be made available round the clock throughout the year.
- Most systems that operate 24/7/365 include Denmark's RealTime24/7, India's IMPS, Korea's HOFINET, Singapore's FAST, South Africa's RTC, Sweden's BIR and UK's FPS.
- Some RTPS, however, only operate on working days, for instance, Mexico's SPEI, Brazil's SITRAF and Japan's Zengin.

Source: Based on Bank of International Settlements Website

Payment Systems: Real-time Payment System (RTPS)

Characteristics of an RTPS Implementation

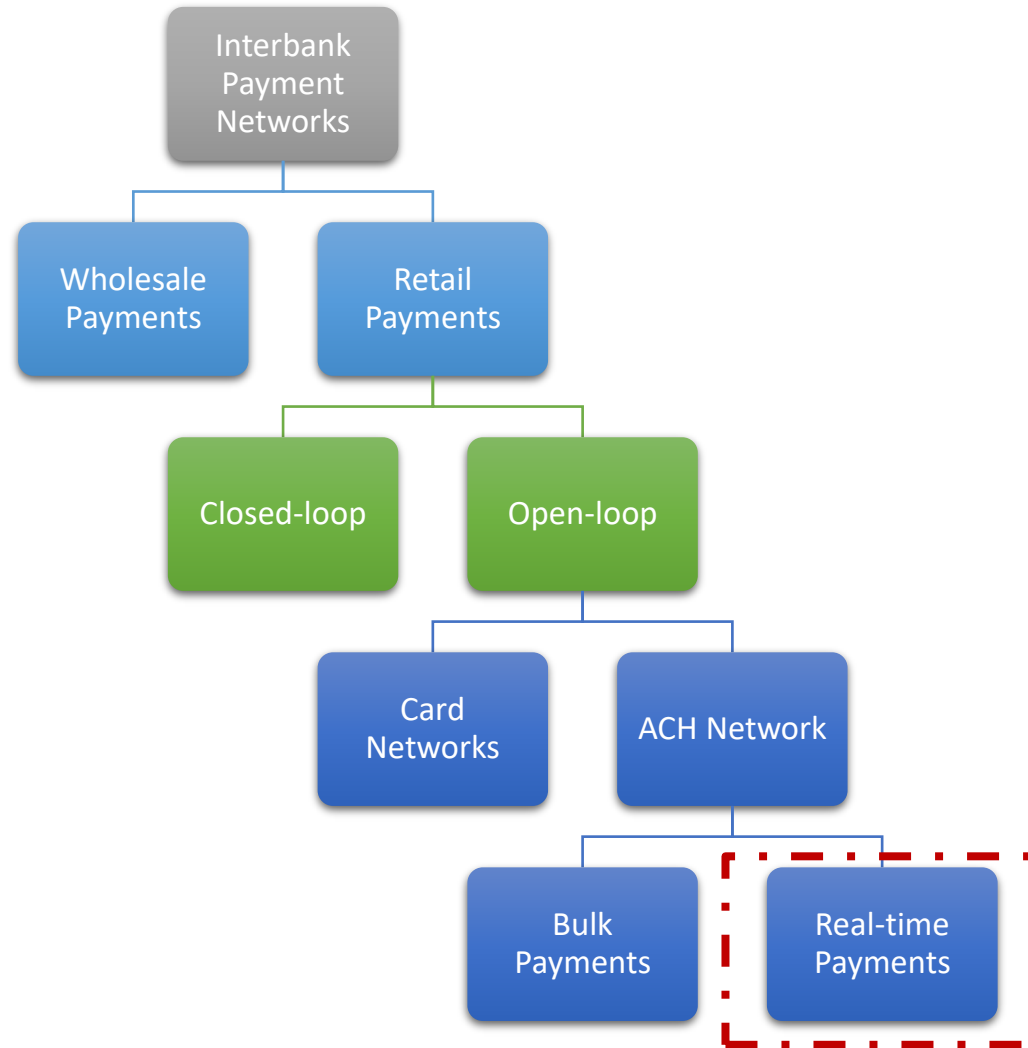


- **Universal Financial Messaging Standards:** The types of financial messaging standards used by RTPS are an important part of the design consideration. In general, the financial messaging standards should be
 - **Interoperable:** Based on an open standard that is widely understood and adopted by various countries and interoperable to support future cross-border payment needs.
 - **Can carry richer information:** Facilitate the inclusion of payment related information such as payer's detail for KYC/AML check, payee's detail such as bill account number to facilitate account receivables reconciliation and support for unicode.
 - **Ease of Straight-Through-Processing (STP) Integration:** Because transaction processing has to take place in real-time, transaction being sent to payee's bank must be automatically processed by the payee's bank the moment a payment instruction is received without human intervention. To facilitate this integration, the messaging standard must be implemented in a form that is easy to program, make changes and verified
 - **Currently available message standard options:**
 - ISO20022 is a new international financial messaging format not specific to payments only. It is the preferred standard for new generations of RTPS due to its more open and extensible XML-based design, able to support for cross-border usage and support larger payload.
 - ISO8583 is the international message standard for card originating transactions used by ATM and EFTPOS. As such networks are usually already in existence in most countries, it is therefore easier to consider piggybacking onto this standard for RTPS

