DVP USE-CASES

Trials & Experiments to ECB NTW-CG

BNP Paribas

15th of November 2023

BNP PARIBAS

The bank for a changing world

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1. Context for Delivery-versus-Payment (DvP) proposals

Within the wide range of possible use-cases brought upon DLT technology for Financial Institutions, **tokenization of securities** displays promising features

- **Programmability** of life cycle events such as coupon payment, redemption ,etc…
- **More transparent data** embedded within the security tokens
- **Simplified and faster lifecycle** (reduction of intermediaries and instantaneous settlement)
- **Reduction of counterparty and operational risks experienced** with current settlement chain

Market interest for tokenized securities is expected to rise in the EU with the **EU-Pilot regime** and its dedicated regulatory statuses (DLT SS, DLT TSS, DLT MTF).

Without wCBDC, security token issuance, lifecycle events and secondary transactions are typically settled through SWIFT payments **not utilizing full potential of the blockchain** technology, speedup of settlement and reduction of counterparty risk. Lack of public DLT-compatible cash instruments **leaves room to private initiatives**, potentially raising questions to policymakers in terms of sovereignty and financial stability

ECB's and National Central Banks' initiatives on DLT-compatible cash for wholesale purposes is most welcome and the NTW-CG framework shall be the ideal forum to demonstrate the added value generated by a robust DvP mechanism compatible with programmable life-cycle events.

For this purpose, BNP Paribas is suggesting to test using **2 different tokenization models :**

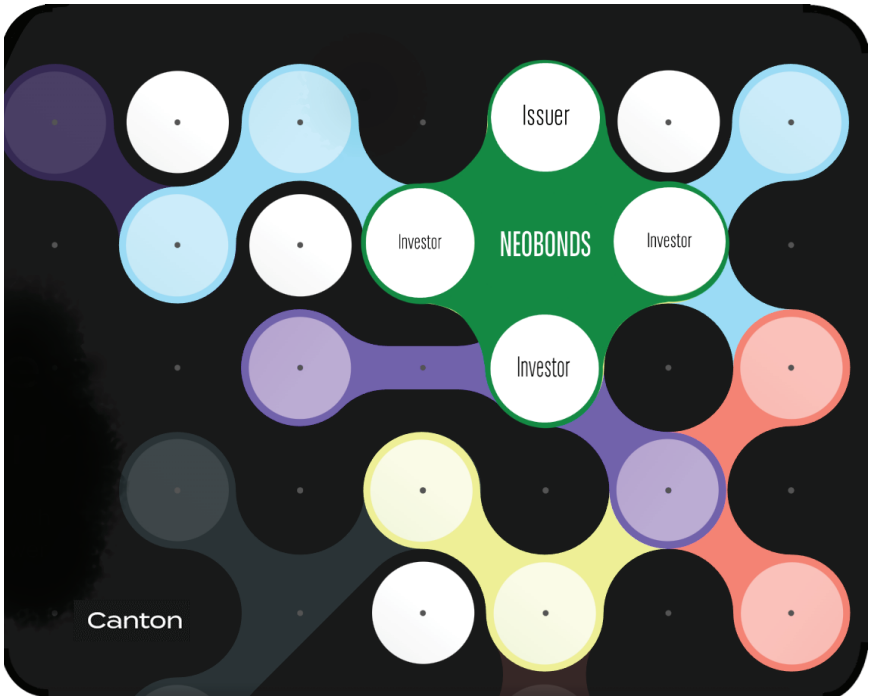
- **Neobonds,** based on private blockchain, integrated with BNPP CIB Global Markets issuance and booking systems
- **AssetFoundry,** based on Ethereum and used for experimental purposes

BNP Paribas is suggesting a DLT based DvP "trial" and 3 "experiments"

2.a “Trial”: DvP solution for Digital bond issuance and secondary trading on private blockchain

BNP Paribas has developed **Neobonds**, a tokenization platform

- Based on a **private blockchain, CANTON,** and smart contracts built using **DAML** language
- Neobonds supports **Syndicated issuance and lifecycle events** (coupons, secondary transactions) over the lifetime of a bond
- Interoperability with third parties will be considered thanks to the **CANTON network** (~30 members), a decentralized infrastructure that connects independent platforms. CANTON shall create a ‘network of networks’, allowing financial markets to interoperate with the appropriate governance, privacy, permissioning, and controls
- **Integration within BNPP Global Markets infrastructure** and interconnected with other CIB businesses such as Securities Services
- **Neobonds** was **tested in June 2023** with live trades.
- **Neobonds is providing investors with an interface** to view and access their tokens. Alternatively, they can rely on their custodians (i.e. BNPP Securities Services or other custodian duly on boarded)



* *Canton Network is the industry’s first privacy-enabled interoperable blockchain network. It will provide a decentralized infrastructure that connects independent applications built with Daml, Digital Asset’s smart-contract language.*

2.b “Trial”: DvP solution for Digital bond issuance and secondary trading on private blockchain

BNP Paribas would like to **propose a “TRIAL”**, i.e. a live transaction with EUR-wCBDC

- The trial would consist in BNPP (or another issuer) to issue, arrange and distribute a new native digital bond.
- Issuance settlement would be performed on chain on T+0 as well as any subsequent event such as coupon payment and secondary trading
- A repo transaction could also be considered

On-chain settlement on Trading would be performed on Neobonds with EUR wCBDC, provided by Banque de France through their “D3LS” platform.

BNPP already performed in the past some experiments with Banque de France in 2021, this trial would be the first live transaction.

EUR Digital Bond Issuance

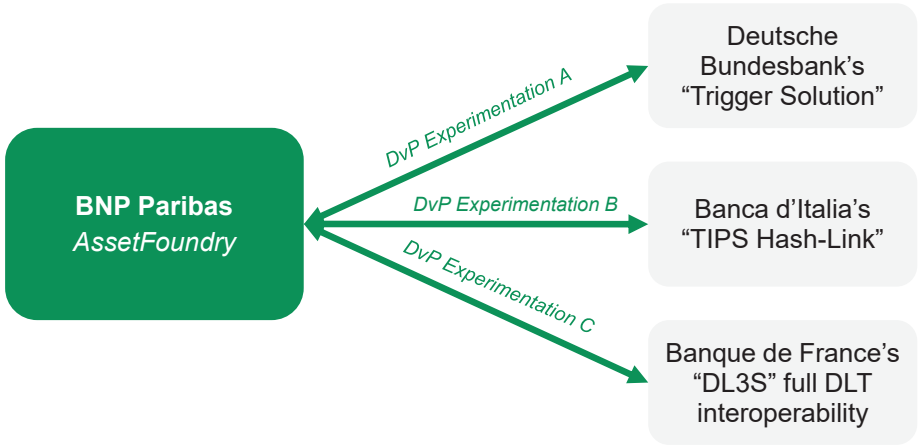
- Issuer: BNP Paribas SA or external issuer
- French law
- Investors:
  - BNPP intragroup entities and/or
  - External investors
- Products :
  - Listed bond (preferably) or
  - Unlisted Private Placement
- Notional : min 10M€
- Coupon : Fixed or Floating
- Maturity : max 2/3 years

3. “Experiments”: DvP solution on Ethereum blockchain

On top of its NEOBONDS platform based on DAML, BNPP is exploring the **benefits of Ethereum** protocol to represent securities

- Ethereum protocol permits the usage of **both *public* and *private* blockchains**, several versions of which exist in the industry
- BNP Paribas has developed an Ethereum-based platform called ***AssetFoundry*** to represent tokenized securities. *AssetFoundry* operates on **Hyperledger BESU** with underlying smart contracts in the **ERC-1400** format

BNP Paribas would like to “EXPERIMENT” (i.e. fictitious transactions) the capacity of *AssetFoundry* to **interact with 3rd party systems in the field of payment for a DvP**, both receiving and sending information from/to such 3rd party systems. BNP Paribas would like to conduct this experiment with all 3 National Bank Solutions in order to objectively assess pros and cons of each solution :



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Joint presentation to NTW-CG

15 November 2023

DZ BANK

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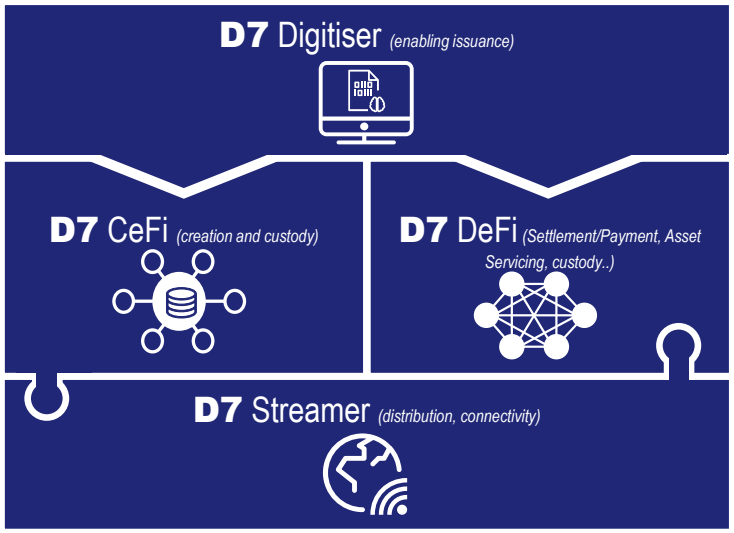
D7 constitutes an institutional-grade, neutral, digital, and future-ready FMI platform

D7 product family

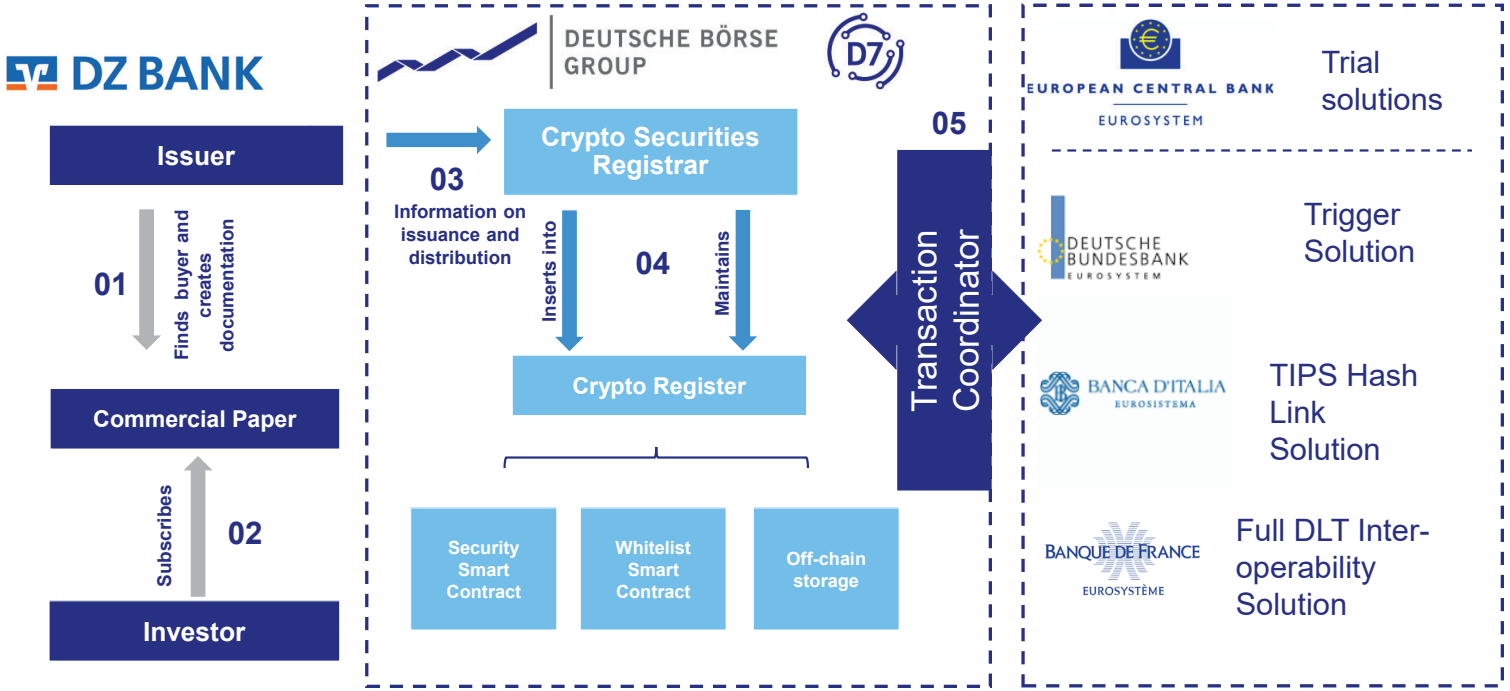


Envisioned value proposition

- D7 provides a set of **services, rulebooks and technology** to allow for the **digitization** of the issuance, transfer, custody and lifecycle management of financial instruments
- In line with new laws and regulation, D7 will not only consist of services organized by a central authority like the CSD (D7 CeFi) but **also services organized outside of a central authority in a decentral manner** (D7 DeFi)
- Common elements like the D7 Digitiser or the D7 Streamer (including API/UI) allow for **high flexibility** to make use of central or decentral services

The D7 DeFi component is of great importance to access and build entirely new types of markets

The project will enable the full lifecycle of a commercial paper in a crypto securities register (eWpG)



Workflow

01 **Origination:** Issuer files necessary issuance documents and finds a buyer for the product

02 **Subscription:** Investor subscribes to the commercial paper

03 **Data provisioning:** All relevant issuance data is provided to the crypto securities registrar, including:

- Reference data of the financial instrument
- Terms and conditions
- Information on distribution including public keys and entry types

04 **Register entry:** The registrar updates the register according to the issuance data, including:

- Setting up the security smart contract
- Settlement/transfer of asset ownership
- Maturity and redemption processing

