ISSA

Crypto Assets:
Moving from Theory to Practice

An analysis of how to issue, settle, safekeep and service Crypto Assets, with recommendations and best practices to maintain compliance with laws and regulations and use standards to maximise inter-operability between market participants

November 2019

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Foreword

The ISSA Working Group on distributed ledger technology (DLT) and Crypto Assets is delighted to present this new paper. It continues the work of a «Infrastructure for Crypto-Assets[1]», a previous paper published by the International Securities Services Association in October 2018 and adds the perspective of both custodian banks and FinTechs.

The new paper explores the issuance, settlement, safekeeping and asset servicing of Crypto Assets from a practical point of view. It also highlights the legal and regulatory implications of developing services and platforms for the issuance and trading of Crypto Assets. Finally, it reviews the current status of efforts to devise market standards and other tools that will enable Crypto Asset service providers and platforms to inter-operate with each other.

The paper draws on the experience of participating members of the Working Group involved in building products, devising strategies or supporting projects that make use of DLT in existing lines of business in the securities industry. It also takes fully into consideration the robust business and technical standards in place today that strengthen the securities services industry and protect the customers being served.

The current status of DLT implementations offers no firm guidance on optimal market structures or business models. These must vary by jurisdiction, especially as existing laws and regulations governing Crypto Assets continue to evolve. In addition, no full-scale DLT system is live as yet, so the wider implications of DLT in terms of technical performance, efficiency gains, business model impacts, new service potentialities and possible future evolutions are difficult to predict.

The ISSA Working Group nevertheless believes that sharing the collective experiences and perspectives of a broad set of industry participants in this paper will contribute to and advance understanding of DLT and Crypto Assets within the securities markets. Its ambition is to promote a grounded, practical discussion that reaches beyond the hype surrounding DLT. The industry discussions, and those within the regulatory community, can help to build a solid foundation for the Crypto Asset market in general and for a safe and efficient post-trade environment for Crypto Asset issuers and investors in particular.

Target Audience

This paper is addressed to market intermediaries, such as custodian banks, clearers, brokers as well as to asset managers, issuers, industry associations, financial market infrastructures, regulators and FinTech providers.

Acknowledgements

This report is the result of efforts by a team of experts drawn from ISSA Operating Committee members and other ISSA participating firms. Special thanks go to the authors and the participating firms listed in Appendix 2. The ISSA Executive Board wishes to thank all supporters for their contributions.

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[1]   Report «Infrastructure for Crypto-Assets: A Review by Infrastructure Providers, 10/2018».
        https://issanet.org/e/pdf/2018-10_ISSA_report_Infrastructure_for_Crypto-Assets.pdf

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0.1   Introduction

Crypto Assets issued on distributed ledger technology (DLT) networks or tokenisation platforms have the potential to disrupt profoundly the incumbents in post-trade areas of the securities industry. They have the potential not only to add new asset types but to make existing processes more efficient, and to create entirely new roles as well as adding new techniques such as smart contracts.

The disruption is less likely to occur through the disintermediation of existing roles than originally thought. This is because the incumbent intermediaries, including central securities depositories (CSDs), central counterparty clearing houses (CCPs) and custodian banks, fulfil important functions that will still need to be performed, even on DLT networks.

For example, Crypto Asset service providers will still need to segregate duties where conflicts of interest exist and will be expected to provide institutional-grade standards of asset safety when safekeeping Crypto Assets. However, the intermediaries fulfilling these functions will need to evolve and adapt their services to cater to the demands of these new asset types and technologies.

For members of networks, new configurations are expected to arise where members of the same network interact directly, and where specialist service providers can tailor and customise their services either by offering bespoke service packages or stand-alone services. So new roles, including DLT network governors and / or operators, are likely to emerge.

The success and proliferation of DLT networks hinges on the use of open platform protocols that enable the same data set to be shared simultaneously with many parties, without compromising on security or reliability. In addition, there is a need to accommodate novel techniques, such as smart contracts, to automate predictable and repetitive processes.

Crypto Assets are categorised in this paper into three main groups, based on prior work performed by other industry bodies and regulators. These are:

- Payment Tokens, which sub-divide into Crypto Currencies, Stablecoins (generally tokenised fiat currencies) and Central Bank Digital Currencies (CBDCs);
- Securities Tokens, which sub-divide into Asset-Backed Securities Tokens, also known as «non-native tokens» because they represent non-digital assets, and Digital Native Securities Tokens;
- Utility Tokens, which give investors access to an actual or prospective product or service, such as an app.

These categories are useful but not exhaustive. In fact, the lack of harmonised definitions of Crypto Assets agreed between and across market participants, regulators and legal jurisdictions continues to inhibit the development of institutional grade Crypto Asset services, especially across national borders.

While Crypto Assets offer a number of potential advantages over traditional securities, notably in terms of efficiency, transparency and possible direct interaction between issuers and investors, their use also entails a number of risks. These risks originate more in the characteristically decentralised governance structures of Crypto Assets than any other factor. To address such risks, safeguards must be devised, especially to protect investors.

Institutional investment in any of the three varieties of Crypto Assets, and Securities Tokens in particular, will require the development of financial market infrastructures and service providers equivalent to those that provide these safeguards in the securities markets of today. Without a sufficiently trustworthy environment, capital will not be committed to these novel instruments.

Partly for this reason, a rapid transition from the securities markets of today to a marketplace dominated by Crypto Assets issued on DLT networks is unlikely to occur. At the moment, securities markets provide trustworthy capital-raising and channelling functions that work well. Instead, permissioned and non-permissioned DLT networks are likely to arise and co-exist alongside traditional securities market infrastructures. This creates the need for them to be able to inter-operate.

0.2   Issuance

Over time, the existing highly intermediated securities issuance process is likely to be first supplemented and then - if the many challenges outlined in this paper including inter-operability are successfully addressed - potentially even supplanted by the issue of Securities Tokens on DLT networks or tokenisation platforms. This would create an environment where investors could interact directly with issuers, and new issue services such as registration, Know Your Client (KYC) checks and paying agency are provided by specialist service providers on the same network.

New issues of Non-native Asset-Backed Securities Tokens must, by definition, be backed by holdings of the underlying assets in a safe custody environment operated by a regulated entity such as a CSD or custodian bank before they can be issued on to a DLT network or tokenisation platform. New issues of Digital Native Securities Tokens, on the other hand, can be issued directly on a DLT network or tokenisation platform.

However, compliance with existing regulatory requirements in terms of investor disclosure, investor protection, asset safety, the integrity of the issue, settlement finality, Know Your Client (KYC) and Anti-money laundering (AML) checks will require the governors and / or operators of DLT networks or tokenisation platforms to meet the necessary regulatory qualifications and standards demanded in the jurisdictions where they are governed.

This is also necessary to avoid regulatory arbitrage between jurisdictions, by which issuers or governors and / or operators of DLT networks or tokenisation platforms exploit differences in the regulation of the same activity or instrument.

These caveats aside, DLT networks or tokenisation platforms are well-suited to making certain illiquid asset classes, such as fine art, real estate and rare coins, available to a wider pool of investors. This is because DLT enables them to be fractionalised as well as tokenised and investors benefit from full transparency into the underlying investments.

0.3   Settlement

Settlement in the securities markets is achieved today through the simultaneous delivery of assets against cash payment (DvP), with finality and irrevocability. Technically, irrevocable DvP can be achieved on DLT networks or tokenisation platforms but only if both the Securities Tokens and the Payments Tokens are available for immediate delivery. This necessitates pre-funding of accounts.

However, pre-funding increases the costs of cash, credit and capital. It also makes it difficult to accommodate certain market strategies and techniques - such as market-making, short-selling, securities financing and netting - that contribute to market efficiency.

The implications of foregoing established market practices of this kind require further research.

In addition, in traditional securities markets, systemically important financial market infrastructures (FMIs) such as Securities Settlement Systems and Payment Systems are subject to strict regulatory requirements that entitle them to confer legal finality on DvP transactions. In order for Crypto Assets to achieve an equivalent level of legally irrevocable finality, a DLT network or tokenisation platform will have to obtain the necessary regulatory qualifications in the jurisdiction from which it operates.

Crypto Asset settlement models can be divided into two main categories. The first is the off-ledger model, where the cash leg of the transaction is settled in fiat currency rather than Payment Tokens. Since fiat currencies will be accessed through payment market infrastructures (PMIs), or a third-party bank with access to a PMI, or via correspondent banking, settlement finality can only take place when the PMI is open.

The second approach to Crypto Asset settlement is the on-ledger model, where Token versus Token (TvT) settlement is possible because both the Securities and the Payment Tokens are on the same DLT network or tokenisation platform. In the absence of CBDCs, Payment Tokens can be expected to be Stablecoins, which are available in several forms.

It is worth noting that the settlement of transactions between counterparties trading the same Crypto Asset, but on multiple DLT networks or tokenisation platforms, will be challenging. Settlement of Crypto Asset transactions on multiple platforms might be susceptible to complex technical solutions. The alternative is agreement on business and technical standards for cash (or cash equivalent Payment Tokens) and Securities Tokens to enable the parties involved to settle transactions once the DLT network or tokenisation platform confirms the Securities Tokens are available for settlement even in a cross-ledger context.

0.4   Asset Servicing

Asset servicing functions, including the processing of corporate actions, the collection of income, the voting of shares by proxy and reclamation of withholding tax deducted, are among the fundamental securities services that investors expect from the custodian banks and CSDs that look after their assets.

It follows that investors in Crypto Assets, and especially in Securities Tokens, will require the same standard of asset servicing as they receive in the securities markets. It will require, for example, the adoption of unique identification numbers, equivalent to the International Securities Identification Number (ISIN) that identifies a particular issue of securities. Without them, inter-operability between DLT networks or tokenisation platforms will be difficult.

Smart contracts have the potential to enable corporate actions to be automated and even self-servicing. However, smart contracts are unlikely to achieve mainstream adoption without strong governance and auditing principles to provide issuers, investors and regulators with assurance that they behave and deliver entitlements as issuers intend.

New types of corporate actions and events specific to DLT networks and tokenisation platforms can be expected to emerge. For example, «forks» - changes to DLT network or tokenisation platform software that improves the existing protocol or introduce a permanent split between the new protocol and the old – need to be carefully reviewed and understood. The management of «forks» should not be treated as a corporate action, and service providers should have the right to opt out of adopting «forks».

0.5   Safekeeping

The need for investors to retain the private keys that prove their ownership of a Crypto Asset has led to the creation of new services to hold private keys securely. The importance of private key protection is especially critical in the context of permissionless DLT networks or tokenisation platforms. Recovery of the loss of private keys in a permissionless network is being studied by the industry and potential solutions are becoming apparent.

Trusted financial institutions could provide services to safekeep private keys and hold Crypto Assets in digital wallets, possibly in partnership with FinTech companies. However, partnerships of this kind entail an assessment of the risks they represent, and the adoption of measures to manage them if the partnership proceeds.

For example, safekeeping of private keys for customers does not fully describe the full scope of independent custody of the Crypto Asset itself. Custodians and CSDs will likely need investors to transfer the Crypto Asset from their own wallet address to a segregated wallet address that is managed by the custodian or CSD.

0.6   Law and Regulation

An extensive corpus of securities laws and regulations exists in all major jurisdictions. Since regulators tend to regulate on the basis of substance-over-form, it is prudent to assume that securities laws and existing regulations will also apply to most classes of Crypto Assets, and especially to Securities Tokens, so it will be important to clarify when Crypto Assets qualify as securities.

The laws and regulations applying to Crypto Assets will not remain static. Regulators in at least 24 jurisdictions are already working on reviewing existing securities laws and regulations to ensure that they remain suitable for the Crypto Asset markets. Their primary concern is to protect end-investors and safeguard the integrity of the markets without jeopardising innovation.

Nevertheless, regulatory certainty is not yet available. Custodian banks and CSDs are today developing Crypto Asset services in an uncertain legal and regulatory environment. Cross-border services are particularly difficult to develop with confidence.

Since the legal and regulatory status of Crypto Assets is still evolving, the role of the governors and / or operators of permissioned DLT networks or tokenisation platforms is of particular importance. The governor and / or operator can administer rules that apply to all members of a network and resolve disputes between them, pending legal and regulatory certainty. It is a role CSDs and custodians are well-suited to play, but other institutions might emerge to fulfil this function as well.

0.7   Inter-operability

Since DLT networks or tokenisation platforms are likely to co-exist alongside the incumbent securities market eco-systems for the foreseeable future, it is essential these networks are able to inter-operate. Otherwise, it will be difficult for DLT networks to be widely adopted, and impossible to secure the benefits of Crypto Asset issuance, capital-raising and investing.

Inter-operability between open or non-permissioned DLT networks is already well-advanced. But permissioned DLT networks or tokenisation platforms have made limited progress in inter-operating with each other and have achieved limited inter-operability with their non-permissioned counterparts. Inter-operability between DLT networks and existing

infrastructures is not progressing at all but this is not surprising, since large-scale applications of DLT do not yet exist.

Ultimately, achieving inter-operability will depend on a combination of business and technical standards. These in turn depend on agreements between participants in the Crypto Asset markets to develop and use them. Proprietary standards are being published, and both the International Organisation for Standardisation (ISO) and the Worldwide Web Consortium (W3C) have begun work on the development of open standards for Crypto Assets.

The ISO 20022 standard that has defined financial messaging norms in the securities and payment markets might provide a useful foundation for open standards in the Crypto Asset markets because it addresses business processes rather than technologies. However, no progress can be made without closer collaboration between all participants in the Crypto Asset markets to accelerate the process of agreeing on business and technical standards.

Finally, leading international policy forums and recognized global standard setters for securities regulation like International Organisation of Securities Commissions (IOSCO) have identified Crypto Assets as a priority, specifically citing concerns over trading, custody and settlement, valuation and intermediation. In this context, IOSCO undertook a consultation focussing on how platforms which trade Crypto Assets are regulated and would like to provide a framework to support regulators, together with a «tool kit» of measures or indicators to identify issues and address failings. Such regulatory harmonization efforts can further help achieve greater inter-operability and should be extended to encompass post-trade services as well.

1.0   Introduction

1.1   The DLT Challenge and Promise to Securities Markets

The Crypto Asset challenge to the securities services industry is more obvious than understood. The disruptive potential of Crypto Assets issued, traded, cleared, settled and serviced on distributed ledger technology (DLT) networks is clear to the custodian banks, market infrastructures and systems vendors that currently provide post-trade services in the securities industry. But exactly how DLT will achieve this, and what the consequences are for existing and new service providers, is not yet clear. This is not surprising, given the complexity of the status quo.

Over a prolonged period, an intricate chain of intermediation has built up in the securities industry. Stocks and bonds are issued and deposited into central securities depositories (CSDs), bought and sold by asset managers, traded by broker-dealers both on- and off-exchange, and cleared by central counterparty clearing houses (CCPs) before being settled between accounts at a CSD and a central bank. The servicing of the securities, in terms of income collection, execution of corporate action instructions and proxy voting, is mainly carried out by the custodian banks in conjunction with the CSDs.

This current procedure requires each intermediary to share data about each securities transaction with the next party or link in the chain. Each intermediary then reconciles its record of the transaction with that of the previous intermediary and adds any missing information before passing it on to the next intermediary in turn. Initial expectations of DLT focused on its potential to disrupt these iterative data exchanges and reconciliations. After all, if all parties to a transaction have simultaneous access to the data, there is no need to exchange it or reconcile it.

But it is clear that intermediaries are not merely symptoms of an inefficient process. The roles they fulfil in the securities markets exist for real reasons that are not made redundant by the issuance, trading and settlement of the Crypto Asset equivalents on DLT-based networks: namely, protection of the integrity of issues, provision of a trustworthy environment for investors, and safe and final settlement of transactions.[2]

However, it is also clear that simply reproducing the existing environment on DLT is pointless. Adopting the technology makes sense only if it enables new configurations or distributions of the work currently done by issuers, custodian banks, CCPs and CSDs. Fortunately, the disruptive potential of DLT does extend beyond a reduction in the number of intermediaries that exchange and reconcile data in the linear chains of intermediation prevailing at present between issuers and investors.

By allowing networks of issuers, intermediaries and investors to connect and collaborate directly, DLT has the potential to shift post-trade processing from a linear model to a networked model. It is likely to encourage the emergence of new eco-systems, some of which will link end-investors and issuers directly. Other eco-systems will likely emerge that enable new entrants and new technologies to supplant existing service providers or provide entirely new services.

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[2]   A previous ISSA paper argued that Crypto Assets have much in common with securities and that investors in them are «looking for a comparably safe and trustworthy environment». See *Infrastructure for Crypto-Assets: A Review by Infrastructure Providers*, ISSA, October 2018, page 5.
https://issanet.org/e/pdf/2018-10_ISSA_report_Infrastructure_for_Crypto-Assets.pdf

These emergent DLT networks, which can be expected to grow as network effects are felt, have several things in common. They include trust based on the minimal risk of data on the network being manipulated; a single but shared version of the «truth» created by data synchronisation and automatic reconciliation between participants; a reliable means of sharing control of transactions and data about transactions whenever required; automation of the terms of contracts through self-executing smart contracts; and the ability, through tokenisation, to represent, hold and transfer value without the risk of duplication and with minimal risk of loss.

