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Advancing the Digital Asset Era, Together

An Industry Paper from DTCC / Clearstream / Euroclear

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This joint industry paper has been produced by DTCC, Clearstream and Euroclear. The statistical data in the paper has been provided by the ValueExchange, a global market research firm specialising in the capital markets. To learn more about ValueExchange, please visit thevalueexchange.co

I. INTRODUCTION

Financial market infrastructures (FMIs) have been supporting the transformation of the world's capital markets for decades. Since the dematerialisation of physical securities began in the 1970s, the world's FMIs have underpinned the evolution of the financial markets by providing scalable, resilient and trusted infrastructures on which the industry can build.

Throughout this journey, The Depository Trust & Clearing Corporation (DTCC), Clearstream and Euroclear have played a pivotal role in helping the world's capital markets adopt and benefit from transformational technologies. While we operate in different geographies, under different regulatory regimes, the objective of harnessing technology to increase efficiency, liquidity, maintain high degrees of resilience and ensure the safe continuity of financial markets is central to our strategies.

Today, the opportunity for us to continue to support the industry's digital transformation is as real as ever. With the accelerating pace and scope of technological change putting significant pressures on firms, we are well-equipped to support our clients in incorporating artificial intelligence (AI), distributed ledger technology (DLT) and other emerging technologies into their operating models — and hence manage the complexities and challenges of today's change agenda as well as drive new business opportunities in the securities space.

In the specific case of DLT and digital asset securities, the last several years have seen a growing number of initiatives drive a new maturity in the use of this technology around the world. These initiatives have demonstrated new opportunities for financial market participants to transform the ways in which they issue, invest and process different asset classes — well beyond traditional securities. After extensive pilots and several larger-scale deployments, new operating models are emerging that deliver unique levels of operational efficiency and liquidity benefits across entire trade flows and asset classes. Intraday repos, fractionalised bonds and natively issued digital structured products, for example, are starting to deliver significant value — and this is just the start.

Looking ahead, there is an industry realisation that the adoption of these operating models at ever-greater scale is contingent on broader regulatory harmonization, industry-wide standardisation and integration of institutional-grade payment rails, as well as connectivity across DLT protocols and legacy platforms. With a growing number of pilots now complete, conclusions are being drawn regarding the need for well-regulated, neutral players to provide trust, resilience and standardised connectivity in their respective ecosystems. This is a role that FMIs have been playing for decades.

There is also increasing market evidence that the adoption of digital assets and modern technologies, such as DLT, are picking up speed. Over the next 15 years, digital assets are anticipated to grow in value to around $16 trillion[1]. As FMIs, we are excited to partner with the industry to help bolster and underpin this growth, unlock the value of the rapidly maturing technology and deliver additional value and opportunities to the financial industry.

[1] Bank of America Securities, "Global Digital Assets Beyond Crypto: Tokenization," Bank of America Securities, June 29, 2023.

II. EXECUTIVE SUMMARY

As FMIs, we see the use of digital assets and modern technologies like DLT in combination with new and existing technology stacks as being similarly transformational as the dematerialisation of the securities markets. As with every major market change, the adoption of DLT and digital assets is inevitably gradual and incremental — spanning several development stages. We are excited about supporting firms as they look to realise operational and liquidity benefits at every step of these development stages.

Over the last few years, the industry's efforts around the use of new technologies have accelerated learning and helped participants to identify the benefits of and constraints related to DLT on a smaller scale. Firms have documented the early operational and liquidity benefits of DLT and digital assets (often at an experimental level) and have begun to evidence their ability to radically reshape securities issuance, accelerate settlements and empower data transparency.

Today, these potential benefits are becoming increasingly achievable for market participants, as we observe an increase in technical maturity, regulatory evolution and market adoption. With 39%[2] of financial market participants now live using some form of DLT or digital assets, the industry's focus has shifted from proprietary deployment of such solutions towards ecosystem deployment as a key enabler to realising benefits at an industry-wide scale. Having proven what is possible, the focus of many industry platforms and players today is on deepening the functional capabilities of their platforms and integrating them into existing processes, whilst adding new counterparties to their DLT networks to drive instrument liquidity and production scale.

