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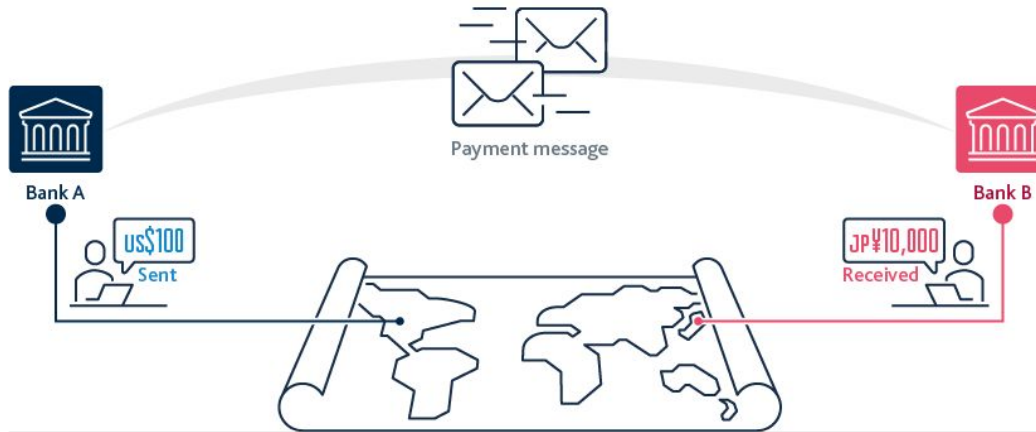
On the Interoperability of Central Banks via DLT: Cross-Border Payments and Tokenized Assets

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Cross-Border Payments

Definition: a payment where a **payer** and a **payee** resides in two **different countries**.



Largely based on **correspondent banking**:

→ bilateral relation between two banks

Payment Systems

A financial infrastructure that enables **transfer of value** between two parties.

Two types of money:

- **Central bank money** (CeBM):
a liability of the central bank → **risk-free** settlement asset
- **Commercial bank money** (CoBM):
a liability of a private bank → a **promise** to convert it into CeBM (credit risk)

A payment system could be:

- Private (e.g., Visa) → settles in CoBM
- **Central Bank System** → settles in **CeBM**



RTGS and IPS

→ **Real-time gross settlement** (RTGS)

- ◆ **Wholesale** payments
- ◆ High-value, time-critical interbank transfers
- ◆ Settles individually and in real time

→ **Instant payment system** (IPS)

- ◆ **Retail** payments
- ◆ 24/7 low-value, high-frequency transfers
- ◆ May use netting to minimize liquidity requirements

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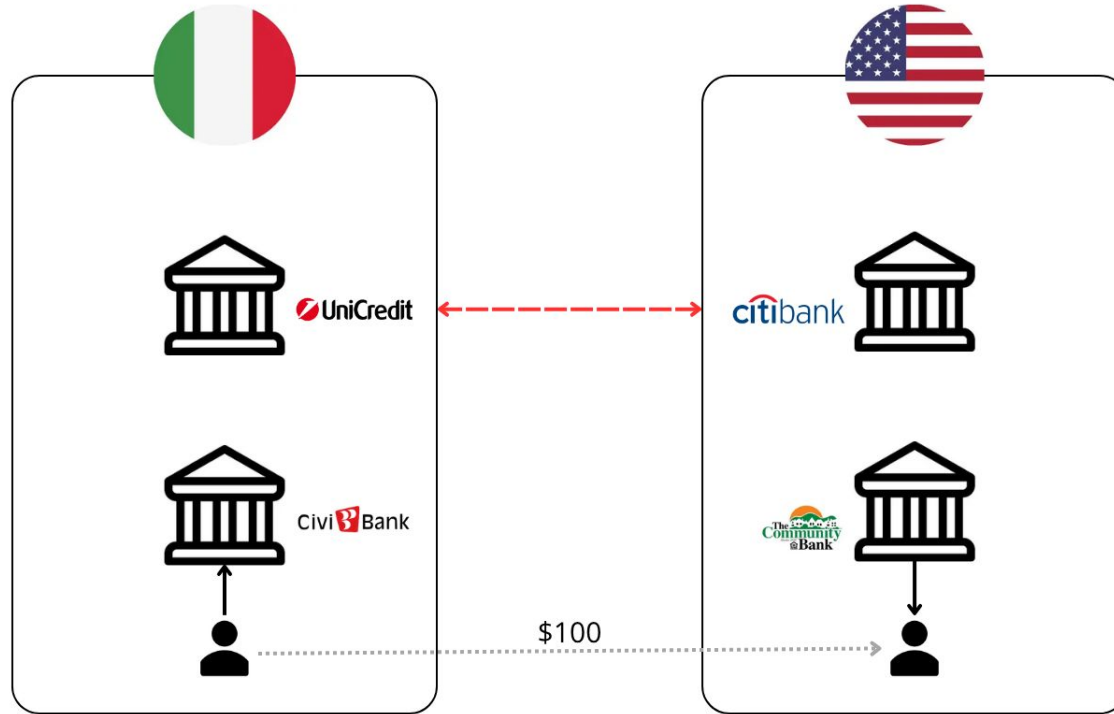