These features do of course operate at the level of data. By using open protocols – sets of programmable rules – DLT networks specify how data can be exchanged between the members of the network. In this sense, DLT has the potential to make as large an impact on financial and commercial activity as did the Transmission Control Protocol / Internet Protocol (TCP/IP) technology used to connect devices on the Internet, because it eliminates the need for counterparties to replicate the same set of data on their own systems. In a DLT system, all parties see and operate from the same set of data.

In theory, by shifting to the protocol level all the work required to synchronise data and authorise its use, DLT can drastically simplify the process by which complicated networks emerge and operate. However, DLT is not yet a mature technology, and its ability to support networks at large scale and high volume remains largely untested. Nor can the technology alone resolve important legal and regulatory requirements (such as governing laws and jurisdictions and data privacy) and commercial imperatives (such as making sure DLT networks can inter-operate).

# 1.2   Crypto Assets Support a Single Version of the Truth

DLT technology has nevertheless made possible already the development of a new type of asset: the Crypto Asset. The term is applied loosely to a wide variety of commodities as well as assets issued on DLT networks - as with most technological innovations, the terminology of an emergent industry is in flux, and no taxonomy can do full justice to the variety of Crypto Asset projects in existence and being launched[3] - but a Crypto Asset is best understood as a specific sub-category of digital assets supporting all counterparties seeing and using the same set of data with cryptographically confirmed issuance, termination, ownership and transfer. A digital asset is any asset that can be issued, valued, owned and transferred in a digital form.[4]

As Figure 1 shows, for the sake of comprehensibility the Working Group has chosen to divide Crypto Assets into three main categories. The first is Payment Tokens, which are essentially synonymous with crypto currencies. They consist not only of genuine crypto currencies such as Bitcoin and Ethereum but also fiat currencies issued in digital form by central banks (Central Bank Digital Currencies, or CBDCs), none of which is yet in existence; and Stablecoins, which attempt to reduce the price volatility of crypto curren-cies by linking their value to real assets or fiat currencies, and enable digital payments.

The second category consists of Securities Tokens, which further divide into two groups. The first are known as Asset-Backed or «non-native» Securities Tokens. They represent existing instruments - such as stocks, bonds, derivatives and funds - in a new digital form, traded, safekept and settled on a DLT network. Asset-Backed tokens could also be used to represent existing illiquid or non-bankable assets such as commodities, titles to real estate and fine art. The second, known as Digital Native Securities Tokens, create a new group of digital assets that are issued directly on to - and exist only on - the DLT network.

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[3]   For a full discussion of the terms used by regulators, see *Global Cryptoasset Regulatory Landscape Study*, Cambridge Centre for Alternative Finance, Judge Business School, University of Cambridge. https://econpapers.repec.org/bookchap/jbsaltfin/-201904-gcrls.htm

[4]   See the Glossary for a comprehensive list of terms used for digital assets.

Figure 1: What is a Crypto Asset?
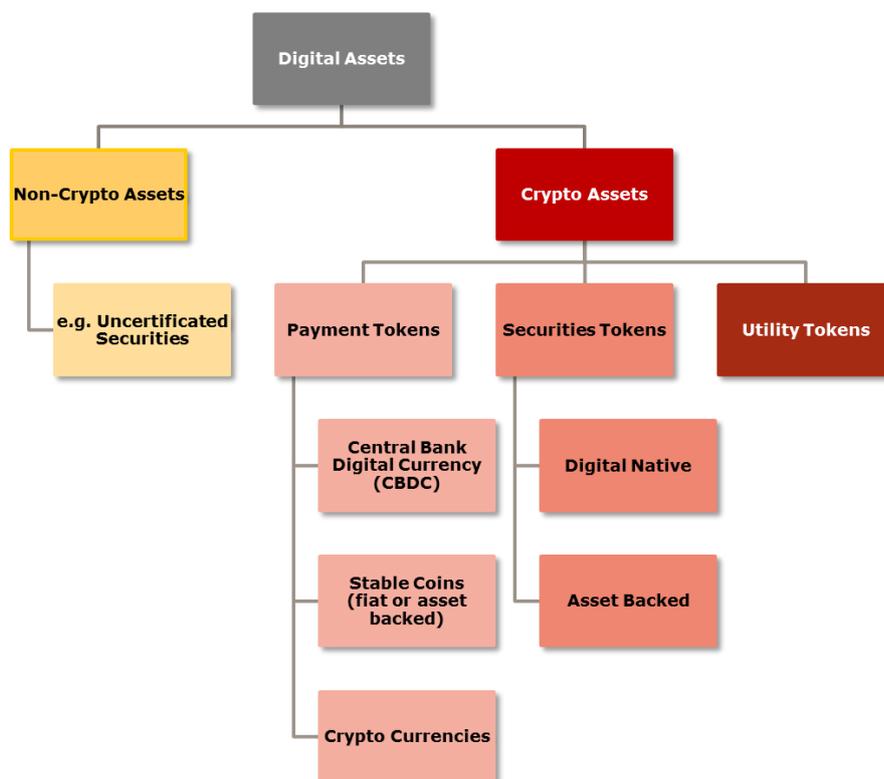
The third category is known as Utility Tokens. These Tokens are designed to be purchased by end-investors interested in gaining access to a current or prospective product or service or app. Their promise to investors is that increased use of the product, service or app will lead to an increase in the value of the Tokens. Golem, for example, is a Utility Token that aims to enhance the value of its Tokens by persuading investors and consumers to rent their unused computing capacity to members of the network.

1.3   The Need for a Safe Environment for Crypto Asset Issuers and Investors

The potential of Crypto Assets to create new investable assets and investment eco-systems is unmistakable. But the markets for the new Payment and Utility Tokens in particular are still maturing, leading to price volatility, and their regulation remains unsettled. Many institutional investors are wary of committing capital to these instruments in the absence of a reassuring set of financial market infrastructures (FMIs) and intermediaries willing to manage the risks associated with the issuance, trading, settlement, safekeeping and servicing of these assets.

In the capital markets of today, FMIs such as CSDs and CCPs and intermediaries such as custodian banks undertake the necessary trust-enhancing functions and provide a set of risk-reducing services. CCPs, for example, mitigate counterparty credit risks. CSDs processing securities transactions provide for the legal finality of settlement and the notarisation of issuance that provides certainty of title to assets. Likewise, custodian banks assume sizeable financial risks in, for example, corporate actions and collateral management.

These forms of intermediation obviously cost money, but they also create value. Securities market FMIs and intermediaries assume or transfer or mitigate or reduce the risks of issuing, transacting, settling and owning securities. They have also developed considerable specialist expertise and, by operating with scale economies, keep the costs of safekeeping, settlement, risk management and regulatory compliance within tolerable bounds.

The willingness of investors to pay for these services is matched by regulatory endorsements of the contributions the services make to the reduction of systemic risk. It is clear that both investors and regulators value intermediation in securities markets. Indeed, it has become equally clear that institutional investment in Crypto Assets depends on the provision of equivalent services, so it is unlikely that the Crypto Asset markets will dispense with them.

In fact, Crypto Assets such as Securities Tokens will need regulated entities to provide a safe and efficient environment to qualify as regulated assets fit for investment by regulated institutions. Fortunately, FMIs and intermediaries active in the securities markets are already responding to this opportunity alongside new entrants such as FinTechs.

The established providers acknowledge the transformative potential of Crypto Assets issued on to DLT networks or tokenisation platforms. They are experimenting with dozens of proofs-of-concept, go-to-market projects and even implementations. The Australian Stock Exchange (ASX), to take the best-known example, has elected to replace its ageing Clearing House Electronic Sub-register System (CHESS) with a DLT platform.

The established providers are also mindful that Crypto Assets in general, and Securities Tokens in particular, are likely to be regulated under existing securities laws and regulations, though regulations adapted to Crypto Assets will likely emerge and stabilise. Since regulators do not wish to introduce regulations that suppress innovative technologies, they have pursued a pragmatic approach to the regulation of participants in the Crypto Assets eco-system. The pragmatic approach can be summarised as «same activity / business, same risk, same regulation».

Their objective of the regulators is to ensure that issuers and investors are protected, and financial market stability is guaranteed, without discouraging innovation by regulating DLT separately. That means that, for the foreseeable future, issuers and investors in Securities Tokens will need regulated third-party providers, such as CSDs and custodian banks, to ensure they remain in compliance. Likewise, issuers and investors active in the Payment and Utility Token markets will also need to address any relevant regulatory requirements.

1.4   Securities Tokens will Co-exist with Traditional Securities Markets

A wholesale displacement of the existing structure of post-trade services in the securities markets by Securities Tokens is unlikely to occur. The risks and costs of making the market-wide changes to the current blend of technologies, governance systems and market structures which have evolved over many decades into a sophisticated, standardised and robust eco-system are too high relative to the foreseeable benefits.

Nor are the participants required to fulfil fiduciary roles, in both incumbent and Crypto Asset markets, willing to write off their investment in existing technologies. So it is safe to conclude that Securities Tokens issued, traded, safekept, administered and settled on DLT networks or tokenisation platforms are going to co-exist with the current eco-system for some time to come. In fact, there may never be a transition to a single model. After all, Securities Tokens as currently construed lack some of the scale advantages of traditional securities, such as the liquidity released by netting of transactions.

In addition, while Securities Tokens remain the subject of experimentation, the securities markets provide a well-established way of raising and channelling capital from savers to organisations that can put it to productive use. The FMIs and other intermediaries processing securities transactions have adopted global standards, best practices and interfaces to provide inter-operability on a global basis. So it is essential that the variety of DLT-based and traditional eco-systems that are now emerging are able to inter-operate successfully, through standardised data exchanges and interfaces. Without inter-operability, both operational efficiency and market liquidity will be imperilled.

Nevertheless, even partial adoption of Securities Tokens will require changes of existing service providers, such as a willingness to take private keys into custody. Entirely new roles, such as smart contract verification services, will also develop. Some of these, such as acting as the governors and / or operators of permissioned DLT networks or tokenisation platforms, will suit existing service providers such as CSDs and custodian banks.

2.0   Issuance

2.1   Crypto Assets have the Potential to Simplify the Issuance Process

The current process of issuing equity and fixed income securities, whether they are issued publicly or to select investors by private placement, is cumbersome (see Table 1). It requires the negotiation, agreement and signature of legal documents in which the terms of the issue – such as the debt covenants, the interest rate references, or the dividend payment dates - are described. New issues also trigger operational requirements, such as collecting subscriptions from investors, paying proceeds to issuers and allocating dividend or interest payments to investors.

In principle, DLT can reduce the cost and complexity of both the legal and the operational aspects of a new issue. However, it cannot obviate the need for legal documentation (for example, an offering memorandum or prospectus) or the need for a regulated entity to take responsibility for the integrity of the issue (such as a CSD).

Yet a number of the tasks and information exchanges required to originate, syndicate and close a new issue can potentially be streamlined and orchestrated more efficiently using DLT and Crypto Assets. Investors can subscribe for the Crypto Assets directly on the network (which should in theory save the issuer underwriting fees) and hold the Crypto Assets either directly or in a digital account on a DLT network or tokenisation platform operated by a CSD or via a custodian bank they appoint.

Table 1: Traditional New Issue Process

Origination
- Appointment of the investment bank by the issuer
- Creation of term sheets
- Pricing of the securities
- Know Your Client (KYC), anti-money laundering (AML), politically exposed person (PEP) and sanctions screening checks on the issuer
- Preparation of legal documentation by external counsel
- Registration of the issue with the CSD (and / or registrar)

Syndication
- Book-building by the investment bank with investors
- KYC, AML, PEP and sanctions screening checks on investors

Closing, signing and settlement
- Finalisation of terms of the issue
- Signing of legal documentation
- Registration of securities owned by investors
- Setting up of payment instructions
- Payment of proceeds to the issuer

Post-issuance administration
- Appointment of paying agent
- Corporate action servicing, e.g. distribution of dividends

Once the Crypto Assets are issued, they can also be serviced in a more efficient manner on a DLT network or tokenisation platform. For example, regular interest payments on a bond issue can be executed by a smart contract. A smart contract could also be used to issue rights to existing investors at a discount if all investors in the Crypto Asset - and the number they held - were registered on a DLT network or tokenisation platform.

In fact, specialist service providers would be able to join the DLT network as separate «nodes» and offer to complete particular tasks, or parts of tasks, on behalf of issuers. KYC and AML checking services are an obvious example of how DLT networks can not only improve coordination between the elements of a transaction but enhance the service. Some or all of the entirely new roles, such as smart contract verification services, could also join the network as «nodes» Issuers could auction the right to perform these services on the network.

2.2   Differences between Native and Non-Native Issuance Processes

However, the issuance process will vary depending on whether the Crypto Assets are «non-native» Asset-Backed Securities Tokens or Digital Native Securities Tokens. Asset-Backed Tokens, which are backed by an underlying asset that exists already, such as a stock or bond, must be supported by holdings of the underlying asset at a CSD or a custodian bank. As Figure 2 shows, the underlying assets are issued and held in the conventional way. The custodian which holds the underlying assets at a CSD or registrar then issues the Crypto Asset on to a DLT network or tokenisation platform.

Figure 2: Issuance of Asset-Backed or Non-Native Crypto Assets
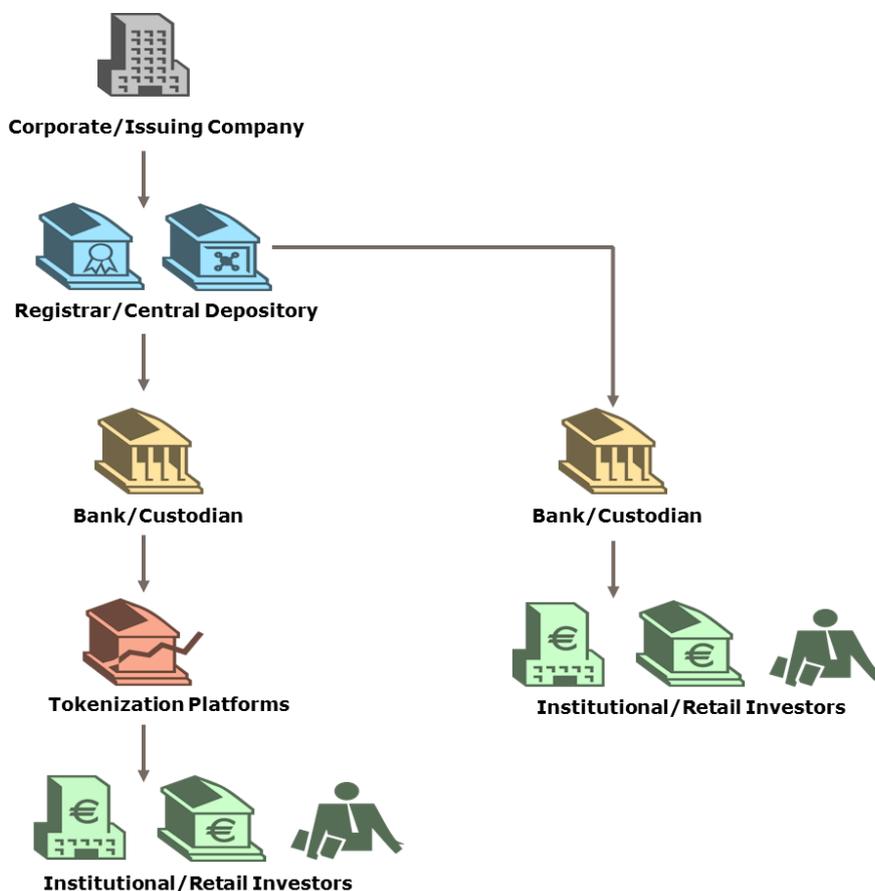
Asset-Backed or non-native Crypto Asset Tokens issued in this way are akin to sponsored depositary receipts (DRs), so the underlying asset-servicing processes would be untouched. Native Crypto Asset Tokens, on the other hand, can be issued and serviced directly on the DLT network or tokenisation platform (see Figure 3).