As we shift from learning to commercialisation, the challenges that lie ahead are very different from those that we have faced so far. Years of smaller-scale deployments have in part resulted in sub-scale, isolated pools of instrument liquidity on proprietary DLTs, which now form obstacles to further industry growth. With a small number of DLT protocols today handling significant, consolidated trading volumes, the fragmentation of digital liquidity and immobility of tokenised value could create barriers, leaving digital assets more costly to maintain and transfer than their traditional counterparts in the short term.

Yet, in the medium- and long-term, there are significant opportunities for which the foundations have begun to be laid.

As FMIs, we view our role as helping to drive digital transformation in the industry by facilitating scale, ecosystem connectivity and industry-wide consistency. Having provided financial market participants with neutral, resilient and trusted connectivity since the inception of dematerialised securities, we are uniquely positioned to enable the next phase of DLT's growth. Working in collaboration with industry players, our aim is to connect the industry and to break down barriers to digital asset security adoption (with a focus on real-money assets) by facilitating:

- Reduced costs of connectivity and entry for existing and new market entrants.
- Standardisation of processes across the digital asset lifecycle — and hence, reduced operating risk and costs.
- Consistent operating standards for platforms, assets and smart contracts within a well-regulated framework.
- Increased optionality and choice of platforms, facilitating connectivity through greater industry consensus on integration and standards.
- Improved interoperability between traditional securities and payment infrastructures, supporting ongoing automation across the asset lifecycle.

[2] ISSA / ValueExchange, "DLT in the Real World 2023," www.thevalueexchange.co.

By co-creating new solutions with traditional and new market participants, we look forward to facilitating greater interoperability across DLT protocols and with traditional systems, as well as the adoption of standards across the trade lifecycle of the digital asset — thus enabling a more seamless realisation of the benefits of DLT and digital assets at scale.

III. A PROVEN RECORD IN SUPPORTING INCREASED MARKET GROWTH AND EFFICIENCIES

The central role of an FMI is to stand at the heart of the financial market ecosystem, to provide a neutral, trusted, consistent and resilient infrastructure on which all participants can depend as they look to grow. We create "guardrails" for the rest of the market to then build on.