→ **Instant payment systems** (IPS)

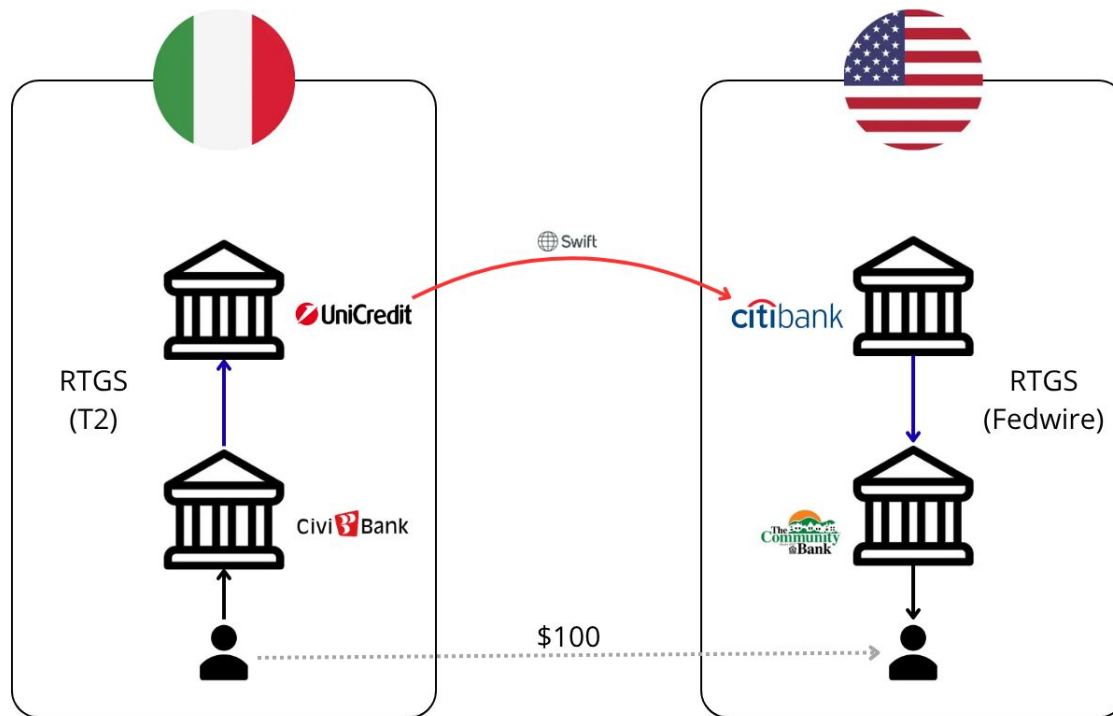
- ◆ **Retail** payments
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Correspondent Banking (i)



Correspondent Banking (ii)



Cross-Border Payments: Inefficiencies

- Multiple intermediaries = **higher transaction cost**
- Systems operating in different time zones = **slower settlement**
- Pre-funded balances = **trapped liquidity**

Lacking of **interoperability** between Central Bank infrastructures.