05 **DvP settlement:** safe and secure transfer of ownership of assets and cash

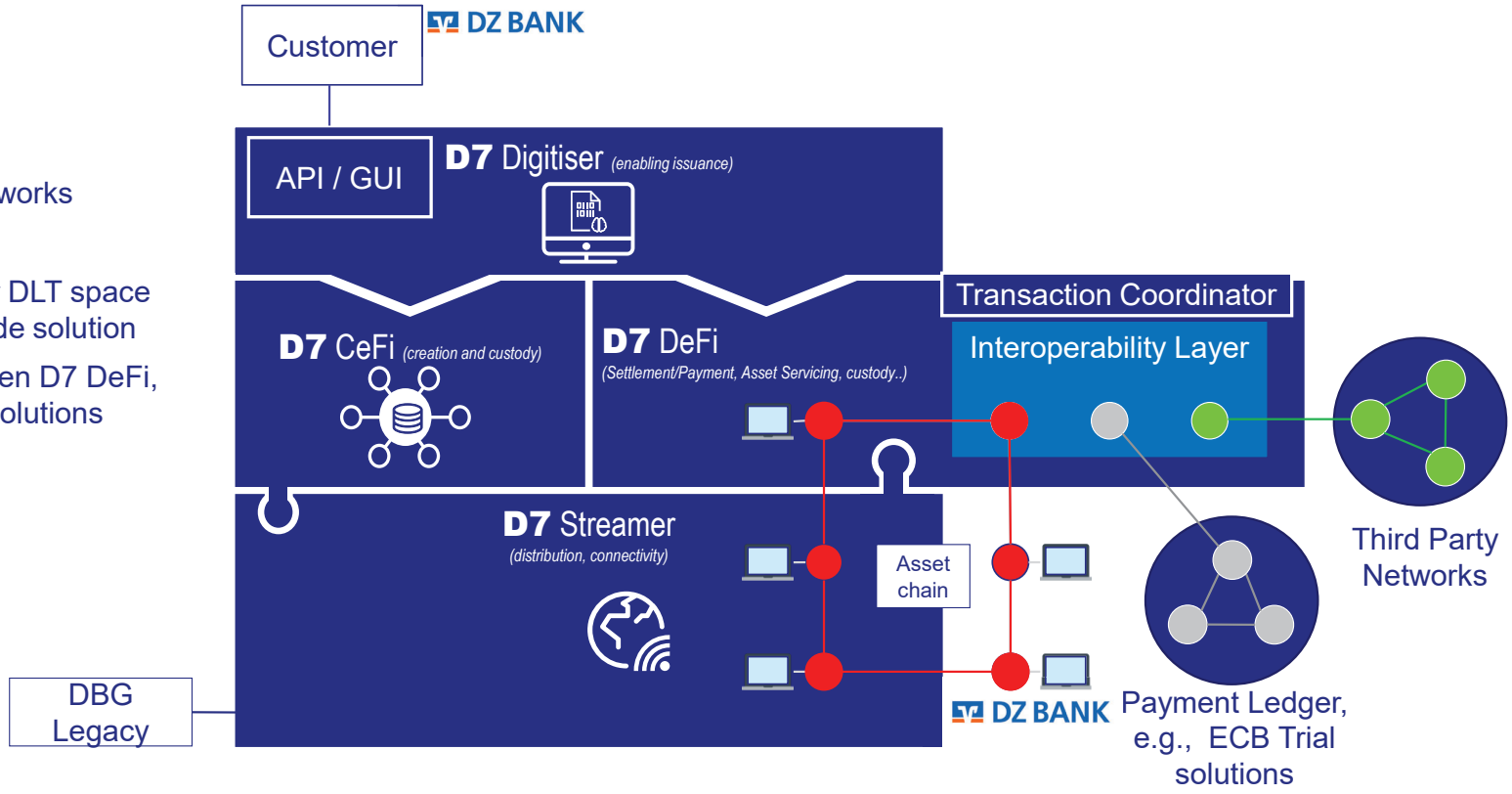
- For primary market transactions
- For secondary market transactions

Depending on client demand, Deutsche Börse could offer connectivity into all three solutions of the central banks

The integrated approach of the D7 platform allows clients full flexibility to choose between central and decentral solutions

Value delivered by D7

- Reach of multiple networks
- On-chain DvP
- Additional security for DLT space due to enterprise-grade solution
- Interoperability between D7 DeFi, D7 CeFi and legacy solutions



Why are we doing this?

- We expect that giving **evolving legal frameworks** allowing for the **issuance of traditional assets onto decentralized services** a growing demand on **the issuer and investor side to issue/invest into these products**
- We are convinced that the technology **(DLT) will allow for quantum leaps** in the processing of lifecycle events for securities – also sharing and joint usage of **golden source information** about securities will significantly lower reconciliation costs
- Deutsche Börse is reflecting those considerations with the **set-up of the D7 project** – at first, addressing the **digitization of the financial instrument** but at the same time **combining central and decentral services** into one joint offering; thus, enabling the **entire value chain from issuer to investor to reap benefits**

Q & A

Thank you!

DEUTSCHE BÖRSE GROUP

DZ BANK

Disclaimer

Digital Commercial Paper

A use case for the Hashlink

NTW-CG November 15th 2023

Content

- **What is the problem the business case would address and what opportunity does it create?**
- **How would DLT overcome/fix the identified challenge(s)?**
  - Why would (only) DLT address the challenge(s)?
  - Where would DLT bring improvements where current infrastructures are unable to?
  - How would you address the challenge(s) without DLT?
- **What are the learnings you envisage to obtain? What is the experience you wish to gain?**

What is the problem the business case would address and what opportunity does it create?

- **Business case**
  - Issuance and life-cycle management of instruments with short duration
- **Background**
  - The growth of a market for digital assets is closely linked to the growing spread, among investors, of platforms based on Distributed Ledger Technologies (DLT), which carry a promise of near-real time reconciliation and settlement;
  - The market is gradually shortening the settlement cycle (transition to T+1 in 2024) and there is a need to automate clearing and settlement processes to achieve ambitious new targets;
  - A number of asset classes are not deposited on traditional depositaries and settled in T2S and nevertheless represent significant business opportunities; setting up secure DvP finality with these instruments would be beneficial for the market, and the use of the DLTs where these assets are issued or tokenised would provide a simple solution.
- **The aim of the initiative**
  - The aim is to design, develop and take to production a digital solution for security tokens, by leveraging the use of DLT via the D7 platform; settlement finality will be offered by linking to the cash leg via the Hashlink smart escrow mechanism.
- **The partner of the initiative**
  - The initiative involves **Deutsche Börse** Group and **Intesa Sanpaolo**.

How would DLT overcome/fix the identified challenge(s)?

- **Why would (only) DLT address the challenge(s)?**
  - Although it may be possible to address some of the challenges via traditional (non-DLT) technologies, a DLT-based solution appears the natural choice for programmable infrastructures to achieve secure delivery-versus-payment on near real-time basis, in line with the scope of NTW-CG;
  - Traditional solutions require a third party supervising the process, beside technological and organizational mechanisms. An example of that kind are securities deposited with a CSD and settled via T2S;
  - Nonetheless, a DLT based solution without supervisors or CSDs may be more convenient, especially for **short duration** instruments (commercial papers, trade receivable …);
  - Furthermore, some forms of corporate actions (which will not be part of our trial) might be obtained with "programmable"(smart) contracts;
  - Redemption (and coupons) of the commercial paper could be automated (smart contract);
  - The use case would be suitable also to negotiate assets in a secondary market.
- **Where would DLT bring improvements where current infrastructures are unable to?**
  - The improvement would be in terms of operational efficiency, *i. e.* costs and time to issue securities and make them available for investors;
  - Moreover, a DLT solution would provide benefits in terms of workflow transparency and auditability.
- **How would you address the challenge(s) without DLT?**
  - Using the traditional steps: issuing in a CSD and settling via T2S;
  - Programmable features should be done with traditional corporate actions, where possible.

What are the learnings you envisage to obtain? What is the experience you wish to gain?

Regulatory items

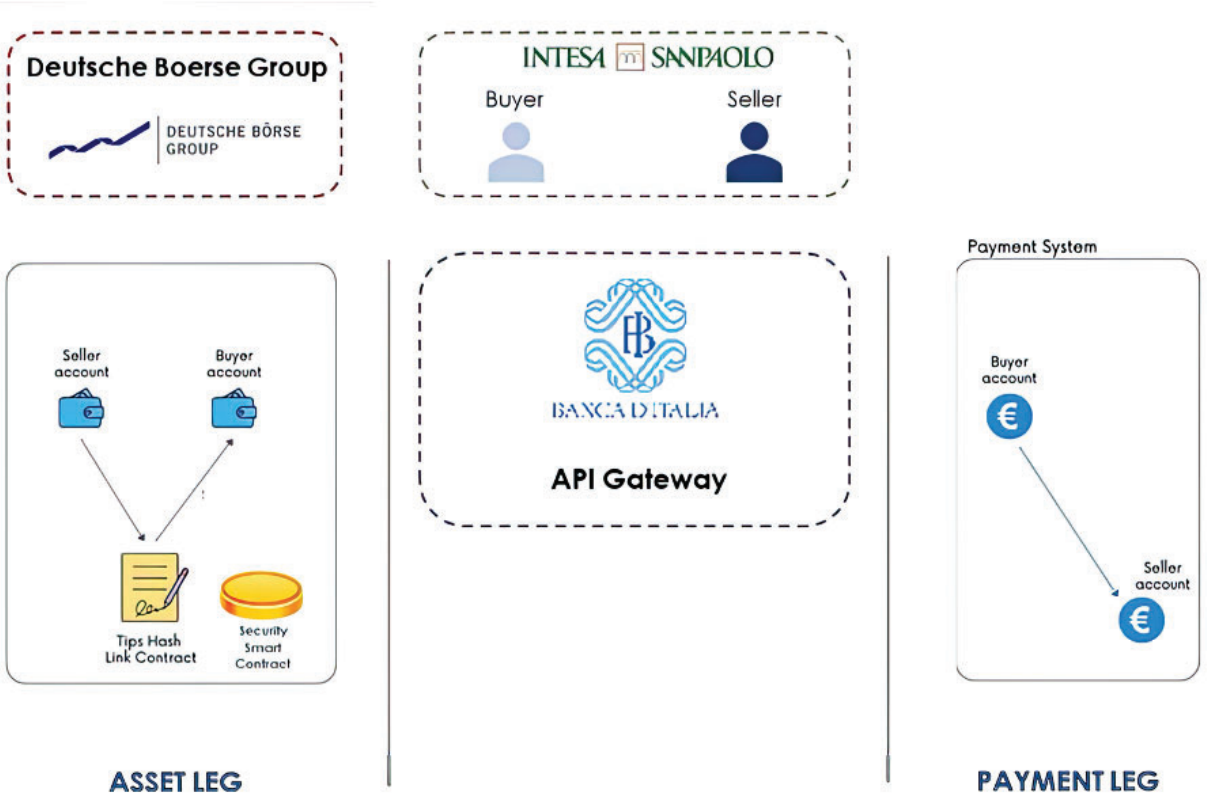
- The trial requires to go through all the legal and regulatory aspects, accounting, internal controls, clients' contracts;
- Direct use of the CBDC for the cash leg (no stablecoin or e-money token);
- Among the regulatory aspects is the registration/listing (in Lux) with XS-ISIN code, under the UK law.

Experience

- We wish to explore the possibility of using a public blockchain to issue and settle digital securities, in collaboration with leading european CSDs;
- The security issuance might involve a institutional clients (such as an asset manager); we expect to gain experience also from implementing the e2e accounting cycle;
- The use case appears suitable to be brought in a production environment, and provide business benefits.

Suggested solution

- **Scope**
  - Issuance of a Commercial Paper
  - Primary distribution via HLC solutiom
  - Redemption processing



KFW
Bank aus Verantwortung

NTW-CG Presentation on KfW Digitalization Strategy

15 November 2023

Digitalization and Innovation at KfW Financial Markets

KfW is one of the largest and most active issuers of bonds and short-term debt instruments and one of the most intensive users of **cross-currency swaps**

Efficient processes and a **high degree of automation** in the **issuance** of securities are of strategic interest to KfW and its stakeholders

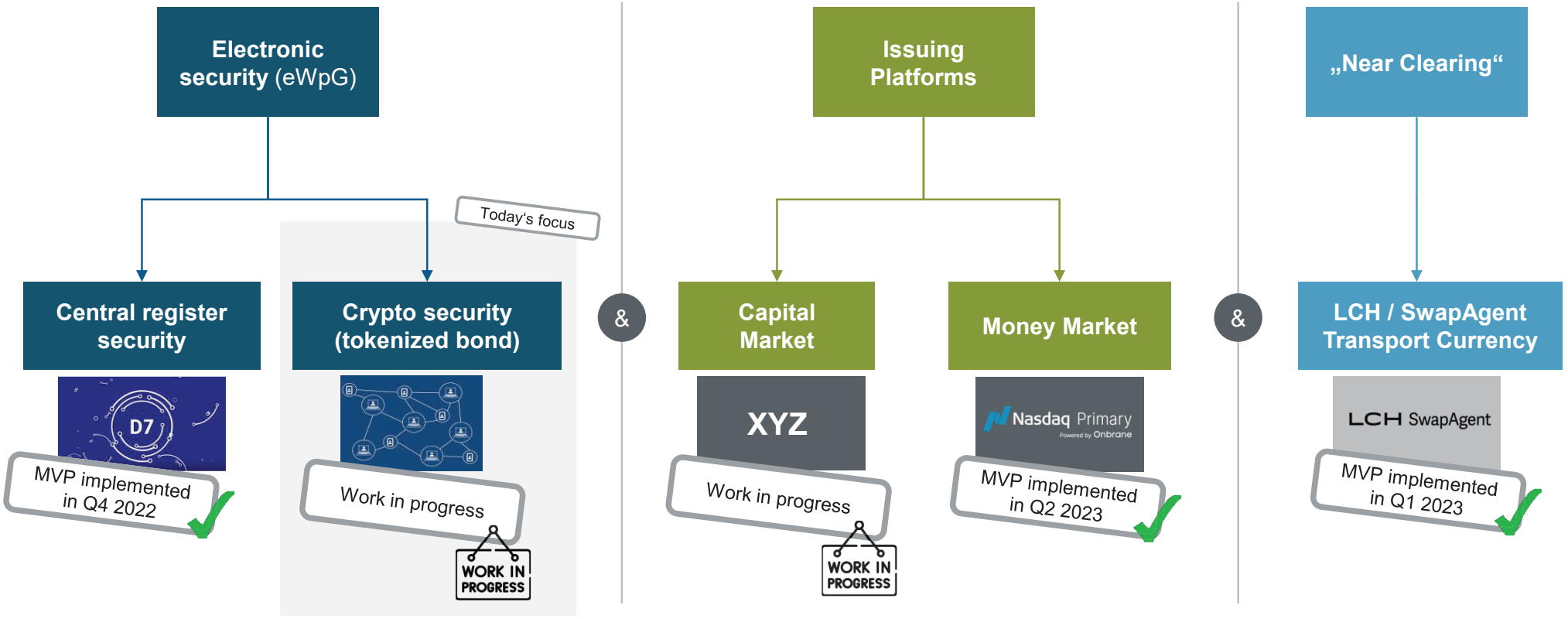
KfW is pursuing **different digitization and innovation initiatives** to drive implementation of pilot projects, gain experience, learn lessons, and **support the development of the overall market**

