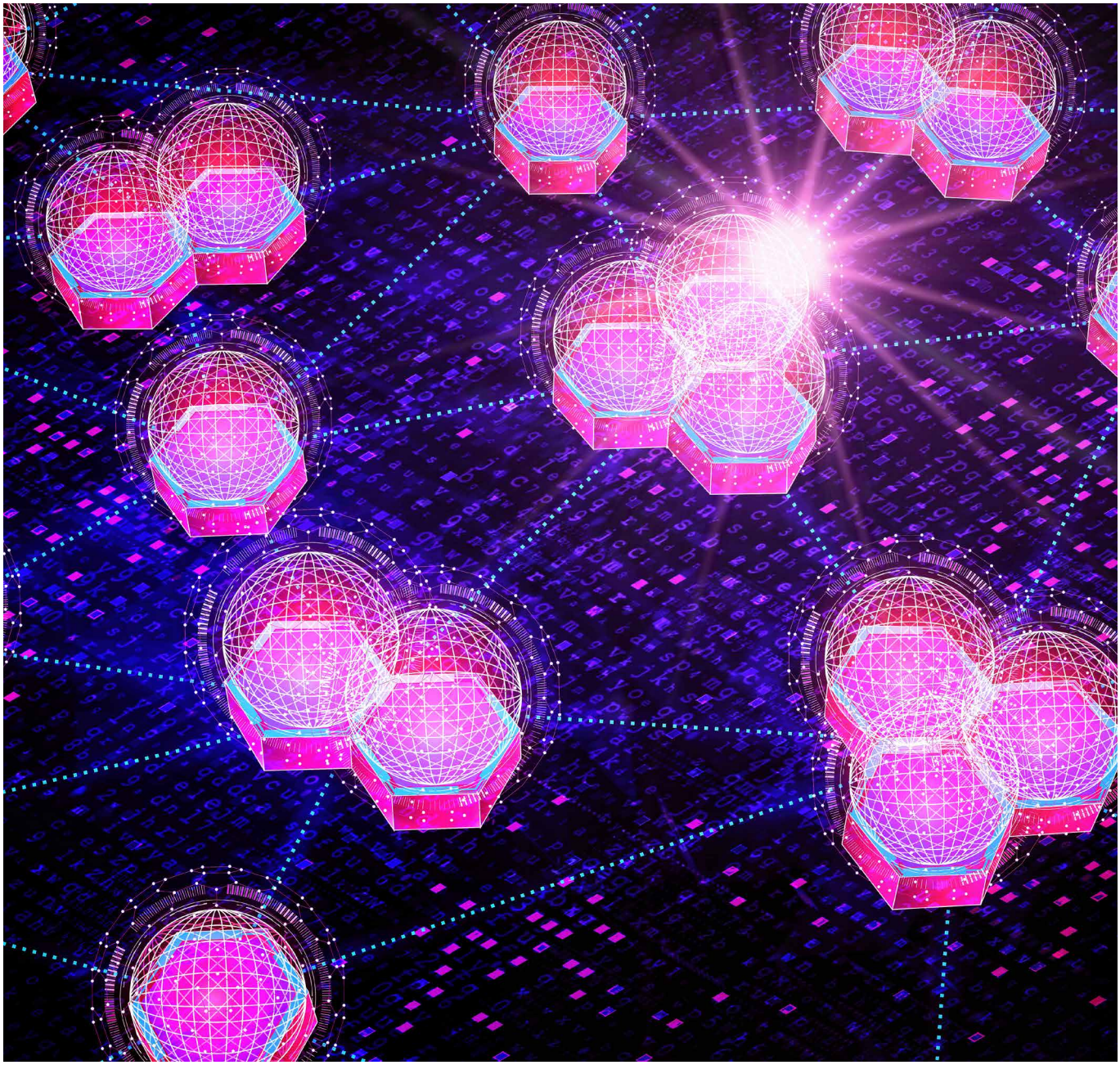
BRYAN, GARNIER & CO

Investment Banking for a Better Future

DIGITAL ASSET SERVICE PROVIDERS

A new era for capital markets



CONTENT

In this white paper we assess the development potential of digital assets and the tremendous opportunity they represent for related service providers. We aim to show that cryptocurrencies and NFTs are only a fraction of the space, and offer limited potential compared with the prospects of other tokenisation assets.

Our analysis suggests Digital Asset Service Providers (DASPs) are likely to be major beneficiaries of what we deem could be a revolution in the capital market infrastructure: an unprecedented move towards asset tokenisation.

Before presenting the results of our research on the digital asset services (DAS) business, we dedicate a first section to describing digital assets and how they could revolutionise capital markets.

DIGITAL ASSETS: AN EMERGING ASSET CLASS

SECTION 1

Digital assets: think Dogecoin, Bored Ape and CryptoPunks ..?

When considering digital assets, what might first come to mind are cryptocurrencies and NFTs. Indeed, the meteoric price rise in 2021 and the dramatic drop in 2022 shed light on what became a trendy topic for investors during the pandemic-related lockdown periods. Despite the hype, we believe the asset class remains highly speculative and we consider only a limited number of initiatives in the space are genuine value creators.

Beyond cryptocurrencies and NFTs, we believe there is a far greater and far more serious opportunity in the digital assets found in tokenisation.

Quick facts:

- Total crypto market cap dropped by -70% between the November 2021 peak and the July 2022 trough
- There are over 20,000 cryptocurrencies out there according to Coinmarketcap
- NFT market cap peaked in January 2022 to USD38.6bn before sliding to USD22.5bn in August according to NFTgo. The latter figure might even be overestimated given that it takes into account listed prices and not actual transaction prices.

FIG 1: GLOBAL CRYPTOCURRENCY MARKET CAPITALISATION

Source: CoinGeko.com; Bryan, Garnier & Co

…Think bigger: think tokenisation

Our analysis suggests tokenisation should represent a huge opportunity topping EUR29tn by 2030e.

What is Tokenisation? As per EY's definition, "Tokenisation converts the value stored in tangible or intangible object into a token that can usually be manipulated along a DLT/Blockchain system". The asset ownership deed is thereby transformed into a unique and secure cryptographic key that represents the asset on a connected network, without requiring the intervention of a third-party intermediary.

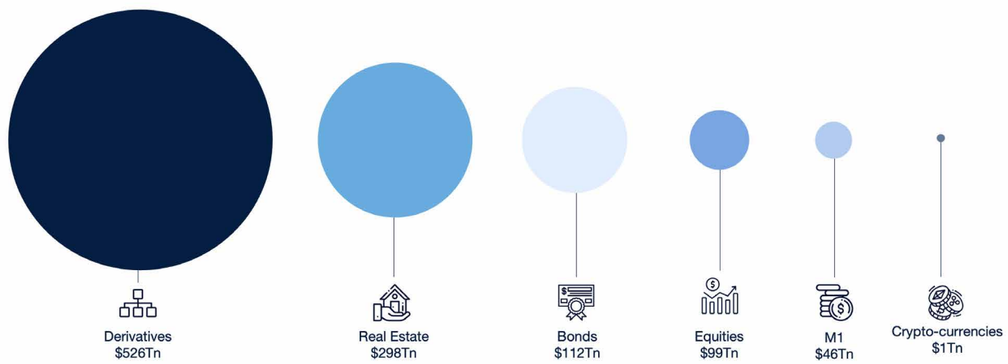
To assess the opportunity harboured in asset tokenisation, we estimate the market value of each asset class and compare it to the cryptocurrency market. While the former had a capitalisation of roughly EUR1tn at the end of H1 2022, derivatives, listed bonds and equities respectively represented a EUR526tn, EUR112tn and EUR99tn market globally. In comparison, the total value of fiat currencies in circulation (M1) was estimated at EUR47tn, and the global real estate market represents some EUR287tn. Hence, within the asset galaxy, looking at cryptocurrencies is taking the telescope by the small end. We have laid out a visual representation of selected asset class capitalisation below.

Given the depth of the pool they represent, we believe the digitalisation of traditional and alternative asset classes could be a complete game-changer in terms of financial market liquidity and efficiency.

The difference between crypto-assets and tokenized assets.

Cryptocurrencies and NFTs are "native assets" of the blockchain and are, by definition, 100% virtual and tokenized. Conversely, financial, and alternative assets like traded bonds, equities, cash, real estate or carbon certificates are considered as "non-native assets" and exist remotely from the blockchain. We consider only a very thin portion of them is tokenized as of 2022.

FIG 2: GLOBAL MARKET SIZE ESTIMATE FOR SELECTED ASSETS CLASSES



Source: BIS; Coinmarketcap; Savills; SIFMA; World Bank; Bryan, Garnier & Co

Are tokens about to eat the world?

Although the cryptocurrency market offers no opportunity for further digitalisation (given it is by nature 100% digitalised), other asset classes are, on the contrary, at a level of digitalisation close to 0%, leaving tremendous potential for further penetration. We expect the move towards tokenisation to take place in three successive waves. Note these are not necessarily related to the degree of digital maturity of the underlying assets.

Three waves of adoption

Currencies should enter the digital era first with Central Bank Digital Currencies (CBDC). Triggered by the soaring number of private, decentralised cryptocurrency projects, the world's major central banks started their own initiative in the digital currency space. According to the International Monetary Fund: "around 100 countries are exploring CBDCs at one level or another. Some researching, some testing, and a few already distributing CBDC to the public" as of January 2022. The opportunity here is tremendous in our view, given that as much as EUR46tn worth of cash could be given a digital upgrade. Furthermore, the asset class is at an advanced level of digital maturity and could rapidly adapt to blockchain technologies. As per our understanding, a digital Euro could launch as soon as 2026 or 2027, while the digital Yuan is already in an advanced testing phase in China. These two examples show how quickly CBDCs could become a reality.

Private, alternative and complex financial assets could soon turn to the blockchain too. Our definition of private and alternative assets encompasses classes like real estate, private equity, property deeds, collectibles, commodities, or even carbon certificates. Complex financial instruments include (but are not restricted to) listed securities like derivatives, complex debt instruments, exchange traded funds or any other post-trade-intensive financial assets. We believe these two classes will benefit and be impacted by tokenisation in different manners.

Complex financial assets are often long to settle, hardly accessible to retail investors and often embed characteristics for which execution could be automated through smart contract features. In the case of ETFs, those often require significant back-office work for valuation calculation and settlement. Tokenising this type of asset represents a huge opportunity for avoiding post-trade process complexity and greater accessibility at a compelling cost.

Regarding private and alternatives, we consider the asset class could benefit from tokenisation mostly through accelerated settlement and improved liquidity via fractional ownership. As liquidity improves market efficiency and therefore asset pricing, there is therefore a greater incentive and urgency for digitalising this class. Given the relatively early stage of digital maturity, and since transactions in this type of asset are often subject to administrative publicity, we believe there is some degree of uncertainty surrounding the timing of adoption. However, we acknowledge several digitalisation projects already exist in this field like the one borne by tZero.

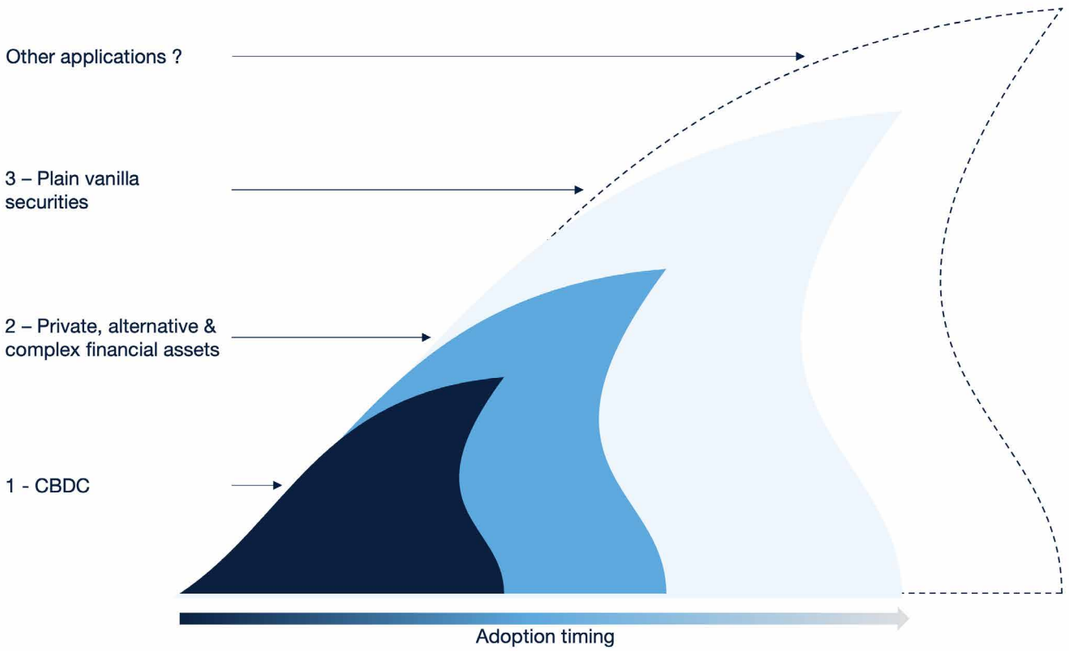
Given the size of the private, alternative and complex asset pool, we believe this class offers tremendous potential in terms of tokenisation and therefore revenue for players enabling tokenisation. We cannot stress enough how massive the impact could be when real estate, private equity, or derivatives turn to the blockchain.

Plain vanilla securities, including mostly listed equity securities and option-free bonds could join the movement in a more distant future. Indeed, we consider the DLT use case is less relevant to the simplest securities like equities that are already quickly settled (notably thanks to T2S in Europe) and widely available to any type of investor. We therefore see limited benefit from a tokenisation making the transformation rather unlikely in the near term. As such, tokenised equities could emerge in a more distant future when the financial system finally reaches a fully-digitalised stage.