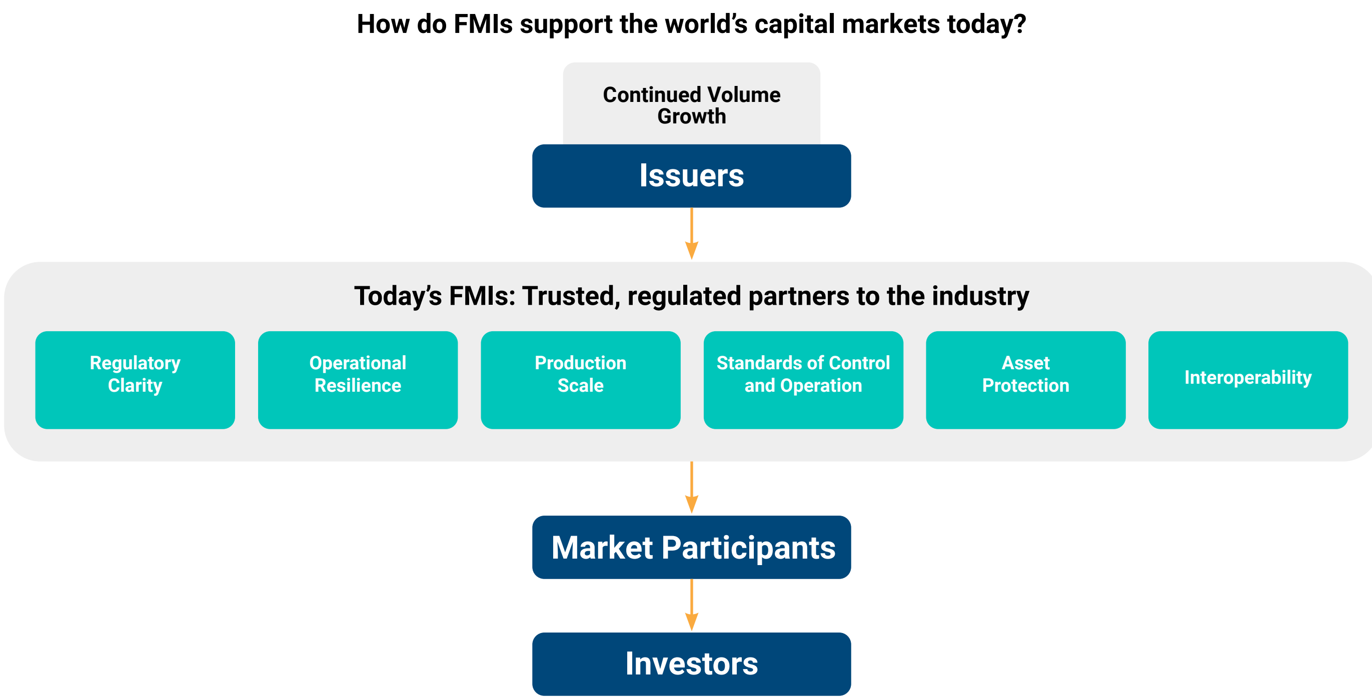
Over decades, we have a proven track record of supporting the continued growth in securities market liquidity by enabling consistency and standardisation across all aspects of trade and asset processing. Working together with the industry, we have leveraged new technologies to dematerialise securities, continually refined trade settlement cycles, introduced clearing models to lower counterparty risk, consolidated settlement funding requirements, increased access to data, supported regulatory compliance, and provided even more automated ways to transact in, process and custody assets. Overall, FMIs have consistently driven down processing costs as well as the cost of capital at a global scale.

Core to each of these initiatives is our unique role in enabling operational resilience and production at scale; maintaining market-leading standards of control and risk management within a regulated environment; and supporting interoperability of services and platforms across our markets.

Operating at the highest levels of operational resilience and risk management, we are trusted by risk managers, treasurers and operations staff to ensure that operational, credit and market risks are not only safely managed today, but that disruption can be minimised tomorrow.

Above all, we have supported the evolution of the capital markets whilst maintaining the trust of and connectivity to participants — from issuers to transfer agents, custodians, brokers, funding banks, technology companies and investors. As the industry book of record for securities and lifecycle events, we are relied upon every day to provide consistent and consolidated connectivity to the world's capital markets —helping to provide scale.

These attributes are also the key requirements that the digital asset landscape now faces as it too looks to scale. As one of our tasks is the safekeeping of traditional securities, we play a key role as a bridge and facilitator in the increasing co-existence of traditional and digital assets. As trusted, neutral guardians of the securities ecosystem for over 50 years, we have the connectivity, experience and track record to help address many of the most pressing challenges in digital assets.



IV. UNLOCKING THE NEXT WAVE OF MARKET VALUE

Whilst we remain in the early stages of DLT's evolution, there is little doubt that DLT and digital assets have now passed their foundational stage in several areas.

Based on the ValueExchange's research, more than USD1.3bn[3] of debt has been issued so far in live digital bonds and over 160,000 digital equities are being transacted daily. In securities finance, more than 15 of the world's leading banks are working together to reduce lending and borrowing costs by over USD100 million per year. Digital repo volumes exceed USD50 billion in daily turnover. These volumes may be small in global terms, but they are indicative of the increasing momentum of DLT and digital assets across the industry.

And these projects have begun to deliver real and measurable benefits.