Figure 3: Issuance of Native Crypto Assets

Corporate/Issuing Company

Tokenization Platforms

Institutional/Retail Investors
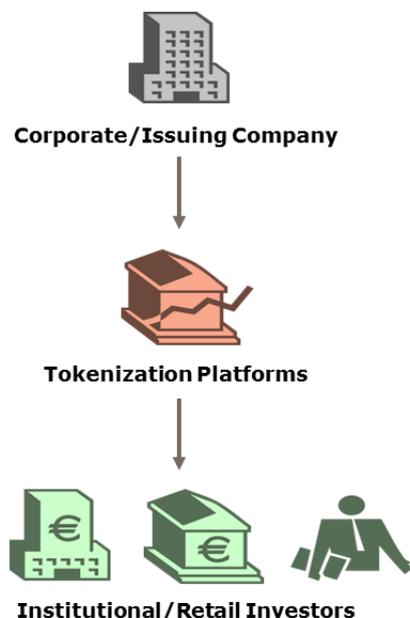
From a technical standpoint, guaranteeing the integrity of the issue of Crypto Assets on a DLT network or tokenisation platform - that is to say, ensuring the number of tokens in circulation does not exceed the number in issue – could be automated. In practice, however, regulators and investors will want assurance that some entity is liable for any losses incurred by investors if the integrity of the issue is breached. Unsurprisingly, maintaining the integrity of the issue is one of the most important responsibilities entrusted to regulated FMIs such as CSDs in the traditional securities markets.

Digital Native Tokens that are regulated as securities will have to be issued into an entity that meets the regulatory requirements set not just by national securities laws and regulations but also by the standards set for financial market infrastructures by the Committee on Payments and Market Infrastructures (CPMI) and the International Organisation of Securities Commissions.[5]

Entities that can match these requirements will be able to act as governors and/or operators of the DLT network or tokenisation platform as well as assuming responsibility for guaranteeing the integrity of the issue. Other services (such as issuing corporate action notifications) can also be performed by such an entity in co-operation with other participants in the network such as custodian banks, agent banks and technology vendors.

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[5]   Committee on Payments and Market Infrastructures (CPMI) and the International Organisation of Securities Commissions (IOSCO), *Principles for financial market infrastructures*, April 2012. https://www.bis.org/cpmi/publ/d101a.pdf

2.3   Illiquid Alternatives are well Suited to Crypto Asset Tokenisation

DLT networks and tokenisation platforms can also host Crypto Assets that represent illiquid alternative investments custodied separately and which are presently available only directly, or in the form of funds, or by investing via proxies, such as the stocks of companies that invest in them. Cases in point are fine art and wine, real estate, or collectibles such as classic motor cars, first editions or rare coins.

At present, investing in these assets generally requires a high level of intermediation by fund managers, secondary fund managers acting as specialist advisers and fund structures, with their complex accompanying requirements in terms of fund accounting and transfer agency. Ownership is recorded by specialist and usually government-controlled agencies, such as copyright offices and land registries.

Making these asset classes available as Crypto Assets on a DLT network or tokenisation platform, by contrast, allows the assets to be fractionalised as well as tokenised. While fractionalisation can be achieved by various methods of digitisation, tokenisation is a relatively new technique for achieving it on a DLT network. In theory, fractionalisation can increase transparency into the underlying investments and enhance liquidity as well as cutting the cost of investment and trading. A number of start-ups have emerged to offer investors access to investments of this kind.

But there is one service which all Crypto Asset issuers and their advisers and service providers will need to access. This is how to settle purchases and sales of Crypto Assets. Settlement could potentially be different from the method used in the established securities markets: delivery into accounts at a CSD versus payment in central or commercial bank money to an agreed timetable.

Issuance: Recommendations / Best Practice Considerations

- Crypto Assets can in theory make the issuance of financial instruments more efficient than it is in securities markets today; however, regulatory and operational practices are not yet established at scale, so further market growth, research and experimentation are required to realise their potential;

- Crypto Assets can offer more convenient access to non-bankable alternative asset classes custodied out-of-network such as fine art or classic motor cars, so the technology has potential for this purpose,[6] including offering issuers and investors both large and small the opportunity to fractionalise such assets;

- Crypto Asset issuance should aim to enhance the existing process by which securities are issued as well as encourage new methods;

- Crypto Assets have the potential to transform primary market origination, syndication, closing and signing processes through the introduction of permissioned DLT networks and smart contracts;

- Smart contracts can also help transform post-issuance administration and asset servicing;

- New roles could emerge e.g. smart contract verification services, but the exact form and regulatory ambit of such roles is yet to be determined.

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[6]   Previous ISSA reports in 2012 and (in conjunction with the Association of Global Custodians (AGC)) in 2014 have highlighted custodians' risks when so-called «out of network assets» are part of a client portfolio custodied by a bank. See https://issanet.org/e/pdf/2014-04_ONA_Report_Final.pdf

3.0   Settlement

3.1   The two Methods of Settling Crypto Asset Transactions

Simultaneous delivery of financial assets to the buyer against cash payment to the seller, or delivery-versus-payment (DvP), is the normal method of settling transactions in the securities markets. Regulators favour it because it minimises the systemic risk of settlement failure, in which one failed delivery or payment leads to a series of settlement failures that cause banks or clients of banks to become insolvent.

In the safest form of DvP, securities move in digital form between accounts maintained by the custodian banks at a CSD, while cash moves between accounts maintained by custodian banks at the central bank. Even when cash payment takes place between accounts at commercial banks – through the correspondent banking system in the case of cross-border payments - the net payments are ultimately settled via the real-time gross settlement system (RTGS) operated by the central bank.

Systemic risk is further mitigated by elimination of the possibility of reversing the transaction: settlement is deemed to be legally final and irrevocable. The Settlement Finality Directive of the European Union (EU), for example, guarantees that transfers of cash or securities are finally settled, regardless of whether the sender has in the meantime become insolvent or sought to revoke the transaction.

Achieving settlement finality means that a transaction is irreversible and irrevocable, and the proceeds of the transaction can be used for additional settlement activities without counterparts or third parties being able to contest the settlement of the transaction. In short, settlement finality allows legal risks to be reduced. This not only reduces systemic risk but is a highly desirable form of protection for investors active in markets in transferable securities.

Investors in Crypto Assets will find settlement arrangements that minimise principal risk and legal risk equally desirable. Indeed, it is a safe assumption that institutional investors in Crypto Assets would prefer their transactions to be settled safely and efficiently in a highly regulated environment comparable to that provided for the securities markets today.

Ideally, the settlement of transactions in Crypto Assets should achieve safe, final and irrevocable settlement between the counterparties. In fact, Crypto Assets issued as Securities Tokens and regulated as securities under existing securities law and regulation will be under a legal and regulatory obligation to provide DvP and settlement finality.

There are two approaches which DLT networks or tokenisation platforms confronted by these requirements can adopt. The first is to settle the cash leg of a transaction off the distributed ledger by making use of commercial or correspondent banks with access to the RTGS system. The second is to settle the cash leg of a transaction on the distributed ledger, by using separate cash tokens exchangeable between accounts on the distributed ledger.

3.2   Implications of the two Methods of Settling Crypto Asset Transactions

The choice of settlement method has implications for both the terms of the trade agreed on a trading platform and the liquidity in the DLT network or tokenisation platform. The on-ledger method allows transactions to be settled immediately through the exchange of Securities Tokens for Payments Tokens, or Token-versus-Token (TvT) settlement. This greatly reduces counterparty risk. The off-ledger method, on the other hand, preserves the counterparty risks that arise between the time of the trade and the time of settlement.

Although trades in transferable securities become enforceable legal contracts from the moment they are first agreed, and the typical terms of trade define the date on which settlement will take place, in off-ledger settlement there remains a risk that the buyer will fail to deliver the cash or the seller will fail to deliver the securities. It follows that operators and users of DLT networks or tokenisation platforms must consider how these counterparty risks will be managed.

The current post-trade infrastructure of the securities markets is designed to manage and mitigate these risks for participants. In particular, counterparty risk is reduced by the intermediation of central counterparty clearing houses (CCPs) which become the counterparty to every trade, offsetting their own risk through a clearing fund coupled with the posting of collateral by the counterparties. By mitigating the risk of a counterparty default triggering knock-on effects that would cause a series of transactions to fail to settle, CCPs reduce systemic as well as counterparty risk.

Importantly, CCPs also enhance the liquidity of the securities markets by allowing transactions between matching counterparties to be netted prior to settlement. In high volume and high value securities and derivatives markets, this netting of transactions is extremely valuable in reducing the costs of cash, credit and collateral. Counterparties are able to enter into more transactions without breaching credit limits or having to find more cash to settle or more securities to post as collateral.

On-ledger TvT settlement of Crypto Asset transactions, on the other hand, calls into question the value of having a CCP to eliminate counterparty risk. However, this so-called «atomic» settlement of a trade on a DLT network or tokenisation platform does require that both the Securities Tokens and the Payments Tokens are available for delivery when the trade is matched prior to settlement. That in turn requires the pre-funding of accounts prior to the start of trading.

Pre-funding has important implications in terms of liquidity and cost, since payments have to be prepared in advance and be available when required to settle the trade.[7] It marks a radical departure from the way settlement works in the securities markets of today, where transactions can be executed, and funding and positioning for settlement arranged later. This allows the market-makers, which are the primary source of liquidity in most securities markets, to sell securities short without drawing on their own liquidity. It also allows market makers or their counterparties to borrow securities (securities borrowing) or cash (credit) to settle a transaction, so neither the cash nor the securities have to be available immediately.

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[7]   The European Central Bank (ECB) distinguishes between post-funded methods (which it describes as «good»), pre-funded methods which require amounts of individual payments to be prepared («fair») and pre-funded methods which require an amount equal to or greater than the individual payment («poor»). See ECB, STELLA- joint research project of the European Central Bank and the Bank of Japan, *Synchronised cross-border payments*, Table 6, page 29. https://www.ecb.europa.eu/paym/intro/publications/pdf/ecb.miptopical190604.en.pdf

The potentially profound implications for the liquidity of markets with the loss of netting and the need for pre-funding go beyond the scope of this document but are worthy of further research. Liquidity in blue chip equities, for example, draws on a number of complex mechanisms that lower the cost of trading and which span cash and derivatives markets.

They include short-selling, securities financing, back-to-back trades, block orders to buy or sell large numbers of securities, and pre-trade allocations to customer accounts as orders are fulfilled, as well as clearing through CCPs. The relevance of these techniques for the liquidity of Securities Tokens needs to be established, if the Crypto Asset markets are to develop successfully.

One final risk should be noted. None of the on-ledger and off-ledger settlement methodologies so far devised are yet adapted to high volumes of transactions, though both require seamless and high capacity links. On-ledger models depend on access to holdings of cash at central or commercial banks for pre-funding. Likewise, off-ledger models require coordination with RTGS systems or payments or correspondent banks, creating counterparty credit risks that will increase in lockstep with transaction volumes.

3.3   Off-ledger Payment Models for Crypto Asset Settlement

The «off-ledger» payment model is easily described at a high level. The Crypto Assets are bought and sold on a DLT network or tokenisation platform, but the cash payment is not made using Payment Tokens at all but concluded off the network in fiat currency using an existing payments market infrastructure such as SWIFT to instruct banks and payment systems. In practice this means the cash component of a Crypto Asset transaction is moved through conventional cash accounts held at cash correspondent banks, with final settlement taking place between the commercial banks through the RTGS system operated by the central bank.

There are two ways in which cash correspondent banks can do this. The first is on a synchronised basis. In this case, the operator of the DLT network or tokenisation platform would have the ability to check in real-time that the payer has sufficient cash to settle the transaction, and possibly earmark a portion of such cash in the RTGS reserve account of its commercial bank to purchase the Crypto Assets. The operator would then settle the transaction by delivering the Crypto Asset to the account of the payer on the DLT network or tokenisation platform at the same time as the bank initiates the delivery of the cash to the bank account of the payee, ultimately through the RTGS system.

Although in theory commercial banks could be given access to DLT networks or asset tokenisation platforms round-the-clock, prudent risk management argues for restricting large value synchronised settlements to periods when the RTGS system is open only.

At other times, and for small value settlements, an interfaced or conditional settlement model could be employed. In this case, cash would be debited from the account of the payer and credited to the account of the payee on the DLT network or tokenisation platform on a contractual basis only. Likewise, the transfer of the Crypto Assets would take place on a contractual basis only, with actual transfer taking place only as the cash component moves. If the cash moved between the accounts of the cash correspondent banks on the next working day, for example, this would create an overnight counterparty credit risk between the banks.

Table 2: Off-ledger Forms of Settlement

Synchronised Settlement	Legal title transfers of assets on any DLT network or tokenisation platform would be supported by instantaneous, synchronised and risk-free settlement of cash obligations between commercial bank reserve accounts in the central bank RTGS system. Central banks may choose to use an existing high value payment system, a CSD or any other systems used by intermediaries such as custodian banks to effect synchronisation of settlements with DLT networks and tokenisation platforms.
Conditional Settlement	Legal title transfers of assets on any DLT network or tokenisation platform are finalised on the basis of a confirmation from the central bank of settlement of cash obligations between commercial bank reserve accounts in the RTGS system. The difference with conditional settlement, by comparison with synchronised settlement, lies in the contractual nature of the transaction. The Securities Tokens, whether they are Asset-Backed or «digital native» Tokens are exchanged for cash that moves between cash correspondent banks.

For regulated Securities Tokens, both processes would be greatly simplified if the DLT network or tokenisation platform was operated by a regulated intermediary. This would place the settlement of Crypto Assets against cash payment in fiat currency under the control of a single entity subject to regulatory supervision and capable of conferring on the transaction the legal certainty of settlement finality.

Neither synchronised nor conditional settlement provides room for multilateral netting, though the value of netting can be significant. The value to the commercial banks of netting transactions through CLS, for example, is enormous. CLS settles on average US$6 trillion a day, but the net funding requirement of the banks is only US$60 billion. Likewise, the netting of equity transactions through CCPs is extremely valuable. In one CCP $US 1.3 trillion in gross daily settlement obligations are netted down to just $19.8 billion and collateralized by just $7.3 billion in margin deposits. The challenge of matching liquidity savings of this magnitude will become a significant factor in the evolution of the Crypto Asset markets as transaction volumes increase.

3.4   On-ledger Payment Models for Crypto Asset Settlement

The «on-ledger» settlement model, where both the Crypto Asset Token and the Payment Token are issued on the same DLT network or tokenisation platform - or at least on DLT networks or tokenisation platforms that are able to inter-operate with each other - has a large theoretical advantage. It makes it possible to achieve TvT settlement on the DLT network or tokenisation platform itself, without the need for the buyer and the seller to move off the network to access fiat currency payments in central or commercial bank money.

In an ideal world, fiat currencies in central bank money would be available on DLT networks or tokenisation platforms in the form of CBDCs. Central banks in several jurisdictions - the Bahamas, Sweden, Thailand, China and Uruguay - are exploring CBDCs.[8] But at present no central bank has issued a CBDC, primarily because of concerns about the impact on bank funding and lending if central banks compete with commercial banks for CBDC deposits.

The present alternative for «on-ledger» settlement is Stablecoins. These are a group of Payment Tokens that – as the name suggests – seek to overcome the price volatility of conventional crypto currencies by linking the Payment Tokens to a more stable store of value. The simplest structures make the Stablecoin exchangeable on a 1:1 basis with an equivalent amount of fiat currency held in an escrow account.

3.5   Types of Stablecoins Useable in On-ledger Settlement

The degree of risk associated with Stablecoins varies by their structure and the type of asset they choose as backing. Some mix other assets (such as gold) with fiat currency. There are structures that reference a non-currency asset such as the price of a commonly traded commodity - oil, for example – without actually holding any of the commodity at all. The issuer might instead hold derivative contracts which pay out in the chosen fiat currency.

It is not unknown for Stablecoins to be backed by Crypto Assets, with over-collateralisation («haircuts») used to compensate for the increased level of risk. Some Stablecoins are not asset-backed at all. The so-called «algorithmic» Stablecoins, for example, claim to maintain their value by restriction of supply alone. The supply of Payment Tokens, in other words, is expanded and reduced according to the dictates of a mathematical algorithm. Other Stablecoins have adopted a hybrid model, in which real asset backing is combined with non-asset-backed measures.

But the most secure type of Stablecoin is not hard to depict. It would be issued by a commercial bank, a consortium of commercial banks or a CSD with a banking licence against the fiat currency it holds in its reserve account at the central bank (see Table 3). In such a case, the central banks would almost certainly insist on regulating the DLT network or tokenisation platform on which the Payment Tokens were issued, in the same way that they regulate PMIs. This suggests that existing market infrastructures, such as PMIs or CSDs, or a consortium of commercial banks, are the natural choice as operators of such cash tokenisation platforms.