We note some projects have already emerged in this space. While these services focus on transforming existing assets into tokens, issuers can also directly go to the market with a blockchain-backed Security Token Offering (STO) that could replace traditional IPOs.

As tokenization opens a wide range of potential applications, new types of tokens could appear at some point. Here we refer (but not exclusively) to utility tokens offering access to a certain type of services or non-fungible personal tokens encompassing uses cases in fields like identity, diplomas, licences, visas or any other type of records carrying personal information. As this type of token is invaluable by nature, and given the breadth of potential applications of such tokens, their impact is elusive and not explicitly taken into account in our market definition. We however mention them as potential fourth wave of adoption of digitalisation technologies.

FIG 3: ADOPTION WAVES OF DIGITALISATION TECHNOLOGIES



Source: Bryan, Garnier & Co

The move towards regulatory maturity

The rising adoption of digital assets has led regulators to take a closer look at the space. The volatility of cryptocurrency markets, multiple theft issues and technical failures (Terra Luna crash) have left retail individuals vulnerable to risks from this nascent asset class. Consequently, regulators now aim to organise the market's development by providing a regulatory framework for digital assets and pilot regimes for DLT-based capital markets infrastructure. Switzerland's FINMA was one of the first countries to introduce such legal regimes, with EU following through with the Markets in Crypto Assets (MiCA) regulation approval in June 2022. In our view, regulation doesn't curb innovation. It actually fosters the development of new initiatives in tokenisation by offering it the legal framework it needs.

We believe the following key regulatory objectives are on the agenda:

- **Consumer protection** against risks associated with crypto asset investments. This also includes protection against fraudulent schemes for transaction inside and outside the EU. DASPs will have to respect stringent requirements to protect consumer wallets and become liable if they lose investors' crypto assets.

- **Avoiding market manipulation** linked to any type of transaction or service, notably through market manipulation and insider dealing. Similar treatment to commodities and listed assets. Will require stricter risk control and KYC/AML compliance.

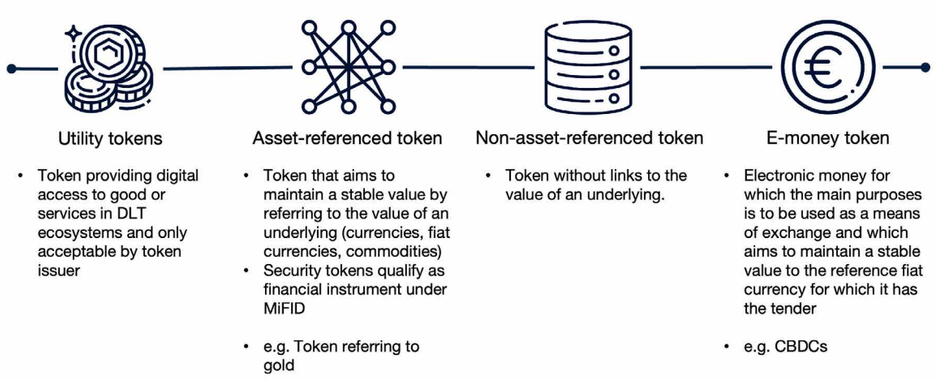
- **Recognising tokens as security** instruments and payment means. New business opportunities for security exchanges and Payment Service Providers (PSPs).

- **Providing a legal framework** for DLT infrastructure for capital markets. Fostering mass-adoption of DLTs.

FIG 4: RECENT DEVELOPMENT IN REGULATORY FRAMEWORKS IN KEY GEOGRAPHIES, LED BY THE SWISS REGULATOR

Source: FCA, ECB, Linklaters, HM Treasury, OCC, SEC, BaFin, Bryan, Garnier & Co

FIG 5: TOKEN CLASSIFICATION BY MICA

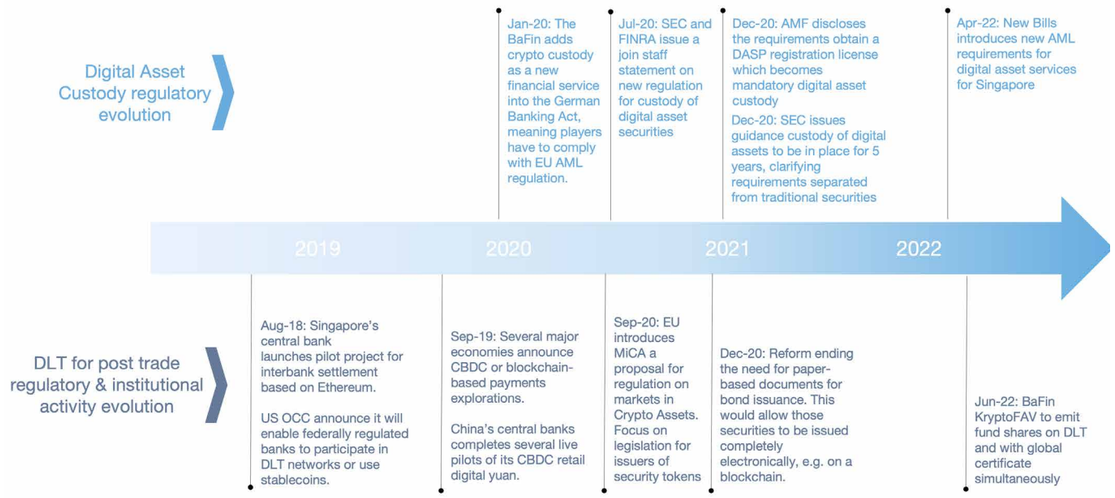


Source: European Commission, Bryan, Garnier & Co

For digital asset custody, the pace of regulation is also accelerating. In France, digital asset custodians must now obtain a license to operate and comply with AML/KYC regulations. In other countries like Switzerland, regulators have already added digital asset custody as a subtype of banking and securities firm licenses. In Germany, the BaFin has fully accepted crypto custodians as a new type of financial service providers meaning they must comply with the regulation. In the US, digital asset custodians do not have their own regulatory framework yet. Some players have resorted to becoming chartered trust companies to obtain the right to hold a client's crypto assets. Becoming a regulated custodian has several implications for DASPs: they are regularly audited and must meet the required custody standards from their respective governing bodies.

We believe that working hand-in-hand with regulators is a key factor in becoming a successful digital asset services provider. In the future, we expect non-compliant players to either face hefty fines or find themselves barred from operating, since security and consumer protection is critical for regulators.

FIG 6: A REGULATORY FRAMEWORK IS EMERGING IN EUROPE



Source: European Commission, Bryan, Garnier & Co

target services | T2S

T2S (TARGET 2 Securities) is a European payment network enabling real-time transactions settlement between central securities depositories taking part n it. T2S enables simultaneous cross-border settlement of securities transaction using central-bank money, thereby slashing counterparty risk. This settlement system, which is one of the most advanced in the world, is capable of achieving the same degree of safety and speed as DLT-based infrastructure. Given the quality of T2S' technology, we doubt European financial institutions feel the urgency of adopting blockchain technologies for vanilla financial assets as they would not add much to the current system.

Helped by a developing regulatory framework in most jurisdictions, tokenisation is set to bring financial and alternative assets to the blockchain. We consider the move towards tokenisation could reshape the financial system. However, the underlying technology it is based on is sometimes tricky to understand. We therefore explain how the tokenisation process work in the following section.

UNDER
THE HOOD

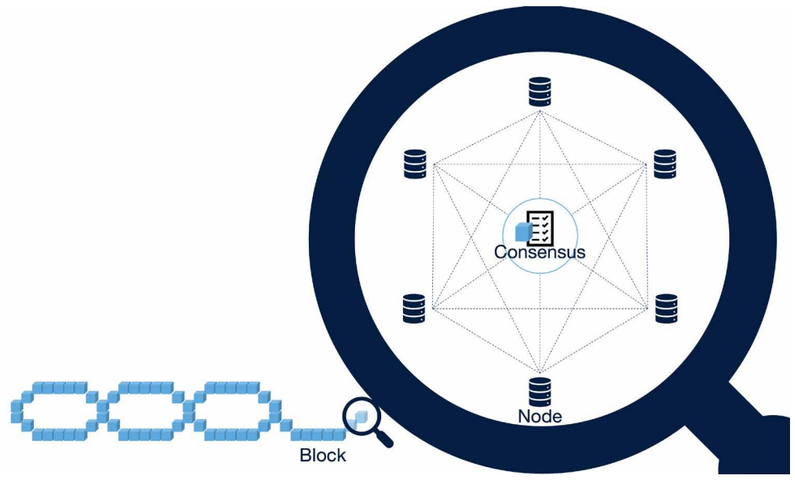
SECTION 2

How blockchain works

To understand how tokenisation works, the concept of Distributed Ledger Technology (DLT) should be explained. We acknowledge there are various types of DLT, but, for simplicity's sake, we only consider DLTs in the form of blockchains.

A blockchain is a distributed data base aimed at recording and certifying the authenticity of transactions between members of a network (also referred to as "nodes"). Nodes collectively work on the verification and validation of transactions (or "blocks") that are irrevocably chained to a ledger once validated.

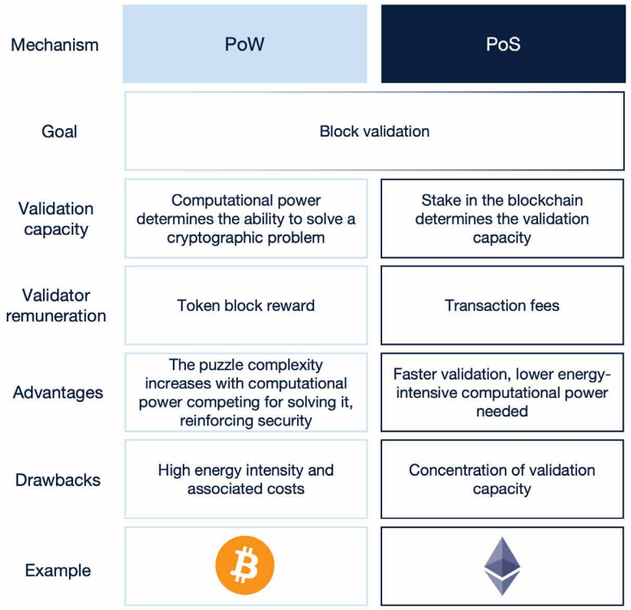
FIG 7: WHAT IS A BLOCKCHAIN?



Source: Bryan, Garnier & Co

The update of the ledger (or the addition of a block) relies on a consensus mechanism. This is the algorithm governing the process by which nodes agree on the current state of the ledger, validate a transaction and thereby amend the ledger. There are several types of consensus algorithms out there, among which Proof of Work (PoW) and Proof of Stake (PoS) are the most common (presented below).

FIG 8: DIFFERENCE BETWEEN POW AND POS



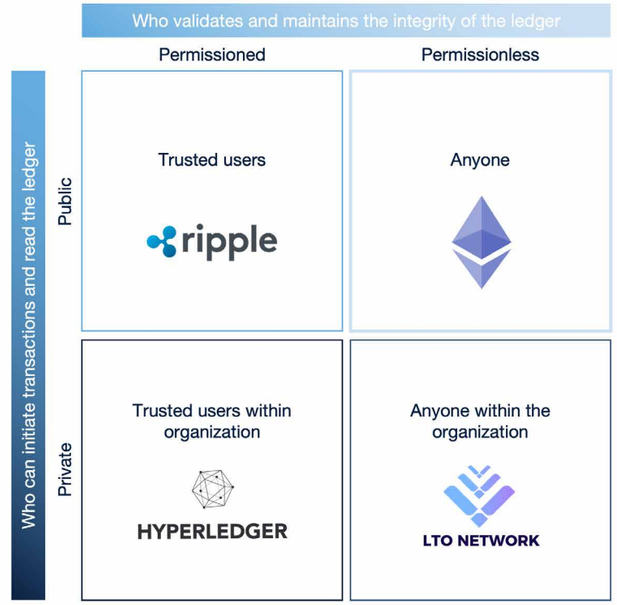
Source: Bryan, Garnier & Co

Block validation under the PoW mechanism is notorious for its extensive energy use. Indeed, the complex cryptographic calculation it performs requires massive computational power and equivalent amounts of electricity. The associated cost was often seen as a drag to the development of DLTs, however, new types of consensus mechanism such as PoS could help cut the energy bill. Indeed, compared with Ethereum 1.0 (based on PoW), Ethereum 2.0 (PoS) could contribute to a 99% drop in energy consumption on this blockchain.

The validation process, also referred to as mining, is the activity through which validators are remunerated for their contribution, either in the form of a token (PoW) or a transaction fee (PoS). Note PoS-blockchains rely on staking, a technique through which a node commits its holding as a proof of integrity of the transaction it validates. Indeed, in the event of erroneous or fraudulent validation, staked assets can be destroyed or slashed, thereby preventing actions that would impair the integrity of the network.

Blockchains are usually classified according to two criteria encompassing the permissions given to block validators and the publicity of the parties initiating or visualising transactions on the ledger. We have mapped classification criteria in the following matrix.

FIG 9: KEY BLOCKCHAIN CLASSIFICATION CRITERIA



Source: Ledgerjournal (Evangelos Benos, Rodney Garratt, Pedro Gurrola-Perez); Bryan, Garnier & Co

In the framework of public permissionless blockchains, the verification process often gives rise to compensation usually in the form of a token (e.g. Bitcoin for work performed on the eponymous blockchain). They enable an efficient identification and verification process of transactions without requiring third-party intervention. Conversely, for private permissioned blockchains, the cost of the authentication process is borne by the sponsor, which grants authorisation to the nodes to validate and/or view blocks.