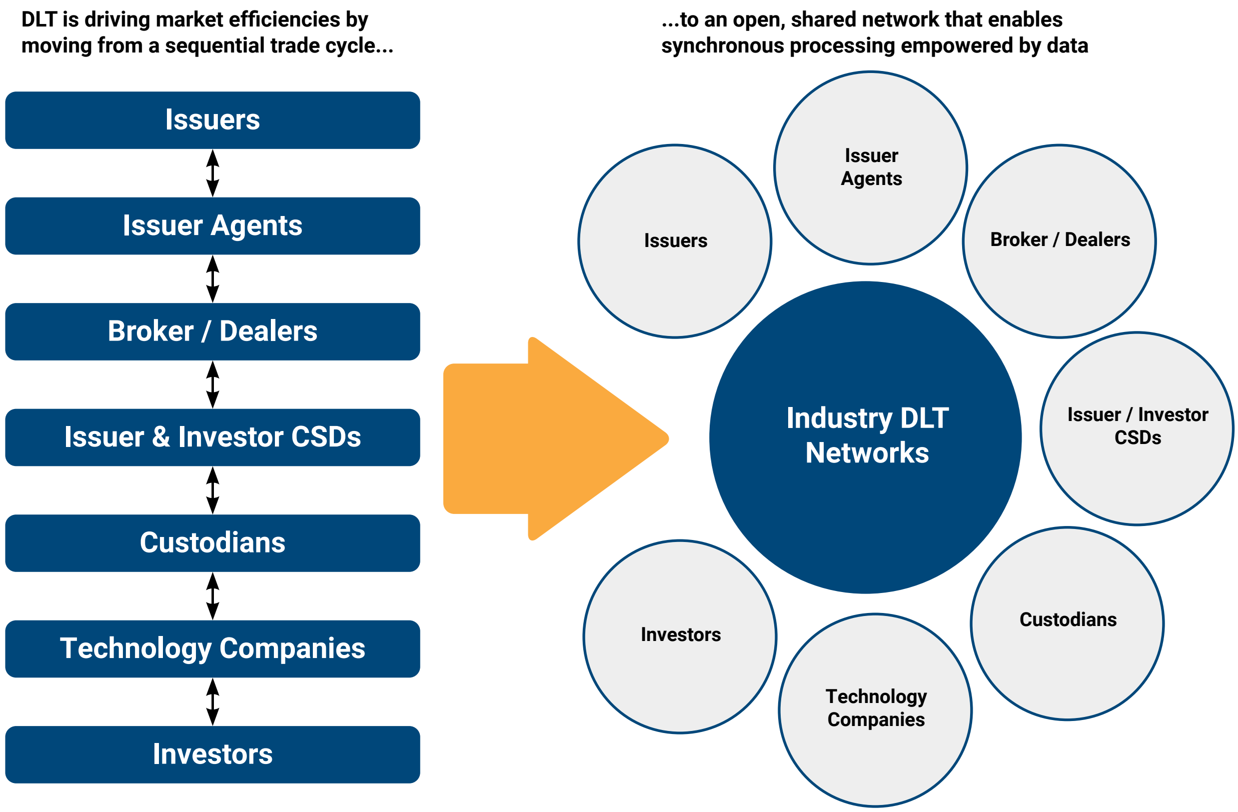
In addition to the overall automation of the issuance process, DLT (and smart contracts) are eliminating days from bond issuance cycles — increasing the speed of funding for issuers, reducing pricing risk and creating new business opportunities, particularly in the structured product space. Elsewhere, fractionalisation is making financial securities more accessible and increasing financial inclusion.

Across the post-trade lifecycle, instant collateral transactions and intraday repos are transforming balance sheets, and the need for extensive reconciliations across the trade cycle is being eliminated. Building on real-time, golden-copy ledgers, the industry is developing smart contracts that drive advanced automation from the front to the back office. The list goes on.

As DLT continues to drive the fundamental shift from sequential to synchronous processing across the trade lifecycle, firms are increasingly seeing a positive, net cost impact emerge. Against potentially increased treasury

[3] The ValueExchange, "Numbers Behind Tokenisation," www.thevalueexchange.co.

costs (from pre-funding) and the costs of implementation, market participants are citing cost savings of up to 60%[4] from the use of different blockchain protocols.