Table 3: On-ledger Payment Tokens Useable in Settlement

Description of the Payment Token	Issuers	Custodian of collateral	Examples (in development or production)
Central Bank Digital Currency (CBDC)	Central banks	Central banks	Sveriges Riksbank E-Krona; Central Bank of the Bahamas' Sand Dollar; Bank of Thailand; Eastern Caribbean Central Bank; Central Bank of Uruguay
Stablecoin backed by cash held in reserve accounts at the central bank and guaranteed by the central bank	PMIs, CSDs, and / or a consortium of commercial banks	Central banks	Digitalised Singapore Dollar (Project Ubin); Stella project of the European Central Bank and the Bank of Japan
Stablecoin with a claim on cash held in a shared central bank reserve account without central bank guarantee	PMIs, CSDs, and / or a consortium of commercial banks	Central banks	Utility Settlement Coin (USC), will likely fall in this category, although its legal and regulatory status has yet to be determined
Stablecoin based on cash deposits at a commercial bank	Commercial banks	Commercial banks	Bank Coin; Signet Coin by Signature Bank; JPM Coin by J.P. Morgan
Stablecoin issued by non-banks	Mainly crypto currency exchanges and related trust companies	Commercial banks	Gemini Dollar (GUSD); Paxos Standard (PAX); Huobi HUSD currency exchange; and Circle and Coinbase's USD Coin (USDC)

Investors who want access to such a secure Stablecoin would deposit fiat currency with their commercial bank in their own books or in an account at a CSD with a banking licence, and request it be converted on a 1:1 basis into Payment Tokens. The commercial bank or CSD would deposit the cash at the central bank and issue the Payment Tokens.

The fiat currency could be immobilised in an omnibus reserve account at the CSD or, if a consortium of commercial banks was used, in the account of the banking entity of the consortium at the central bank, with traceable links back to the commercial bank(s) which made the deposit.

The Tokens can move independently across the DLT network or tokenisation platform. However, the number of Payment Tokens in issue and circulation will always need to be equal to the amount of immobilised fiat currency held at the central bank, so the owner of the Payment Tokens can at any time convert them back into fiat currency on a 1:1 basis.

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[8]   See https://www.consulting24.co/post/worldwide-testing-of-digital-currencies-by-central-banks

By doing so, the owner would reduce the amount of Payment Tokens in issue and, by extension, the amount of fiat currency immobilised in the omnibus account at the central bank (see Figure 4). However, the process might not be as simple as Figure 4 suggests. The exact regulatory oversight and supervision of the operator of such a Stablecoin platform, as well as the reconciliation of holdings of fiat currency with the holdings of Payment Tokens, needs further research.

Figure 4: **Creation and Destruction of Stablecoin Backed by Currency held at Central Banks by a Consortium of Commercial Banks**
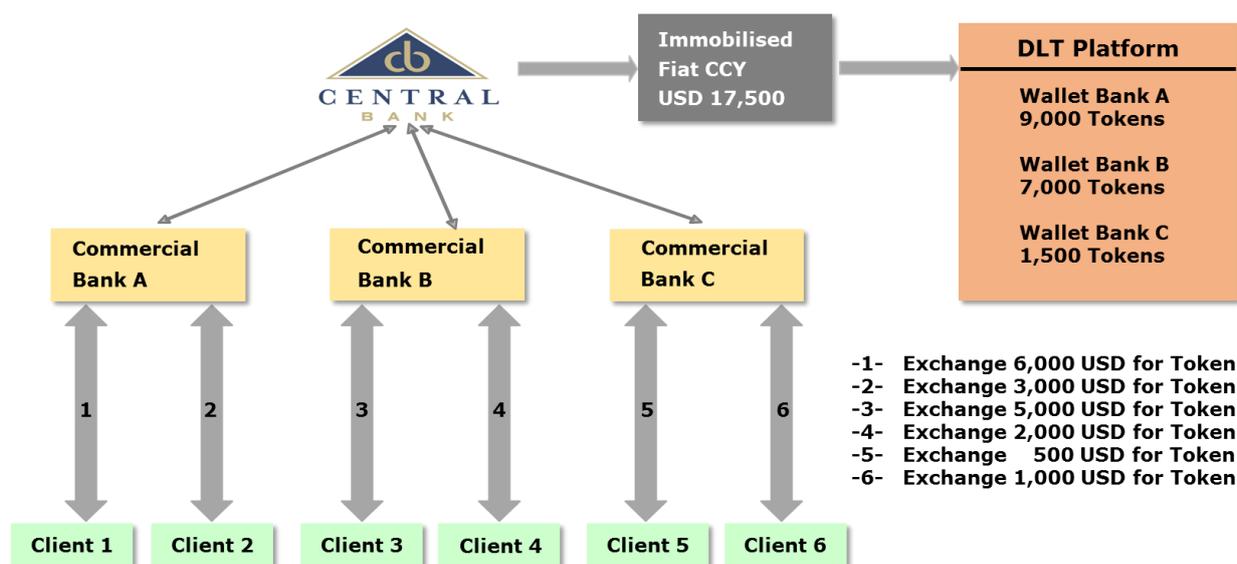
The advantages of a Stablecoin backed by central bank money are nevertheless clear. For the purposes of settlement, the principal benefit is that Crypto Asset transactions can occur on a TvT basis on the DLT network or tokenisation platform without any need for daily interaction with the RTGS system of the central bank, eliminating dependence on its operating hours. Interaction with the central bank would occur only when holders of the Payment Tokens want to buy more Tokens or convert them to fiat currency.

Stablecoins issued by commercial banks against deposits of cash on their own books are demonstrably less attractive precisely because they represent a claim on - and hence a credit risk - on the legal entity of the commercial bank that issues the token. A further unhappy consequence is that Stablecoins issued by commercial banks are not fully fungible with Stablecoins issued by other commercial banks, because they represent different credit risks. Nevertheless, such a model could prove quite attractive in managing settlement and liquidity within the client network of a single large commercial bank.

The most risk-prone forms of Stablecoin are those already being issued by non-bank entities, and especially crypto currency exchanges.[9] The value of these is tied to deposits of cash at a commercial bank. Although the cash is usually controlled by a separate and separately audited trust company, recent events at the Bitfinex Crypto Currency exchange

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[9]   The legal status of these non-bank Payment Tokens is unclear. Logically, if they are deemed by a regulator to be equivalent to cash, the issuer should expect to be required to obtain a banking licence to hold client cash balances on a DLT network or tokenisation platform.

- issuer of the Tether Stablecoin - prove that there is a risk that cash held as collateral for Payment Tokens can be used to cover losses elsewhere in a business.[10]

This is why the governance,[11] the collateral arrangements, the valuation procedures and the reconciliation of collateral versus tokens for Stablecoins are so important. If the issuer of the Stablecoin also operates the DLT network or tokenisation platform on which the Payment Tokens are issued, the need to protect against malfeasance is higher. If the collateral is held in an account controlled by the issuer or operator, as opposed to being held by a third-party custodian or trust company on behalf of the investors, the risk is also higher.

Stablecoin issuers or platforms also need to guarantee the integrity of the issue – that is to say, that the total amount of Stablecoins in circulation will always be backed by an equivalent amount of underlying collateral. This obligation is likely to take the form of specific fiduciary obligations and liabilities being laid on such issuers or platforms.

3.6 On-ledger Trading and Settlement on a Single DLT Network or Tokenisation Platform

The settlement process is simplest when both the order matching and the settlement process take place on the same DLT network or tokenisation platform. This is a model which can be built and operated by CSDs and custodian banks as well as stock exchanges and other trading venues running continuous books of buy and sell orders in the securities markets today.

To achieve immediate settlement on a single DLT network or tokenisation platform, where trading and settlement are part of the same system, the process is straightforward. Both the Securities Tokens and the payment for them (whether it is via Payment Tokens or off the ledger via the RTGS system or cash correspondent banks) have to be available for delivery if matching and settlement is to follow validation of the information about the transaction.

But once a transaction is validated and matched, and it is confirmed that the assets for exchange are available, the ledger can be amended immediately to record the purchase and sale. On a single DLT network or tokenisation platform, settlement of the cash component off the ledger is not very different from the securities settlement processes of today.

TvT - using Payment Tokens for the cash component – would represent an even more immediate exchange of value. Even in this case, however, banks need to be involved. Figure 5 illustrates how banks would be needed to support payments in the case of a DLT network or tokenisation platform where trading and settlement are parts of a single ledger.

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[10]   See «We all become MF Global eventually, Tether edition,» FT.com, 26 April 2019.
[11]   For example, if the Crypto Asset Tokens represent tokenised assets that are not on the DLT network or tokenisation platform (e.g. underlying securities, commodities, physical assets, fiat currency cash), then the rules of the DLT network or tokenisation platform should define how and when the underlying assets can be regained in possession.

Figure 5:   Settlement of Securities Tokens on a Single DLT Network with External Payment Token Settlement
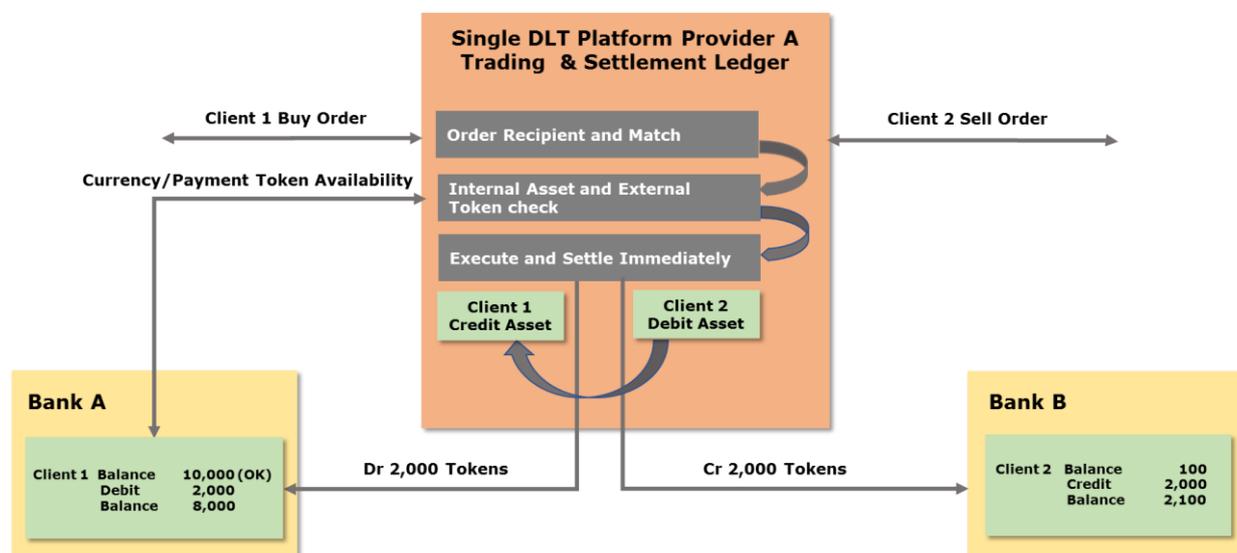
3.7   On-ledger Settlement on Multiple DLT Networks or Tokenisation Platforms

While a single DLT network or tokenisation platform that combines both trading and settlement is the simplest model, market forces are almost certain to create an eco-system of competing DLT networks and tokenisation platforms. This implies multiple ledgers, some of which integrate issuance, trading and settlement, and some of which specialise in issuance or trading or settlement, or some other combination of the three. This will complicate the settlement process.

It is possible to foresee multiple trading ledgers supported by a single settlement ledger, akin to a CSD settling securities traded on multiple trading venues in the securities markets of today. It is also possible to envisage multiple settlement ledgers competing with each other for the business of multiple trading ledgers trading different Securities Tokens, and settling them in the same Payment Tokens, or settling the same Securities Tokens in different Payment Tokens.

A study by the European Central Bank (ECB) and the Bank of Japan (BoJ) concluded that it would be possible to deliver two Securities Tokens on two separate ledgers by using «cross-chain atomic swaps.»[12] The risk of using this approach is that a transaction is posted in one ledger but not in the second ledger because the locking time is not properly set or there is a miscommunication between the ledgers.

Whether or not this method can be made to work, it is clear that business and technical standards will have to be agreed that enable banks to provide the cash or cash equivalent component as well as enabling trading platforms to confirm to other networks that Crypto Asset Tokens are available for settlement. Figure 6 illustrates the flows of information between the various entities that are necessary to secure final settlement of transactions across multiple DLT networks.

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[12]   See European Central Bank, *BOJ/ECB joint research project on distributed ledger technology*, 27 March 2018, page 2. https://www.ecb.europa.eu/pub/pdf/other/stella_project_leaflet_march_2018.pdf

Figure 6:   Settlement of Securities Tokens on Multiple DLT Networks or Tokenisation Platforms
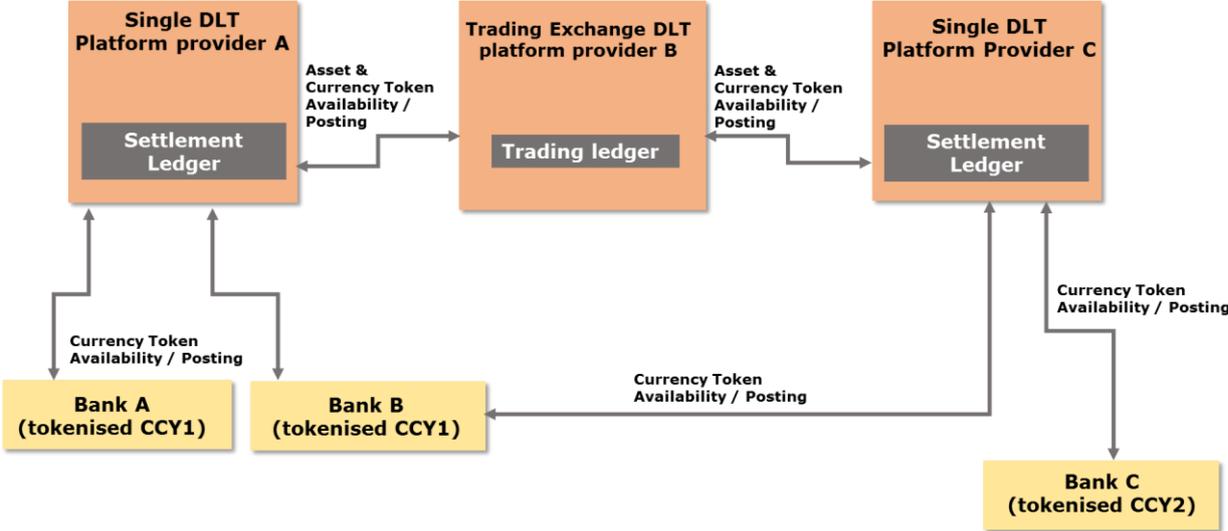
Settlement: Recommendations/Best Practice Considerations

- Settlement of Crypto Asset transactions will require delivery-versus-payment (DvP) to reduce risks and should support legally binding settlement finality;

- Until central banks issue central bank digital currencies (CBDCs) or support synchronised settlement in their real-time gross settlement (RTGS) systems, there is a likelihood that Crypto Asset transactions will entail some credit risk on the cash payment side;

- Where Payment Tokens are Stablecoins not issued by a central bank, additional governance policies and audit controls are needed to ensure the integrity of the issue and the collateral which backs it;

- There are existing regulatory frameworks to regulate and manage the payment and credit risks relating to DvP settlement and these should be applied to Tokens regulated as securities;

- On-ledger settlement of Crypto Asset transactions makes immediate settlement possible, holding out the prospect of improved settlement practices, and these possibilities should be pursued;

- However, immediate settlement of Crypto Assets by Token versus Token (TvT) methods raises unresolved issues about the costs of pre-funding of accounts, the loss of the benefits of netting and erosion of the value to liquidity of market making, short-selling, compression, block trades and other techniques used in the securities markets, all of which need further research and investigation;

- Achieving legally sound settlement finality, which in the securities markets is provided by securities settlement systems such as central securities depositories (CSDs), is vital to the provision of an environment for the legal transfer of title to Crypto Assets, and to ensure that investors comply with legal requirements;

- DLT networks and tokenisation platforms hosting Crypto Asset settlement processes must ensure they have the relevant regulatory qualification to provide finality of settlement;

- In all cases of tokens regulated as securities, DLT networks and tokenisation platforms must seek regulatory authorisations and approvals;

- DLT networks or tokenisation platforms which host Crypto Assets need either their own cash Payment Token or the support of a CBDC or a Stable Coin Platform, preferably operated by a CSD or a PMI, to provide investors with the same degree of reassurance about good title, safe settlement and asset safety as existing services provided to the securities markets by custodian banks and CSDs;

- DLT networks or tokenisation platforms holding cash or Crypto Assets in custody on behalf of investors should either seek relevant licenses depending on the jurisdiction, such as a banking licence or authorisation as an e-money operator or outsource the work to a custodian bank or CSD with a banking licence.

4.0   Asset Servicing

4.1   The Servicing Needs of Crypto Assets

Settlement with finality is the process by which investors in Crypto Assets, like their counterparts in the securities markets, can perfect their title to the instrument. Once ownership is secured, the investor acquires the right to be paid any entitlements offered by the issuer of the Crypto Asset. In other words, just like securities, Crypto Assets have to be serviced. Asset servicing, including the notification and instruction of corporate actions, the collection of income, the exercise of shareholder rights through proxy voting and the reclamation of withholding tax under double taxation treaties, are core services provided to investors by custodian banks and CSDs. Crypto Asset investors will expect their service providers to deliver an equivalent range of services.