Blockchain use cases for capital market operations

As DLTs enable efficient and accurate bookkeeping while offering both scalability and security features, it is no surprise the technology is used to support certain capital market transactions. Blockchains are therefore an entry point to decentralised capital markets, materialising in three ways, namely: Initial Coin Offering (ICO), Security Token Offering (STO) and Tokenisation.

FIG 10: CAPITAL MARKET APPLICATIONS FOR BLOCKCHAIN TECHNOLOGIES

Source: Bryan, Garnier & Co

An ICO consists of issuing a token or a "coin" to finance the development of a blockchain project. Note the issued token does not exist outside of the blockchain it was minted on. Bitcoin, Ether or Solana are famous examples of coins financing eponymous blockchains.

An STO is a type of DLT-based asset issuance. Through this process, an entity can issue any type of debt or equity security (with the associated ownership deed) to finance its operations without having to fill a security registration document on a regulated market. Equity STOs are to some extent a sort of disintermediated initial public offering. Although the issuing entity exists outside the blockchain, the security is only tradable through the blockchain.

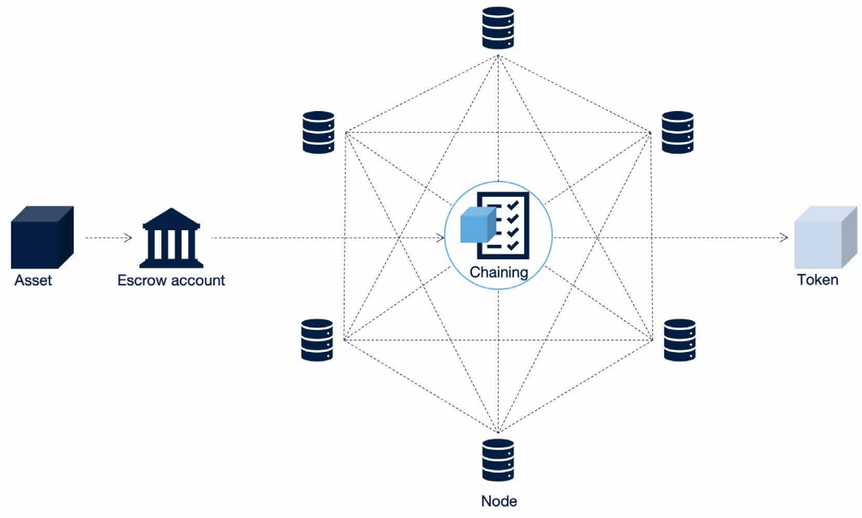
Tokenisation is the process through which an existing asset is given a digital existence on a blockchain. Unless the process is carried out in a synthetic manner, the asset being tokenised is held as a counterpart by the node minting the token on a given blockchain. It therefore represents a secondary market operation on a security that already exists in another trading venue.

tether

The Tether example is a relevant illustration of this process. Tether, as a firm, issues coins on a blockchain that each have a value of USD1, and stores the exact same amount of actual cash in an escrow account backing the token value. The issued security can therefore be traded on any crypto exchange at a value pegged to the dollar it represents on the blockchain.

A difference should therefore be made between "native assets" that are originated on the blockchain (like the ones resulting from ICOs and STOs) and "non-native assets" that originated outside the blockchain and are brought to it through tokenisation (like a tokenised piece of Apple share).

FIG 11: HOW TOKENISATION WORKS



Source: Ledgerjournal (Evangelos Benos, Rodney Garratt, Pedro Gurrola-Perez); Bryan, Garnier & Co

tokeny

Tokeny is a provider of tokenisation solutions. It offers issuing, custody and related services on the Ethereum and Polygon blockchains. The firm is backed by Euronext, which owns a 23.5% stake.

The case for tokenisation

Tokenisation has a wide range of applications for capital markets, among which:

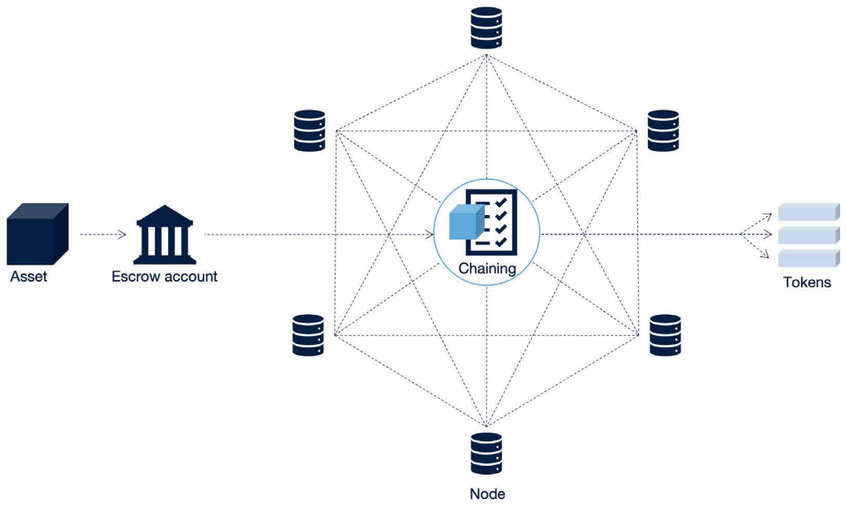
Smart contracts. Thanks to tokenisation, digital assets can onboard smart contract features. These consist of embedded code enabling the automatic execution of certain terms of a contract whenever a given event arises. A concrete application for tokenised equities includes the enforcement of transferability restriction, lock-up or vesting periods for example. It also applies to tokenised derivatives that can embed automated margin calls or settlement for example.

Fractional ownership of assets. Once tokenised, assets can be sliced into smaller pieces, each representing a fraction of the initial asset. As an example, a traded bond can be divided into a multitude of smaller fragments, each owned and exchanged separately by a larger securityholder base.

Hedera Hashgraph

Hedera offers tokenisation services that are designed to accommodate smart contracts. Hedera's public permissioned ledger is capable of processing over 10,000 transactions per second for a cost as low as a hundredth of a USD cent.

FIG 12: FRACTIONAL OWNERSHIP



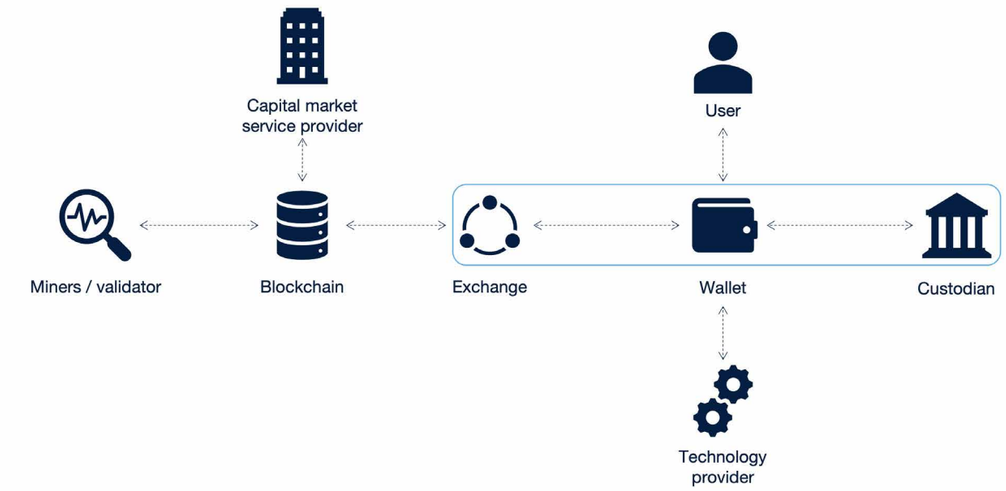
Source: Bryan, Garnier & Co

Public record transparency. Blockchains are transparent by design, implying that any node can access the ledger and observe the history written on it (on public blockchains). As such, tokenisation of assets could improve transparency and efficiency of financial transaction record-keeping.

Where DASPs come into play

Within the blockchain-based financial ecosystem, DASPs are key players providing the technological infrastructure and services needed for the digital asset operations to run smoothly and efficiently. Their role is therefore of paramount importance as they help the ecosystem thrive and unlock new capital market opportunities for both investors and issuers. Different business models have emerged in this field, with some like Coinbase or Binance opting for a bundled service offering ranging from exchange operation, custody and technology management, while others like Fireblocks, Taurus or Metaco adopted a specialist technology provider position in the value chain. The following diagram illustrates how these players interact to serve capital markets services providers and users/investors.

FIG 13: DASP VALUE CHAIN



Source: Bryan, Garnier & Co

FIG 14: DIGITAL ASSET SERVICES VALUE CHAIN

Source: Companies; Bryan, Garnier & Co

** Note that the exchange's matching capacity implies there are no blockchain-related operations before netting is performed after a trading period (typically one day) in order to avoid supporting gas fees on each and every transaction.*

In our view, technology providers are at the heart of the ecosystem as they provide the infrastructure upon which the DLT-based financial system is built.

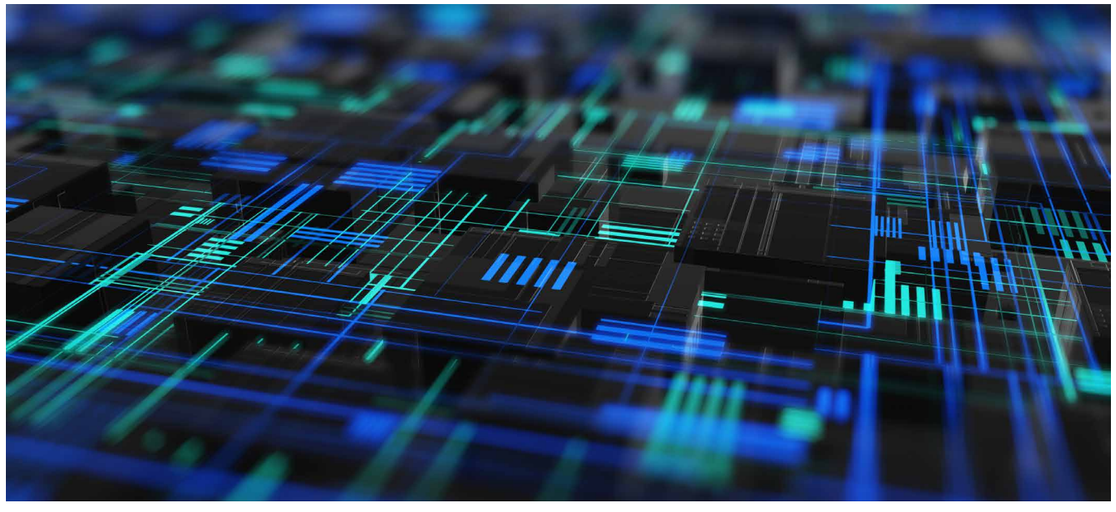
Focus on the role of digital asset custodians

Once acquired, minted or mined, digital asset can be held in two ways that we define as storage and staking. Both concepts are summarised in the following table.

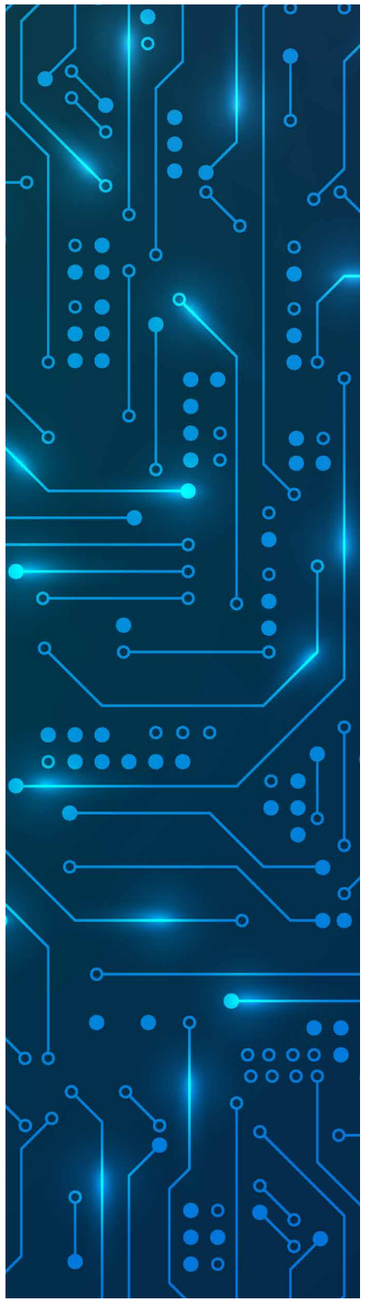
FIG 15: STORAGE VS STAKING

	Storage	Staking
Why storing or staking ?	Digital asset needs to be held in some way: they can either be stored with a custodian or staked with a PoS blockchain Note both techniques are not mutually exclusive as many custodians offer staking services	
How it works	Encrypting private key data in a secure place (physically or digitally)	Committing assets to a validation node / pool (digital only)
Advantage	Safe storage with versatile possibilities from self-custody to delegated custody and risk transfer. Maintain control over stored assets	Revenue generation through PoS under the form of transaction fees
Drawbacks	Each storage technique gives rise to a cost (fixed or variable) and comes with different security features and risk exposures	Loss of control: staked assets are locked up for a predefined period Slashing risk: asset destruction in case delegated PoS behaves fraudulently Availability: Staking is not available with every asset, it is only offered to a subset of cryptocurrencies including Ether 2.0, SOL or Tezos.
Techniques	Cold / Warm / Hot Hardware-based / Combination / Software-based	Direct commitment or delegated staking (pooling of assets to constitute a validation node)
Comments	Storage techniques enable greater control of assets and can accommodate safest features but come at a cost, while staking generates a yield. Once again, storage and staking are not mutually exclusive, as stored assets can be staked. In both cases, neither storage nor staking protects from the asset volatility risk.	