Cross-Border Payments: Emerging Solution (i)

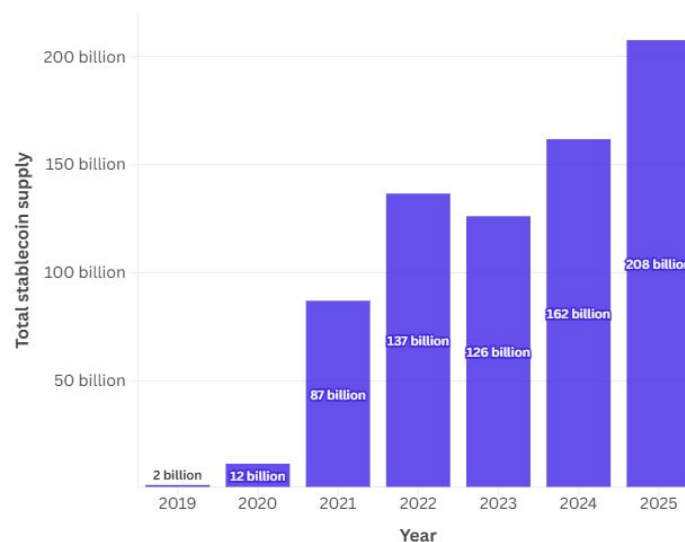
Stablecoins

→ cryptocurrencies whose **value is pegged to another asset** (e.g., fiat currency)

Market cap: ~\$320B

Dominated by the U.S. dollar, nearly 99.6% of the entire market share

Average supply of stablecoins in circulation, across all stablecoins:



Source: [Allium & Visa](#)



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Cross-Border Payments: Emerging Solution (ii)

Risks from Central Banks perspective:

- **Dollarization** of domestic digital ecosystems
- Weakening of the **domestic currency** role
- **Dependence** on foreign actors
- Risk of **financial contagion**



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The Central Banks Answer

Leveraging DLT to achieve **interoperability**.

Goals:

- Shorten transaction chains
- Enable atomic cross-currency settlement
- Keep CeBM as the settlement anchor



The Surveyed Projects

Survey covers **14 institutional DLT projects**.

- All use permissioned ledgers, with central banks involved
- Two main ecosystems:
 - ◆ **BIS Innovation Hub** → proofs of concept and prototypes (8 of 14)
 - ◆ **Eurosystem (ECB)** → staged path: exploratory work → Pontes → Appia



Three-Axis Taxonomy

We classify each project along **three axes**:

1. Target segment
2. Architectural pattern
3. Settlement-asset representation



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Target Segments

→ Wholesale

- ◆ High-value transfers between financial institutions
- ◆ Settled in CeBM

→ Retail

- ◆ High-volume, lower-value payments for end users
- ◆ Mediated by PSPs or commercial banks

It shapes choices on the other two axes

Architectural Patterns

Three recurring patterns, by decreasing integration depth:

- **Common platform** (CP) — one shared ledger
- **Interlinking / synchronization** (IL) — independent systems coordinated
- **Infrastructure bridge** (IB) — DLT triggers existing settlement



Architectural Patterns: Common Platform

Definition: a single **shared multi-jurisdictional ledger**.

Cross-border settlement happens on-platform.

→ Advantage:

- ◆ coordination depth — atomicity, FX, and compliance in on-platform smart contracts

→ Costs:

- ◆ Governance complexity
- ◆ Path dependence (lock-in)