4.2   Corporate Actions

However, investors also need to appreciate that, depending on the type of Crypto Asset, corporate action lifecycles in particular may unfold in ways that are different from those of securities. An Asset-Backed Securities Token, backed by an underlying security such as a listed equity, for example, poses a different corporate actions servicing challenge to a «digital native» Securities Token not backed by an underlying asset.

In the case of an Asset-Backed Securities Token[13], a corporate action could arise either because of a corporate action event announced at the level of the underlying security or because of an independent corporate action taken by the issuer of the Token. Holders of «digital native» Securities Tokens, on the other hand, will find that corporate actions occur at the level of the Token only. Payment Tokens are hard to fit into either category. Though Stablecoins are asset-backed, central bank digital currencies (CBDC) are not. The various possibilities are summarised in Table 4.

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[13]   ISSA assumes that in tokenisation scenarios, underlying assets will be immobilised or held in trust. If not, the key benefits of Tokens (such as real time settlement and ease of transfer) will be hard to achieve.

Table 4: Corporate Action Event Categories by Crypto Asset Type

Type of CA Events	Asset-Backed Securities Tokens	Digital Native Securities Tokens	Payment Tokens (e.g. CBDC, Stablecoins)
Corporate action events due to a corporate action on the underlying security (see Figure 7 for illustration)	As the Asset-Backed token is tied to underlying securities, any corporate action on the underlying securities must also be supported and synchronised at the level of the Token. This can be compared to Depositary Receipts (e.g. ADRs/ GDRs). Corporate action lifecycle challenges are comparable too, with layers of intermediaries to translate and transmit the corporate action on the underlying security to the end-investors in the Tokens, especially in terms of dissemination of information, collection of instructions and distribution of proceeds.	N/A – as there are no underlying securities.	There is likely to be limited business cases for corporate actions on the underlying asset, since most Payment Tokens are cash backed.
Corporate Action on the Token itself independent of any underlying securities (see Figure 8 for illustration)	Since the Token may be issued by an independent or unrelated party from the issuer of the underlying securities, corporate actions can be taken by the issuer of the Token, such as a change of denomination (see Figure 3 for an illustration).	Corporate actions on «digital native» Tokens should follow the same principles and standards as corporate actions on traditional securities. Adoption of a standard token identifier (similar to ISIN standards) could help facilitate inter-operability.	The ability to handle corporate actions may also be influenced by the issuance method. In the case of issuance on a decentralised non-permissioned ledger (such as Bitcoin), corporate actions by a traditional issuer are unlikely. For payments or exchanges of Tokens issued through a centralised permissioned ledger, corporate actions are likely to follow a path similar to that of Asset-Backed and «digital native» Securities Tokens.

Figure 7 illustrates how a corporate action on a security underlying an Asset-Backed Securities Token is managed on behalf of investors. The issuer of the Securities Token pays a cash dividend entitlement to its holders. This entitlement is derived from the cash dividend that was announced and distributed by the issuer of the underlying security.

This process can be more difficult than Figure 7 suggests, especially if there is a mismatch of settlement cycles between the Asset-Backed Securities Token (e.g. T+0) and the underlying securities (e.g. T+2). This could mean the record dates - the cut-off date set by the issuer which determines which investors are entitled to a dividend or distribution – of the Securities Token and the underlying securities are not synchronised. In theory, this could create dividend and tax arbitrage opportunities between the Securities Token and the underlying securities.

Figure 7: How a Crypto Asset Issuer Pays Entitlements on Underlying Securities to Investors

Blue-Chip Company issues traditional shares on a trading venue, for which ABC (after acquiring some of the shares) issues digital assets / Tokens. Dividend announced by the Blue-Chip Company as traditional CA event. ABC as registered shareholder collects traditional dividend and then creates its own CA event to convert / reflect such dividend at Token level.
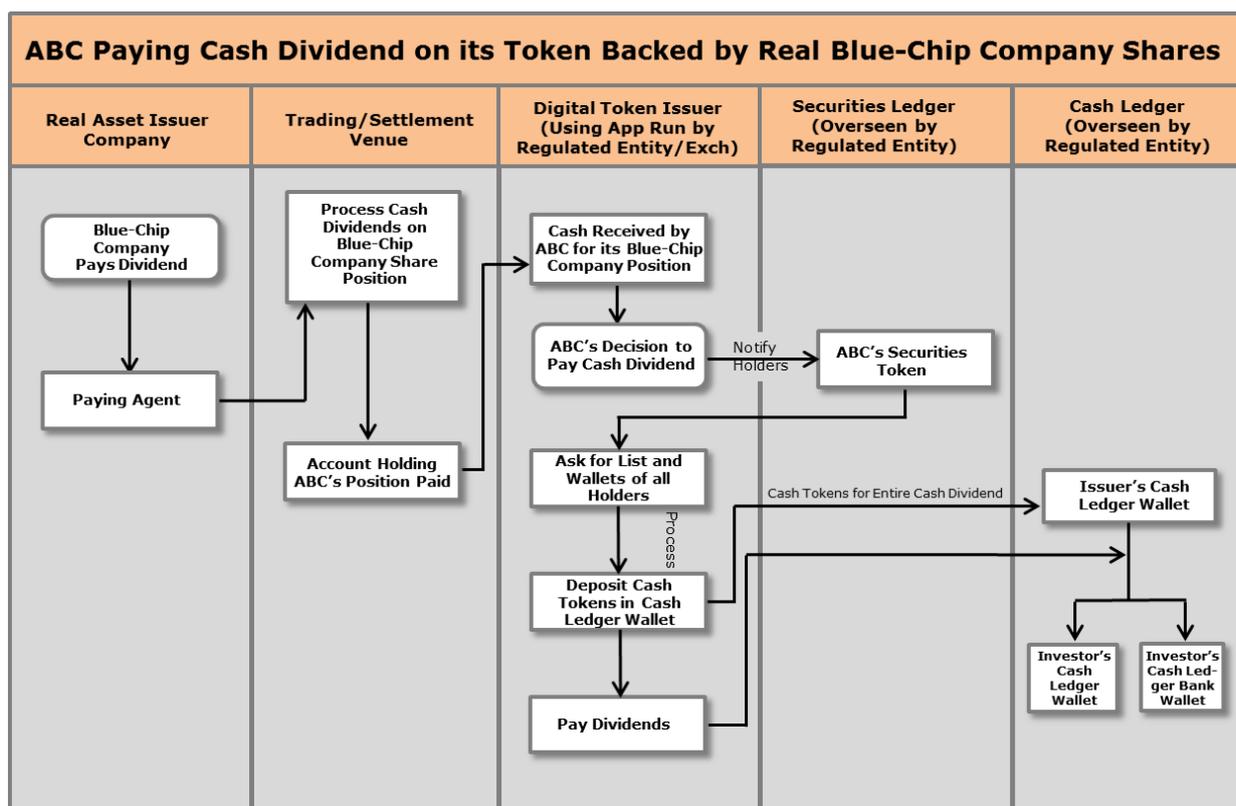
There are other potential challenges to consider. Cash entitlements could be paid in traditional fiat currency, but could also be paid in crypto currencies, which may not be universally supported by all service providers. Elective corporate actions events (e.g. rights issues, certifications, proxy voting) may also carry additional processing challenges if the DLT network or tokenisation platform is a public, permissionless one. It makes it difficult to

identify the beneficial owner of an entitlement, except by a signature provided «pseudonymously» using the private keys.[14]

Figure 8 provides an example of a corporate action by the issuer of an Asset-Backed Securities Token pertaining to the Token itself, independent of any corporate action event on the underlying securities. In this case, the issuer has announced a Token split, dividing its Tokens into multiple Tokens to – for example – boost their liquidity. This action, which reduces the value of each Token, has to be communicated accurately to all Token holders according to how many Tokens they hold.

Figure 8: How a Crypto Asset Issuer Effects a Token Split

ABC, as the issuer of Blue-Chip Company Tokens, announces its own CA event (which has no correlation with any event at Blue-Chip Company level) – for instance because it decides to split the Token.
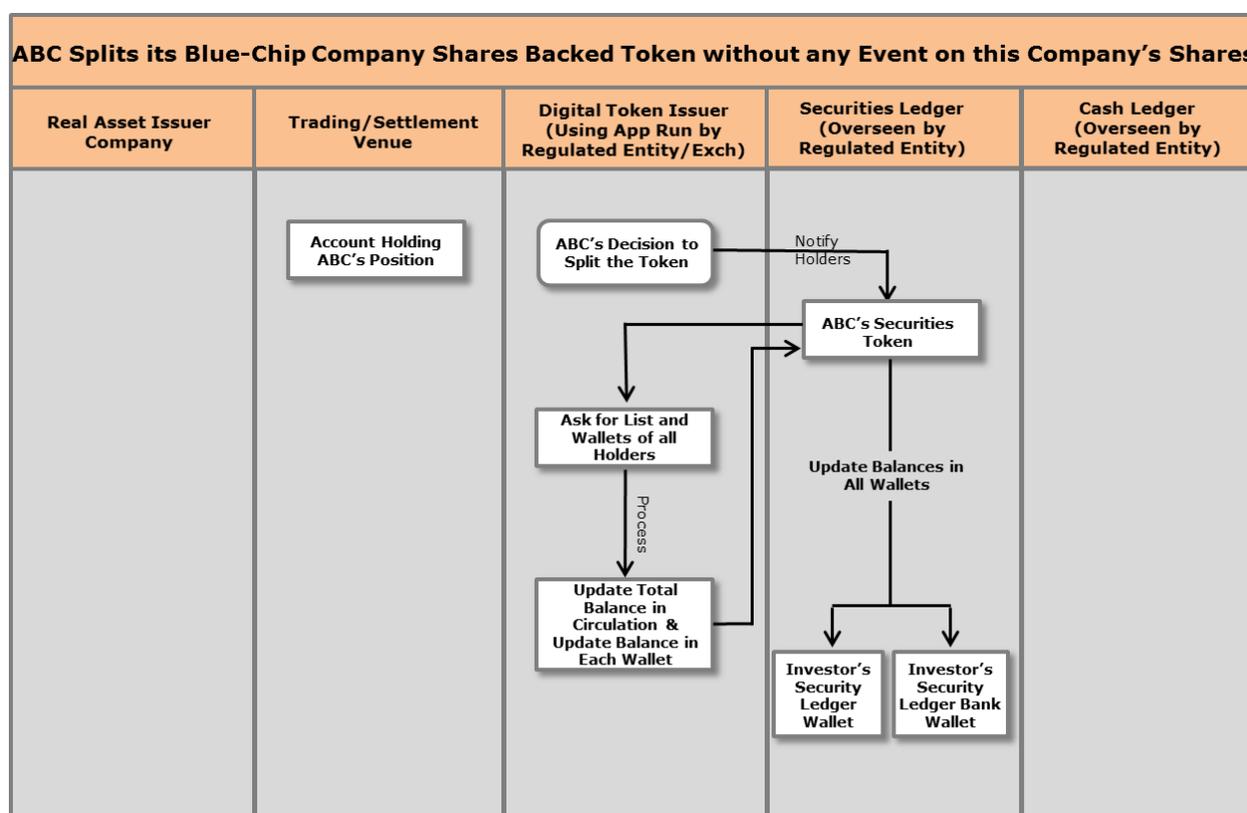
The scope for inadvertent error is large. It would help if DLT networks and tokenisation platforms hosting Securities Tokens adopted equivalent standards to those set for listed companies by conventional stock exchanges. Adoption of established listing and governance rules would contribute to higher transparency for Securities Tokens investors and improve inter-operability between DLT networks and tokenisation platforms. It would also reduce the probability of a corporate action not being supported by a service provider.

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[14]   Registration of cryptographic private keys and their associated public addresses would make it easier to identify beneficial owners.

The Potential Benefits of DLT in Traditional Corporate Actions

In addition to posing novel challenges in terms of processing corporate actions on Crypto Assets, distributed ledger technology (DLT) has the potential to streamline and improve corporate action information flows on traditional securities. It could, for example, provide a decentralised database where issuers, CSDs and custodian banks could bring together their respective sets of information: the corporate action announcement, the holdings of investors in the securities at the CSD - and the holdings in sub-custodian bank accounts. This would make it easier to notify investors, obtain instructions and submit instructions on behalf of the underlying investors. A database of this kind could significantly reduce current frictions and inefficiencies, such as the duplicated layers of validating the same information throughout the chain of corporate action intermediaries.

4.3   Withholding Tax

Tokenisation also has implications for tax reclaims. In the case of an Asset-Backed Token, the underlying securities are likely to be held by a trust company or special purpose vehicle (SPV), which would be registered in a particular tax jurisdiction. However, the end-investors in the Tokens are likely to have a different tax residence, or a variety of tax residences.

Depending on local tax regulations, an investor in a Token may not be able to reclaim tax withheld in full under the relevant double taxation treaty if, for example, there is a mismatch between the location of the trust company or SPV and the tax country of residence of the investor. The parallel with the difficulties that can be faced by investors in other asset classes domiciled offshore, such as alternative investment funds, does not need to be laboured.

Payment Tokens, being an entirely new asset class, are likely to lack comparable precedents. Income events derived from Payment Tokens might necessitate new forms of income classification. If so, they are likely also to necessitate new tax rules.

4.4   Self-servicing of Crypto Assets Using Smart Contracts

Crypto Assets issued on to DLT networks or tokenisation platforms offer an opportunity to increase the level of automation in corporate actions, notably through the use of «smart contracts». A smart contract is a self-executing computer programme that performs pre-defined tasks based on a pre-defined set of criteria or conditions. Smart contracts cannot be altered once deployed, which ensures the faithful completion of contractual terms.

Based on this technology, financial assets could «self-service». They could automatically accrue interest payments or distribute dividends (in the form of fiat cash or in Tokens or in securities) through smart contracts embedded directly within the Tokens. This can be achieved by inserting the terms and conditions of a Token (such as its interest rate, accrual period, redemption date or currency) into the smart contract.

Although there is nothing disturbing about this prospect in principle – in fact, smart contracts could be used to make corporate actions processing more efficient in the securities markets today, let alone the Crypto Asset markets of tomorrow – the value of smart contracts is not so obvious that they can be introduced without further examination.

Usage of smart contracts will likely require the emergence of new governance rules, standards and services. Unlike a traditional corporate action announcement, smart contracts are written in software code. It will be necessary to ensure that the software code embedded in the smart contract matches the terms of the corporate action.

Although such codes could be made public and be auditable, it would require technical knowledge and tools to validate them – in effect, a reconciliation is required. Specialist services may be required to perform this reconciliation to ensure that the smart contract delivers to investors what issuers intend.

There are other obstacles to rapid adoption of smart contracts. One is that it is unclear which party is accountable for the performance of a smart contract.[15] Custodians and CSDs

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[15]   See DTCC, *Guiding Principles for the Post-Trade Processing of Tokenized Securities : A White   Paper to the Industry*, March 2019, available at http://www.dtcc.com/news/2019/march/13/dtcc-outlines-guiding-principles-for-post-trade-processing-of-tokenized-securities

will be reluctant to assume responsibility if a smart contract created by a third party fails to deliver to investors what they are owed.

Another is that smart contracts might complicate inter-operability between DLT networks or tokenisation platforms. An original smart contract might guarantee a certain outcome in one DLT network or tokenisation platform but need to be re-written to achieve the same effect in another. Without appropriate governance, a DLT network or tokenisation platform will be reluctant to simply implement a smart contract written for another DLT network or tokenisation platform.

A further difficulty is that smart contracts are embedded at the time of issuance of the Token and are unalterable. This means that not all corporate actions will be amenable to smart contracts since some events, such as rights issues and takeovers and mergers, are created and announced long after the issuance of the Token.

Lastly, the information flows for elective corporate actions, such as choosing between cash and securities in a dividend or a takeover, need to be described accurately and in detail if they are to be written into a smart contract. Would corporate action instructions, for example, have to flow off-chain? How can old Tokens be exchanged for new ones? How can restrictions specified by investors be validated on a non-permissioned DLT network or tokenisation platform?

Finally, DLT networks and tokenisation platforms, by making it possible to tokenise new asset classes, are likely to generate new types of corporate actions. Corporate actions on previously out-of-network alternative assets, made tradeable in fractions, might surface. They will need to be handled in a secure way.

4.5   Management of «Forks»

Crypto Assets present a technical challenge unknown in conventional corporate actions. This is the «fork», a change in the software underpinning a Crypto Asset necessitated by, say, a security risk. They take either a «hard» or a «soft» form. Though a fork is a technical event, it can impact Crypto Asset processing flows, especially in terms of fungibility and compatibility (see Table 5).

Table 5: Types of «Forks»

Hard Fork

A hard fork can be defined as a software change to the distributed ledger technology (DLT) protocol that introduces a permanent split (thus the term «fork») between the new protocol and the old protocol, making them incompatible («backward incompatible»).

The decision to proceed with a hard fork may be due to a number of reasons. One is a schism in the vision of the future of the DLT protocol. Another is to correct a security risk or risk of fraud, in which case the hard fork is used as a means to roll back the blockchain and unwind the tainted transactions in the old nodes, while at the same time retiring the old fork.