Source: Bryan, Garnier & Co



Storage



To complete a blockchain transaction, the user needs to provide the network with a public and a private key. The public key is merely an address identifying the investor and is visible by any node of the blockchain. The private key is destined to remain secret as it is a sort of signature or password enabling the public key to execute transactions on the blockchain. Put differently, the private key is a safeguard to the assets stored with the public key. Both keys are unique and unrecoverable, implying that in the event of loss or theft, they can in no way be recovered. We thus understand the importance and sensitivity of the private key, which to a certain extent, is the digital asset it protects.

Although digital assets are often thought of as being stored in a given place, they actually are not. They are stored nowhere else apart from the blockchain and the actual storage or safekeeping service concerns private keys that provide access to the assets in question.

On the Bitcoin blockchain, a private key is a randomly generated hexadecimal 256-bit number like the following one:

A9873D79C6D87DC0FB6A5778633389B4453213303DA61F20BD67FC233AA33262

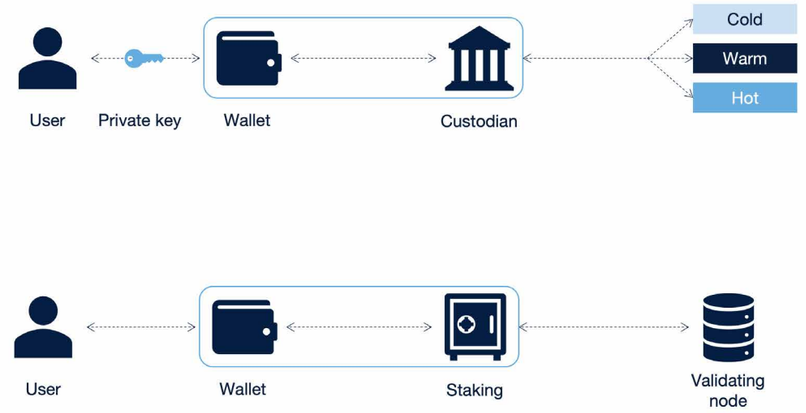
Obviously, such a complex key is unlikely to be remembered by a human being and must be stored in some way. This is where custodians jump in. In this field, they offer three options for storing private key data, or a spectrum of techniques arising from combinations of the following. Cold storage, relying on hardware, hot storage relying on software, and warm storage, being a combination of both.

Warm storage custody providers typically offer all types of custody which includes cold and hot storage.

Hardware Security Module (HSM) storage is a safekeeping technique consisting of storing data in a hardware secure piece either attached to a server/computer or in a physical device remote from a computer. HSM is a therefore a cold-storage technique.

Multi-Party Computation (MPC) is a software-based storage method that consists of splitting private key data among several nodes and avoiding single-place storage and hence risk concentration. Technically, the private key data is distributed throughout several nodes that contribute to validating a transaction without revealing the piece of data they store.

FIG 16: HOW STORAGE WORKS



Source: Bryan, Garnier & Co

FIG 17: DIFFERENT TYPES OF STORAGE

Storage type	How it works	Advantage	Drawback	Providers
Cold	Private key storage on a physical device	Most secure: remote from network and, by definition, from cybersecurity threats	Recoverability issue in case of theft or loss. Non-immediate access to assets, human factor reliance	LEDGER, TREZOR
Warm	Combination of both solutions, usually software-based	Security advantage from hot storage and near immediacy of Cold storage approach	Not as immediate and not as secure, likely higher costs	TAURUS, METACO, Fireblocks
Hot	Software-based private key storage connected to the internet	Ease of use, immediacy of access to digital assets, private key recoverability	Private key held within a connected network implying the existence of a cybersecurity risk	coinbase Wallet, edge

Security +

Recoverability +

Source: Bryan, Garnier & Co

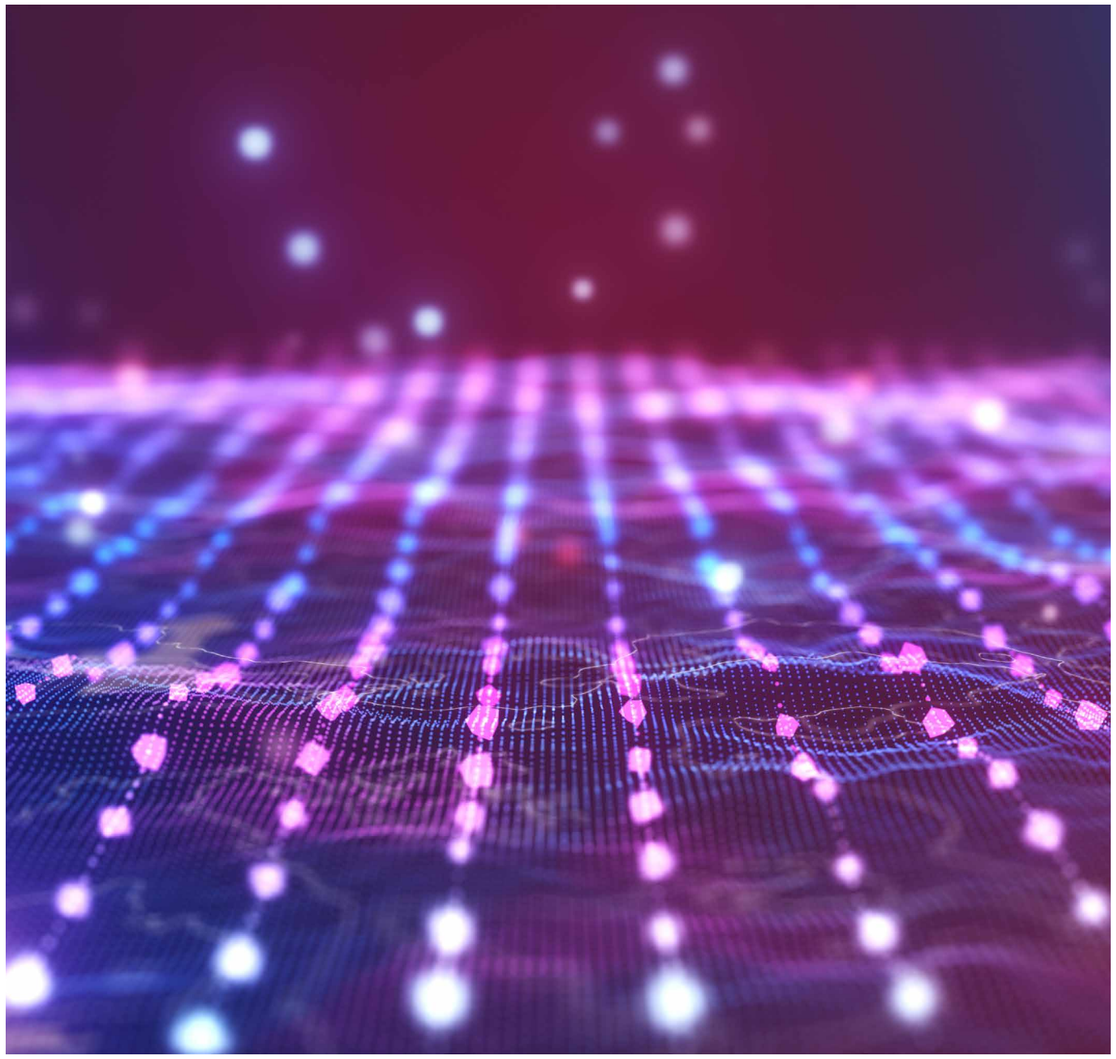
Staking

Staking is a way of safekeeping digital assets leveraging a decentralized network. Note this technique does not circumvent the need for private key storage, it rather is a way of putting one's assets at work. Staking is intrinsically linked to a PoS consensus mechanism: it consists of locking up digital assets for a given period of time to contribute to a blockchain project. Indeed, the committed assets are used as a proof of integrity for a validating node, which contributes to the network stability. For investors, the advantage of staking is that it generates a yield (via transaction fees) on top of being a way of storing a crypto-asset.

SOLVING

PAIN POINTS

SECTION 3



Post-trade flow: a cumbersome process

Today's financial markets rely on a post-trade ecosystem that is complex, costly, and highly intermediated. To some extent, this relies on legacy technology infrastructure, requires cumbersome data reconciliations, and a complex layer of exchanges between intermediaries within the ecosystem for a security settlement to occur.

How does post-trade flow currently work?

Once a trade is executed, the post-trade ecosystem can be broken down into three functions: clearing, settlement and custody. Interactions between buyers, sellers, brokers, securities exchanges, custodians, clearing houses and central depository institutions are described below.

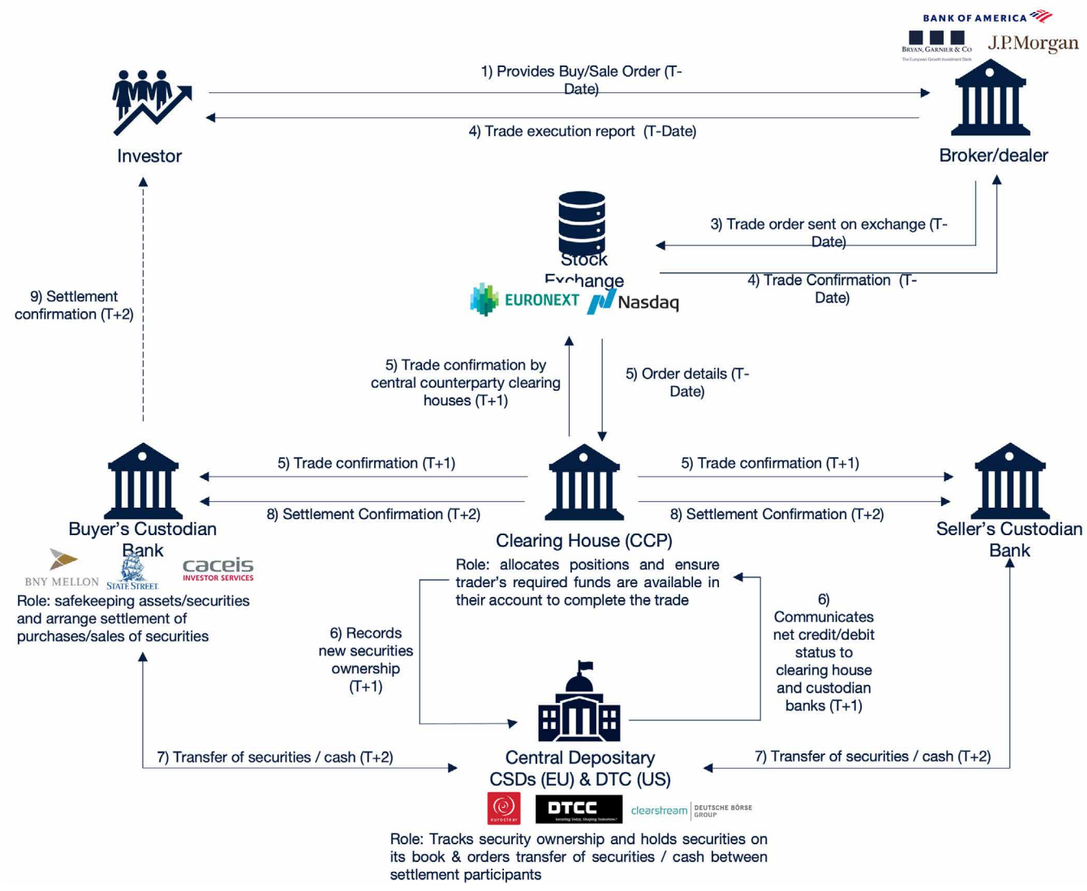
- **Trade execution:** A market order placed through a **broker** is routed to a **securities exchange**, where securities are listed, for execution. When an investor places an order, their broker will execute the trade on the exchange by entering a quote into the exchange's system. Once the order is matched, the buyer and seller enter a legally binding contract to transfer securities in exchange for cash.

- **Clearing:** After execution, the exchange sends the order's details to central **counterparty clearing houses** (CCPs), which are responsible for clearing securities transactions. When a trade is executed, the CCP enters a contract as an intermediary and becomes the buyer to each seller or the inverse, thereby shouldering the risk that the trading counterparty has neither the securities nor the cash at hand to clear the trade. In addition, a CCP nets and allocates the positions from the order, performs risk management, calculates the margin requirements to be settled, and checks with the custodian bank whether the involved parties hold sufficient funds to execute the transaction.

- **Settlement:** this is the last step of the post-trade process whereby, after a trade is cleared, securities ownership changes - the buyer receives the purchased securities and the seller receives the corresponding cash in exchange for the securities. After clearing, the CCP sends the trade information to a **central securities depository (CSD)**, which is responsible for settlement of securities transactions. The CSD records the number of issued securities, the identity of the issuer, and each change in ownership. The securities do not physically change hands in the settlement process. What happens instead is that the central depository updates its records with the trade details and accordingly instructs the transfer of cash between the buyer's and seller's respective **custodian bank** accounts. In Europe, there is one CSD per country, and two 'international' CSDs (ICSDs – ClearStream and Euroclear). Euroclear and ClearStream represent around 80% of total settlement volumes in the EU. In the US, the DTCC has a monopoly position and performs nearly all settlement volumes.

- **Custody:** Ownership of financial securities is recorded and held by national custodians or CSDs which play a different role to custodian banks. Investors typically have a custody account at a CSD (Euroclear, Euronext or ClearStream in Europe) that keeps track of which securities they own while the account is operated by custodian banks. **Custodian banks** are used by investors to hold their securities and cash through safekeeping accounts. These banks are 'custodians' because they do not directly hold securities but rather administer their clients' assets held in CSDs facilities. They also provide administrative services related to securities, such as income and tax processing, valuation, reporting services and proxy voting. Custodians are essential to the post-trade cycle as they receive information from clearing and interact with CSD for settlement.