Different digitization initiatives **focus on different strands of the overall issuance process** and provides a solution for a sub-process of securities issuance

Overall strategic goal: Increase the **efficiency** of processes, lower **costs**, achieve a high degree of **automation**

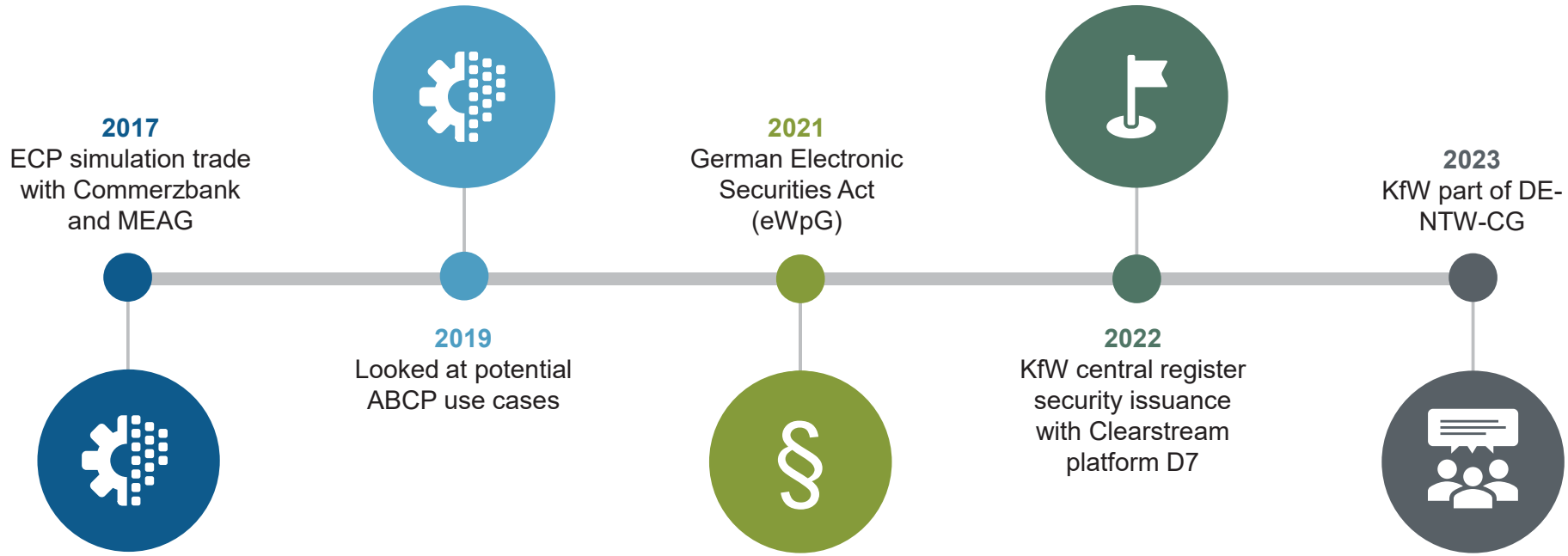
Digitalization and Innovation Initiatives at KfW Financial Markets

Multitrack approach across three complementing strands sets end-to-end view into focus



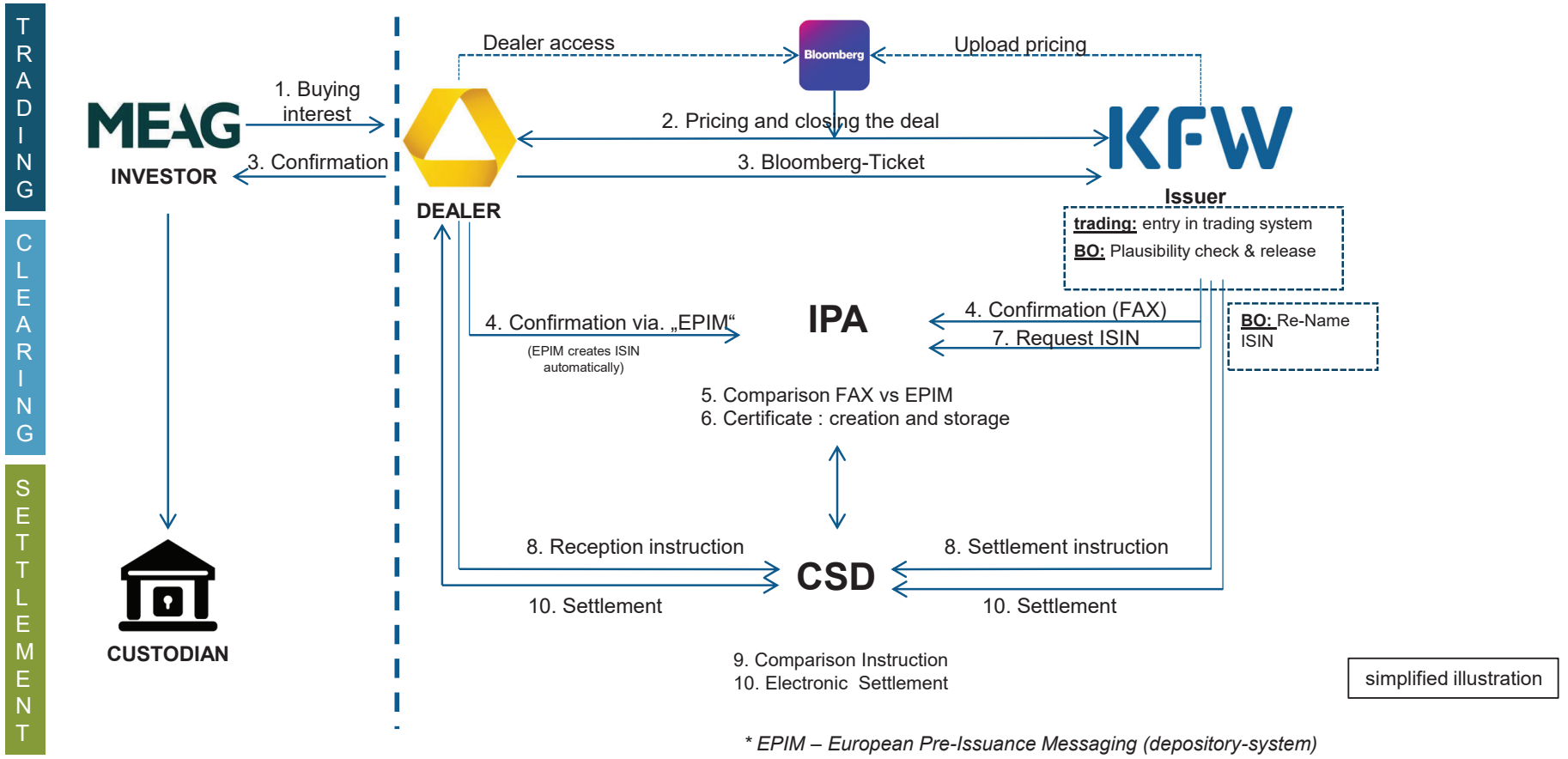
KfW and Tokenization

Recap of KfW efforts and significant market developments setting the stage for the future



Current Issuance Setup by the Example of Europ. Commercial Paper

Delivery-versus-payment (DvP) creates highly-complex structures with multiple involved parties



** EPIM – European Pre-Issuance Messaging (depository-system)*

Identified Challenges and how DLT can Overcome/Fix Them

Current challenges regarding the issuance process can be clustered into asset and payment leg

Asset leg

- **Identified challenge**: Each of the involved parties in the issuance process has its own data set
  - On the asset leg, there is no consistent and coherent data across all involved parties that everyone can agree on ("trusted")
  - Current solution involves via central intermediaries, e.g. clearing systems
- **Possible solution**: creation of a unified data platform that can be trusted and all involved parties can agree on
  → **DLT could be a solution**

Payment leg

- **Identified challenge**: Current system has a completely separate structure by dividing payment and asset stream
  - As a consequence, the systems do not communicate with each other in a trustful manner
  - Current solution involves via central intermediaries, e.g. clearing systems
- **Possible solution**: Merge asset and payment leg information to have an automatic DvP possibility
  → **DLT could be a solution**

→ Across both asset and payment legs, the identified challenges lead to inter alia **higher costs**, **time delay** and **increase in operational risks**

Proposed KfW Use Case on Tokenization

Use case enables learning journey for end-to-end view of the issuance process on DLT

Use case motivation

- **Learning journey** for end-to-end view of the issuance process on DLT
- Strengthening of the **European financial market** and **European capital markets union**
- Currently high **dynamics in the field of tokenization efforts** on the international money and capital markets, e. g. EIB, Siemens, World Bank
- Use case strengthens KfW‘s role as **innovation hub** and **enabler**
- Use case with **clear contribution to KfW group strategy**, in particular "Digitalization and Innovation“ sector
- Opportunity to **develop scalable solutions** through current regulatory framework, possibly EU DLT pilot regime

Proposed KfW use case

- Testing of the possibility of issuing a **tokenized bond** in the form of a **crypto security** compliant to the **German Electronic Securities Act**
- Conceptualizing the potential bond issuance together with a **dealer/bookrunner consortium** (KfW → dealer/bookrunner → investors)
- Accompaniment of the bond issuance with **workshops/learning sessions** to reach out to several parties and, in addition, give investors the best chance to participate
- **Exploration of new parties and roles** involved and how they could be integrated into the existing KfW landscape, e. g.
  - crypto securities registrar („Kryptowertpapierregisterführer“)
  - crypto custodian
  - usage of smart contracts
  - potentially new trading venues → secondary market liquidity
  - participating in the DLT network, e. g. running own nodes

Learnings we envisage to obtain are consequently along the end-to-end view of the issuance process

Payments on tokenized basis, i. e. with integrated payment leg („DvP“)

Possibilities to achieve secondary market liquidity

Crypto custody solutions

Coupon payments per smart contract in shorter intervals than once per year

Measuring of CO_2 in grams of the blockchain tokens

Dynamic reporting of bond-related information directly from token to wallets

KFW

Thank you!

15 NOVEMBER 2023

DIGITAL SUSTAINABLE BOND WITH CARBON FOOTPRINT

Presentation to the ECB New Technologies for Wholesale settlement - Contact Group (NTW-CG)

Societe Generale - FORGE

SOCIETE GENERALE

FORGE
SOCIETE GENERALE GROUP

WHAT IS THE PROBLEM THE BUSINESS CASE WOULD ADDRESS AND WHAT OPPORTUNITY DOES IT CREATE?

Enhance efficiency, transparency, and security while reducing costs by leveraging decentralized and immutable ledger technology

What is the issue?

Financial markets remain prone to various risk and inefficiencies stemming from rigid infrastructure and operational schemes, and are not capturing the full potential of digital solutions from an organisational, distribution and product structuring perspective. Role and responsibilities are highly fragmented across different operators.

Why does Blockchain address it?

- **Transparency, Traceability and Trust**: Blockchain solutions provide a WW tamper-resistant and transparent ledger of financial transactions. This transparency fosters trust among market participants, reducing the need for intermediaries, data duplication and potential for fraud.
- **Efficient Settlement and Clearing**: Blockchain streamlines the settlement and clearing processes in financial markets, allowing for near-instantaneous, cost-effective, and error-free transactions. Traditional systems often involve multiple intermediaries and delays.
- **Reduced Counterparty Risk and Operational Costs**: Blockchain mitigates counterparty risk by enabling real-time reconciliation and reducing the need for manual processes and multiple databases. This results in lower operational costs and increased efficiency compared to legacy systems that are susceptible to errors and operational overhead.

Can't traditional infrastructure address it?

Blockchain enables a more profound systemic overhaul, leveraging its unique features for addressing financial market challenges unattainable by centralized systems. Building aside current solutions a new web3 infrastructure reduces operational risk of a big bang shift while allowing innovation ambitions to reveal themselves.

Programmability and traceability at financial instrument / trade level open new opportunities.

BUSINESS CASE OF DIGITAL SUSTAINABLE BOND

Operational improvements through digitalisation linked to innovative ESG features

Upgrading traditional bond issuance infrastructure…

Issuer	[Supranational / Agency]	**Governing law**	[French] / [German]
Rating	AAA	**Form of the notes**	Dematerialized, native token on a DLT
Notional	EUR [100 – 300]m	**Listing**	Yes, trading within the Pilot Regime
Tenor	[2 – 5] years	**Settlement**	T+0 using a CBDC solution
Target market	Professional investors, RegS	**Blockchain**	Ethereum Public

Reporting on-chain on the **carbon footprint** of security token issuances; DLT allows to evaluate specific components of a security issuance over its life-cycle, offering reporting insight into the granular inner workings of the issuance chain.