Once the hard fork is implemented, digital assets in the old and new forks become non-fungible with each other although they share a common ledger history (up to the point of the fork). Nodes running on the old version fork will not be accepted in the new version fork, but they can technically continue their path in the old fork.

Soft Fork

A soft fork can be defined as a change to the DLT software that is «backward compatible», which means that, unlike hard forks, there is no splitting or branching out of the blockchain. Soft forks are used to implement improvements – for example, to improve governance and validation rules - but adoption of the them remains optional for the participants in the DLT network or tokenisation platform. Crypto Assets continue to be fungible after the soft fork is deployed.

Some have argued that fork events are comparable to traditional corporate actions. This view is hard to sustain (see Table 6). Traditional corporate actions are business-driven. The issuer decides to pay a dividend or issue rights. Forks, on the other hand, are technically driven. The members of a DLT network or tokenisation platform decide, for example, to upgrade the node validation protocol of the network via a change in the software.

Table 6: Traditional Corporate Actions versus «Forks»

Traditional CA Events	Forks Management
Types: Dividend, Interest, Bonus issue, Rights issue, etc.	**Types:** Hard fork (e.g. Ethereum vs Ethereum Classic) vs Soft fork (e.g. Bitcoin BIP66 Blockchain fork)
Events are business-driven, i.e. typically resulting from an event pertaining to the issuing entity	Forks are technically driven, i.e. due to a decision to change software protocols
Typically announced by the issuer; event that impacts the security (e.g. distribution of cash or securities entitlements, re-capitalisation, annual general meeting)	A fork can be proposed by «anyone», and there are challenges in sourcing information about upcoming forks (since they are not issuer-specific)
Corporate actions are well codified and follow markets standards and rules in terms of information flow, distribution, election, etc.	Before taking the decision to support a fork, DLT network node operators must assess the technical feasibility, timeline and cost impacts along with the viability and attractiveness of the to the community
Securities services providers such as CSDs and custodians would typically support all types of corporate actions impacting their clients' holdings	At this stage, it is not reasonable to expect that any service provider could commit to supporting every possible fork
	In extreme cases, if a new fork is not supported, investors may end up not being able to access their Crypto Assets

Nevertheless, the impact of forks on investors means they cannot be ignored. This is especially true of «hard» forks, which make previous versions of the software incompatible. In worst case scenarios, «hard» forks can create serious instability. They can increase the risk of double spending across the old and new forks or lead to complete loss of the Crypto Assets.

These risks mean that it is unlikely that a CSD or custodian bank could reasonably guarantee to support any future «hard» or «soft» forks. This is especially true of public, permissionless DLT networks or tokenisation platforms, where literally anyone could present a proposal for a fork. The same consideration makes it almost impossible to source accurate information about fork announcements. The costs of trying to adhere to every fork would soon outweigh the benefits.

4.6   Airdrops and Coin Burning

The concept of «airdrop» is also likened to a corporate action. The idea is specific to Crypto Assets, and especially to crypto currencies and Utility Tokens. An «airdrop» is loosely comparable with a traditional «bonus issue» in which an issuer distributes to shareholders free bonus shares. However, there is an important difference between an «airdrop» and a bonus issue. This is that «airdrop» can be used as an incentive to attract new investors that do not yet hold the Token.

In this sense, «airdrops» are more akin to a marketing strategy than a reward distributed to existing investors. To benefit from an «airdrop» it is not necessary to be an existing

holder of the Token. The distribution methodology can vary depending on the strategy of the issuer. Tokens can be distributed to randomly selected investors, sometimes in an unsolicited way. This poses challenges for custodians and CSDs in terms of financial crime compliance and KYC and AML compliance.

Likewise, «coin burning» describes a process akin to a share buy-back, in which an issuer removes Tokens permanently from circulation by reducing the supply. This can be compared to traditional corporate action such as a de-listing, a capital reduction or the return of the underlying shares after an investor in a depositary receipt programme redeems the holding.

Asset Servicing: Recommendations / Best Practice Considerations

- Depending on the type of Crypto Asset, corporate actions can apply at the Token level but can also apply to underlying securities in the case of Asset Backed Securities Tokens, entitlements can be paid in fiat currency or crypto currency;

- Corporate actions on Crypto Assets, and especially on Securities Tokens, should follow the same principles and standards as traditional securities;

- Adoption of unique identification codes for Tokens, such as the ISINs used for securities, would facilitate inter-operability between DLT networks or tokenisation platforms;

- Withholding tax reclaim implications for Asset-Backed Securities Tokens need careful consideration, given the high probability of differences between the tax residence of the entity holding the underlying securities and the investors in the Tokens;

- Smart contracts have the potential to enable Tokens to self-service in terms of corporate actions, but this will require the emergence of strong governance and auditing principles to guarantee that smart contracts deliver the contractual outputs expected;

- «Hard» and «soft» forks management is not comparable with the management of corporate actions;

- Due to the risks inherent to «forks», service providers must have the right to decline to support future forks.

5.0   Safekeeping

5.1   Protecting the Private Keys of Investors from Loss

A challenge in paying entitlements to Crypto Asset investors lies in identifying beneficial owners. The soundest guide to beneficial ownership is possession of private keys: the cryptographic signatures that authorise the spending of crypto currency or the transfer of Crypto Assets.

In a public or «permissionless» DLT network, private keys are the only way to identify the owner of a Crypto Asset. Anybody who holds the private key to a public address (the DLT equivalent of a securities account and its standing settlement instructions) on a permissionless DLT network will enjoy full rights of ownership to that Crypto Asset. Being anonymous as well, Crypto Assets held in this way are comparable to bearer share and bond certificates.

Just as loss of the bearer certificate is tantamount to loss of the asset, so the loss of the private key to a public address is equivalent to losing the Crypto Asset. In fact, it is precisely because Crypto Assets are created and exist solely through a DLT network or tokenisation platform that institutional investors are wary of investing in Crypto Assets on permissionless DLT networks. Their concern is justified. In May 2019, for example, Crypto currency exchange Binance announced a data breach that resulted in the loss of $40 million in crypto currency[16].

To address this problem for investors in permissionless DLT networks or tokenisation platforms, technologies are being developed. Techniques such as the ERC 884 token allow for the burning and reissuing of Securities Tokens in the event of the loss or theft of the private keys. Holders of tokens on permissioned networks have the assurance of access to the «master keys» (sometimes known as «seeds») used to create all the private and public keys on the network.

However, the risk of loss of private keys leading to a loss of assets in permissioned DLT networks or tokenisation platforms is reduced mainly by governance and control measures. In fact, the most obvious risk mitigant is the fact that a permissioned network is a closed one. This means the ability to «write» information on to the ledger and create a consensus on the validity of transactions is restricted to a group of pre-approved members.

Another risk-reducing measure is that permissioned networks can apply an old-fashioned «maker-checker» or «four eyes» process that makes transfers less open to manipulation. A third risk mitigant is the fact that ownership of Crypto Assets can be recorded in «off-ledger» databases controlled by trusted third parties as well as «on-ledger». Indeed, the operator of a permissioned DLT network or tokenisation platform can create new private keys to replace any that are lost.

5.2   Safekeeping the Crypto Asset itself

The discussion above makes it surprising to find private keys routinely identified as the principal asset in need of safekeeping when it comes to investing in Crypto Assets. Of course, custodians or CSDs providing safekeeping services to investors in Crypto Assets must offer assurance that private keys are held securely. But if private keys are all an independent custodian holds in custody the service amounts to little more than a digital version of locking a paper security in a vault. The custodian is in no position to protect the

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[16]   «Hack Brief: Hackers Stole $40 million from Binance Crypto Currency Exchange»,
         Wired, 8 May 2019. https://www.wired.com/story/hack-binance-cryptocurrency-exchange/

actual Crypto Asset or prove that instructions to transfer it are valid. It is little more than a useful back-up service for investors which lose their private keys.

If an investor requests a custodian or CSD to safekeep the private keys only, the custodian or CSD has no right to access the Crypto Asset. The investor retains control over access to the Crypto Asset, in much the same way that a bank client retains control of access to an item in a bank vault. A custodian or CSD that safekeeps private keys only is in no position to guarantee the safety of the actual Crypto Asset or to validate that any transfer instructions originated from the investor. The Crypto Asset could in principle be transferred to anyone by anyone who knows the private keys.

The safekeeping of the actual Crypto Asset by the custodian or CSD is a more secure alternative, which better reflects the reality of service offerings in the market. In this case, the investor transfers the Crypto Asset to the digital wallet address of the custodian or CSD, along with the ability to directly access and transfer the Crypto Asset. The private keys are held by the custodian or CSD only. The digital wallet provided by the custodian or CSD can also offer segregated wallet addresses (in which the Crypto Asset is held in the name of the investor) or omnibus wallet addresses (in which the Crypto Assets of multiple investors are commingled).

Clients can buy and sell Crypto Assets by using existing authentication mechanisms to access the systems of the custodian or CSD and issue transfer instructions. Authentication can be bolstered by a variety of established techniques adapted to the digital age. They include threshold signatures (in which the ability to construct a signature is divided across multiple devices, in the same way that two factor authentication works) and multiple signatures (where it takes multiple private keys to authorise a transaction).

5.3   The Varieties of Digital Wallets

Digital wallets come in three varieties, each of which strikes a different balance between safety and liquidity. A «hot» wallet remains connected to the Internet, and so is vulnerable to being hacked, but means the Crypto Assets are available on-line for immediate transfer.

«Cold» wallets, on the other hand, keep private keys offline in physical form (usually paper) or in devices which are not connected to the Internet. The Hardware Security Module (HSM), or hardware wallet, is a way of storing private keys which ensures they never leave the physical device. All functions requiring access to those keys are then executed directly on those devices, complemented by additional security features such as two factor authentication, personal identification numbers (PINs) and the «four eyes» principle. Because transactions are always signed within the separate device, the private keys are never exposed to hackers. However, transfer of Crypto Assets from «cold» wallets of this kind is inevitably more cumbersome and time-consuming and inhibits immediate liquidity.

In addition to «hot» and «cold» digital wallets there are hybrids known as «warm» wallets. The most popular of these can receive Crypto Assets from any public address but can transfer Crypto Assets to a restricted list of (generally «cold») wallet addresses only. Their operation is akin to a retail deposit savings account whose contents can only be transferred to a retail checking account held by the same investor. This provides a degree of liquidity while reducing the risk of fraudulent transfer to unspecified parties.

The risk of being hacked is not, of course, peculiar to assets issued and held on DLT networks or tokenisation platforms. Securities held in digital form at CSDs and custodian

banks are equally vulnerable to being stolen by hackers.[17] That said, Crypto Assets do create novel risks. Smart contracts, in which contractual obligations are fulfilled automatically, making mistakes hard to reverse, is one example, exacerbated by the legal uncertainty of smart contracts.

But in practice DLT networks or tokenisation platforms create few genuinely unprecedented risks. And despite the novelty of the terminology, the purpose of all the safekeeping measures - private keys, «hot,» «cold» and «warm» digital wallets, Hardware Security Modules, and threshold and multiple signatures – associated with Crypto Assets is deeply familiar.

Custodians and CSDs between them fulfil two vital responsibilities in the securities markets. The first is to protect investors against the risk of the loss of their assets and the entitlements that belong to those assets. The second is to ensure that they retain ready access to them when they wish to sell or pledge collateral. They are well-placed to fulfil the same responsibilities in Crypto Asset markets.

After all, securing good title, and ensuring that transfers are valid and fully authenticated, are techniques custodians and CSDs have combined to deliver to investors in securities for a long time. More importantly, their fulfilment can also help investors in Crypto Assets comply with extant laws and regulations which apply as certainly to Crypto Assets as they do to securities.

5.4　Shareholder Transparency Requirements

However, there is one emerging aspect of safekeeping in which DLT networks or tokenisation platforms appear to offer an advantage over familiar methods. This is shareholder transparency or, more broadly, the improvement of communications between issuers and investors. The intention is that investors play a more significant role in the strategies and behaviour of the companies they own, and issuers engage investors more in their decision-making processes.

Today, communications between issuers and end-investors is intermediated by five or more layers of service provision, including asset managers, CSDs, global custodian banks, sub-custodian banks, proxy voting agencies and others. Direct contact between issuers and investors is infrequent. The processes of collecting and updating shareholder information, communicating it to investors and collecting their voting preferences are complex and time-consuming.

In theory, Securities Tokens issued on to DLT networks or tokenisation platforms can shorten this extended chain of intermediation and bring issuers and investors directly into contact with each other on a single network, where safe custody and asset servicing can also be provided directly. Even a more limited application of DLT, such as using the technology to support a parallel platform that maintains an updated list of shareholders per issuer based on settled positions inputted by custodians, could make existing processes more efficient. The same system could then be used to facilitate communications between issuers and investors.

The issue is topical because regulators in a number of jurisdictions are encouraging richer and more frequent dialogue between issuers and investors. In the European Union (EU), for example, the second iteration of the Shareholders Rights Directive (SRD II) imposes obligations on custodian banks to improve and accelerate proxy voting services and make

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[17]　See *Cyber Risk Management in Securities Services*, a report by the ISSA Working Group on Cyber Risks in Securities Services, October 2018. https://issanet.org/e/pdf/2018-10_ISSA_Cyber_Risk_in_Securities_Services.pdf

it quicker and easier for issuers to identify their shareholders. The use of DLT networks and tokenisation platforms should be explored for these purposes alone.

Safekeeping: Recommendations / Best Practice Considerations

- The risk of loss of assets or entitlements in Crypto Asset investing is relatively high and must be managed through appropriate safekeeping models and procedures;

- The need for independent private key custody services is an emerging demand from Crypto Asset investors, along with the concept of hot, warm and cold wallet services;

- The distinction between the safekeeping of private keys and the safekeeping of the Crypto Asset itself needs clarification, on legal and practical grounds;

- This clarification is important in defining whether the scope of Crypto Asset custody is limited to back-up of private keys or an end-to-end protection of private keys and the Crypto Assets themselves;

- Regulated entities like custodians and CSDs could offer a secure custody of the Crypto Assets over the mere safekeeping of private keys where the investor transfers the Crypto Asset to the digital wallet address of the custodian or CSD, along with the ability and control to directly access, safekeep and transfer the Crypto Asset. Investors can then use existing authentication mechanisms and transfer instructions to buy and sell their Crypto Assets;

- DLT networks or tokenisation platforms can facilitate direct communication between issuers and investors, helping fulfil regulatory obligations laid down in measures such as the second iteration of the Shareholder Rights Directive (SRD II) of the European Union (EU), and the technology should be explored for this purpose alone;

- Safekeeping of securities is defined by law and regulation in all major jurisdictions and it is prudent to assume that the same requirements apply to Crypto Assets in general and Securities Tokens in particular.

6.0   Law and Regulation

6.1   The Legal and Regulatory Status of Crypto Assets is Evolving

The issuance, trading, settlement and safekeeping of securities is well-defined in both law and regulation in every jurisdiction with an active capital market. Though the extension of these legal and regulatory frameworks to eco-systems based on DLT networks or tokenisation platforms is not yet settled, it is already prudent to assume that securities laws and regulations apply to Securities Tokens. It is also reasonable to expect existing securities laws and regulations to be extended and adapted over time to accommodate Crypto Asset eco-systems, not least because many regulatory authorities around the world are already working to achieve this.

Nevertheless, issuers and investors in Crypto Assets are currently operating in an environment in which the legal and regulatory status of these new instruments is evolving. In these circumstances, the techniques developed by the securities services industry to comply with laws and regulations governing the issuance, settlement, custody and servicing of securities provide valuable insights into how investors in Crypto Assets can be protected and the integrity of the markets maintained.

There is time to draw on these insights. A wholesale shift by participants in the global securities markets to Securities Tokens is not imminent, partly because no jurisdiction yet offers legal and regulatory certainty. In April 2019 the Financial Stability Board (FSB) published a directory of Crypto Asset regulators covering 24 jurisdictions and seven supranational organisations.[18]

By listing the responsibilities of each regulator, the directory reminds its readers that the regulation of Crypto Assets is at a relatively primitive stage in every jurisdiction. Another study of 23 jurisdictions found that regulatory responsibility was so diffuse that on average three separate regulatory bodies per jurisdiction had issued an official statement on Crypto Assets.[19]

The same study found that regulators had concentrated on immediate priorities such as Initial Coin Offerings (ICOs) and crypto currency exchanges, and that jurisdictions without legacy legal and regulatory frameworks had made the most progress in regulating Crypto Assets. In mature markets, regulators have proceeded with caution, being interested primarily in ensuring that their work on regulatory certainty does not inadvertently close new business opportunities or hamper useful innovation.

Though it is primarily responsible for global financial stability, the FSB has expressed concern about legal and regulatory issues raised by Crypto Assets: the room for tax evasion, the threat that Crypto Assets will be used by criminals to circumvent AML and measures to combat the financing of terrorism (CFT) controls, the need for investor protection, the scope for unlawful public offerings and the lack of market integrity protocols.