FIG 18: POST-TRADE - A FRAGMENTED PROCESS



Source: Euroclear, Euronext, DTCC, Bryan, Garnier & Co

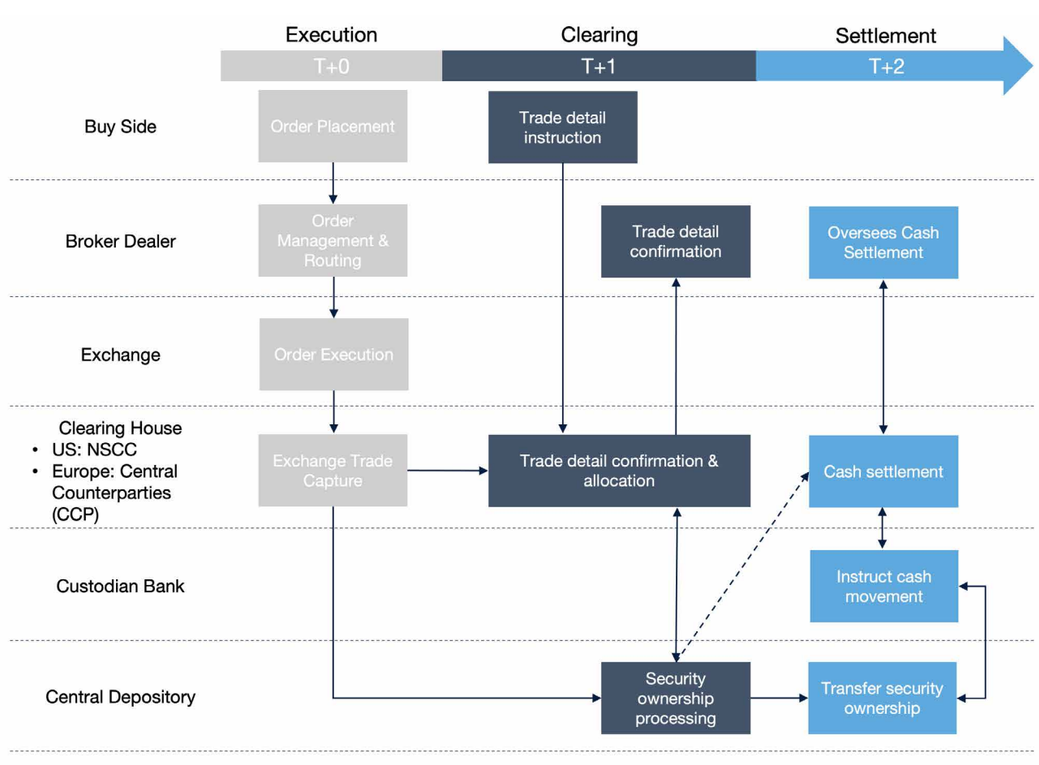
Why does a shorter settlement cycle matter?

Given the fragmented nature of the post-trade ecosystem, market orders in Europe and the US can take up to two days to be settled, depending on the type of assets traded. The use of DLT could help bring the trade clearing and settlement cycle to near real-time, thereby reducing counterparty risk – the period during which an investor is at risk that its trade counterparty does not meet their obligation to deliver cash or securities on the settlement date.

Reducing the settlement period could increase liquidity by freeing up collateral for post trade participants. In the US, the DTCC which is responsible for the whole post trade infrastructure, estimated that by removing an entire day from the settlement cycle in 2017, average daily capital requirements for clearing trades were reduced by 25%, saving the industry USD1.4bn in margin requirements daily.

We provide more details on the typical simplified timeline to trade a security in the US below.

FIG 19: SETTLEMENT TIME: FROM T+2 TO T+0?

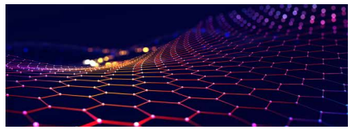


Source: DTCC, Bryan, Garnier & Co

Post-trade costs

The key question for DLT adoption concerns costs. Banks, brokers and other market participants are likely to circumvent centralised exchanges if they find a secure and cost-efficient way to perform clearing and settlement. Settlement, custody and asset servicing processes represent a significant cost for market end-users.

The players



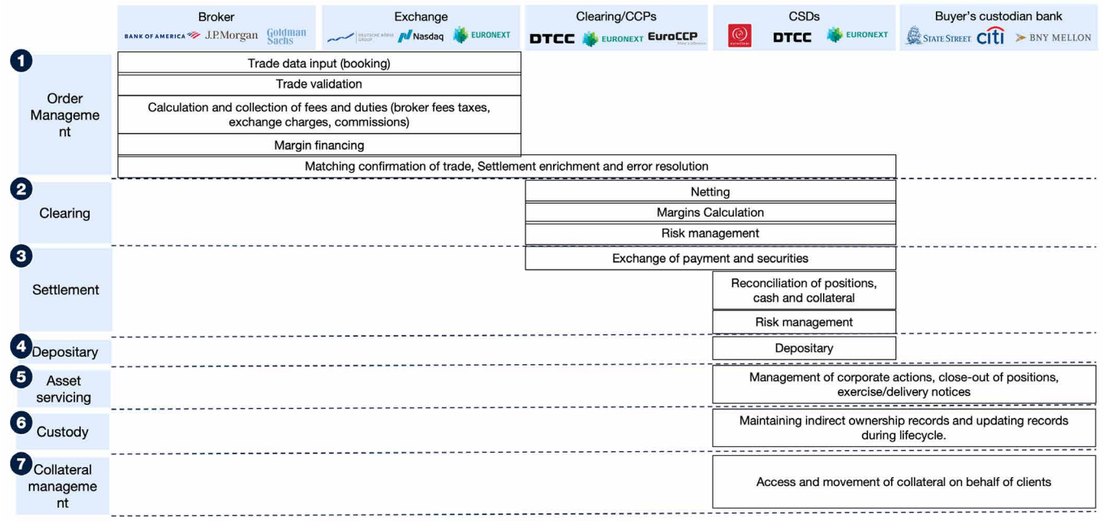
As discussed, the post-trade ecosystem is highly intermediated and relies on legacy processes and technologies. The following section describes who these intermediaries are and how the market is structured.

FIG 20: KEY INDUSTRY PLAYERS

Source: Bryan, Garnier & Co

What do each of these players do? We set out the functions they fill in the post-trade ecosystem.

FIG 21: A CONCENTRATED MARKET

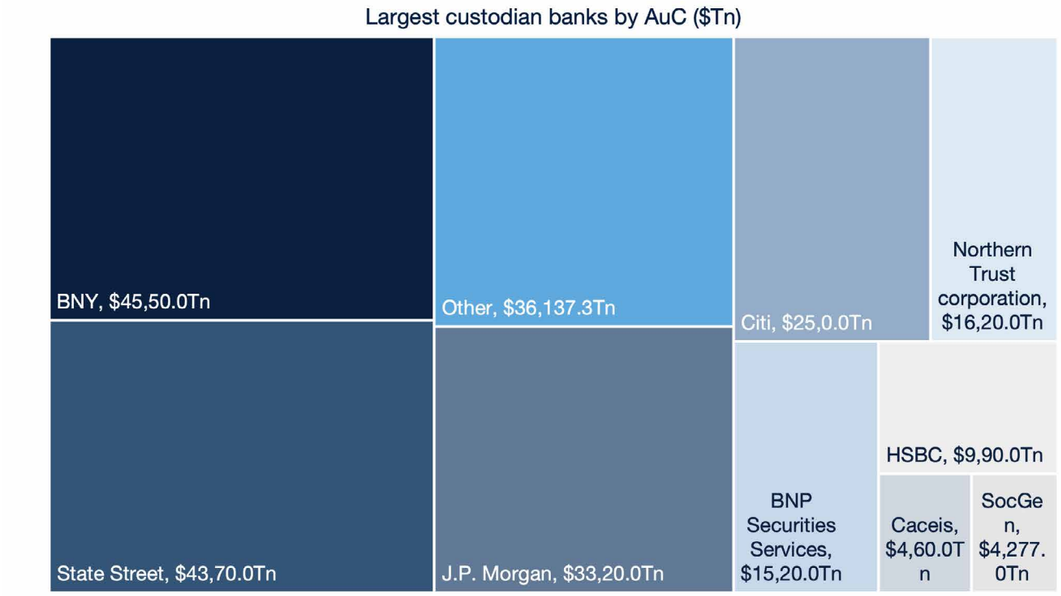


Source: The Economics of Distributed Ledger Technology for Settlement, Bryan, Garnier & Co

Traditional custodian services

The custodian services market is concentrated in a handful of providers. Indeed, we estimate that the six largest players control nearly 60% of assets under custody and we present these below.

FIG 22: AUC REPARTITION ACROSS MAJOR PLAYERS



Source: Companies; Bryan, Garnier & Co

Given that most custodian banks offer other services beyond pure custody, the total amount of fees collected by these players needs to be dissociated from the revenues generated by other security-related activities. Our research suggests c.50% of the total revenue generated by custodian banks traces back to pure custody services and the remainder stems from other securities services. The following chart shows the typical breakdown for major players in the sector.

FIG 23: AUC AND ASSOCIATED FEES

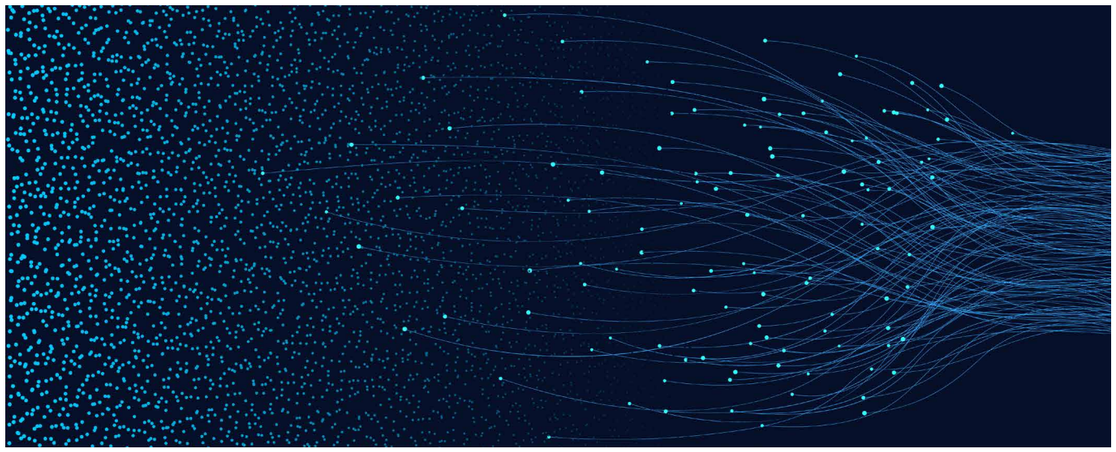
	State Street	BNY Mellon	J.P.Morgan	citi	Northern Trust	BNP Paribas	Total
Assets under Custody ($Tn)	USD45.5tn	USD41.7tn	USD33.2tn	USD25tn	USD16.2tn	USD15.2tn	$176Tn
Avg. custody fee (%)	1.8bps	1.3bps	1.3bps	1.8bps	2.8bps	1.6bps	avg ~ 1.8ps
Securities services fees ($Bn)	USD8.2bn 25% of rev.	USD5.5bn 50% of rev.	USD4.3bn 0.5% of rev.	USD2.8bn 6% of rev.	USD4.4bn 65% of rev.	USD2.4bn 5% of rev.	USD27.8bn

Source: Companies; Bryan, Garnier & Co

From digitisation to tokenisation

In our modern financial system, most securities already exist in a digital format. Security ownership is essentially the information that ties a legal person to a financial security, its corresponding stream of cash flow, and other rights such as shareholder votes. Whether we use DLT or existing post-trade systems, the custody and settlement concept remain the same: an exchange of security ownership. Thus, the key issue for DLT adoption is to determine for which securities the above process is better handled using DLT.

From our discussions with various post-trade players, we understand that the use of DLT for equity capital markets would not provide a significant improvement in terms of reducing the settlement period. The infrastructure in place is already capable of supporting same day settlement. We also understand that for equities, using DLT would not lead to a significant cost reduction in the short term because post-trade costs related to equity trades would be somewhere similar if we were to use DLT.



Benefits of DLT-based asset services

Post-trade service providers will need to adopt DLT for same day settlement in order to avoid losing their spot in the post-trade flow. As the shift towards asset digitalisation is already under way, major custodian banks are expanding their custody services to digital assets, relying on the expertise of third-party technology provider like Fireblocks, Taurus or Metaco. Indeed, custodian banks are not the savviest technology developers and tend to use more and more external solutions for their technology needs, as illustrated by the move towards third-party-developed core banking systems over the past decades.

In our view, the adoption of this new infrastructure offers a great opportunity for traditional players and underlying technology providers. As set out below, digital asset services offer several advantages for capital markets participants compared with the legacy form.