Source: Based on Bank of International Settlements Website

Payment Systems: Real-time Payment System (RTPS)

Characteristics of an RTPS Implementation

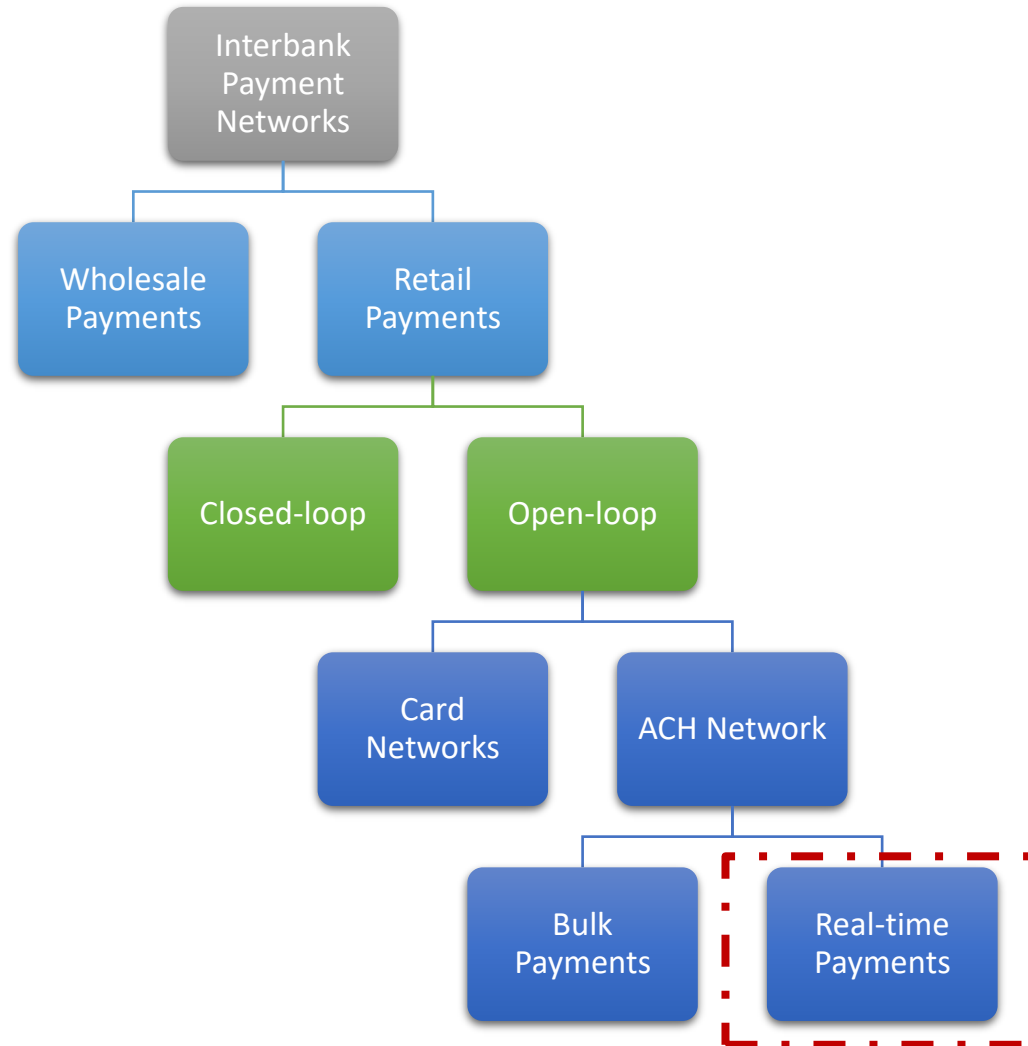


Source: Based on Bank of International Settlements Website

- Universal Financial Messaging Standards
 - Currently available message standard options:
 - Industry can also create their own bespoke and proprietary message format. Some may use **legacy SWIFT FIN message** format that is commonly used in telegraphic transfer. The benefit is that the domain knowledge is more readily available but this standard is in the process of being phased out by the newer ISO20022 standard.
 - **ISO20022 is a new international financial messaging format** not specific to payments only. It is the preferred standard for new generations of RTPS due to its more open and extensible XML-based design, able to support for cross-border usage and support larger payload. However, ISO20022 is relatively new and evolving, industry adoption is still at early stage. The cost to change can be high and require heavy investments for systems upgrade and applications integration. Countries using ISO20022 include Singapore's FAST, Australia's NPP, Denmark's RealTime24/7, Sweden's BIR.
 - **ISO8583 is the international message standard for card originating transactions** used by ATM and EFTPOS. As such networks are usually already in existence in most countries, it is therefore easier to consider piggybacking onto this standard for RTPS. However, ISO8583 has its limitations as each implementation may use its own proprietary binary format and is constraint by the amount of data it can carry. However, this is usually a choice when a country has deep investment on ISO8583 network and switching to ISO20022 may require change and cost. Countries using ISO8583 include UK's FPS, India's IMPS.