…with DLT solutions…

- Enlarged distribution channel
- Position and trade transparency / knowledge of the UBO
- Reduced issuance cost, no unsold amount, and lower minimal notional issuance
- Faster and cost-efficient settlement, leverage for ALM automation
- Reduced custody cost / position monitoring and key safekeeping
- Enhanced structuring for new products (through smart contracts)

Whilst the traditional infrastructure is tested & proven, DLT solutions bring enhancements as they are:

- Programable & automatable
- Secure & immutable
- Fast, allowing for instant DvP
- Operationally efficient & disintermediated
- Transparent
- ESG beneficial
  - Information-wise: carbon footprint can be calculated on a per transaction granular level
  - Impact-wise: data duplication reduction

…brought to their full potential by central bank support

1. CBDC allows robust & dynamic management of settlement all along the lifecycle of the notes
2. CBDC enables collateral monetary operations

SOCIETE GENERALE – FORGE

Bridging the gap between capital markets and digital assets

Door-to-door **security services suite** based on **public blockchain** ethereum

SG-Forge is both licensed as an **investment firm** and **the 1st company licensed as Digital Asset Service Provider** in France (and as such almost MiCAR-compliant)

Structuring

Issuance

PRIMARY ISSUANCE LAUNCHPAD

- Structure digital-native securities
- Issue, allocate and transfer security tokens on behalf of issuers and investors

Bonds | *Money Market* | *DLP* | *Structured Products* | *Settlement Products*

Post-trade

FLEXIBLE SETTLEMENT OPTIONS

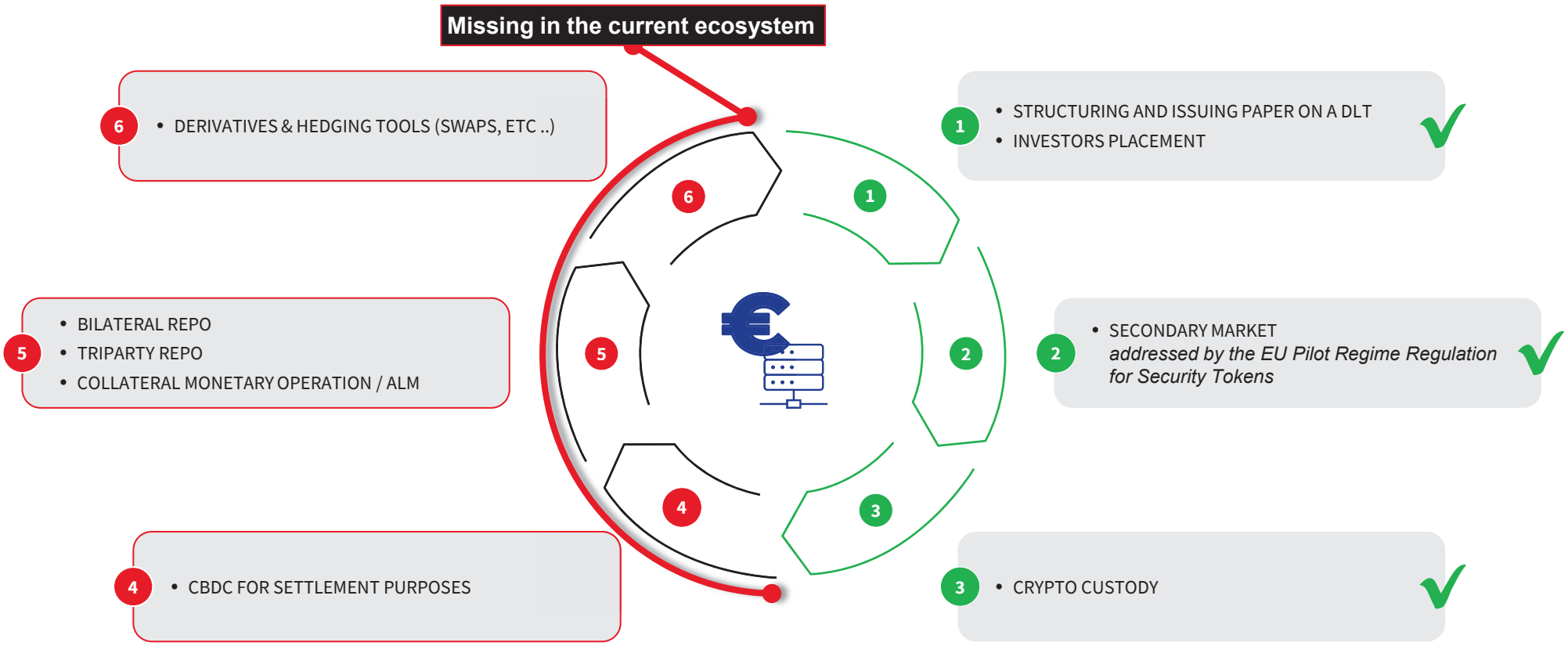
Cash (TARGET) | CoinVertible *Settlement token (EURCV) on-chain* | *CBDC (DL3S)*

Asset servicing

DIGITAL CUSTODY SOLUTION

Digital assets custody solution | *Repo*

WHOLESALE DIGITAL EURO IS AN ESSENTIAL ECOSYSTEM ENABLER

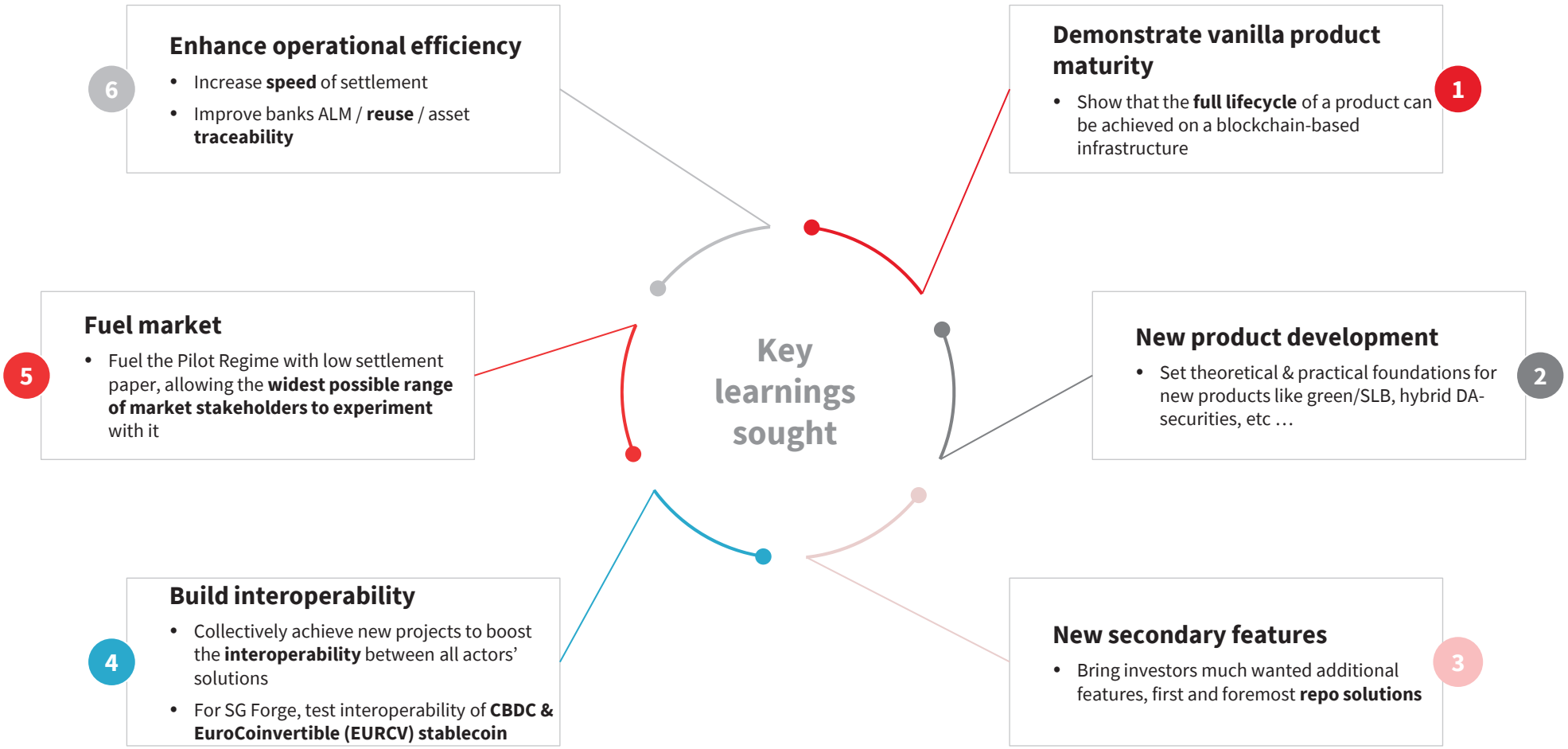


CBDCs are an essential component of DLT solutions for financial markets because they provide a bridge between the traditional financial system and the decentralized, blockchain-based DLT infrastructure. They offer several advantages:

1. **Interoperability**: CBDCs can facilitate seamless transactions between DLT and traditional financial systems, making it easier for market participants to transition and coexist within a hybrid ecosystem.
2. **Regulatory Compliance**: CBDCs, when issued and regulated by central banks, ensure compliance with existing financial regulations and provide a familiar legal framework, assuaging concerns about regulatory challenges in DLT solutions.
3. **Stability and Trust**: CBDCs issued by trusted central authorities instill confidence and stability in the DLT ecosystem, addressing concerns about the potential volatility and trust issues associated with cryptocurrencies.

BUILDING MARKET COHESION BY EXPERIMENTATION

Feedback from ECB trials and experiment would serve efficiency & interoperability, supporting wider market adoption



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FORGE

SOCIETE GENERALE GROUP

Agenda item 2: Interoperability standards between different DLT platforms

2.1: Proposals for interoperability standardisation

Background: members of the NTW-CG were invited to report share their views on the need for standardisation and suggest proposals on what aspects should be standardised and how it could be achieved.

In previous NTW-CG meetings and via written consultations, members repeatedly raised the importance of standardisation when using different DLT platforms for wholesale financial transactions settled in central bank money. In a joint presentation, the four members share their views and proposals where they see the need for standardisation (e.g., for interoperability between different DLT and non-DLT platforms, of protocols, data) and how this could be achieved.

5th NTW-Contact Group
meeting 15/11/2023

Applying DLT into the financial plumbing

The need for standards

ECB NTW Group
Joint contribution by:

ICMA	**Fnality**
Swift	**ING**

Problem statement: why we need standards

In a world where we expect many different DLT platforms around various business needs, we need many connections between those platforms.

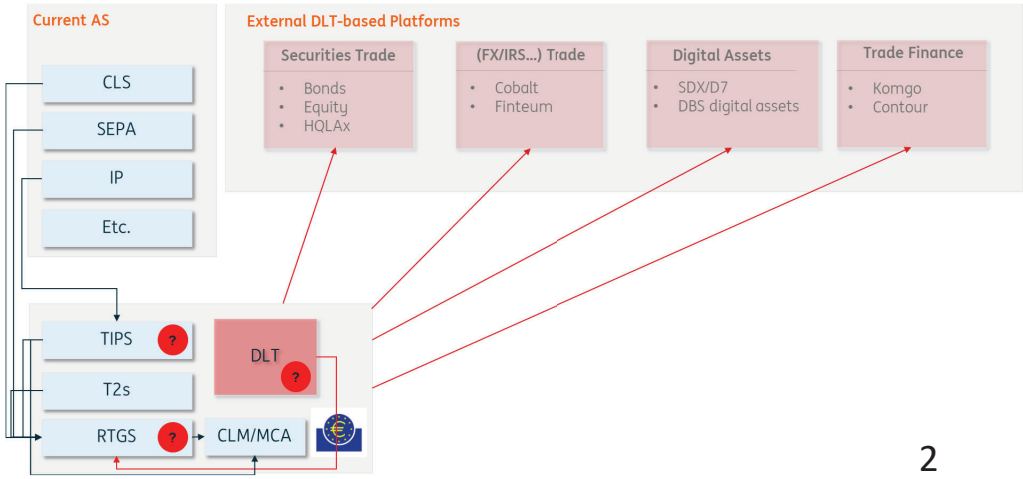
As such we need standardization in order to avoid:

- Fragmentation in technical solutions (different technical setup at bilateral interoperability level).
- Fragmentation in practical application of the underlying business needs (eg operating hours, free flow of liquidity when needed, legal certainty of assets and money on various platforms, business rules).
- Inefficient cross currency setup – we need central banks to align on their application of central bank money cross the various platforms in order to ensure smooth function in the various currencies and cross currency.
- Unsustainable maintenance and control of the evolving landscape – without alignment of the required standards to run a multilateral interoperability setup, it will be impossible (or at least very slow and costly) to move ahead in a fast developing landscape. We must invest upfront and avoid repair at a later stage.
- "Interoperability is necessary for the implementation of new financial market technologies that are characterised by interdependencies and network effects."