FIG 24: BENEFITS OF THE DLT-BASED INFRASTRUCTURE

	Legacy technological infrastructure					DLT-based infrastructure	
Settlement time	Equity	Bonds, derivatives	Alternative			(Near) real time	
	T+1	T+2/3	Undefined				
Cost	Total	Execution	Clearing & settlement	Custody	Other	Total	DLTs blur the delimitation lines between service providers. The emergence of new business models in the sector (like SaaS) makes the segment pricing comparison less relevant.
	20 bps	0.75 bps	0.75 bps	1.5 bps	17 bps	10 bps*	
Post-trade procedure	Cumbersome, manual, error-prone					Shrunk to minimum requirement, automated	
Liquidity	Equity	Bonds, derivatives	Alternative			Strong across the board, especially on private assets	
	High	Average	Low				
Security	High security but still exposed to errors and system failures					Limited human intervention, no systemic risk given distributed nature of DLTs, secure encryption features	
Comments	Unclear advantage for equity tokenization, strong traction for illiquid assets, bonds and OTC derivatives that would benefit most from tokenization and DLT-based. We consider scale effects are a powerful cost reduction weapon that should foster adoption rate of DLT-based infrastructure.						

*: assuming average adoption of DLT by 2030e

Source: Bryan, Garnier & Co

Liquidity

The deployment of blockchain-based applications could have a massive impact on capital markets liquidity and capital requirements. Indeed, as post-trade activities are performed nearly instantaneous with DLTs, counterparty risk and embedded capital requirements should vanish, thereby freeing up massive amounts of cash within the financial system. Needless to say, liquidity is at the heart of capital market efficiency and is essential in the price formation process. Tokenisation can bring liquidity to any asset class. Tokenized financial assets would effectively not be barred by the same boundaries as traditional securities. They could be tradable on a 24/7h basis independently of geographical restriction, bringing new influx of liquidity through the broadening of investor base. The divisibility of tokens (tokens can be traded in fractional amounts) would also enable investors with lower amounts of capital to participate in asset classes not easily accessible to retail investors (e.g. bonds). Each of these features would enhance capital markets efficiency, helping asset prices to mechanically fluctuate towards their fundamental value.

Collateral management in the repo market

The tokenization feature has interesting implications for the collateralised money market and securitisation in general. Indeed, tokenised assets could free up massive amounts of liquidity through the avoidance of overcollateralisation stemming from settlement lags and asset illiquidity; that are set to nearly disappear thanks to tokenisation. As such, DLT-based financial services should enable capital seekers taking part in the collateralised market to manage their cash and balance sheet in an optimal manner, avoiding the inefficiencies of illiquidity discounts and overcollateralisation. We concede these discounts are often minor, yet given the depth of the repo market and securitisation (USD3-5tn daily), even a 1bp change in collateral requirement has massive implications for liquidity across capital markets.

Cost avoidance

At scale, the blockchain is a highly cost-efficient technology for bookkeeping activities. As such, capital market services providers will lever this opportunity to slash their middle and back-office costs thanks to the great automation capacities embedded in DLTs.

Revenue opportunity stemming from new use cases

As the emergence of a new technology is often paired with revenue opportunities, we believe a DLT-based financial system should unlock market opportunities in securities emission, secondary trading and custody. Given the depth of the addressable market and the high volumes of transactions, we believe trillions of dollars are about to change hands with tokenisation.

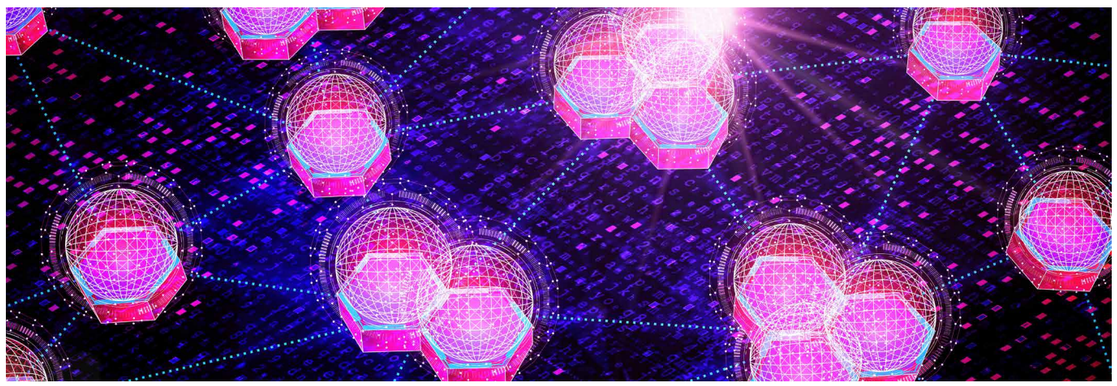
These trillions are actually about to move to a completely different market infrastructure and will require a whole new technology stack that the likes of Metaco, Taurus or Fireblocks are capable of providing.

Although blockchain-based technology offers numerous advantages, it remains likely that a full-scope DLT market infrastructure will never emerge. Indeed, some segments of the market infrastructure are already well optimised (especially in equity trading), such that upgrading to blockchain-based technologies would offer very limited improvement potential, thereby constituting a hurdle to mass adoption.

A hybrid model

Given that a full-scope adoption of DLTs is quite uncertain, we consider a hybrid model where blockchain and legacy infrastructure would co-exist and work hand-in-hand is likely to emerge. The partial adoption of DLTs and the emergence of a hybrid model backs the idea that legacy service providers will have to upgrade their offering or partner with new entrants to remain in business. As such, we see many potential evolutions for DASPs' business model. As an example, technology providers could leverage their imbrication with their clients' IT infrastructure to become a sort of augmented core banking software providers and ousting incumbents' solutions.

Although incumbents could invest massively in developing DLT-related services, we consider they are unlikely to do so. Indeed, the high technological entry barrier and uncertainty regarding the emergence of a full-scope DLT capital market infrastructure, offers limited visibility on ROI for these investments. As such, the most sensible solution for traditional custodians would be to partner with blockchain-native service providers to distribute or integrate their products.



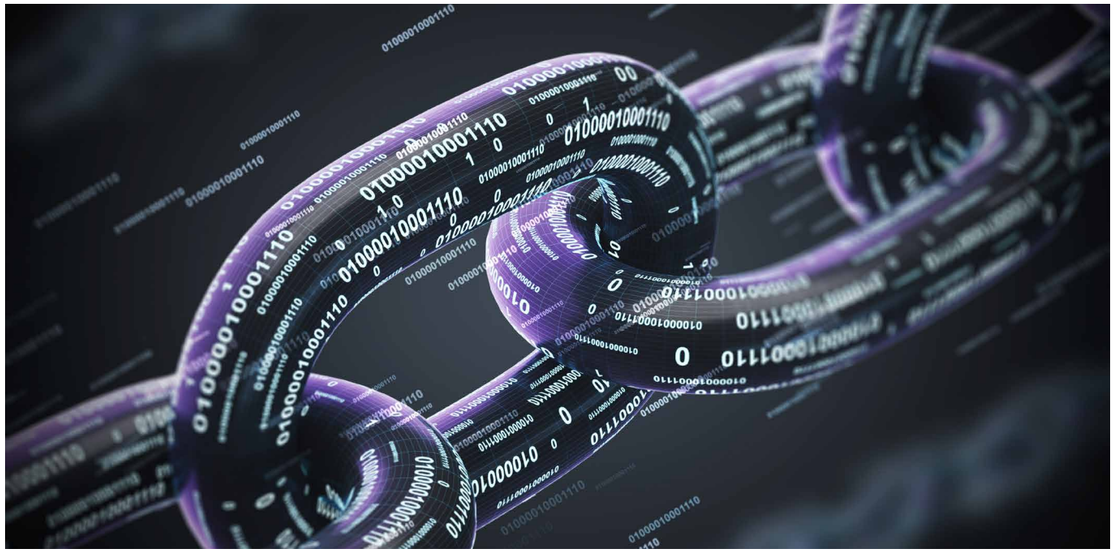
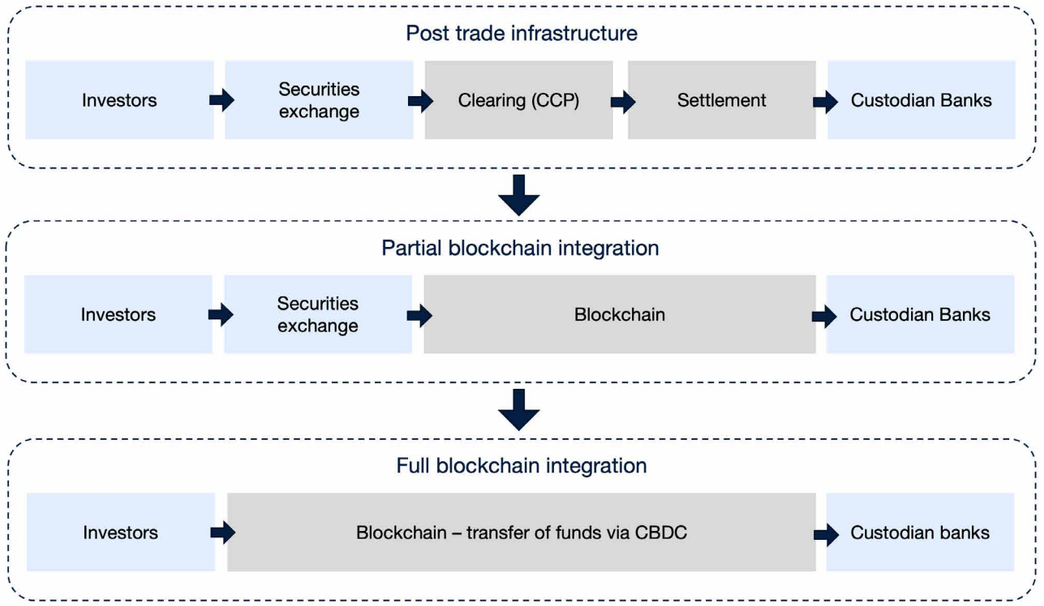


FIG 25: A HYBRID MODEL



Source: Bryan, Garnier & Co

MARKET
OPPORTUNITY

SECTION 4

As discussed earlier, the digital asset service market is currently limited in size since it is still in the teething stages. Nonetheless, it could grow at an exceptional rate as tokenisation gradually unlocks the opportunities harboured in the EUR780+tn financial system. As there is limited visibility in the evolution of the tokenised asset market, we believe agnostic technology providers (i.e. refraining from taking directional bets) are the best armed to adapt to and take advantage of the digitalisation waves ahead of us.

Our approach to market sizing

We decided to tackle the market sizing issue from an AUC standpoint: we determined DASPs' addressable revenue pool by multiplying the total value of tokenised assets by an average custodian fee. We acknowledge this method consists in applying a probably outdated business model to an emerging industry that is more likely to generate revenue from subscription, license sales or pay-as-you-go schemes. Although this technique is unperfect as it doesn't fit the new monetisation models that could emerge, we consider it as valid quantitative approach to this exercise. We acknowledge our methodology is unable to capture the market potential emerging from utility tokens and non-fungible personal tokens as these can hardly be valued and therefore subject to a value-based custody fee.

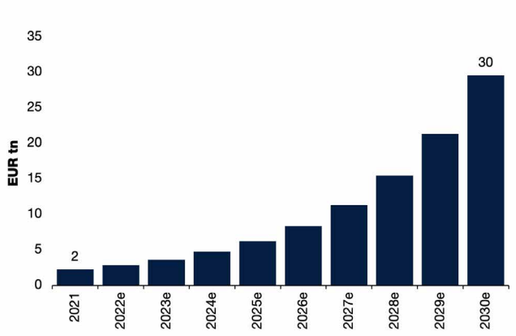
A deep and expanding market opportunity

As mentioned, the revenue opportunity for the DAS sector is defined as the total market value of digital assets multiplied by the average service fee charged for these services. The growth rate of the sector's revenue should be a balance between the sharp progress in the tokenisation rate (driven by adoption of the technology) on the one hand and deflation in service fees (as a percentage of the value of the asset being serviced) on the other hand.

Our central scenario suggests this market could represent about EUR29bn in revenue by 2030e, implying a 26% CAGR of what we estimate is currently a EUR4bn market. These figures are based on the following assumptions.

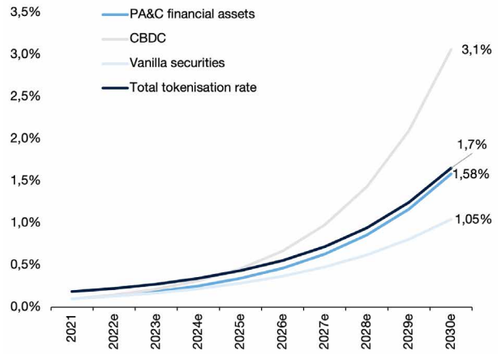
The tokenisation rate of assets is set to soar from an estimated 0.1% in 2021 to 1.7% by 2030e. As such, the share of cryptocurrencies in the total digital asset market is set to drop from roughly 45% to 7% within the timeframe mentioned. Our estimates are based on the assumption that nearly 30% of the fiat currency base could turn into CBDC; 10% of private, alternative and complex financial will become tokenised while vanilla securities are expected to reach a rate of tokenisation of 5% within the next 15 years.