Payment Systems: Real-time Payment System (RTPS)

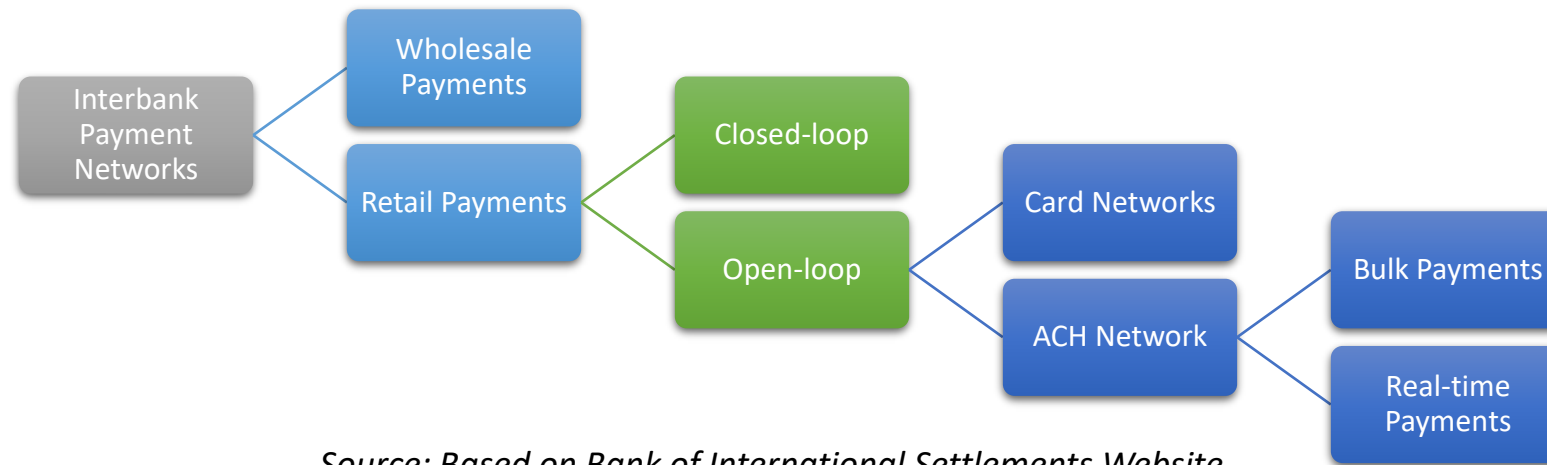
Characteristics of an RTPS Implementation



- **Overlay Services**
- It is expected in most implementations that banks and payment service providers will develop new and innovative services that overlay on the platform that provides new value-adds to the consumers.
- This is a somewhat “If you built it, they will come” mentality that is predominantly assumed.
- One of the most common overlay services that is implemented together with RTPS is known as the addressing service. It is the ability to allow payer to make payments to a payee using an alternative form of identification without the need to use bank account numbers.
 - Zelle already allows for sending money via email identification
 - India’s IMPS uses a seven-digit Mobile Money Identifier (MMID) to link a customer’s bank account to their mobile phone number.
 - Australia’s NPP, addressing is identified as a part of the core function integral to the platform

Source: Based on Bank of International Settlements Website

Payment Systems: Overview



Source: Based on Bank of International Settlements Website

	Availability	Clearing	Settlement	Scalability	Costs	Ubiquitous
Wholesale Payment	Working Days	NA	Fast	Low	High	Low
Card Payment	24 / 7	Fast	Slow	High	High	High
Closed-Loop Payment	24 / 7	NA	Fast	Maybe	Low	Low
ACH Bulk Payment	Working Days	Slow	Medium	High	Low	High

Risk Management Principles for RTPS

- Since funds are cleared between banks in real-time but settled later, payer bank is exposed to counterparty risk between time of clearing and time of settlement.
- One of the ways to mitigate this risk is to increase the frequencies of settlement
 - Singapore's FAST payment network is settled twice a day
 - UK's Faster Payment settles three times a day
 - Australia's NPP is designed to cater for 24 × 7 real-time settlement.
- The network can also adopt certain risk management measures such as collateral management, debit cap, daily transaction limit and loss sharing.

Risk Management Principles for RTPS

Collateral Posting

- Banks are required to create special collateral accounts for holding funds that can be used for settlement of real-time payments.
- The disadvantage is that this can lock in the bank's funds in a reserve and limiting the bank's liquidity.

Imposing a Daily Debit Cap

- Banks can be imposed with a cap that limits the net debit settlement position (i.e. the amount to be paid out by the bank during settlement).
- Sending of funds cannot take place until either the bank receives incoming payments to reduce its net debit position or after settlement cutover takes place.