  ECB report on the Use of DLT in post-trade processes, April 2021

We see the need for standardisation across the following:

- **Asset definition / Tokenisation**
- **Flow orchestration / choreography**
- **Interoperability layers**



Multilateral interoperability for wholesale DLT

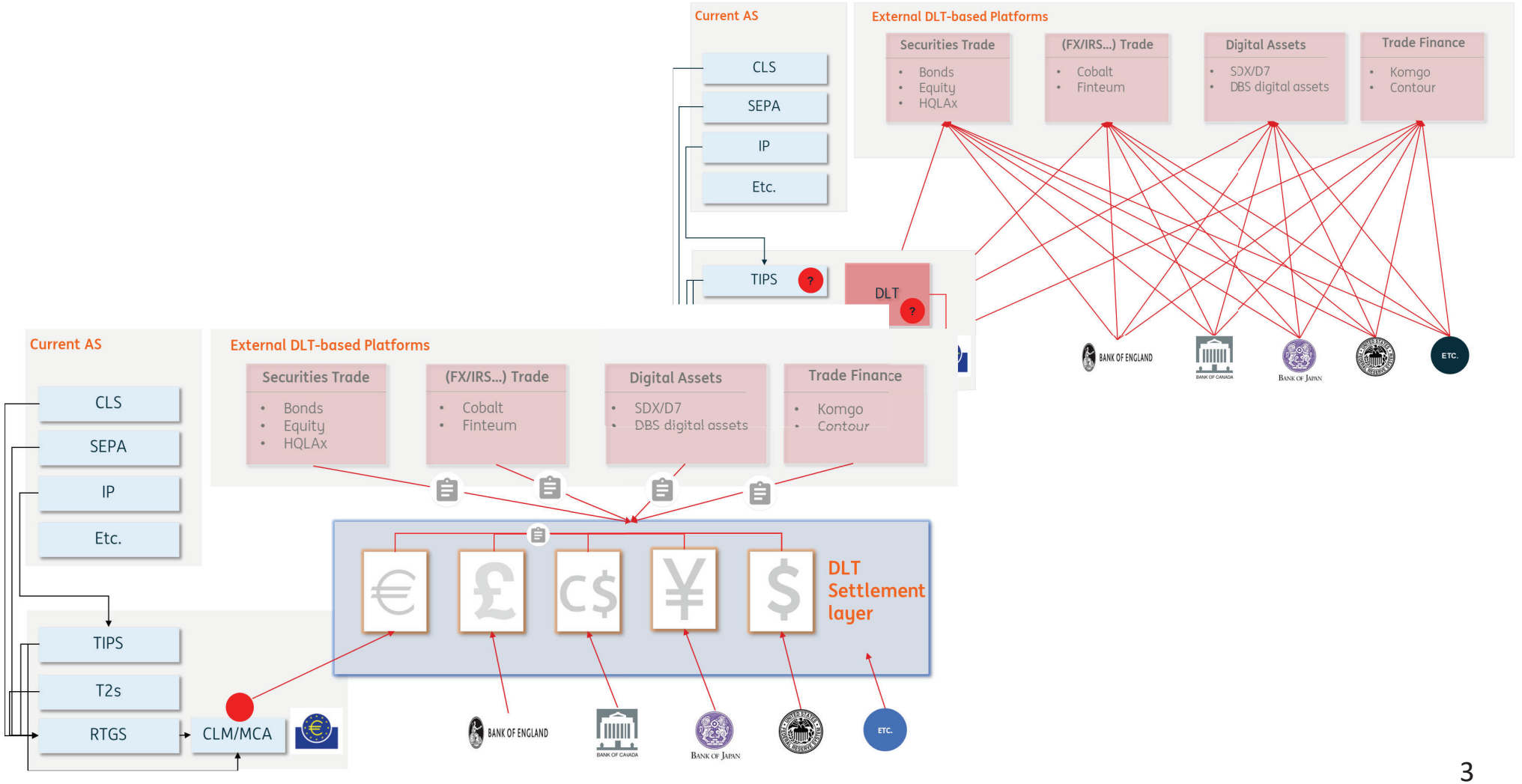
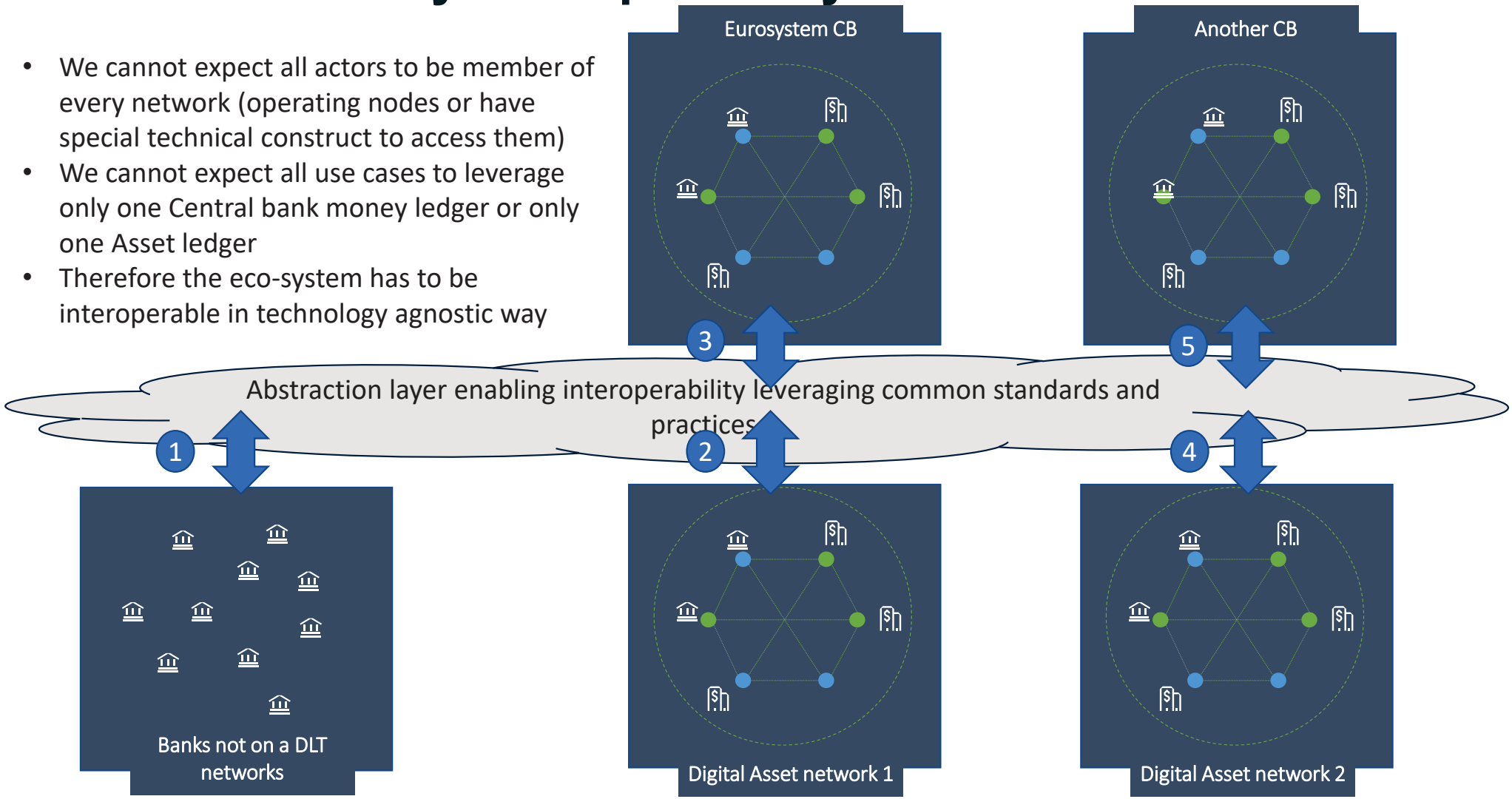
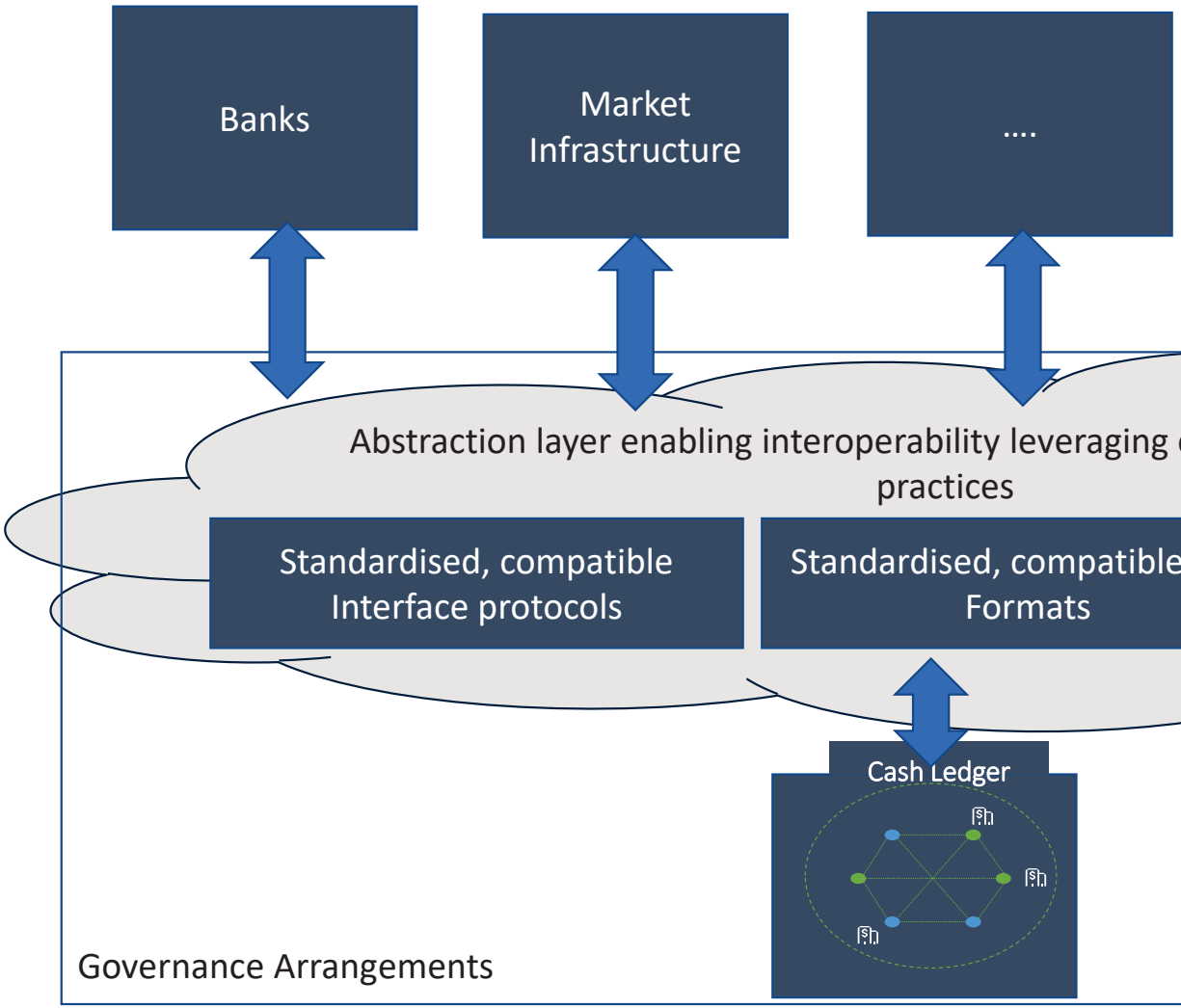


Illustration of why interoperability standards are needed

- We cannot expect all actors to be member of every network (operating nodes or have special technical construct to access them)
- We cannot expect all use cases to leverage only one Central bank money ledger or only one Asset ledger
- Therefore the eco-system has to be interoperable in technology agnostic way



Interoperability layers: visualisaton



The "abstraction layer" comprises of compatible, standardised protocols and data formats.

This approach allows for an open ecosystem, thus increasing overall resilience and reducing the need for new infrastructure.

Interoperability layers: examples from “traditional” finance

Standardised, compatible Interface protocols	Standardised, compatible Data Formats	Standardised DvP protocols (atomicity for asset exchange)
Financial actors’ applications can leverage trusted, secured communication channels with value added services controlling roles and rights of actors in order to trigger business actions between account owners, account servicers and executing parties • *Swift* • *Sia* • *FIX* • …	Financial actors’ applications performing functions that require exchanges of information can rely on messaging standards to remove any ambiguity on content and context of the information provided • *ISO 15022 MT54x for post trade settlement* • *ISO 20022 Pacs.00X for RTGS or interbank payments*	Financial actors’ application can implement consistent rulebooks and practices when performing a certain action in a certain context. • *SMPG Receiving Delivering Depository market practices presenting domestic settlement scenario, and CSD to CSD scenarios…*
DLT ledgers are new form of end points that need trusted interfaces and channels	**DLT ledgers are new form of applications that need standardized data formats**	**DLT ledgers are new forms of settlement places that need practices**

Standardization needs to enable interoperability

ASSET DEFINITION

1. **Each type of digital asset should ideally be defined across ledgers and technical platforms assets with**:
   - Commonly defined in terms of data elements and structure for a similar class in machine readable data (ISO based)
   - Properly identified DLT related references in terms of place of settlement, address and type of processes,

=> Example: Bond Data Taxonomy

FLOW ORCHESTRATION

2. **Once defined, to be traded and liquid, these assets require**:
   - Standardized functions that will perform key events on the asset (e.g. transfer, coupon payment, …)
   - These functions should have behaviours coherent with market practices

=> Illustration: SMPG trade initiation confirmation flows mapped onto token smart contract function; Common Domain Model (CDM) for end-to-end workflow automation across asset classes (eg available in Java, Python)

3. **These functions have to be callable through a common abstraction layer that does not require specific investments to allow direct or indirect access**

=> Illustration: abstraction layer as to address various DVP situations

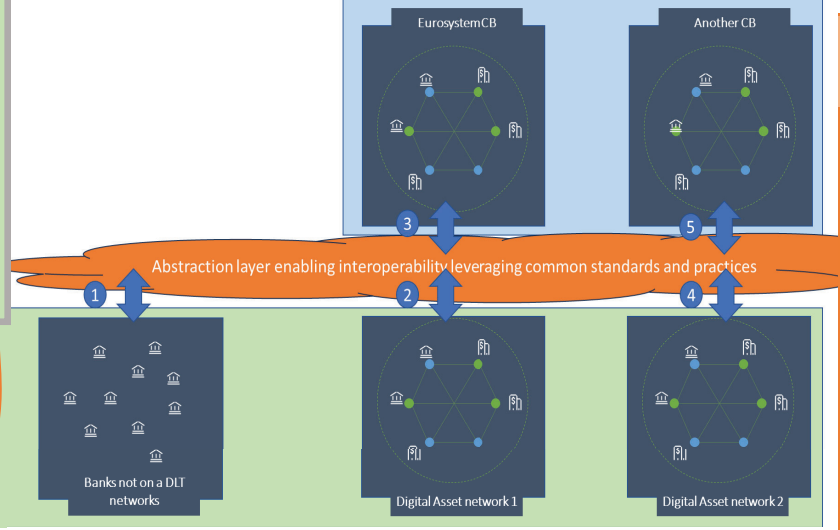
ASSET DEFINITION

1. Central bank ledgers should have Coherent application of central bank money

FLOW ORCHESTRATION

2. Coherent set of functions supporting the various DVP or PVP use cases across central banks

3. These functions have to be callable through an abstraction layer that does not require specific investments for each CB



3 INTEROPERABILITY LAYERS

Assets ledgers and Central Bank money ledgers should have:

- Industry interoperability standards
- Defined on agreed DVP methods
- Setting Technology agnostic principles that are not constrained by the asset or central bank ledgers set-up

Asset Definition: ICMA's Bond Data Taxonomy

What is the BDT?