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[18]   Financial Stability Board (FSB), *Crypto-assets regulators directory*, 5 April 2019. https://www.fsb.org/wp-content/uploads/P050419.pdf

[19]   *Global Cryptoasset Regulatory Landscape Study*, Cambridge Centre for Alternative Finance, Judge Business School, University of Cambridge, page 12. https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2019-04-ccaf-global-cryptoasset-regulatory-landscape-study.pdf

6.2   The Current Regulatory Status of Crypto Assets

Amid these uncertainties and concerns, one legal and regulatory issue is paramount for custodians and CSDs. Clarity over the regulatory standing of a Crypto Asset is a prerequisite for adoption by issuers, investment by investors and support from service providers, since it has implications for the legal soundness of the investment and the legal status of the entities servicing such assets and the services they provide. Moreover, the legal status of a Crypto Asset also influences its accounting treatment.

The key distinction to be established in regulation is whether a Crypto Asset is a security or a payment or something else. The criteria by which a Crypto Asset is judged to be a security varies between jurisdictions, complicating any assessment of the risks Crypto Asset service providers incur in different jurisdictions – or at least forcing service providers to make judgments on a jurisdiction-by-jurisdiction basis.

Some regulators assess Crypto Assets on a case-by-case basis but others use fixed criteria. Some jurisdictions, such as the United Kingdom, have come up with guidance frameworks to categorise Payment Tokens, Utility Tokens and Securities Tokens. Other jurisdictions have provided frameworks to help market participants assess whether securities law applies to particular Crypto Assets. In the United States, for example, the Securities and Exchange Commission (SEC) «Framework for 'Investment Contract' Analysis of Digital Assets» uses the Howey test.[20] In France, the Autorité des marchés financiers (AMF) has used the PACTE (Action Plan for Business Growth and Transformation) Law to support the development of specific types of Crypto Assets.

There nevertheless remains considerable legal uncertainty at this stage as to the regulatory status of Crypto Assets in many jurisdictions, including in some cases within the same jurisdiction. In general, however, regulators tend to prefer a substance-over-form approach, in which a Crypto Asset which has the same characteristics as a regulated security is then regulated in the same way.[21]

6.3   Regulatory Considerations for Providers of Crypto Asset Services

Custodians and CSDs see the continuing regulatory uncertainties as representing serious reputational and operational risks. It is why they are developing issuance, settlement, custody and asset servicing products for Crypto Assets cautiously. Operating in a securities industry that spans national borders, they also appreciate that the lack of regulatory and legal certainty in any jurisdiction means certainty is not yet available.

While jurisdictional differences are a feature of the securities markets today, assets are not held and nor are transactions completed in more than one jurisdiction. In the current system, both custody and settlement occur within a single infrastructure in one legal jurisdiction. But on a DLT network or tokenisation platform, Crypto Asset holdings and

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[20]   The Howey Test, created by a Supreme Court judgment in a case of 1946 (SEC v. Howey), stipulates that an investment is a security if money or other assets are invested; the investment is expected to yield a profit; the investment is made into a common enterprise; and the profit is generated not by the efforts of the investor but by the efforts of a third party. It forms the basis of the «Framework for `Investment Contract' Analysis of Digital Assets», published by the Securities and Exchange Commission (SEC) to help market participants decide if a Crypto Asset is a security or not.

[21]   European regulators such as the European Banking Authority (EBA) and the European Securities and Markets Authority (ESMA) seem to apply a «substance over form» approach (i.e. if a Securities Token has the same characteristics as a financial instrument regulated under the Markets in Financial Instruments Directive (MiFID) it should receive the same regulatory treatment). International Financial Reporting Standards (IFRS) also require a «substance over form» approach.

transactions will probably span multiple jurisdictions, each of which might take a different view of the legal status of the same asset or transaction.[22]

Furthermore, to the extent that Securities Tokens are regulated as securities, a CSD or custodian providing digital wallet custody services could be subject to different licensing requirements depending on the types of services they provide to investors in Securities Tokens. For example, an entity facilitating transactions in Securities Tokens regulated as securities within the EU is likely to find itself being regulated as an investment firm under the second iteration of the Markets in Financial Instruments Directive (MiFID II). That implies compliance with the licensing requirements and conduct of business rules of MiFID. On the other hand, an entity that enables an investor to do no more than check the balance of a payment account or initiate payment for a Securities Token is more likely to find itself regulated as a payment service provider under the second iteration of the Payment Services Directive (PSD II).

Likewise, if a Payment Token is equivalent to cash, it can under EU regulation be held by institutions with banking licences only or for certain limited purposes permitted to «payment institutions.»[23] This might inhibit the involvement of CSDs in the Crypto Asset markets. Though they are allowed under EU law to provide payment services, the majority of European CSDs do not have banking licences.[24]

CSDs might also find their Crypto Asset settlement and custody services regulated under the national regulations of their home country. They will need to assess whether they can provide new services such as digital wallets under their existing licences. CSDs in the EU, already seeking authorisation under the Central Securities Depositories Regulation (CSDR), will need to assess whether such services qualify as non-banking ancillary services under that regulation or whether they want to provide the services through the relevant licence for a non-CSD entity.

As the legal definition of securities varies across jurisdictions, the legal qualification of a Crypto Asset may differ between jurisdictions. This means a digital wallet service provider might end up with a different legal status in one jurisdiction from another, complicating the design and delivery of the service across borders. An obvious implication is that the liability of digital wallet service providers towards clients in case of loss of assets will vary.

Another uncertainty surrounds the regulatory status of new roles that emerge from the development of DLT networks and tokenisation platforms. An obvious case in point is smart contract verification services, which are an opportunity for digital wallet service providers. Such unprecedented roles naturally do not fall within any existing legal or regulatory regime, though they could be considered infrastructural in nature. Regulators and policymakers will need to consider how to define and regulate such novel roles.

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[22]   There may be a difficulty determining which law applies to a particular Crypto Asset or Crypto Asset transaction. Is it the governing law of the place of issuance, or the place where the Crypto Assets are held, or the transaction is settled? Overcoming potential conflicts of law (*lex situs*) for Crypto Assets issued, held and transferred on a DLT network, and having no existence prior to or independent of the DLT network, may be problematic. Elective situs or place of the relevant operator (PROPA) may be necessary to solve the problem.

[23]   Under the 2015 Payment Services Directive (PSD II) of the European Union (EU), a «payment institution» is not permitted to conduct the business of taking deposits or other repayable funds from the public. Payment institutions can receive and hold funds from payment service users with a view to the provision of the payment services only (which would not constitute taking a deposit or other repayable funds). If the service provider collects deposits and other repayable funds within the meaning of Article 9 of the 2013 EU Directive on the activity of credit institutions and the prudential supervision of credit institutions and investment firms (the Banking Directive), they have to obtain a banking licence.

[24]   Under EU law, CSDs are not required to be licensed as payment institutions if they provide payment services in relation to securities settlement. According to Article 3 (h) of the second Payment Services Directive (PSD II), payment transactions carried out within a payment or securities settlement system between settlement agents, central counterparties, clearing houses and / or central banks and other participants of the system, are excluded from the scope of application of PSD II and the licensing requirements it imposes.

6.4   The Application of Property Law to Crypto Assets and its Implications for Custody

A further uncertainty is the status of Crypto Assets as property. It is important for service providers to know whether a Crypto Asset constitutes property under the applicable private law in any jurisdiction where they provide services. This is because, if a Crypto Asset does not constitute property, it cannot be owned, transferred in law, be purchased or sold, allow rights of ownership to be asserted when it is stolen, or be used as collateral in a transaction.

If a Crypto Asset does constitute property, the question arises as to what type of property it is. For example, English law recognises physical things (choses in possession) and legal rights (choses in action) as property. If a Crypto Asset is recognised as property under English law, does it fall into one of these two categories or must it fall into some new category of property? The consultation paper published by the UK Jurisdiction Taskforce (UKJT) of the LawTech Delivery Panel in May 2019 shows that there is not yet a clear-cut answer to these questions. [25]

The legal status of private keys to Crypto Assets is equally unsettled. Asked whether taking private keys into custody provides the custodian with legal title to the underlying asset, different jurisdictions offer different answers.

This uncertainty means that custodians and CSDs might be unwilling to take the private keys of customers into custody because the keys could have been replicated before being handed over and therefore not guarantee the protection of the underlying Crypto Asset. To protect themselves, custodians and CSDs might ask customers to transfer the Crypto Asset itself to their omnibus digital wallet address or to open a segregated digital wallet address with them.

In either case, investors need to consider their legal entitlement to the Crypto Assets. If they are held at an omnibus digital wallet address, for example, they are made fungible with other Crypto Assets by virtue of being held in the same omnibus «account». Investors also need to ask whether the existing legal framework applying to dematerialised securities will apply mutatis mutandis (once the necessary changes or clarifications have been made) to the safekeeping of Crypto Assets. The answer matters, because it governs whether the Crypto Asset investor is protected against the insolvency of the custodian or CSD or a failed counterparty in a transaction.

A concern also arises on the commingling of custodian and client assets, which increases the risk of misappropriation of client assets. Regulators expect custodians and CSDs to put adequate controls in place, and to have them audited regularly. However, what controls would be considered adequate by regulators is yet to be defined. There is also a risk that existing auditing services lack the skills and expertise necessary to audit a Crypto Asset digital wallet safekeeping service adequately.

6.5   ML, KYC and CFT Compliance

What is clear is that, insofar as Securities Tokens qualify as securities, digital wallet service providers will be subject to the same or similar anti-money laundering (AML), Know Your Client (KYC) and Countering the Financing of Terrorism (CFT) obligations as incumbents servicing traditional securities.

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[25]   See The Law Tech Delivery Panel, UK Jurisdiction Taskforce of the LawTech Delivery Panel, Public consultation, *The status of crypto-assets, distributed ledger technology and smart contracts under English private law*, May 2019. https://www.lawsociety.org.uk/news/documents/ukjt-consultation-cryptoassets-smart-contracts-may-2019/

In the EU, for example, an entity providing services to safeguard private cryptographic keys on behalf of its customers, to hold, store and transfer virtual currencies, will be subject to existing AML and KYC rules. These include the obligation to notify suspicious transactions to the relevant national financial intelligence units, once the fifth version of the Anti-Money Laundering Directive (AML V) is transposed into national laws (no later than January 2020).

Financial crime compliance obligations such as AML, KYC and CFT, which have a long history in payments, are now being extended not just to the securities industry by inter-governmental bodies such as the Financial Action Task Force (FATF) but to digital assets as well.[26] It is sensible to expect these requirements to apply to Crypto Assets in general, and Securities Tokens in particular.

6.6 The Value of the Role of DLT Network Governors and Operators

Regulatory and legal uncertainties of this kind are likely to persist for some time. In the continuing absence of a sound, internationally agreed legal and regulatory regime governing the Crypto Asset markets, the best practical solution is for each DLT network or tokenisation platform to appoint a network governor and / or operator.

The governor and / or operator can write rules to govern the behaviour of all participants in a distributed network such as a tokenisation platform, and monitor adherence to the rules by members of the network. Where breaches occur, or disputes arise, the governor and / or operator can also resolve them.[27]

Appointing regulated entities as network governors and / or operators could be especially useful in managing another issue created by the persistence of the past: the need for the members of one DLT network or tokenisation platform to interact not only with members of other DLT networks or tokenisation platforms but with members of legacy infrastructures as well.

The governors and / or operators can establish rules to govern their interactions, including the resolution of any regulatory inconsistencies between them.[28] The principles for financial market infrastructures published in April 2012 by the Committee on Payments and Market Infrastructures (CPMI) and the International Organisation of Securities Commissions[29] could provide a source of inspiration for the governance, role and obligations of network governors and / or operators.

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[26]   See Financial Action Task Force, *Virtual Assets and Virtual Asset Service Providers: Guidance for a Risk-Based Approach*, 2019. https://issanet.org/e/pdf/2018-10_ISSA_report_Infrastructure_for_Crypto-Assets.pdf

[27]   ISSA raises this possibility in a previous paper. See ISSA, *Infrastructure for Crypto Assets: A Review by Infrastructure Providers*, October 2018, pages 17-18 and 21. https://issanet.org/e/pdf/2018-10_ISSA_report_Infrastructure_for_Crypto-Assets.pdf

[28]   An example of this is the application of the settlement discipline regime introduced by the European Union (EU) under the Central Securities Depositories Regulation (CSDR), which is due to come into force in September 2020. It imposes financial penalties on counterparties which cause transactions to fail to settle on time and, if the transaction remains unsettled for certain number of days, also imposes a mandatory buy-in of the missing securities. Since Crypto Asset Tokens settle directly between buyers and sellers on a DLT network or tokenisation platform, the CSDR settlement regime will apply to counterparties they transact business with on legacy infrastructures only.

[29]   Committee on Payments and Market Infrastructures (CPMI) and the International Organisation of Securities Commissions (IOSCO), *Principles for financial market infrastructures*, April 2012. https://www.bis.org/cpmi/publ/d101a.pdf

Law and Regulation: Recommendations / Best Practice Considerations

- Essential aspects of laws and regulations governing the issuance, settlement, safekeeping and asset servicing of securities need to continue to exist in the Crypto Asset eco-system;

- Internationalisation of Crypto Asset issuance, trading, settlement and custody is difficult because law and regulation vary between jurisdictions, so it is best to experiment with Crypto Asset services in single jurisdictions;

- Legal and regulatory frameworks that apply to securities should be applied equally to Crypto Assets that exhibit the same economic features as existing securities;

- This regulation by «substance-over-form» avoids the risks associated with regulatory arbitrage by ensuring activities that entail the same risks are not regulated in different ways within the same regulatory and legal framework;

- Policymakers and regulators can be expected to adopt a pragmatic and dynamic approach to developing the framework to govern and regulate Crypto Assets, and service providers should proceed to develop services on the basis of this understanding;

- New and amended legal and regulatory requirements are likely to be published to preserve legal certainty for issuers of Crypto Assets and their investors and service providers, and service providers should monitor official sources to ensure they remain up-to-date;

- Legal and regulatory frameworks can be expected to favour innovation while preserving neutrality between technologies, so service providers should assume DLT networks or tokenisation platforms will be regulated in a technology-neutral fashion;

- Convergence of regulations, including the classification of financial instruments, is highly desirable to better support cross-border activities, avoid market fragmentation and facilitate inter-operability;

- Providers and users of Crypto Asset services should remain mindful of risks, both novel and familiar, and be cautious about the risks they assume in providing the services;

- Service providers should monitor international as well as national policymakers and regulatory bodies for significant policy announcements and regulatory developments.

7.0   Inter-operability

7.1   Inter-operability between DLT and Existing Networks has yet to Develop

Effective governance of inter-operability between DLT networks or tokenisation platforms, and between DLT networks or tokenisation platforms and legacy networks, is essential, because the different systems will co-exist for the foreseeable future. Unless DLT networks or tokenisation platforms can interact successfully with existing services, there is a risk of fragmentation and loss of efficiency. Lack of inter-operability is also one of the main reasons why DLT has yet to be widely adopted.

Inter-operability between open or non-permissioned DLT networks or tokenisation platforms is feasible, but still a work-in-progress. DLT has a generic capacity to allow for the exchange of information between separate networks simultaneously. Inter-operability between separate digital wallet providers is facilitated by the fact that all such systems use the same cryptographic techniques. Digital wallet providers have found they can support Crypto Assets running on almost any non-permissioned DLT network.

Permissioned DLT networks, whose membership is controlled, have made little progress in inter-operating with each other and even less in inter-operating with their non-permissioned counterparts. Inter-operability between DLT networks or tokenisation platforms of both the permissioned and the non-permissioned variety and legacy infrastructures has made virtually no progress at all.

Although initiatives do exist – SWIFT gLink, Liquidshare, ASX – achieving compatibility between DLT networks or tokenisation platforms and existing services remains a distant ambition. To the extent that this inter-operability can be accomplished without adding complexity, multiplying risks, restricting access and undermining the value of innovative technology, it will enable issuers and investors to reap the benefits of Crypto Assets.

7.2   Inter-operability Depends on Standards

The key to efficient inter-operability is standards. The securities industry has long made use of standards to automate exchanges of information between the various parties involved in post-trade processing. Standards have cut costs and risks throughout the industry. But these benefits were hard-won. Securities markets spawned multiple proprietary formats, and it took many costly migrations and substantial re-engineering of processes to converge on common standards.

Something similar to the early days of the securities markets is visible in the Crypto Asset markets. There are competing protocols, such as Ethereum, EOS and Bancor. New standards are being developed for digital wallet services, such as the «hierarchical deterministic wallets» (HD wallets), which can be shared partially or entirely with different DLT systems (and which are known by their mnemonic codes BIP39, BIP32 and BIP44).