Risk Management Principles for RTPS

Imposing a Daily Maximum Account Transfer Limit

- A daily limit can be imposed by a bank to control the maximum value of funds that can be sent by an individual account for a single day to limit the bank's credit exposure.
 - UK's Faster Payment impose a limit of 100,000 GBP per day and Singapore's FAST impose a limit of 50,000 SGD.

Loss Sharing

- In the event of member's default, the collateral put up by the defaulted member will be disbursed to the remaining members on the network.
- In return, all other members on the network will be obligated to provide liquidity to fund the shortfall due to the member's default.

Society for Worldwide Interbank Financial Telecommunication

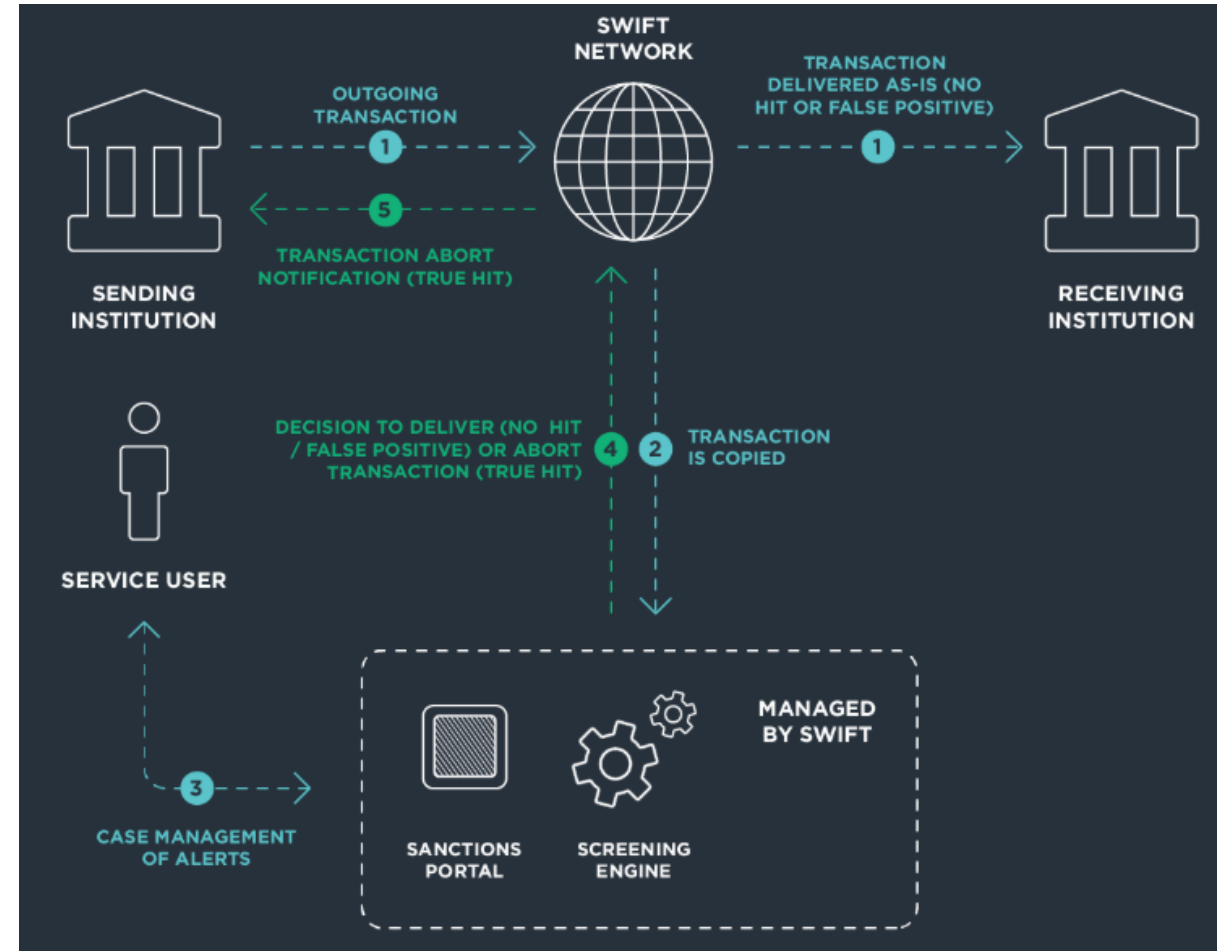
(SWIFT)

Society for Worldwide Interbank Financial Telecommunication (SWIFT)

- The SWIFT is a global member-owned cooperative that is headquartered in Brussels, Belgium.
- It was founded in 1973 by a group of 239 banks from 15 countries which formed a co-operative utility to develop a secure electronic messaging service and common standards to facilitate cross-border payments.
- It provides its services to over 11,000 banks and financial institutions in over 200 countries and sends over 6.5 billion financial messages a year.
- It carries an average of approximately 26 million financial messages each day.
 - While SWIFT started primarily for simple payment instructions, it now sends messages for wide variety of actions, including security transactions and treasury transactions.
 - Nearly 50% of SWIFT traffic is still for payment-based messages, but 43% now concern security transactions, and the remaining traffic flows to treasury transactions.
- SWIFT was created to replace the old telex transfer system, which was slow, unreliable, and vulnerable to security breaches.
- It addressed all problems and led to a much improved interconnected financial system—in the 1970s.
- SWIFT is not a payment system, but only a messaging service.