FIG 26: DIGITAL ASSETS TOTAL MARKET VALUE



Source: BIS; Coinmarketcap; Savills; SIFMA; World Bank; Bryan, Garnier & Co

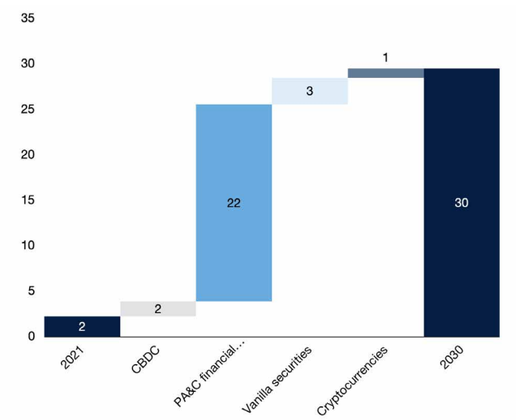
FIG 27: ASSUMED TOKENISATION RATE BY ASSET CLASS



Source: BIS; Coinmarketcap; Savills; SIFMA; World Bank; Bryan, Garnier & Co

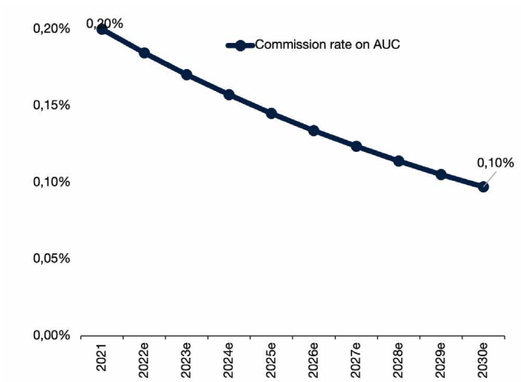
Consequently, the total market value of digital assets could soar from EUR2tn to EUR30tn between 2021 and 2030e, implying a CAGR of 33%. Given that private, alternative and complex assets are by far the deepest class within the total pool, this category should be a major contributor to asset digitalisation (see below).

FIG 28: DIGITAL ASSETS - MARKET SIZING BRIDGE (EURTN)



Source: BIS; Coinmarketcap; Savills; SIFMA; World Bank; Bryan, Garnier & Co

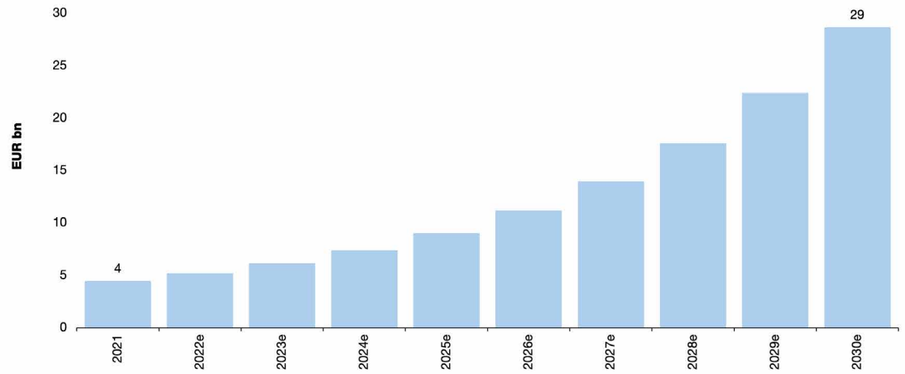
FIG 29: AVERAGE SERVICE FEE



Source: BIS; Coinmarketcap; Savills; SIFMA; World Bank; Bryan, Garnier & Co

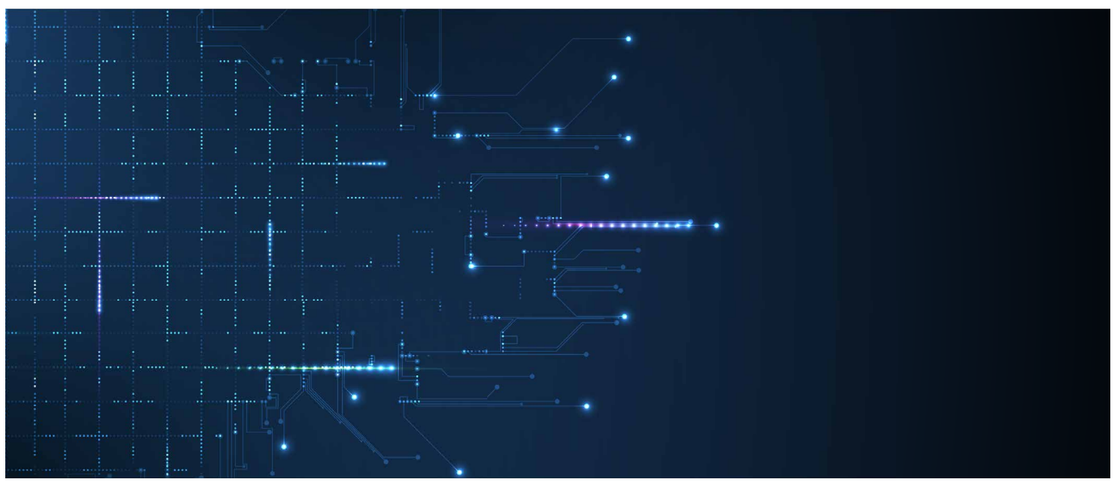
By 2030e, the cost of DAS will drop by nearly 50% to an average of 0.1% of AUC. Our assumption factors a 70% long term decline that will be driven notably by the economies of scale harboured in the high scalability and fixed costs implied by the blockchain technology. Factoring the +33% CAGR in total digital asset market and the -8% CAGR erosion in fees, our calculation trace to a 26% CAGR progression in revenue opportunity out to 2030e. The DAS business would therefore represent a EUR29bn opportunity by 2030e.

FIG 30: DASP ADDRESSABLE REVENUE POOL ESTIMATE



Source: BIS; Coinmarketcap; Savills; SIFMA; World Bank; Bryan, Garnier & Co

Our forecasts are far from aggressive considering that we assume only 1.7% of the total value of financial assets could be tokenised by 2030e. Furthermore, our estimated 70% long-term drop in the average DAS fee is a very conservative approach to the industry, reinforcing the credibility of our forecasts.



Alternative scenarios

To complement our central assumptions, we also provide bull and bear scenarios for comparison.

Bear case: 12% CAGR

Our bear scenario factors a slower adoption of tokenisation in the financial system (0.6% in 2030e) leading to a total token market value of EUR13tn. These assumptions imply a revenue opportunity of EUR13bn, or a 12% CAGR out to 2030e.

FIG 31: DIGITAL ASSETS TOTAL MARKET VALUE (EURTN)

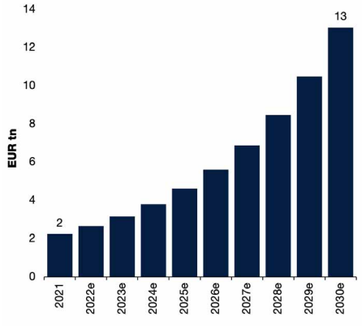


FIG 32: ASSUMED TOKENISATION RATE BY ASSET CLASS

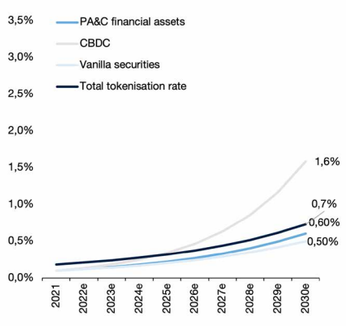
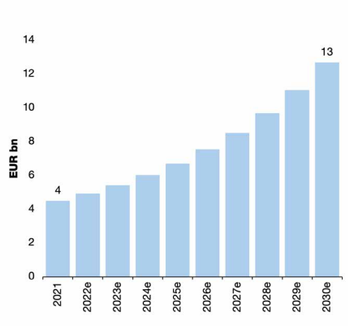


FIG 33: DASP ADDRESSABLE REVENUE POOL ESTIMATE (EURBN)



Source: BIS; Coinmarketcap; Savills; SIFMA; World Bank; Bryan, Garnier & Co

Bull case: 32% CAGR

Our bull scenario factors a faster adoption of tokenisation in the financial system (3.2% in 2030e) leading to a total token market value of EUR57tn. These assumptions imply a revenue opportunity of EUR55bn, or a 32% CAGR out to 2030e.

FIG 34: DIGITAL ASSETS TOTAL MARKET VALUE (EURTN)

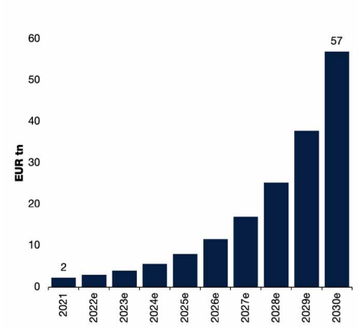


FIG 35: ASSUMED TOKENISATION RATE BY ASSET CLASS

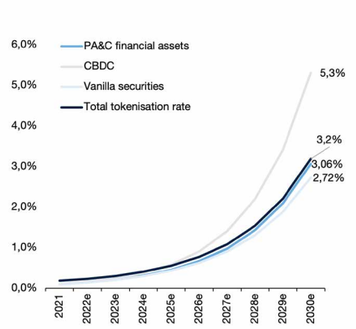
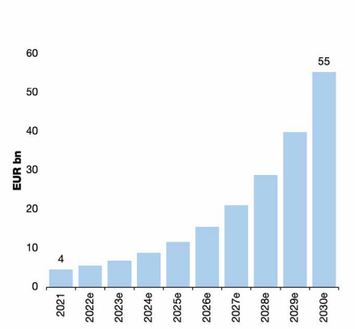


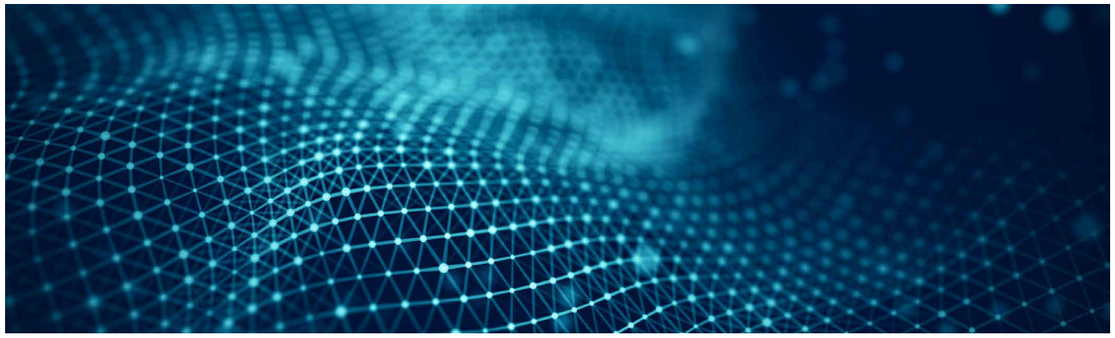
FIG 36: DASP ADDRESSABLE REVENUE POOL ESTIMATE (EURBN)



Source: BIS; Coinmarketcap; Savills; SIFMA; World Bank; Bryan, Garnier & Co

The upside to these scenarios will depend on the penetration rate of tokenisation and the evolution of the fee collected by DASPs. Our assumption of a sharp decline in commissions (-70% in 15 years) could prove too conservative and would add further upside to our scenarios.

Let us recall that our market sizing estimates are derived from the assumptions that the DAS industry will generate revenue based on the value of the asset under their custody. We acknowledge this approach does not reflect their actual business model but we consider it as a valid approach to tackle the issue.



Economics of digital asset services (or why outsource to specialists)

As demonstrated, DASPs are a highly scalable business tapping into a tremendous market that is likely to grow at a CAGR of 26%.

Given their cost-related competitive advantage, DASPs should attract customers at an accelerating rate, fostering scale effects that should in turn fuel the operating leverage flywheel. We expect this movement to foster concentration within the industry and reinforce the position of the most efficient players. The latter could therefore end up with monopoly-like profitability levels.

Following this reasoning, there is no doubt traditional service providers should partner with digital assets specialists to offer such services instead of developing their home-grown offer. Indeed, early signs of this trend are already noticeable as several traditional custodian banks have formed partnerships with digital asset custody specialists to offer such services.

Consequently, we expect the DAS business model to be increasingly distributed as a white label service for legacy incumbents.

The market seems to be moving this way, as there are already several examples of notable partnerships between legacy custodian banks and digital-native service providers (see below).

FIG 37: NOTABLE PARTNERSHIPS

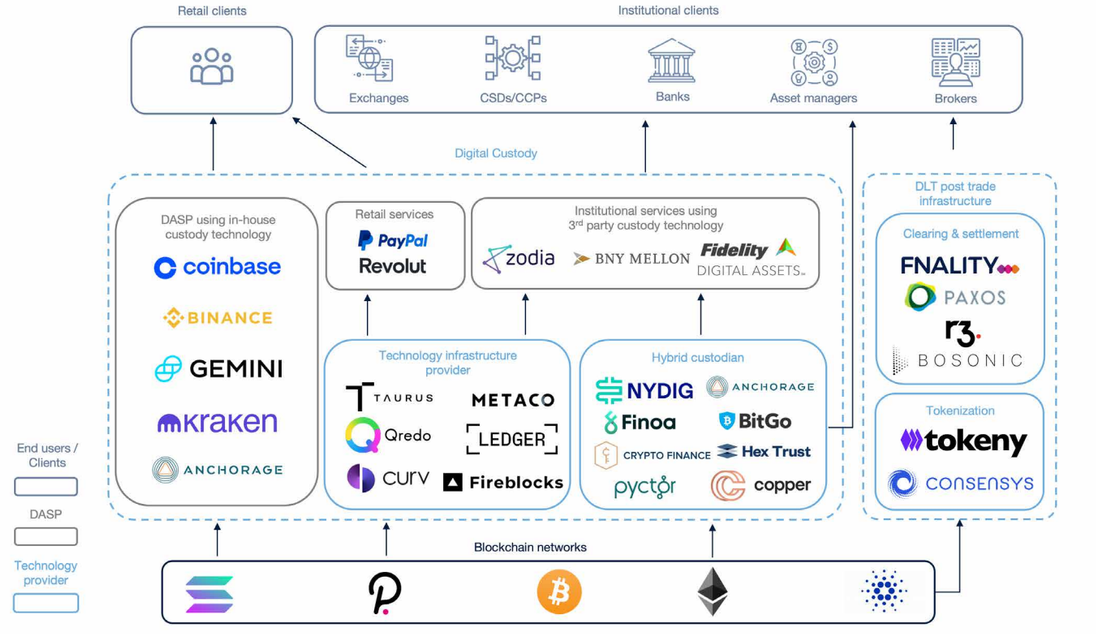
DASP	METACO	copper	Fireblocks	TAURUS
FMIs/Bank	citi, SOCIETE GENERALE, BNP PARIBAS SECURITIES SERVICES	STATE STREET	standard chartered, BNY MELLON, BNP PARIBAS SECURITIES SERVICES	caceis INVESTOR SERVICES
Business model	Digital asset technology infrastructure provider	Hybrid Custodian	Digital asset technology infrastructure provider	Digital asset technology infrastructure provider
Storage method	Hot/warm/cold storage	Hot/Warm storage	Hot/warm storage	Hot/Warm/Cold storage
Product	Digital asset management platform *(White-label)*	Digital asset management platform with direct custody	Digital asset management platform *(White-label)*	Digital asset management platform *(White-label)*
Description	Provider of an institutional-grade core end-to-end orchestration software which enables institutional clients to issue, store, trade, and manage digital assets.	Digital asset service provider offering self, and 3rd party custody as well as trading and settlement solutions for institutional & retail clients.	Tech provider offering a SaaS solutions enabling institutional clients to move, store and issue digital assets.	Technology infrastructure provider offering end-to-end technology stack for digital asset issuance, trading and storage.
Client type	Institutional clients	Institutional & retail clients	Institutional clients	Institutional clients

Source: Companies; Bryan, Garnier & Co

Some banks have developed in-house digital asset solutions such as JP Morgan. Since 2020, the bank operates a blockchain-based settlement service platform named Onyx, dedicated to information, wholesale payment, and digital assets exchanges. The platform enables atomic settlement for digital assets transactions using the JPM Coin system which serves as the payment leg in a transaction. JP Morgan will likely need to partner up with 3rd party DASPs nonetheless as many other capabilities such as digital asset custody platform would be needed in order to safeguard and operate its tokens.