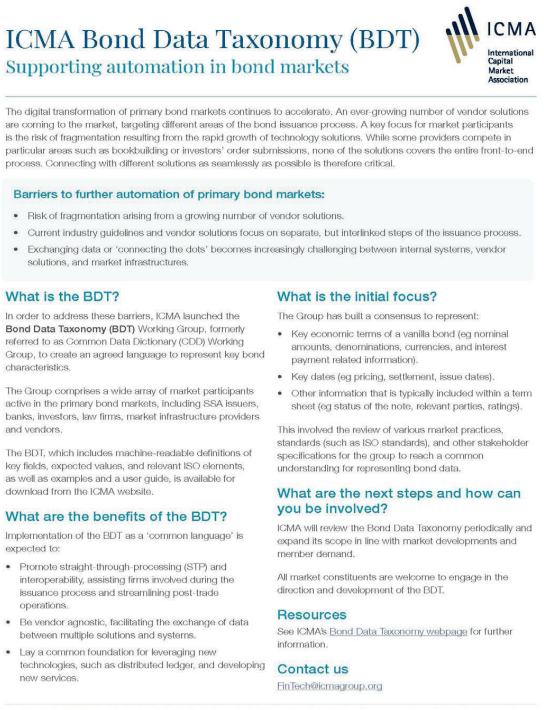
- A common language, built on industry consensus, to represent key bond information in a (i) standardised and (ii) machine-readable manner.
- The BDT comprises over 90 key economic terms and related information of a vanilla bond typically included within a term sheet.

What are the benefits of the BDT?

- **Promote automation and interoperability**, assisting firms involved during the issuance process and streamlining post-trade operations.
- **Vendor agnostic**, facilitating the exchange of data between multiple solutions and systems.
- **Common foundation for leveraging new technologies**, such as DLT.

Who is involved?

- SSA issuers, banks, investors, law firms, market infrastructures and vendor firms active in the international debt capital markets. See further information here.



ICMA Bond Data Taxonomy (BDT)

Supporting automation in bond markets

ICMA International Capital Market Association

The digital transformation of primary bond markets continues to accelerate. An ever-growing number of vendor solutions are coming to the market, targeting different areas of the bond issuance process. A key focus for market participants is the risk of fragmentation resulting from the rapid growth of technology solutions. While some providers compete in particular areas such as bookbuilding or investors' order submissions, none of the solutions covers the entire front-to-end process. Connecting with different solutions as seamlessly as possible is therefore critical.

Barriers to further automation of primary bond markets:

- Risk of fragmentation arising from a growing number of vendor solutions.
- Current industry guidelines and vendor solutions focus on separate, but interlinked steps of the issuance process.
- Exchanging data or 'connecting the dots' becomes increasingly challenging between internal systems, vendor solutions, and market infrastructures.

What is the BDT?

In order to address these barriers, ICMA launched the **Bond Data Taxonomy (BDT)** Working Group, formerly referred to as Common Data Dictionary (CDD) Working Group, to create an agreed language to represent key bond characteristics.

The Group comprises a wide array of market participants active in the primary bond markets, including SSA issuers, banks, investors, law firms, market infrastructure providers and vendors.

The BDT, which includes machine-readable definitions of key fields, expected values, and relevant ISO elements, as well as examples and a user guide, is available for download from the ICMA website.

What are the benefits of the BDT?

Implementation of the BDT as a 'common language' is expected to:

- Promote straight-through-processing (STP) and interoperability, assisting firms involved during the issuance process and streamlining post-trade operations.
- Be vendor agnostic, facilitating the exchange of data between multiple solutions and systems.
- Lay a common foundation for leveraging new technologies, such as distributed ledger, and developing new services.

What is the initial focus?

The Group has built a consensus to represent:

- Key economic terms of a vanilla bond (eg nominal amounts, denominations, currencies, and interest payment related information).
- Key dates (eg pricing, settlement, issue dates).
- Other information that is typically included within a term sheet (eg status of the note, relevant parties, ratings).

This involved the review of various market practices, standards (such as ISO standards), and other stakeholder specifications for the group to reach a common understanding for representing bond data.

What are the next steps and how can you be involved?

ICMA will review the Bond Data Taxonomy periodically and expand its scope in line with market developments and member demand.

All market constituents are welcome to engage in the direction and development of the BDT.

Resources

See ICMA's Bond Data Taxonomy webpage for further information.

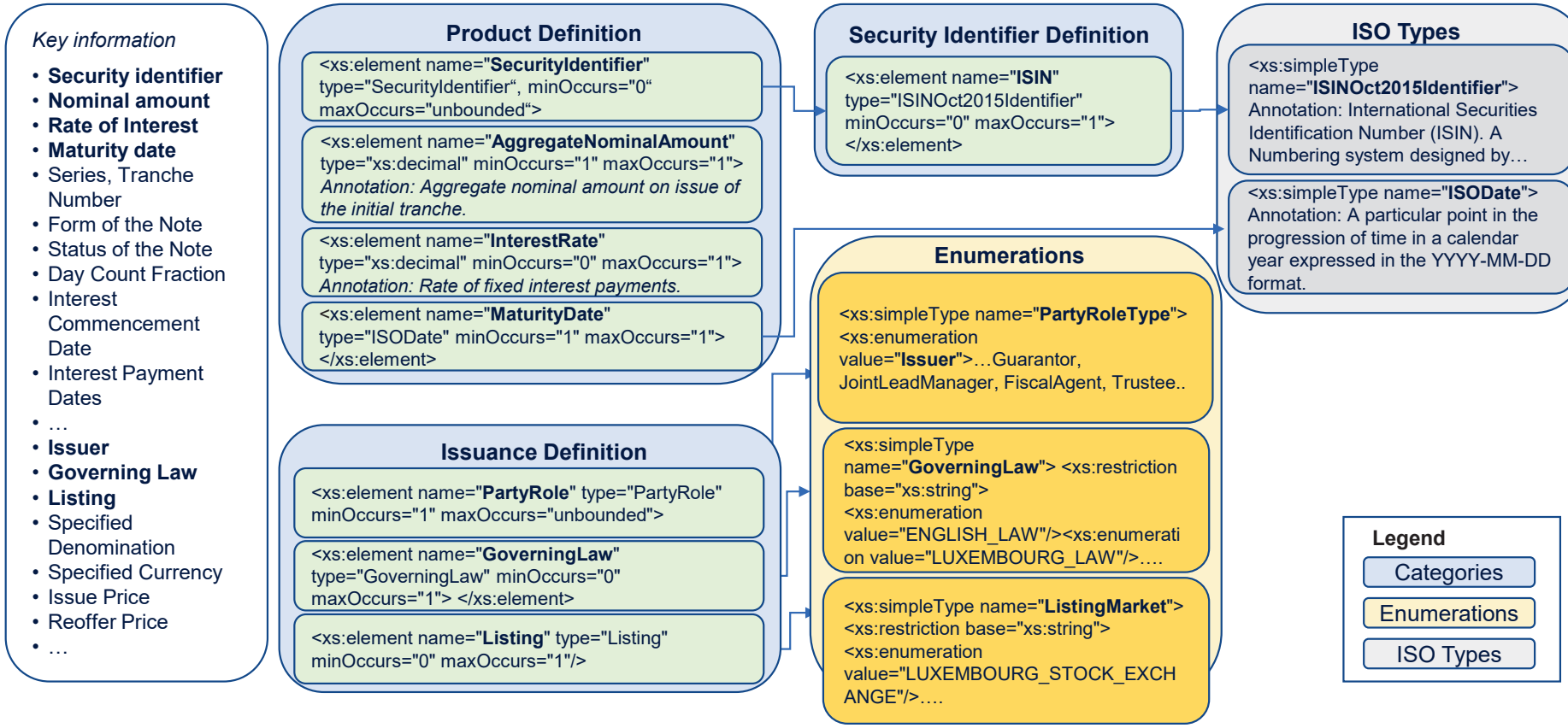
Contact us

FinTech@icmagroup.org

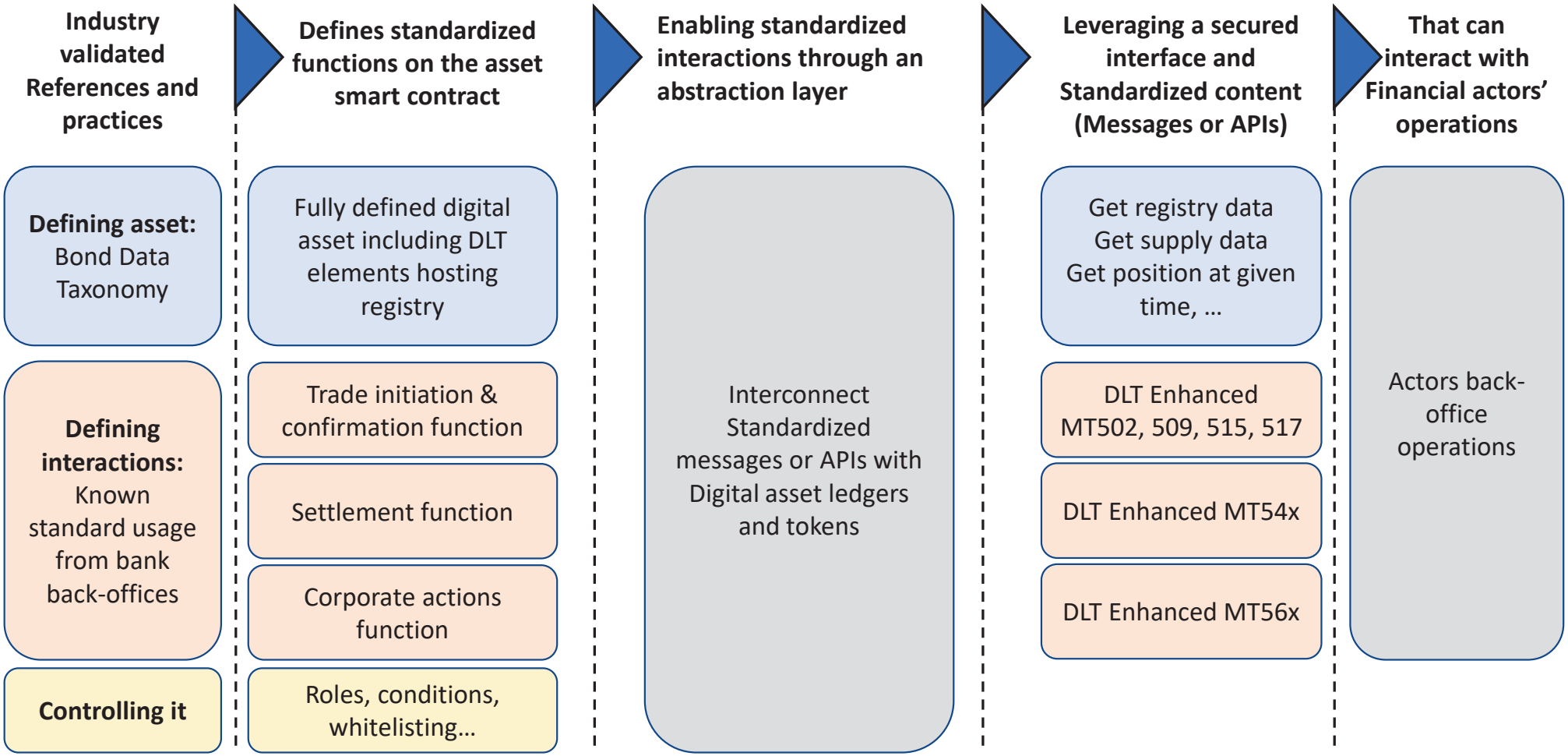
See also: ICMA BDT Factsheet

Asset Definition: ICMA's Bond Data Taxonomy

An agreed language, which is technology and vendor agnostic, to represent key bond information in a (i) standardised and (ii) machine-readable format



Flow Orchestration: Standardizing flow orchestration on the asset ledger - concept



Flow Orchestration: End-to-end automation of trades and lifecycle events across asset classes

CDM
COMMON DOMAIN MODEL

The CDM is available open-source in FINOS and is designed to be used by:

- ❑ **Market participants** using different execution venues, protocols, and vendor solutions.
- ❑ **Market infrastructures, trade repositories, vendor firms and service providers**.
- ❑ **Firms seeking to enter the market** by using a standardised industry model.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  "initialMargin" : {
    "margin" : [ {
      "haircut" : -0.04762
    } ],
    "marginType" : "CASH"
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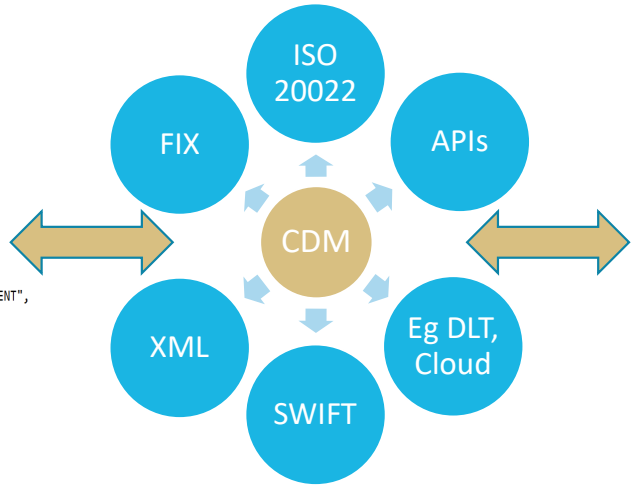