Society for Worldwide Interbank Financial Telecommunication (SWIFT)

- The SWIFT is a secure financial message carrier
 - It transports messages from one bank to its intended bank recipient.
- Its core role is to provide a secure transmission channel:
 - So that Bank A knows that its message to Bank B goes to Bank B and no one else.
 - Bank B, in turn, knows that Bank A, and no one other than Bank A, sent, read or altered the message en route.
- Banks, of course, need to have checks in place before actually sending messages.



Source: <https://fin.plaid.com/articles/what-is-swift>

Society for Worldwide Interbank Financial Telecommunication (SWIFT)

- Typically, clearing a SWIFT transaction involves three people:
 - Maker
 - Checker
 - Verifier.
- The maker initiates the transaction, and inputs from the checker and verifier are used to authorize it.
 - These act as additional layers of security to minimize frauds.
- Once the transaction goes through, a confirmation message is sent to the bank, as it happens in other banking transactions.

Society for Worldwide Interbank Financial Telecommunication (SWIFT)

- In order to use its messaging services, customers need to connect to the SWIFT environment.
- There are several ways of connecting to it:
 - Directly through permanent leased lines
 - Internet
 - SWIFT's cloud service (Lite2)
 - Indirectly through appointed partners.
- Messages sent by SWIFT's customers are authenticated using its specialized security and identification technology.

Society for Worldwide Interbank Financial Telecommunication (SWIFT)

- Encryption is added as the messages leave the customer environment and enter the SWIFT Environment.
- Messages remain in the protected SWIFT environment, subject to all its confidentiality and integrity commitments, throughout the transmission process while they are transmitted to the operating centers (OPCs) where they are processed — until they are safely delivered to the receiver.
- While all customers are responsible for protecting their own environments, SWIFT established the customer security programmed (CSP) in early 2016 to support customers in the fight against a growing cyberthreat.
- In April 2017, SWIFT published a detailed description of the mandatory and advisory customer security controls. This framework describes a set of controls for its customers to implement on their local infrastructure.

SWIFT Codes

- SWIFT assigns each financial organization a unique code that has either eight characters or 11 characters.
- The code is interchangeably called the bank identifier code (BIC), SWIFT code, SWIFT ID, or ISO 9362 code.
 - First 4 characters- bank code (only letters).
 - Next 2 character- ISO 3166-1 alpha-2 country code (only letters).
 - Next 2 character- location code (letter and digits).
 - (Passive participant will have '1' in the second character).
 - Last 3 character- branch code, optional ('XXX' for primary office)(letter and digits)
 - <https://www.bankofamerica.com/foreign-exchange/wire-transfer/>
- To understand the SWIFT message codes & types see:
https://www.swift.com/sites/default/files/documents/swift_corporates_mt_ig_trade_guide.pdf

SWIFT Messages

- SWIFT network supports two message standards:
 - MT (ISO 15022): based on a proprietary format, composed of boundary delimited blocks, also known as FIN
 - MX (ISO 20022): the new SWIFT standard based on XML syntax – *general availability from March 2023.*
- SWIFT MT messages are identified by a 3-digit number, the first digit representing the Category and the following two representing the specific message inside the category.

Category	Description	Model classes
0	System Messages	MT0nn
1	Customer Payments	MT1nn
2	Financial Institution Transfers	MT2nn
3	MT3nn - FX, Money Market & Derivatives	MT3nn
4	Collections and cash letters	MT4nn
5	Securities Markets	MT5nn
6	Precious Metals & Syndications	MT6nn
7	Documentary Credits & Guarantees	MT7nn
8	Travellers Cheques	MT8nn
9	Cash Management & Customer Status	MT9nn

- SWIFT MT messages consist of five blocks of data including three headers, message content, and a trailer.
 - {1: Basic Header Block}{2: Application Header Block}{3: User Header Block}
 - {4: Text Block or body}
 - {5: Trailer Block}
- To understand the SWIFT message codes & types see: https://www.swift.com/sites/default/files/resources/swift_corporates_mt_ig_trade_guide.pdf
- To understand the structure of SWIFT messages see: <https://www.prowidesoftware.com/about-SWIFT.jsp>

SWIFT Breaches

- In February 2016, in the Bangladesh Bank heist, \$81 million was fraudulently withdrawn from the central bank of the country, at the Federal Reserve Bank of New York through the SWIFT network.
- Fraudulent transactions totaling ₹11,500 crore (\$1.8 billion) that were carried out in March 2011 at Punjab National Bank, India, were not noticed for seven years.