As we look to further accelerate the benefits of DLT and digital asset initiatives in the future, we face two important constraints —and opportunities.

The first is size and scale. In 2023, 74%[5] of DLT projects across the capital markets involved fewer than six participants, meaning that most (but not all) projects are still yet to experience industry scale. As real as the above benefits may be, their impact remains limited at an industry level given that the majority of today's projects are mostly siloed, peer-to-peer initiatives.

The second is alignment. With limited industry standardisation and interoperability, today's DLT and digital asset initiatives are highly disparate, meaning that existing blockchain propositions vary significantly in:

- Their regulatory treatment of digital asset and custody processes.
- Their technical connectivity, integration into legacy processes and eligibility standards.
- The management of core processes (such as funding treatment, mobility of the asset, processing of collateral, etc.).
- The supervision and maintenance of smart contracts.

These disparities in turn create costs which undermine the appeal and potential benefits of DLT for market participants and clearly limit the speed of adoption:

- Liquidity remains spread at (often) sub-viable levels across different isolated networks, limiting scale effects.

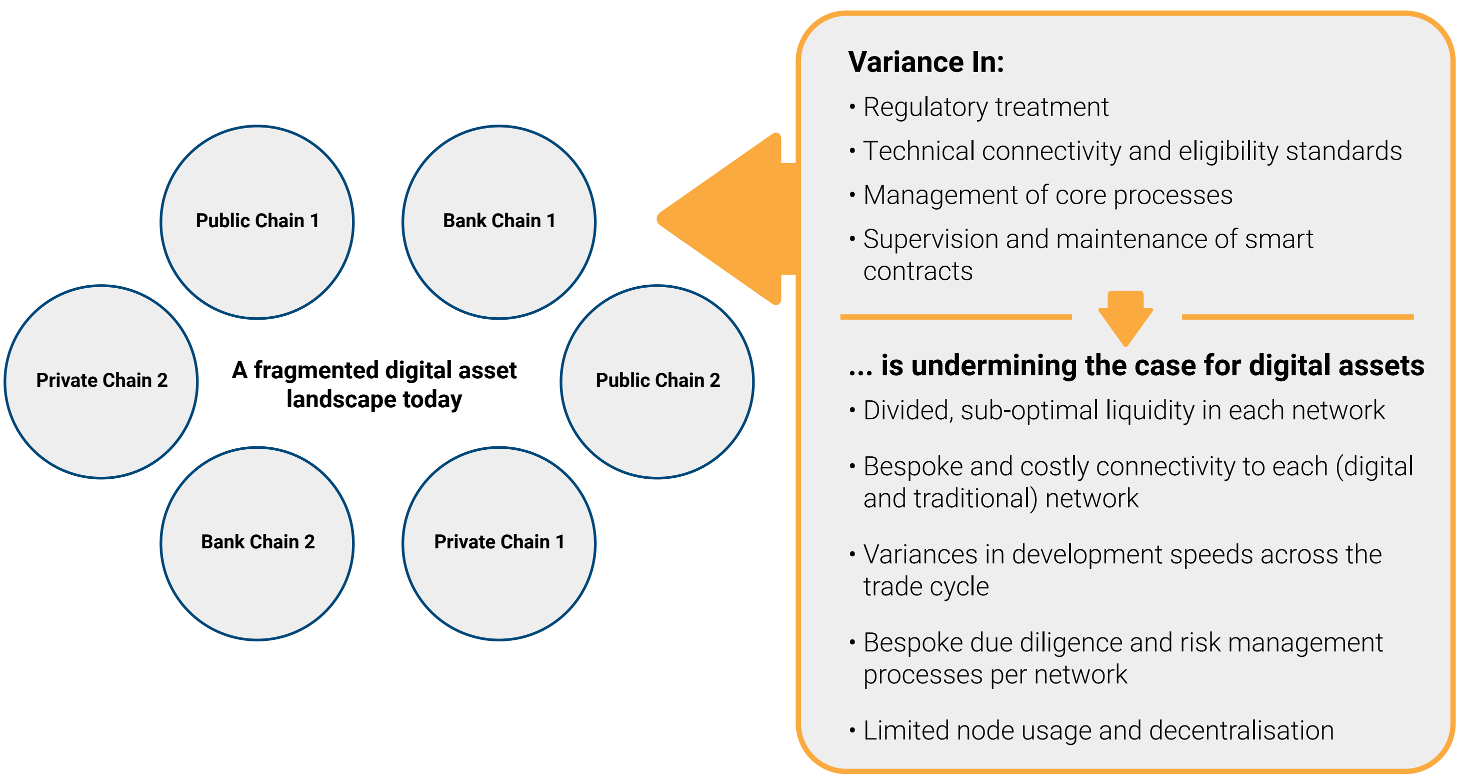
[4] The ValueExchange, "Numbers Behind Tokenisation," www.thevalueexchange.co.