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"securityPayout" : [ {
  "initialMargin" : {
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      "globalKey" : "c0fc2368"
    },
    "settlementAmount" : {
      "amount" : 1292748.30,
      "currency" : {
        "value" : "USD"
```


Each party uses the CDM as a 'common language' to process repo, securities lending, bond and derivative transactions. See ICMA's CDM demo.

See also PvP cross-currency FX swap Business case presented at NTW-CG meeting on 7 September 2023.

Interoperability layers

Interoperability layers can be achieved via multiple complementary models

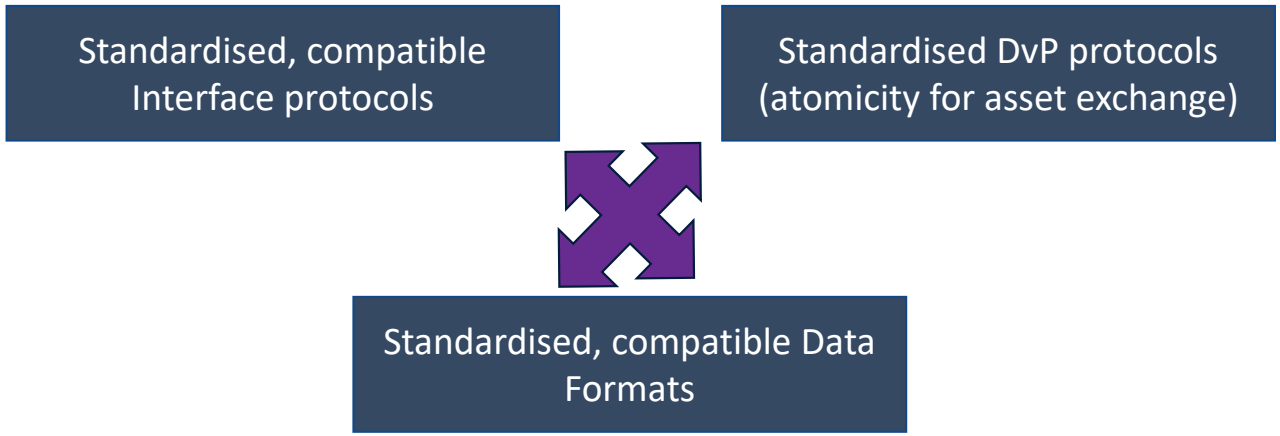
Successful operation of these models will rely on agreed market principles such as:

- Standard models and methods for the operation of DvP and PvP: earmark-based, escrow and release, HTLC or other mechanisms
- Standardised management of central bank liquidity: a full DLT solution for a cash network, an assigned pool for digital transactions or re-use of existing pool or omnibus account, combined with payment orchestrator service operator

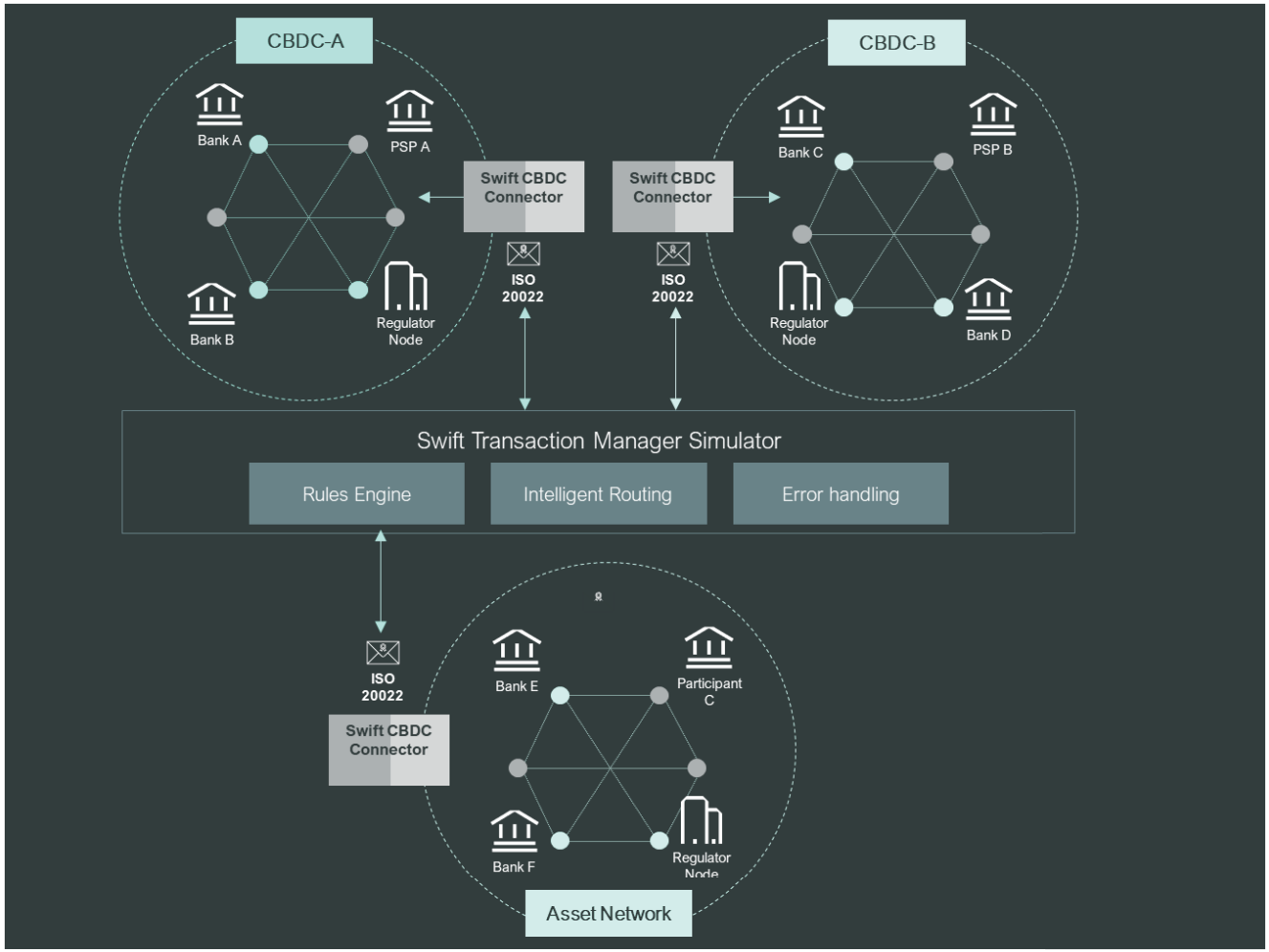
Interoperability layers

"Interoperability" standardisation has different dimensions.

- **Data Formats *and* Interfaces**: to avoid fragmentation in technical solutions leading to increased costs of integration, both *Interfaces* to access different Platforms, or Ledgers, as well as the *Data Formats* being used to communicate should be standardised: commonly accepted formats and interfaces can create a 'virtual' interface, compatible across asset classes, to enable information to freely flow from/to different Platforms.
- **DvP/PvP coordination:** common standards of coordination to achieve atomic settlement between diverse systems and actors should be maintained, to ensure that abstraction does not reintroduce settlement risk or undue counterparty risk.



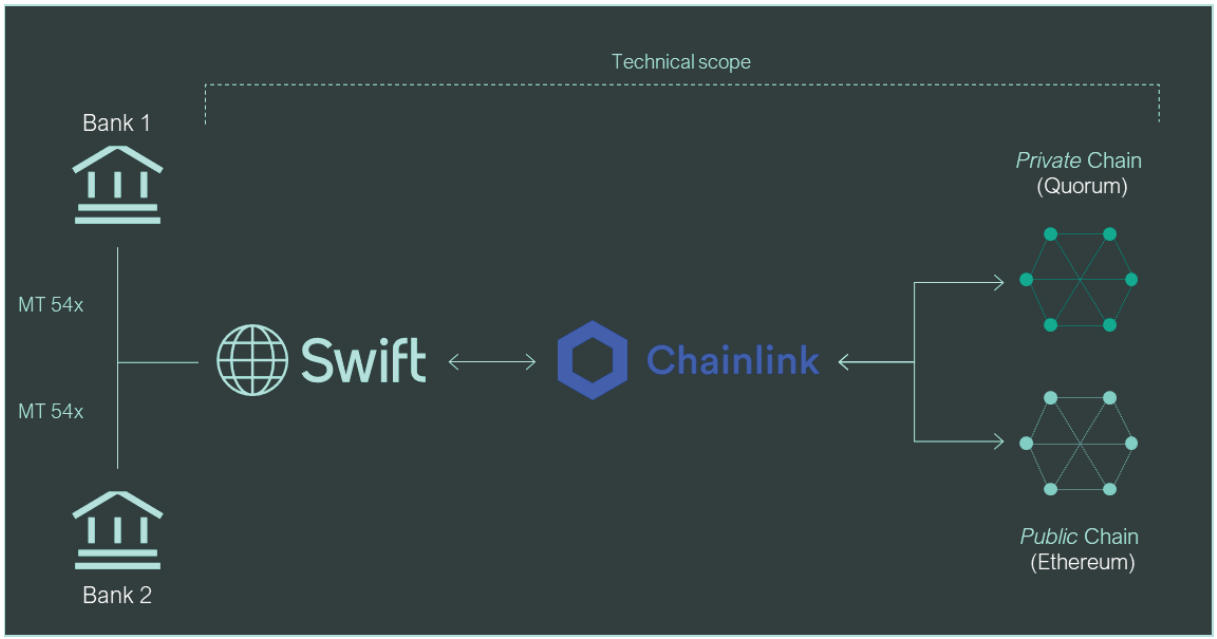
Interoperability layers: example of a connector model (e.g. Swift CBDC connector)



Connector Model for Interoperability

- A Connector model can enable DvP and PvP transactions between digital money networks (e.g. CBDC networks) and digital asset networks
- Can work with existing payments infrastructures, as well as private blockchain based networks
- In this model, the connector integrates with the relevant network and provides transaction conversion into standardized format (e.g. ISO20022)
- A middle layer (in this example, the Swift Transaction Manager) provides routing and synchronisation of the transaction
- This model is currently being beta tested by 3 central banks, and in a CBDC sandbox with >30 participants

Interoperability layers: example of a protocol-based model (e.g. recent blockchain experiments)



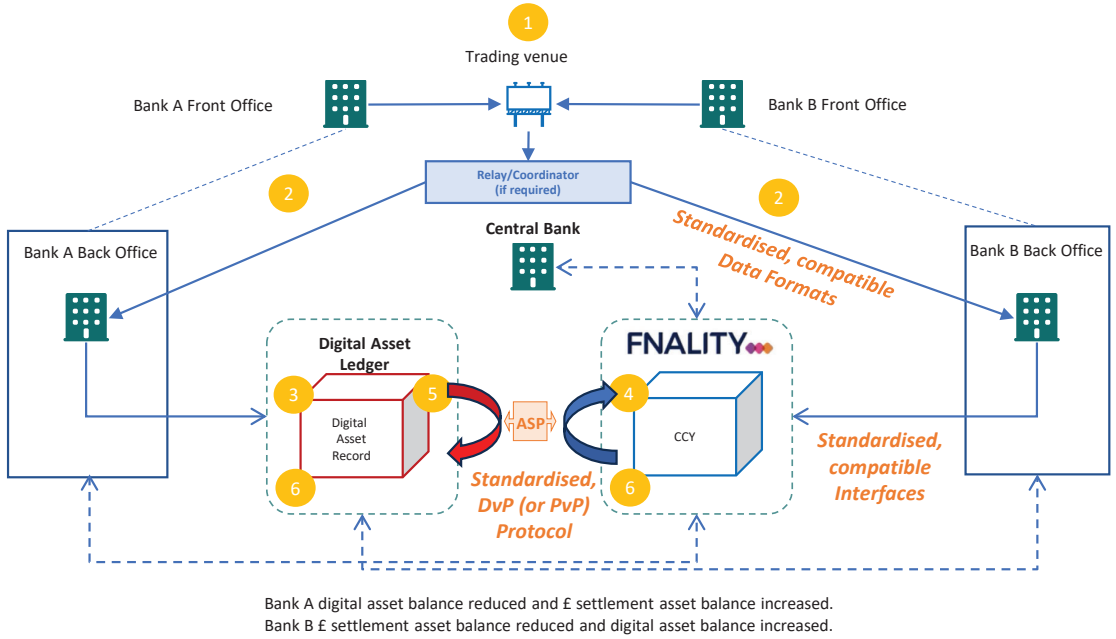
Experiment use cases

1. Transfer of tokenised asset **between two wallets on same public DLT network** (Ethereum)
2. Transfer of tokenised asset **between two wallets on different public DLT networks** (Ethereum, Avalanche)
3. Transfer of tokenised asset **from a public DLT network** (Ethereum) **to a private DLT network** (Quorum)

Protocol-based Model for Interoperability

- A Protocol-based model can enable digital / tokenised asset transfers across *public* and private blockchain networks
- A protocol compatible with those blockchains is used to interact with them – in the Swift experiment, Chainlink CCIP was utilised
- In the experiment, Swift acted as a single access point for the experiment participants so they could continue to use standardised messaging to initiate the transactions (i.e. no change to bank back-end infrastructures)

Interoperability layers: example of a protocol-based model (e.g. recent blockchain experiments)



1. Bank A and Bank B FO place an order at a venue; Bank A to sell digital assets, Bank B to buy. The workflow can be handled peer to peer, or through a third party coordinator.
2. Orders are matched, execution order with settlement details goes to all parties.
3. Bank A initiates the settlement. Digital asset ledger records earmark of Bank A's digital asset according to the terms of the settlement. A message is sent to the FnPS ledger via standardised API, in a standardised format.
4. FnPS ledger receives and records proof of earmark and initiates corresponding earmark of Bank B's Funds according to the terms of the settlement.
5. Digital asset ledger receives and records proof of earmark from FnPS via interoperability framework.
6. Proofs of earmark validated and recorded, signed digital asset order is executed on digital asset ledger, and signed currency order is executed on FnPS (settlement complete and final).

Protocol-based Model for Interoperability – PvP and DvP Standards for settlement

- A protocol based model for **PvP, DvP settlement** – in this example, outlining the "**Atomic Settlement Protocol**" (ASP) allows two networks to coordinate atomic settlement, thus thus reducing counterparty / Herstatt Risk.
- **Standards are composable:** standardised Settlement on a DvP, PvP basis is **"composable"** with other standards (i.e. Interfaces, and Data Formats)
- Despite settlement is handled by the underlying Asset Ledgers, being DLT based or Traditional**, it can be facilitated by third party relays or Coordinators**, and it can and does leverage APIs to exchange information between settlement systems.

Follow-up: Standards development and implementation

The ECB, working with industry participants, can play an important role in the development of standardisation…

… taking into account and leveraging the efforts of existing market-led initiatives already underway, such as the BDT, the CDM, CAST framework, and the Swift CBDC sandbox

Annex

Standardised DvP protocols – Examples (DvP, PvP)

Fnality and HQLAX demonstrate the first cross-chain repo swap pilot

05-Dec-2022 10:32:49 / by **Fnality Press Office**

Tweet

Fnality and HQLA^X demonstrate together with Banco Santander, Goldman Sachs and UBS, the first cross-chain repo swap pilot across Corda and Enterprise Ethereum, paving the way for the settlement of intraday transactions

Fnality & Finteum settle the first pilot cross-chain FX in seconds

04-Oct-2022 10:30:00 / by **Fnality Press Office**

Tweet

Fnality and Finteum have executed the first cross-chain FX settlement transaction test across the two platforms, reducing cross-currency settlement to T+0