SWIFT's new directions

SWIFT and e-voting (March 2019)

- SWIFT has teamed up with the Singapore Exchange and four banks to trial a platform for e-voting based on blockchain tech.
- The proof-of-concept (PoC) trial sets out to test a DLT voting solution involving issuers and a central securities depository (CSD), with data managed over a permissioned private blockchain.
- The partners will also examine the viability of hybrid solutions that merge financial messaging standard ISO 20022 with DLT to boost interoperability and “avoid market fragmentation”.
- Deutsche Bank, HSBC and Standard Chartered Bank will act as participants for the effort, while DBS and SGX will act as both participants and issuers.
- SWIFT will host the trial in its sandbox testing environment, while the partners will use the SWIFT network and their existing SWIFT infrastructure and interfaces as they test the technologies.
- The trial will also examine SWIFT's capacity to host applications in its sandbox and to reuse its security and interface stack for other purposes.

SWIFT's new directions

SWIFT Global Payments Innovation (gpi): which aims to increase the speed, predictability and transparency of cross-border payments.

- The goal is to help corporates to improve supplier relations whilst achieving greater treasury efficiencies by enhancing the payments service:
- Beneficiaries will now receive same day access to payments instead of waiting periods of several days.
- Businesses will know in advance how much a bank transfer will cost adding further transparency to fees in the transfer process.
- End to end payments tracking through a cloud based service will allow easy tracing of funds from initiation through intermediary banks to the recipient bank account. Message notification that funds have reached the beneficiary account will also be sent to the payer.

SWIFT's new directions

R3 partnership (Jan 2019)

- SWIFT is forming a partnership with R3 to integrate R3 platform into SWIFT GPI offering
- SWIFT CEO Gottfried Leibbrandt said "we are announcing ... a proof-of-concept with the R3 blockchain on trade, where you can initiate a payment on the trade platform and then it goes into gpi."
- The mechanics of the relationship are that financial institutions (FIs) using the blockchain offering known as Corda will authorize and, ultimately, settle payments through a gateway known as the gpi Link.

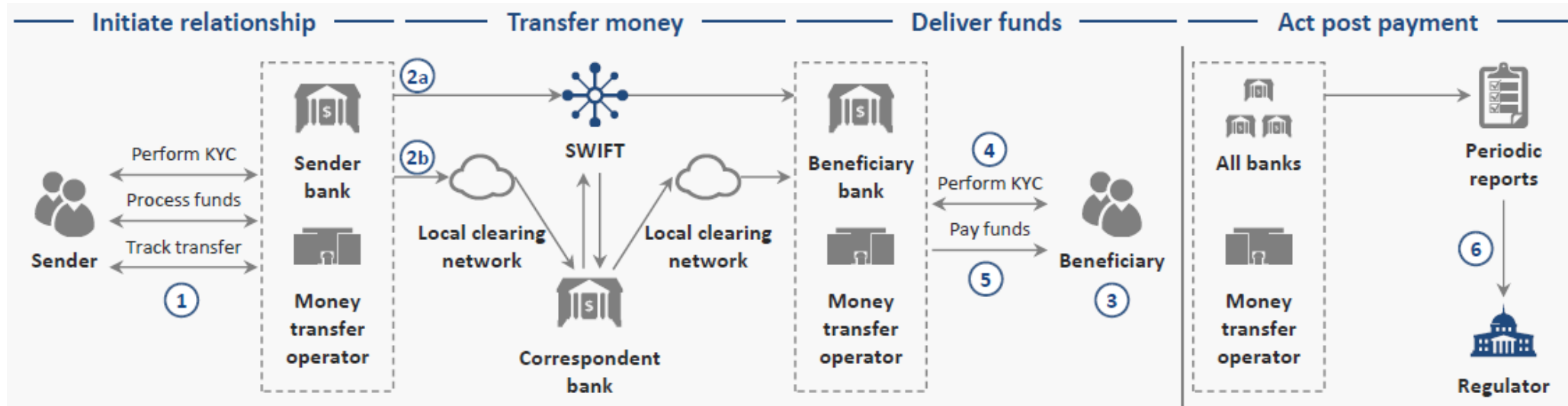
SWIFT's new directions

Common API Standard (Oct 2018)

- SWIFT published a blueprint for common API standards following collaboration with European banking standards bodies, STET and Berlin Group NextGenPSD2.
- SWIFT's white paper, "*Towards a global platform for the Financial Services API economy*", concludes that a successful transition to an API-based financial ecosystem is only possible if financial standards bodies converge towards a shared business standardization methodology.
- These efforts come after European regulators have put forward PSD2.
- For more see: <https://www.emergingpayments.org/article/swift-creates-financial-sector-api-blueprint/>