[5] ISSA / ValueExchange, "DLT in the Real World 2023," www.thevalueexchange.co.

- Connection to (and aggregation of) liquidity across multiple chains is a bespoke effort and therefore acts as a disincentive to scale for participants.
- Differing rates of adoption risk is giving rise to divergent industry operating models (based on traditional vs. digital technologies) for end-investors, such as the need for digital wallets vs. traditional custody accounts.
- Connectivity between traditional securities and digital assets is still being defined on a case-by-case basis and limits scale, especially in the context of the legacy platforms that continue to support core processing today.
- Integration of further relevant process components, such as payment processes on chain, remain unavailable at wholesale grade.
- Variances in regulatory clarity globally drive different speeds of evolution across different assets and parts of the trade cycle (e.g., issuance vs. clearing vs. collateral).
- Due diligence and risk management processes have to be tailored to each blockchain operator, creating an unscalable oversight burden.
- Complexities in governance requirements make many participants reluctant to run their own blockchain nodes, limiting the decentralised nature of the networks.

Whilst digital asset liquidity is evidently growing, the fragmented digital (and traditional) asset landscape is running counter to the core potential efficiencies of DLT today. By increasing costs and limiting liquidity for participants, the current state of DLT and digital assets risks making further adoption (and the replacement of traditional assets) highly challenging. It may be possible to issue a digital bond today but, if it costs more to maintain, cannot be sold in a highly liquid secondary market or is not accepted as collateral by all counterparties, the value of the bond is limited.

As the industry looks to move from its foundational stage towards the scale adoption stage, it is critical that these challenges be addressed. Beyond simple connectivity, there is a clear need for scalable and consistent answers to a range of issues —on which the industry can depend and rely as they build new solutions for their clients.



V. FMIs: TRUSTED, NEUTRAL ENABLERS OF DLT's TRANSFORMATIONAL BENEFITS

Given FMIs' critical importance in the financial ecosystem, we are carefully regulated and subject to stringent controls. We are chartered to support the industry as it grows, responding to regulatory, market and technological changes, all while ensuring the safety and soundness of the global markets.

Leveraging our traditional role as trusted, regulated and collaborative infrastructures at the heart of the capital markets ecosystem, FMIs can drive industry-wide consensus in a number of areas including but not limited to:

- **Operational resilience:** Verifying that the DLT-based infrastructures which we connect to are fit for purpose in terms of underlying principles, access, security and control.
- **Production scale:** Ensuring that technologies and processes can perform at enormous scale with appropriate controls and fail-safes —all within a well-regulated environment.
- **Standards of control and operation:** Supporting the common application of standards for both DLT networks and their smart contracts across markets, to ensure that functions performed are understood, will operate with minimal risk and that parties across the industry can participate using consistent methods (see examples in the table below).
- **Interoperability:** Facilitating the integration of liquidity across traditional and digital asset venues and ensuring the interoperability of positions, cash and collateral across financial systems, today and tomorrow.