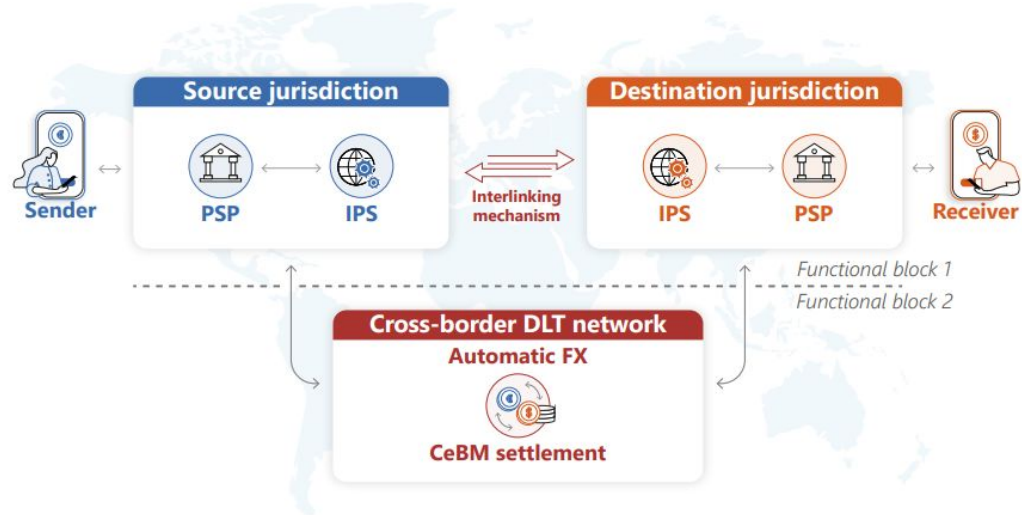
Architectural Patterns: Interlinking / Synchronization

Definition: independent systems coordinated through a **neutral layer** (each keeps autonomy).

Synchronization operator (SO)
needed for each legacy system.

Trade-offs:

- Liveness dependence
- Trusted SO



Architectural Patterns: Infrastructure Bridge

Definition: protocol-level **connectors** let market DLT platforms trigger settlement in legacy systems.

No **on-chain settlement asset** is created.

- Advantage:
 - ◆ Minimal coupling
 - ◆ Incremental deployment
- Trade-off: point-to-point interoperability



Settlement Asset Representation

Three models, by decreasing monetary novelty:

- **Native CBDC token** (NT) — the token is CeBM
- **Proxy token** (PT) — a claim on escrowed CeBM
- **Off-chain settlement** (RS) — no on-chain asset



Settlement Asset Representation: Native CBDC Token

The on-chain token **constitutes** central bank money.

Strongest settlement finality in principle — final on-chain, no separate RTGS step.

Limit: CBDC legislation is still nascent worldwide.

(Appears mainly in early experiments)



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Settlement Asset Representation: Proxy Token

The token is a **claim** on CeBM held in a segregated RTGS account.

Keeps the RTGS as the canonical monetary layer.

Three costs:

- Prefunding — escrowed funds earn no interest, count as trapped liquidity
- No elastic intraday credit
- Holder bears risks



Settlement Asset Representation: Off-chain Settlement

No on-chain monetary asset exists.

The DLT coordinates or triggers; the RTGS performs the transfer.

→ Strength:

- ◆ No new instrument
- ◆ Finality inherited from RTGS

→ Limit:

- ◆ Programmability is sacrificed
- ◆ Only "weak" atomicity across ledgers



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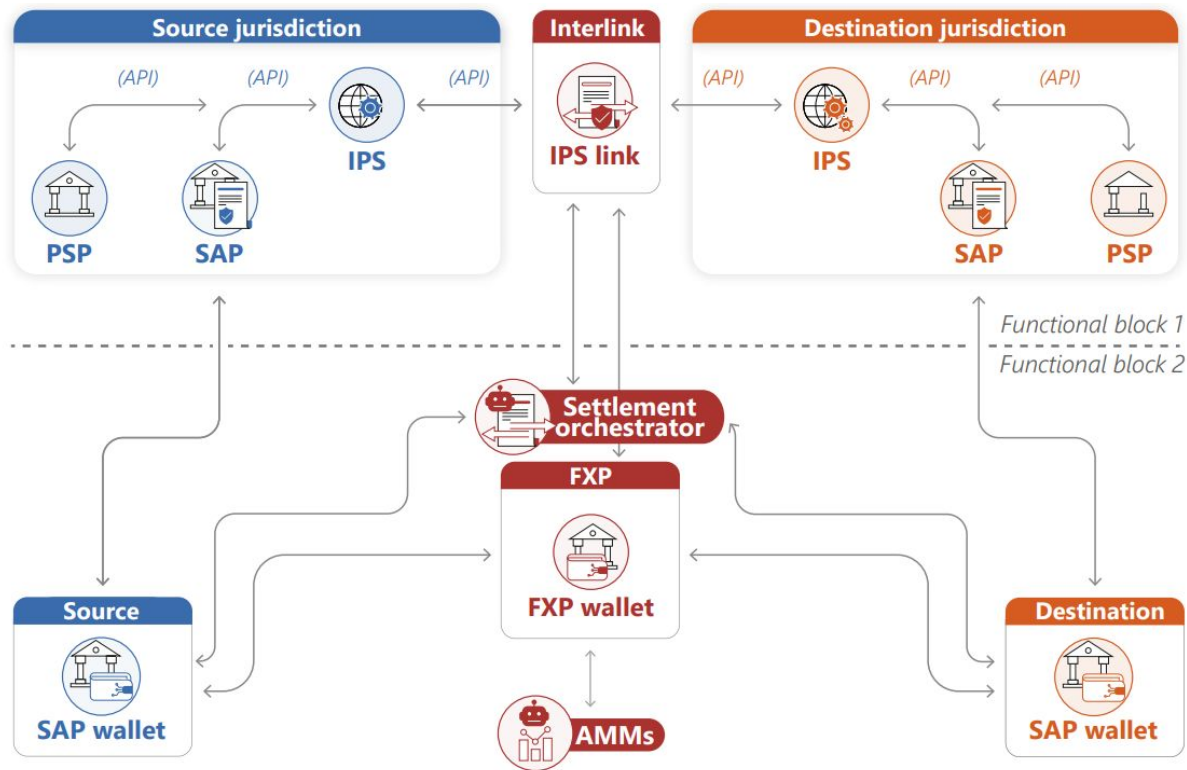
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Three-Axis Taxonomy