Present and Future of Payments

Present flow of payments



Current-state process description

- 1 Sender needs to send money to another country and approaches a bank or money transfer operator, which does the following:
- Performs AML/KYC activities
 - Collects funds and fees
 - Confirms and supports transfer inquiries/disputes

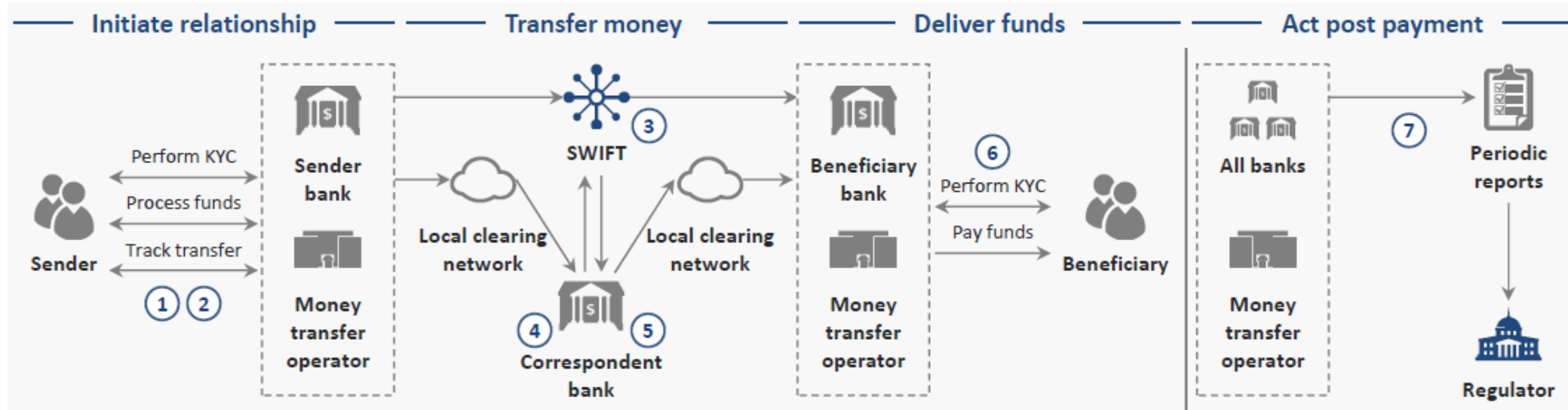
- The bank or money transfer operator will move money across borders through either of the following mechanisms:
- 2a Utilizes SWIFT network (part of SWIFT network)
 - 2b Facilitates transfer via correspondent banks (not part of SWIFT network)
- * Transactions can either be "netted" or initiated per-transaction

- 3 The beneficiary is notified and approaches a bank or money transfer operator
- 4 Depending on the pre-existing relationship, KYC may be performed by the bank or money transfer operator
- 5 The amount due in local currency is paid

- 6 Periodically, according to local regulations, the bank and money transfer operator will provide reports to regulators containing transaction details (e.g. sender and beneficiary ID, currencies, transferred amount and timestamps)

Source: World Economic Forum (2017)