DLT networks and tokenisation platforms are publishing their own standards for Tokens. The Ethereum Request for Comments (ERC) standards are the most developed. Hyperledger Fabric and R3 Corda are finalising their own token standards, known as FabToken and Corda Token respectively. Digital wallet technologies are being modified to accommodate as many of the new token standards as possible.

There is a number of initiatives in train to create universal token standards, including the Token Taxonomy Initiative by Enterprise Ethereum Alliance, which aims to create a DLT-

neutral token definition. Ripple is building an Interledger protocol designed to facilitate token transactions between separate DLT networks or tokenisation platforms. R3 has developed a system that allows applications built on its platform to interact seamlessly with other DLT systems.

The International Organisation for Standardisation (ISO) has created a new technical committee (TC 307) whose brief is to create cross-industry DLT standards, starting with foundational work on a common terminology and reference architecture. The Worldwide Web Consortium (W3C) has launched an inter-operability initiative based on the definition of open standards.

The benefits of standards are well-understood by Crypto Asset market participants. The ERC-20 standard for fungible Tokens, and ERC 721 for non-fungible Tokens, are credited with driving the Utility Token boom. The ERC 1400 Securities Token standard is being touted as the way to achieve the same for Crypto Asset Tokens. But until these initiatives find widespread adoption and network effects are felt, proprietary standards will remain an obstacle to inter-operability between DLT networks.

7.3   A potential Role for ISO 20022

One way forward is to align Crypto Assets with ISO 20022, the standard that defines the development of financial messaging standards. Messaging standards describe formally the content of business messages exchanged by market participants to complete business processes, such as settling transactions or issuing corporate action notifications and instructions. They also describe the roles played by the different links in a transaction chain, and the message flows required to complete a particular transaction.

Messaging standards draw on reference data standards whenever possible, to minimise ambiguity in a financial message. Reference data standards define universal codes for all the common data elements in a financial message, such as the currency (using shorthand codes such as EUR and USD), the securities (using International Securities Identification Numbers, or ISINs) and the counterparties (using Bank Identification Codes (BICs) or Legal Entity Identifiers (LEIs)). There is no reason why the same reference data standards cannot be used by operators of DLT networks or tokenisation platforms.

The principal value of a DLT network or tokenisation platform lies in the fact that the same data is shared automatically with all parties to the transaction. Financial messages, by contrast, are passed from point-to-point, and reconciled by each link in the transaction chain. Like reconciliation, point-to-point financial messages are redundant in DLT-based markets, such as those in Crypto Asset Tokens.

However, the semantics - the meaning of the business terms – that underpin existing financial messages can be re-used for DLT networks or tokenisation platforms. The business layer of the ISO 20022 standards is designed to fit the business process rather than the technology on which it is implemented, so it is in principle adaptable to DLT networks or tokenisation platforms.

In other words, the business layer of the ISO 20022 standard can be used to guide definitions of DLT-based products and services such as smart contracts. ISO 20022-compatible application programming interfaces (APIs) could also be used to facilitate communication between different DLT networks or tokenisation platforms.

7.4   A Collaborative Approach is Needed to Develop new Standards for a new Technology

It may still be necessary to create entirely new standards for DLT networks or tokenisation platforms - no agreed set of standards for them yet exists - because they do operate in a different way and so create different forms of data. In financial messaging, the meaning of the data is explicitly contained in the data itself. An exchange of USD for EUR between BIC1 and BIC2, for example, means two banks are engaged in a US Dollar-Euro trade. In a DLT network or tokenisation platform, by contrast, an exchange of Payment Tokens between two digital wallets captures all that can be known about the counterparties and the transaction, without the need for additional data fields.

These novelties are an issue. For all the similarities with securities markets, Crypto Asset Tokens issued, traded, settled and custodied on DLT networks or tokenisation platforms make use of a different automation paradigm for which no business standards currently exist. For example, there is no standard way to define or represent the behaviour of a smart contract. Standards can be expected to emerge as the technology matures and best practices are adopted. But they will not emerge unaided.

Participants in both the established securities industry and the emergent Crypto Asset industry should use the opportunity created by the present concatenation of circumstances – a mature industry pondering the prospects and threats posed by a new technology – to collaborate, both informally and through bodies such as ISO, to create the standards needed to drive inter-operability between DLT networks or tokenisation platforms and existing services.

International and cross-industry collaboration of this kind can help accelerate agreed definitions of business terms, and so foster agreement on standards. Those standards should aim to achieve and maintain compatibility at the data semantics level with existing industry standards, including business concepts and processes, tokens, digital wallets, smart contracts and a common mechanism for cross-referencing legal and smart contracts.

Creating and adopting common standards to increase inter-operability between DLT and legacy networks will require strong industry collaboration to cope with the range of potential arrangements. Having conventional assets managed using DLT and Crypto Assets managed using conventional technology – most obviously for custodial services – has the advantage of bringing together two different worlds, which can learn from each other.

Conventional asset classes could benefit from the efficiencies of DLT, and Crypto Assets from the accessibility and operational stability of established market infrastructures. Adoption of common standards to foster inter-operability between the two worlds will reduce the complexity of the international financial system. However, resources will have to be invested to replace or adapt legacy systems. In addition, data might have to be duplicated in different systems to maintain inter-operability, at least for the foreseeable future.

However, inter-operability between the old markets and the new is nevertheless an outcome which regulators demonstrably favour. They believe in opening financial markets

to as many authorised participants as possible, with the aim of enlarging their size, increasing competition and fostering innovation – and they believe careful management of the risks of inter-operability alongside the use of internationally accepted standards are the best tools for securing this outcome.[30]

Inter-operability: Recommendations / Best Practice Considerations

- Inter-operability between non-permissioned DLT networks has progressed well, but inter-operability between non-permissioned and permissioned networks has progressed slowly;

- Adoption of DLT networks can be aided by inter-operability with traditional securities eco-systems;

- In developing their DLT technologies, vendors should facilitate inter-operability with legacy systems by providing messaging gateways, standard middleware and APIs;

- The securities industry should collaborate to develop the standards that will enable DLT networks to inter-operate with each other and legacy systems safely and efficiently;

- Standards and inter-operability are essential to encourage adoption of Crypto Assets by issuers and investors;

- The worldwide adoption of open source platforms for decentralised applications will help to encourage the development of inter-operability between DLT networks because it ensures choices are not imposed but selected by participants for their effectiveness;

- Vendors of DLT technology should collaborate under the auspices of international standards bodies such as the International Organisation for Standardisation (ISO) to ensure that DLT networks can inter-operate at the technical level;

- Technical standards bodies should facilitate the work of technology vendors by providing foundational standards that simplify collaboration between technical groups;

- The work of the International Organisation of Securities Commissions (IOSCO) in harmonising Crypto Asset trading platforms should be extended to encompass post-trade services.[31]

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[30] Principle 20 of the CPMI-IOSCO principles for financial market infrastructures urges market infrastructures to «identify, monitor and manage» the risks of inter-operating and Principle 22 urges them to use «relevant internationally accepted communication procedures and standards in order to facilitate efficient payment, clearing, settlement and recording. See Committee on Payments and Market Infrastructures (CPMI) and the International Organisation of Securities Commissions (IOSCO), *Principles for financial market infrastructures*, April 2012, pages 109 and 119. https://www.bis.org/cpmi/publ/d101a.pdf

[31] See International Organisation of Securities Commissions (IOSCO), *Issues, Risks and Regulatory Considerations Relating to Crypto-Asset Trading Platforms, Consultation Report*, May 2019. https://www.iosco.org/library/pubdocs/pdf/IOSCOPD627.pdf

8.0   Conclusion

Crypto Assets issued on DLT networks or tokenisation platforms will not leave the present order in post-trade securities services unchanged. Securities Tokens and Payment Tokens have the potential to make a number of existing services more efficient, extend the range of asset classes that are investable and liquid and widen the number and type of providers that are engaged in servicing issuers and investors. They also promise to introduce entirely new products and services and unprecedented ways for service providers and their clients – and issuers and investors - to interact as members of networks.

The settlement and safekeeping services that currently support the securities industry will have to evolve and adapt to manage the threats and seize the opportunities that Crypto Assets represent. New roles, of which network governance and / or operation is the most obvious, will emerge and develop. New ways of completing old tasks, such as smart contacts, will be adopted. But the essential responsibilities of the custodian banks and CSDs that provide safekeeping and settlement services will remain unchanged: the protection of investors and the preservation of the integrity of the capital markets.

The form may change, but the substance will remain the same is also the attitude adopted by policymakers and regulators. They are encouraged by the possibilities of innovation – increased market size, greater liquidity and lower transaction costs – and seek to foster it. But they will adjust laws and regulations to continue to protect investors and preserve the integrity of markets. If a Securities Token exhibits the characteristics of a security, it will be regulated in a manner equivalent to a security. If a Payment Token has the characteristics of cash, it will be regulated in the same way as cash.

Custodian banks and CSDs are well-advised to monitor both national and international policymaking and regulatory bodies for material changes to the legal and regulatory status of Crypto Assets. For now, however, substance-over-form provides sufficient legal and regulatory certainty for issuers, investors and service providers to continue to experiment with Crypto Assets, albeit within the confines of individual jurisdictions. Legal and regulatory differences between countries make it too difficult to internationalise Crypto Asset issuance and investing yet, although awareness and collaboration can help to evolve global standards over time.

The technology behind DLT networks and tokenisation platforms is at an early stage but maturing, and custodian banks and CSDs are proceeding – understandably – with caution anyway. Several operational issues remain unresolved. On-ledger settlement is not yet superior to simultaneous delivery versus payment (DvP) in the securities markets. Safe custody of private keys and financial assets that back "non-native" Securities Tokens both need technical, legal and regulatory refinement. The standards that will enable DLT networks to inter-operate with each other, and with legacy systems, are not yet developed. The best way to overcome these challenges is to collaborate. Every participant in the Crypto Asset industry - issuers, investors, regulators, CSDs, custodian banks, CCPs, FMIs, vendors and FinTechs - will benefit from collaboration. By working together, agreement can be reached on the definitions of Crypto Assets, the legal and regulatory frameworks which govern them, and the business and technical standards that will allow all the eco-systems to inter-operate. It is the measure of agreement on those issues that will determine the rate of growth of the Crypto Asset markets.

Appendix 1

Glossary of Terms

API	Application Programming Interface, a set of sub-routines definitions, communication protocols and tools for sharing data between different systems.
Asset-Backed Tokens	Tokens backed by holdings of underlying assets. See Digital Non-Native (or Asset-backed) Tokens.
Asset Tokens	These tokens represent assets such as participations in real physical underlyings, companies, or earnings streams, or entitlements to dividends or interest payments. In terms of their economic function, the tokens are analogous to securities.
Bitcoin	A crypto currency issued on the first public blockchain network created in 2009 that aims to compete with fiat currencies as a means of exchange. It has no intrinsic value, asset backing or links to other projects, and is not backed by any authority such as a central bank. Bitcoins are not securities, but commodities.
Blockchain	A database that places records of transactions in blocks on a DLT network. Each block is linked (or «chained») to the previous block, using cryptographic signatures that make the transactions they contain immutable. This allows blockchains to operate as distributed ledgers, which can be shared with anyone without fear that the data they contain will be manipulated.
Central bank digital currency (CBDC)	A fiat currency issued in digital form, backed by a central bank. There are none in issue yet.
Crypto Asset	Includes Payment Tokens (central bank digital currency, Stablecoins and Crypto Currencies), Securities Tokens (digitally native or asset-backed) and Utility Tokens. A Crypto Asset shares the characteristics of a digital asset (see below) and, in addition, allows for issuance, termination, ownership and transfer of ownership to be guaranteed via cryptography.
Crypto currency	Often used as a synonym for payment or exchange tokens to distinguish them from Utility or Securities Tokens.
Digital Asset	An asset in binary form that comes with a right to use, that has clearly defined notions of issuance, termination, ownership, and transfer of ownership, a definable monetary value, which may be between specific counterparties, and which may be based on a right to use, or may be based on the principle of limited supply. A digital asset is not necessarily analogous to a security.
Digital asset securities	Digital asset which are securities.
Digital token	A transferable unit generated within a distributed network that tracks ownership of the units, usually through the application of blockchain technology.
Digital currency	A currency which does not exist in physical form.

Digital financial asset	A term used to distinguish financial assets in digital form from other assets, such as images, videos and texts that are also rendered in digital form.
Digital Native Tokens	Digital assets that originate on a distributed ledger.
Digital Non-Native (or Asset-backed) Tokens	Assets represented digitally on a distributed ledger.
DLT asset	An asset transacted on a distributed ledger technology (DLT) platform.
DLT system	A system of electronic records that enables independent entities to establish a consensus around a shared ledger without relying on a central authority to provide or authenticate the authoritative version of the records. The consensus is established by the authoritative ordering of cryptographically validated («signed») transactions made persistent by replicating the data across multiple nodes and tamper-free by linking them via cryptographic hashes. The shared result of the consensus process serves as the authoritative version of the records.
Electronic currency	Synonymous with digital currency.
Ethereum	A public blockchain network launched in 2016, and also a crypto currency that aims to compete with fiat currencies as a means of exchange. It has no intrinsic value, asset backing or links to other projects, and is not backed by any authority such as a central bank. Ethereum is not a security but a commodity.
Fiat currency	Domestic legal tender that is issued by governments rather than backed by a physical commodity such as gold.
Fork	A «hard fork» can be defined as a software change to the DLT protocol that introduces a permanent split between the new and the old protocol, making them incompatible (backward incompatible). A «soft fork» can be defined as a change to the DLT software that is «backward compatible» meaning that unlike «hard forks», there is no splitting or branching out of the blockchain.
Fungible token	A token that is interchangeable with an identical token and divisible into smaller units.
Litecoin	A crypto currency that aims to compete with fiat currencies as a means of exchange. It has no intrinsic value, asset backing or links to other projects, and is not backed by any authority such as a central bank.
Non-fungible token	A token that has unique characteristics which make it neither interchangeable nor divisible into smaller units. CryptoKItties are an example.
Payment Tokens	These are synonymous with cryptocurrencies or Stablecoins and have no further functions.
PMI	Payments market infrastructure, such as the real-time gross settlement systems (RTGSs) operated by central banks or the automated clearing houses (ACHs) used by commercial banks to net payments prior to submission to an RTGS.

Securities Token	A token giving the holder an entitlement to underlying assets, companies, earnings streams, dividends, interest payments or other tokens. They are sometimes treated as securities.
Smart contract	Self-executing computer code that performs pre-defined tasks based on a pre-defined set of criteria or conditions. Smart contracts cannot be altered once deployed, since only this can guarantee faithful fulfilment of contractual obligations. A smart contract could, for example, be used to instruct a regular interest payment on a bond to be made to registered investors.
Stablecoin	A class of crypto currency designed to eliminate the price volatility of crypto currencies by backing them with real assets, fiat currencies or a mixture of both. A Stablecoin whose price reference is the US Dollar, for example, would be backed 1:1 by US Dollars in a custody account. Investors redeeming the Stablecoin would receive one US Dollar for each Stablecoin.
Token versus Token (TvT)	Entirely digital transaction settlement on a DLT network in which the exchange of value is made between an Asset-Backed or Digital Native Token and a Payment Token.
Tokenised securities	A term used to distinguish tokens regulated as securities from tokens which are not regulated as securities. However, they can encompass asset classes that are not generally securitised, such as fine art and real estate.
Utility Token	Tokens which are intended to provide digital access to a current or prospective application or service.
Virtual currency	Synonymous with crypto currency

Appendix 2

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The following individuals have contributed significantly to authoring the final report:

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Rok Sketa	KDD, Slovenia
Garion Jung	Korea Securities Depository
Hyeongju Kim	Korea Securities Depository
Perry Kim	Korea Securities Depository
Charlie Shin	Korea Securities Depository
Vic Arulchandran	Nivaura Ltd
Nadezhda Lukasheva	NSD Russia
Philippe Juanola	SLIB, France
Hari Chaitanya	Standard Bank
Jyi-chen Chueh	Standard Chartered Bank
Zhu Kuang Lee	Standard Chartered Bank
Mary Ann Callahan	State Street Corporation
Charles-Raymond Boniver	SWIFT
Cécile Dessambre	SWIFT
Nuthatai Cheewakriengkrai	The Stock Exchange of Thailand
Kitti Sutthiatthasil	The Stock Exchange of Thailand
Mark Cunningham	VP Securities Denmark

Other member organisations represented in the Working Group:

- Acupay System LLC
- Banque Internationale à Luxembourg
- Canadian Depository for Securities Limited / TMX
- Central Securities Clearing System Plc, Nigeria
- Clearstream / Deutsche Börse Group
- Consensys AG
- Credit Suisse AG
- DECEVAL, Colombia
- Deutsche Bank
- Exante XNT Limited
- Fnality International Limited
- HSBC Securities Services
- KSEI, Indonesia
- Monte Titoli
- Nasdaq
- NSDL India
- SEB
- Singapore Stock Exchange
- Strate