DLT Networks

Description: Eligibility criteria that identifies network types, technology and governance arrangements used to select DLT networks.

Why? Not all DLT networks are fit for purpose and can support the resiliency, security and performance requirements needed to register a regulated financial instrument.

Access

Description: Fine grain entitlements and standard roles that determine who can access smart contract data and functions.

Why? Financial institutions and infrastructure providers must be able to manage and control securities registered on the DLT, relative to their role in market as a CSD, issuer, custodian, etc.

Data Privacy

Description: Standards around what data is allowed on-chain and methods that protect private data supported by anonymisation and pseudonymisation.

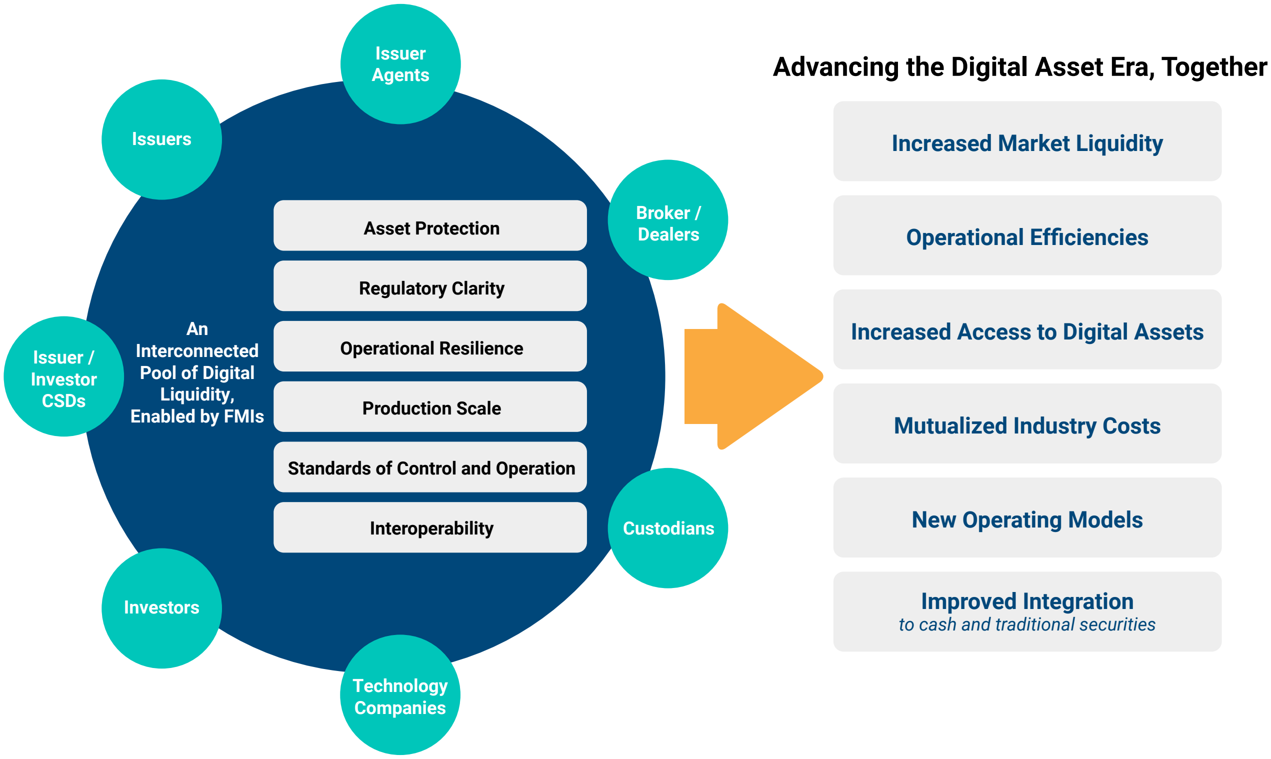
Why? Entities on a given network should not have access to other entities' PII, private or firm specific proprietary data.