Issues with Present flow of payments

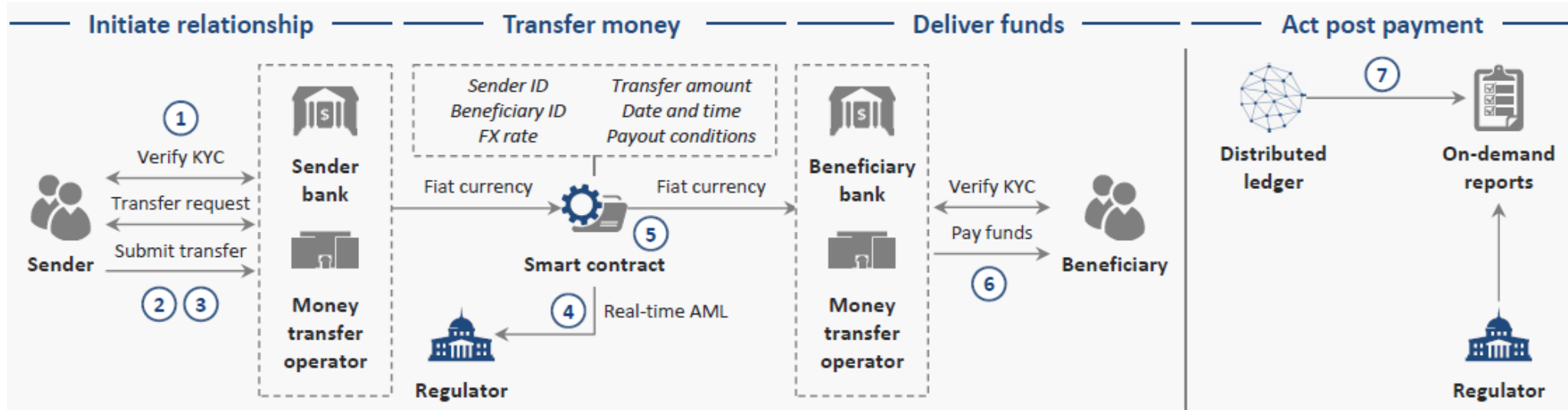


Current-state pain points

- | | | | |
|---|--|---|---|
| <p>① Inefficient onboarding: information about the sender and beneficiary is collected via manual and repetitive business processes</p> <p>② Vulnerable KYC: limited control exists over the veracity of information and supporting documentation, with various maturity levels across institutions</p> | <p>③ Cost and delay: payments are costly and time consuming depending on route</p> <p>④ Error prone: information is validated per bank/transaction, resulting in high rejection rate</p> <p>⑤ Liquidity requirement: banks must hold funds in nostro accounts, resulting in opportunity and hedging costs</p> | <p>⑥ Vulnerable KYC: similar to #2, limited control exists over the veracity of information and supporting documentation, with various maturity levels across institutions</p> | <p>⑦ Demanding regulatory compliance: due to various data sources and channels or origination, regulatory reports can require costly technology capabilities in addition to complex business processes (often supported by multiple operation teams)</p> |
|---|--|---|---|

Source: World Economic Forum (2017)

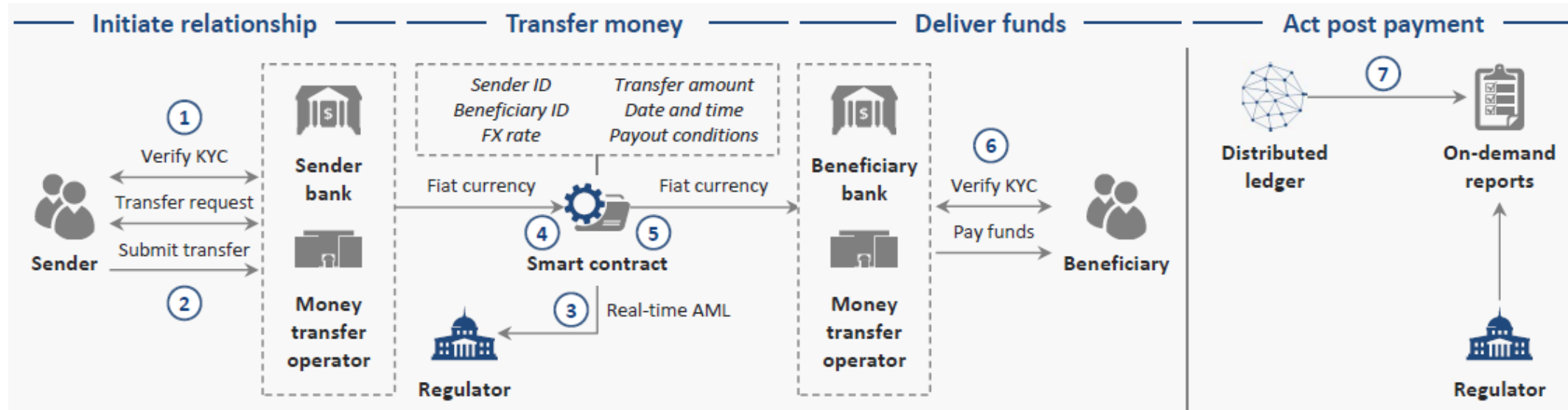
Proposed flow of payments



Future-state process description			
<p>① Trust between the sender and a bank or money transfer operator is established either via traditional KYC or a digital identity profile</p> <p>② A smart contract encapsulates the obligation to transfer funds between sender and beneficiary</p> <p>③ The currency conversion is facilitated through liquidity providers on the ledger</p>	<p>④ The regulator can monitor transactions in real time and receive specific AML alerts through a smart contract</p> <p>⑤ A smart contract enables the real-time transfer of funds with minimal fees and guaranteed delivery without the need for correspondent bank(s)</p>	<p>⑥ Funds are deposited automatically to the beneficiary account via a smart contract or made available for pickup after verifying KYC</p>	<p>⑦ The transaction history is available on the ledger and can be continuously reviewed by regulators</p>

Source: World Economic Forum (2017)

Benefits of proposed flow of payments



Future-state benefits

- ① **Seamless KYC:** leveraging the digital profile stored on DLT establishes trust and authenticates the sender
- ② **FX liquidity capabilities:** through smart contracts, foreign exchange can be sourced from participants willing to facilitate the conversion of fiat currencies
- ③ **Real-time AML:** regulators will have access to transaction data and can receive specific alerts based on predefined conditions
- ④ **Reduced settlement time:** cross-border payments can be completed in real time
- ⑤ **Cost savings:** with fewer participants, the improved cost structure can generate value
- ⑥ **Seamless KYC:** leveraging the digital profile stored on DLT establishes trust and authenticates the beneficiary
- ⑦ **Automated compliance:** the regulator will have on-demand access to the complete transaction history over the ledger

Source: World Economic Forum (2017)