EIB issues euro-denominated digital bond on a private blockchain with hedging activity leveraging industry developed Common Domain Model for interest rate swaps – 29 November 2022 (Link)

European Investment Bank

- The EIB is continuing to spearhead developments in the digitalisation of capital markets with the first fully digitally native bond issue on a private blockchain.
- It is pushing innovation even further with this second digital transaction (the first on a private blockchain), issuing the first digital bond with same-day settlement in cooperation with Banque de France and Banque centrale du Luxembourg.
- Project Venus is also the first syndicated digital bond issued by a public institution to be admitted on the Luxembourg Stock Exchange's Securities Official List.
- In addition to issuance on blockchain, hedging activity leveraged the industry developed Common Domain Model for interest rate swaps, in a market first implementation and step towards more consistent data structures across the industry.

CAST: KEY EXAMPLE OF SECURITY TOKEN STANDARDISATION INITIATIVE BY THE INDUSTRY

CAST | COMPLIANT ARCHITECTURE FOR SECURITY TOKENS

AN OPEN-SOURCE INITIATIVE TO FOSTER ADOPTION

“The CAST framework is an open-source initiative designed to foster adoption of digital assets, by providing legal, operational and technical frameworks, to ease at lower cost and secure the on-boarding of potential market participants and their service providers”

CAST Challenges: Open-source hackathons to foster shared operating models and tools

Use Cases in CAST Challenge 2023 (2nd Ed.)

#1. “Create standards to translate CAST into CDM / ICMA BDT compatible language”
This use case consisted in integrating within CAST-based smart contracts of the ongoing standardization processes of the international trade associations ICMA and ANNA.

#2. “Build Delivery-versus-Payment tooling”
This use case focused on the creation of tools designed to facilitate “on-chain DvP” of security tokens transactions.

Use Cases in CAST Challenge 2022 (1st Ed.)

#1. Creating **cross-chain solutions** to facilitate **data reading and editing on blockchains**
#2. Developing **cross-chain standards** for the **Security Tokens structuring**
#3. Developing **cross-chain standards** for **settlement assets**
#4. Enhancing the **connectivity with SWIFT**

CAST 2024 Roadmap

CAST Interoperability developments to enhance data standardisation

Developing cooperation with ICMA and ANNA to facilitate the integration within smart contracts of standardised data on DLT-based securities

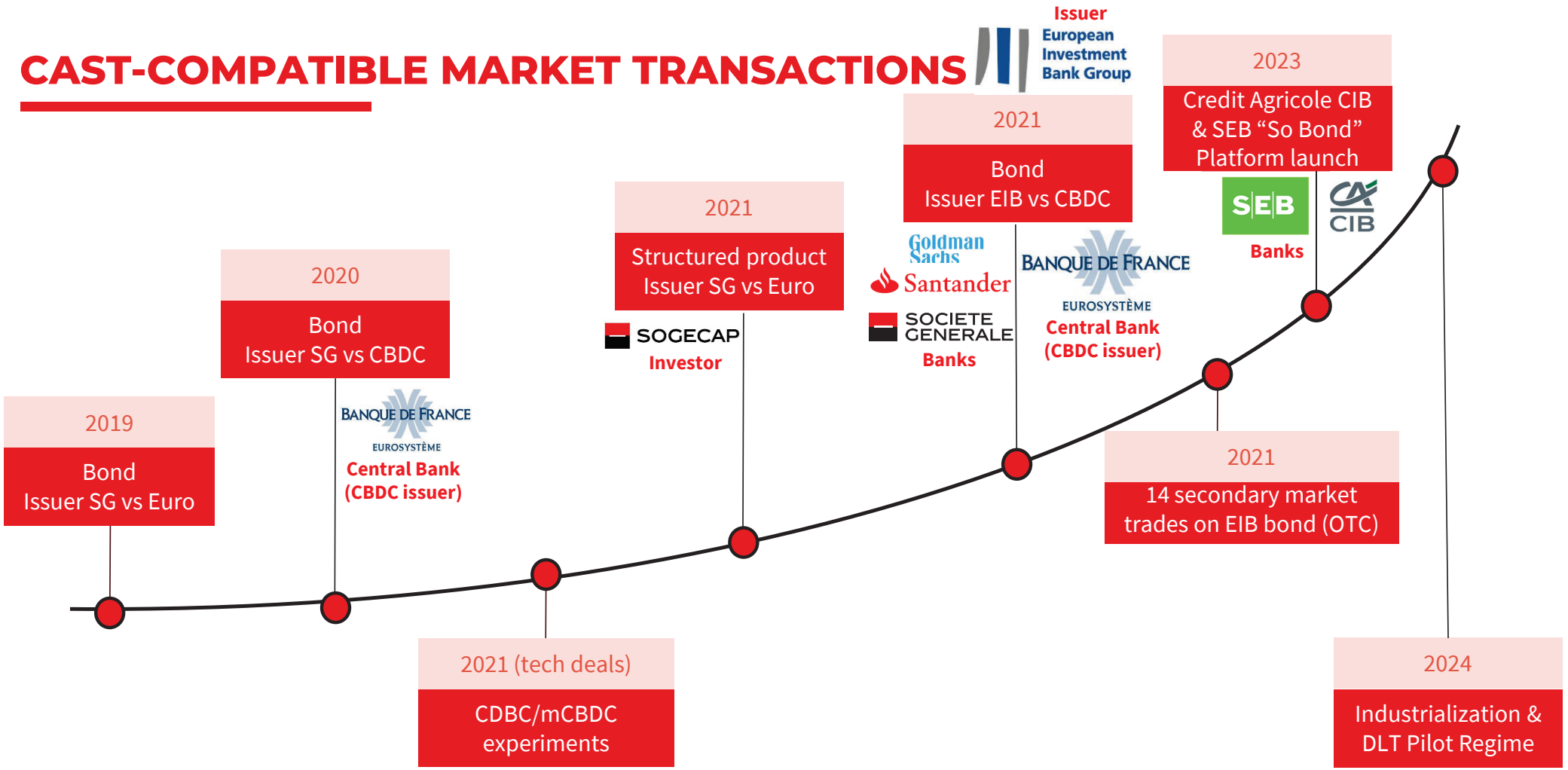
Bridge of CAST initiative with current assessment on Smart Contracts Standardisation

CAST initiative deeply involved in the current assessment on Smart Contracts Standardisation by major traditional trade associations (GFMA, etc.)

CAST initiatives on On-chain DvP

Various open-source projects based on the CAST Framework to promote shared operating models and IT Tools on Chain DvP planned in 2024

CAST-COMPATIBLE MARKET TRANSACTIONS



Smart Contract Standardisation

ECB NTW-CG Meeting
15 November 2023

Project Background – Large potential benefits from smart contracts use.

GFMA landmark report on DLT in Global Capital Markets shows potential for DLT and smart contracts:

- Markets for tokenised assets to grow from $0.3 trillion now to $16 trillion by 2030.
- $100+ billion annual freed up of collateral due to atomic settlement.
- Major operational efficiency gains in corporate actions and settlement: $15-20 billion annually, particularly in fixed income.

Project Background - Blockers to at-scale use of DLT/smart contracts

Smart-Contract Fragmentation constraints scaling DLT-Based Capital Markets

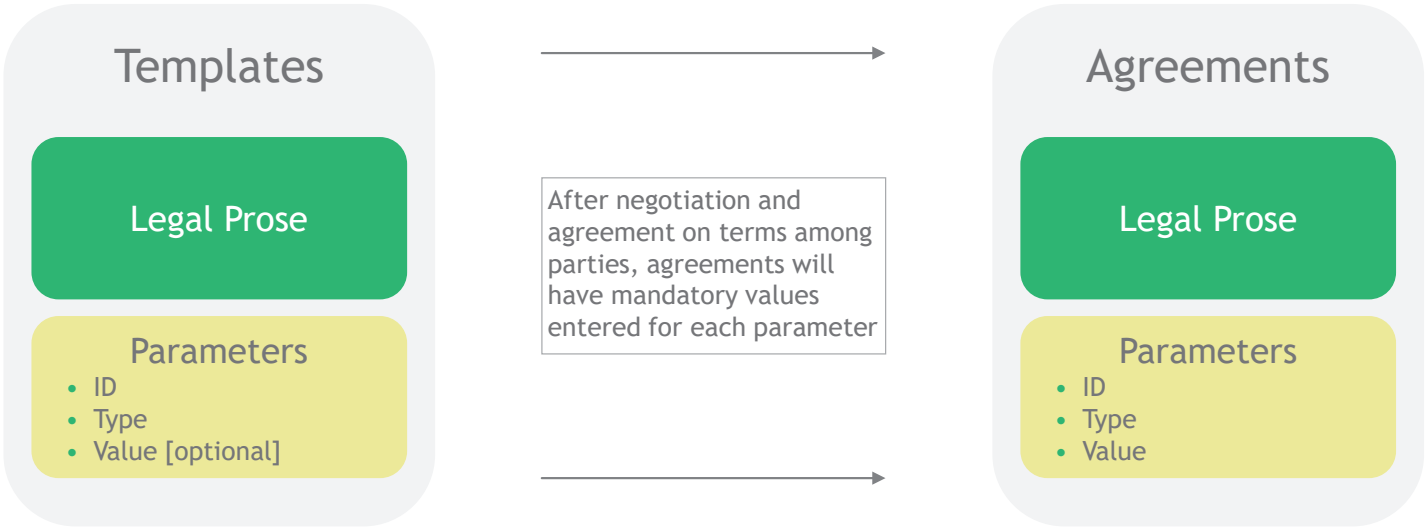
- Different chains use different formats and languages.
- This constraints:
  - Opportunities for scaling up, in particular at a global level.
  - Interoperability between chains.
  - Ability of digital assets markets to scale.

Project Objective – Overall Project Aim

Developing a collective industry view on standardisation of smart contracts to support asset tokenisation and interoperability to help scale issuance and distribution.

Project Objective – Use Case Asset Servicing

One area where smart-contract standardisation can yield efficiency gains is asset servicing:



Source: Clark, Bakshi, and Braine (2017)

Project Objective – Use Case Asset Servicing

Standardisation can help move from current limited ecosystem to smart contracts as default.

Asset Servicing

Limited ecosystem around smart contracts (standards, regulation etc.)

- Proof-of-concept testing for smart contracts supporting DLT-based income payments (e.g., coupons, dividends)
- Partnerships to build capabilities but open questions remain (e.g., legal, regulatory, risk and governance, standards)

Growth in piloting of DLT-based asset servicing

- Standardization of smart contracts drives traction in DLT-based income payments (e.g., coupons, dividends)
- Functionality to support tax and regulatory reporting processes piloted
- Clarity across legal, regulatory, risk and governance frameworks

DLT-based asset servicing becomes default in selected asset classes

- Corporate actions embedded in smart contracts tied to securities at issuance
- Dividends, coupons, and tax withholding processes automated and settled with DLT-based payments
- Targeted 'embedded supervision' introduced for real-time regulatory visibility and monitoring

Project Deliverables

Phase I – Setting Principles for Smart Contract Standardisation

- Common principles around smart-contract design:
  - Product-fit vs functions supported by contract standards, external auditing, best practices.

- Outline for a template-based and chain-agnostic approach to smart-contract design
  - At a minimum across the EVM ecosystem, public or private.

- Outline for a roadmap to standardisation.

- Recommendations for regulators and market practitioners to address compliance/ legal challenges
  - Functional requirements to achieve ‘ideal state’.
  - Legal certainty and regulatory clarity - “Same risk, same regulatory outcome” and tech neutrality
  - Need for global standardisation and interoperability.

Project Deliverables

Phase II – Sample Smart-Contract template for 1 asset class/product

- Sample template for prioritised asset class/product.

Phase III - Multi-Asset Class Template Development

- Templates for asset classes and more complex products (e.g. including derivatives).