Smart Contracts

Description: Standards that define the underlying security, bookkeeping models and security lifecycle operations (i.e., issuance, settlement, etc.).

Why? Standards create efficiencies and reduce security processing risks. Standards help avoid costly bespoke integrations and facilitate interoperability within the ecosystem.

This approach to market development is a core part of each FMI's mandate and is an important, daily activity in every market globally. We have supported the industry through decades of market and technology change, and we look forward to working with market participant firms and providers as the DLT and digital asset ecosystem evolves.



VI. A SHARED COMMITMENT TO SHAPING THE DIGITAL ASSET ERA

We believe that DLT and digital assets are beginning to deliver transformational benefits to market participants at every step of the trade lifecycle. Given current momentum and levels of adoption, we also believe that DLT is here for the long term.

Yet as an industry we face a challenge in realising these benefits at a large scale. The individual and private explorations of DLT's potential now need to become an industry-wide effort to consolidate and connect digital liquidity, based on common standards and processes.

As FMIs, DTCC, Clearstream and Euroclear commit to being at the forefront of this discussion. We are neutral, trusted and resilient partners to the industry, and we have a unique role to play in unlocking the value of digital assets for the benefit of the markets and underlying investors.

Our unprecedented collaboration and common engagement on this theme highlight the strength of this commitment. This is just the starting point. Working with partners and participants, our organisations will continue to collaborate to support market development by:

- Driving open, market feedback around the required characteristics of DLT networks, data access, privacy and smart contracts
- Enabling greater interoperability across DLT protocols through the adoption of standards
- Enhancing operational resilience
- Accelerating production scale

Success in realising the significant benefits of DLT will come through market collaboration and cooperation. We are ready to help smooth market participants' transition to the digital asset era and to extract its significant benefits, and we welcome the market's engagement so that we can continue our path of co-development together.

About DTCC

With 50 years of experience, DTCC is the premier post-trade market infrastructure for the global financial services industry. From 20 locations around the world, DTCC, through its subsidiaries, automates, centralises, and standardises the processing of financial transactions, mitigating risk, increasing transparency, enhancing performance and driving efficiency for thousands of broker/dealers, custodian banks and asset managers. Industry owned and governed, the firm innovates purposefully, simplifying the complexities of clearing, settlement, asset servicing, transaction processing, trade reporting and data services across asset clases and bringing increased security, enhanced resilience and soundness to financial markets. To learn more, visit www.dtcc.com.

About Clearstream

Clearstream is the innovative and trusted post-trade business for the global markets. It runs the leading securities and funds servicing ecosystems of tomorrow.

The company operates the German and Luxembourg central securities depositories and an international central securities depository for the Eurobonds market. With 17 trillion Euros in assets under custody, it is one of the world's largest settlement and custody firms for domestic and international securities. Its digital post-trade platform D7 provides a fully digital alternative to conventional physical issuance and processing of securities. It also delivers premier fund execution, distribution, data and reporting services, covering over 50 fund markets worldwide.

Clearstream is part of the Deutsche Börse Group, an international exchange organisation and provider of innovative market infrastructures. To learn more, visit us at www.clearstream.com or connect via LinkedIn.

About Euroclear

Euroclear group is the financial industry's trusted provider of post-trade services. Guided by its purpose, Euroclear innovates to bring safety, efficiency and connections to financial markets to sutainable economic growth. Euroclear provides settlement and custody to domestic and cross-border securities for bonds, equities and derivatives, and investment funds. As a proven, resilient capital market infrastructure, Euroclear is committed to delivering risk-mitigation, automation and efficiency at scale for its global client franchise. The Euroclear group comprises Euroclear Bank, the International CSD, as well as Euroclear Belgium, Euroclear Finland, Euroclear France, Euroclear Nederland, Euroclear Sweden, Euroclear UK & International and MFEX by Euroclear. To learn more, visit www.euroclear.com