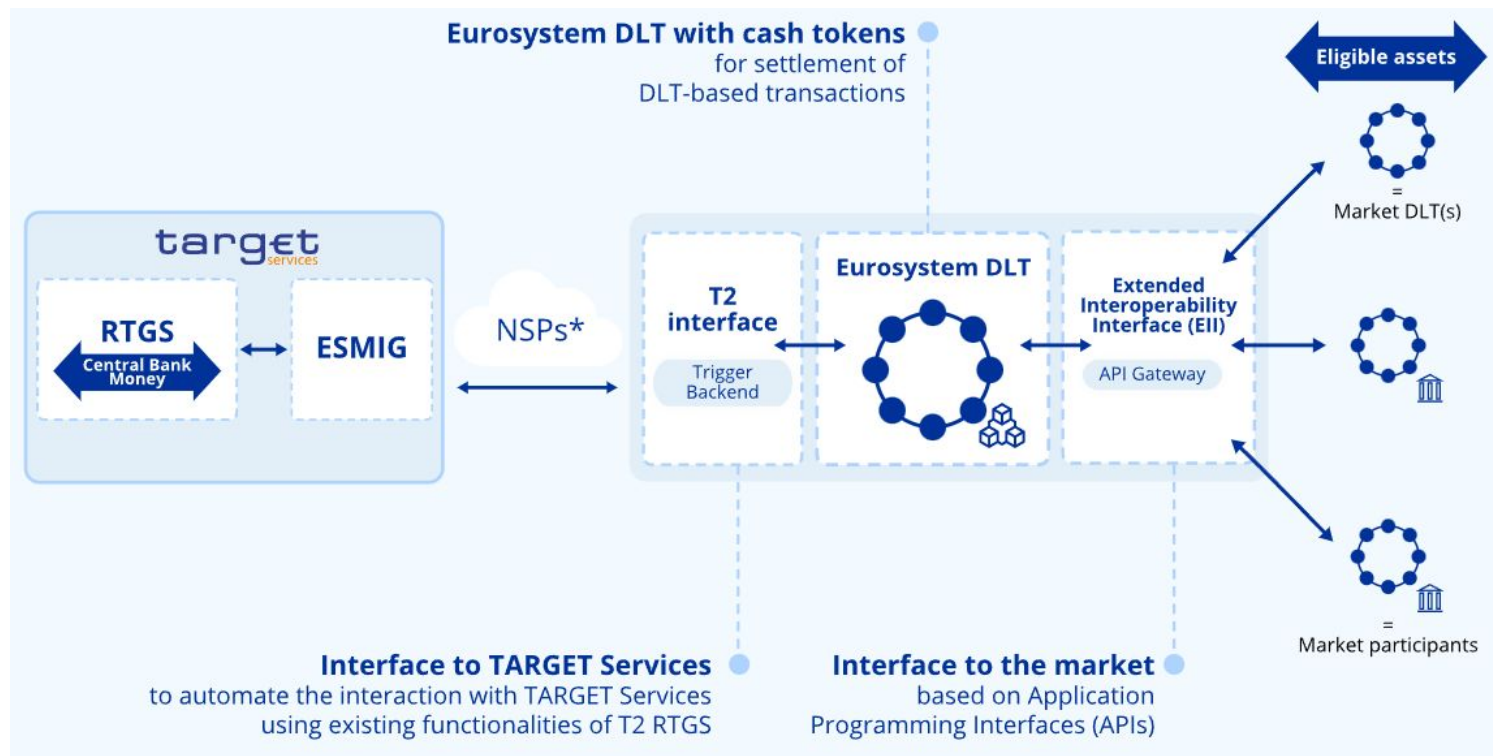
Project	Seg.	Arch.	Settl.	Atomicity	FX	Maturity	Institution
Trigger Sol. [†]	W	IB	RS	HTLC	—	Concluded (2024)	DBB
DL3S [†]	W	IL	PT	HTLC	—	Concluded (2024)	BdF
TIPS Hash-Link [†]	W	IL	PT	HL	—	Concluded (2024)	BdI
Pontes	W	IB + IL	PT + RS	PL + HL	—	Pilot (exp. Q3 2026)	Eurosystem
Appia	W	CP / IL	TBD	TBD	TBD	Consultation (2026)	Eurosystem
Rialto ^a	R	IL	PT	PL	AMM + FXP ^b	PoC (2025)	BIS, BdF, BdI, BNM, MAS
Meridian FX	W	IL	RS	EaR	SO-orch. ^b	PoC (2025)	BIS, BoE, BdF, BdI, DBB, ECB
Helvetia/SDX ^c	W	CP + IB	NT + RS	PL	—	Live pilot (ext. 2027)	SNB, SIX/SDX
mBridge ^d	W	CP	PT	PL	OTC	MVP (2024)	HKMA, CBUAE, BoT, PBC, BIS
Agorá	W	CP	PT	PL	Planned ^b	Prototype (2025)	BIS, IIF, 7 CBs
Dunbar	W	CP	NT	PL	OTC	Concluded (2022)	BIS, RBA, BNM, MAS, SARB
Jura	W	CP	PT	PL	OTC	Concluded (2021)	BdF, SNB, BIS
Mariana	W	CP	NT	PL	AMM	Concluded (2023)	BIS, BdF, MAS, SNB
Icebreaker	R	IL	NT	HTLC	FXP mktpl. ^b	Concluded (2023)	BIS, IL/NO/SE CBs

[†] Eurosystem exploratory work component [12]. ^a Technical atomicity within ZK-rollup (EVM); functional atomicity (compensating refund) across the IPS–DLT boundary. ^b Vehicle-currency routing demonstrated or planned. ^c Since 2025, the SNB also explores an RTGS-link approach (IB, RS) alongside the integrated wCBDC model (CP, NT) [21]. ^d BIS Innovation Hub withdrew in late 2024.

Rialto – BIS Innovation Hub



Pontes – ECB



Conclusions

- Production-track initiatives are **architecturally composite**.
- **Proxy tokens** and **off-chain settlement** dominate mature designs (preserving RTGS).
- Common direction: **extend existing settlement infrastructure** rather than replacing it.

Thank you!



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