Business models

FIG 38: KEY STAKEHOLDERS



Source: Blockdata; Bryan, Garnier & Co

The Digital asset custody ecosystem is already fragmented. They are several types of business models serving either retail or institutional clients and offering physical or digital custody services. We identify three main types of business model operating in the space.

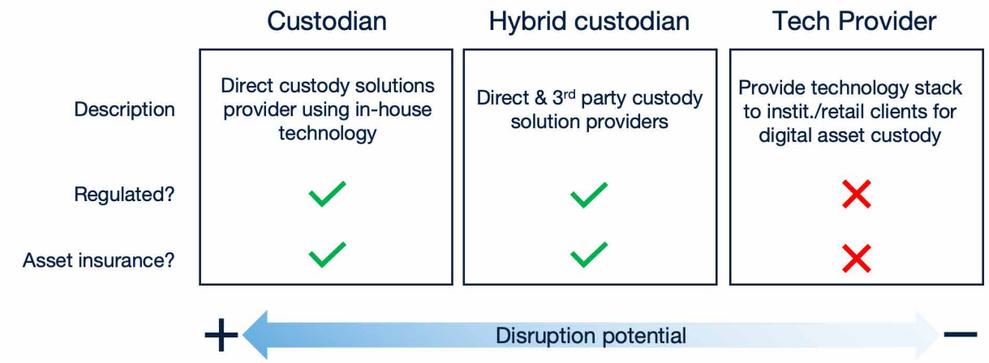
Pure custodians are responsible for the safekeeping of a client's private keys against theft or loss. They have control over a client's private keys and are liable in the event of theft or loss up to certain amounts.

These are typically crypto-exchange native players that have evolved to offer in-house custody solutions bundled with wallets. They mainly serve retail clients and must be regulated entities in regions where the legislation is in place.

Hybrid custodians provide direct digital asset custody and third-party solutions that can be integrated via APIs so that retail and institutional players can offer custody solutions. They remain the custodian and take on the risk of safekeeping the digital assets. They do not use third party technology and typically rely on their own infrastructure.

Technology infrastructure providers equip institutional or retail players with the technology stack enabling them to provide digital asset custody services to their clients. They give their clients a high degree of flexibility to make up their own security rules to store assets. The private keys are managed by the client (e.g. an institution or custodian), and as such, they do not take on the risk of loss of the asset under custody from their clients (or only if the technology fails).

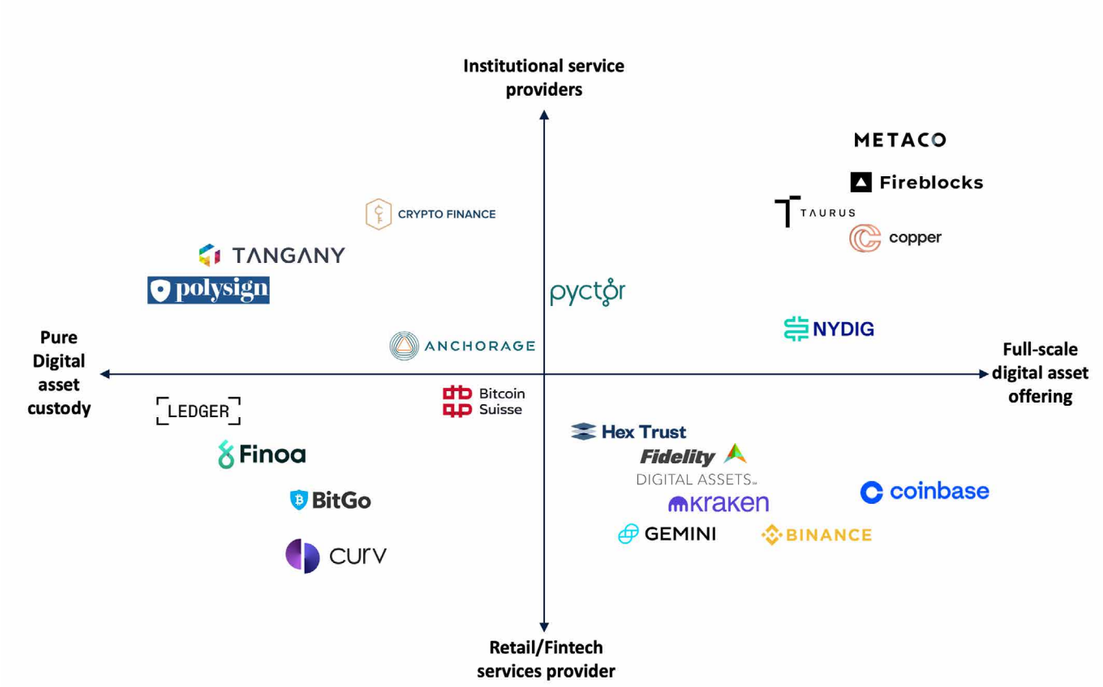
FIG 39: CLASSIFICATION BY TYPE OF SERVICE OFFERED



Source: Bryan, Garnier & Co

Finally, we have mapped the sector's key players according to two criteria: the breadth of their offering from pure digital asset custody to a full-scale technology and asset service offering on the x-axis; and the type of client addressed (retail vs institutional) on the y-axis. We consider the top-right corner (full-scale service offering for institutional clients) is the least exposed to disruption and offers the greatest potential (see mapping below).

FIG 40: KEY PLAYERS MAP

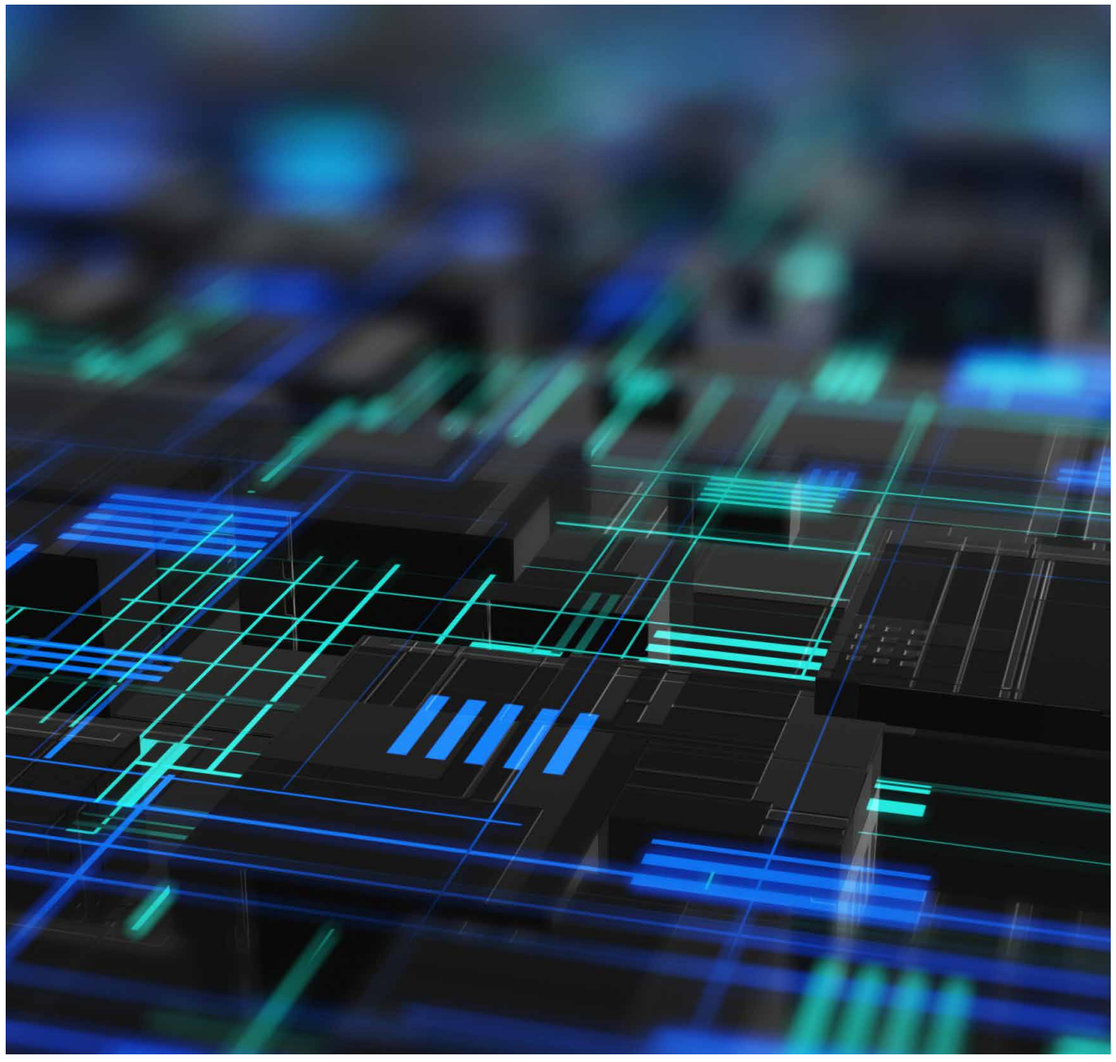


Source: Bryan, Garnier & Co

We consider technology providers are the best positioned players to take advantage of the take-off in the digital asset economy. Indeed, their application-agnostic technology makes them less exposed to potential disruption, while their business model embeds revenue recurrence and potential economies of scale. In our view, DASPs providing the technology stack for the custody, trading, and issuance of digital assets to financial institutions have the opportunity become the backbone of tomorrow's capital markets infrastructure. Multiple collaborations are emerging. In Feb-22, BNY Mellon announced the launch of crypto custody services in collaboration with Fireblocks to equip its clients with cryptowallets powered by their technology. Taurus recently partnered with CACEIS, a leading European asset servicing institution, to offer digital asset custody solutions through its platform. They plan to jointly develop solutions to automate corporate actions processing and dividend payments using smart contracts. But, custody technology is not the only entry door anymore. Ahead of the EU DLT pilot regime, Metaco has recently gained a lot of traction with the largest financial institutions. The firm secured agreements with global banks including Société Générale, BNP Paribas, Citi Bank, Standard Chartered to license its orchestration platform enabling the end-to-end management (from issuance to trading) of digital tokens.

KEY PLAYERS
& LANDMARK DEALS

SECTION 5



EURONEXT

Euronext is a leading pan-European market infrastructure player and the largest stock exchange group in Europe. It was originally created via the mergers of the Amsterdam, Paris, and Brussels stock exchanges in 2000. Euronext now operates exchanges in Paris, Amsterdam, Brussels, Lisbon, Dublin, Oslo, and Milan. Many popular European benchmark indexes are created by Euronext, such as AEX, BEL 20, CAC 40, and PSI 20. Euronext's offerings cover a wide array of assets, including equities, exchange traded funds (ETFs), warrants and certificates, bonds, derivatives, commodities, and indices.

Euronext is also the 3rd largest CSD operator, after Euroclear and ClearStream, with EUR6.3tn in AUC, and 120m settlements instructions per year. Euronext operates around 3 verticals: 1) Listing & trading 2) Clearing, custody & settlement 3) Data services.

Euronext has been active on the digital asset space and plans to offer exposure to crypto assets through a suite of new products. After having successfully listed cryptocurrency ETF equivalents (ETPs), the group will soon launch a new family of Euronext branded crypto-indices. Moving forward, Euronext wants to provide its clients with exposure to crypto-assets with the same level of regulatory security and operational efficiency as on Euronext's core markets. The acquisition of a 23.5% stake in Tokeny showcases the group's ambition to integrate next generation post trade solutions to their offering.

Fireblocks

Fireblocks is a digital platform provider delivering the technology infrastructure to move, store, and issue digital assets. Fireblocks enables exchanges, custodians' banks, liquidity providers, and hedge funds to securely scale their digital asset operations through Fireblock's network that connects them to crypto currencies capital markets. On top of that, they provide custody solutions through their MPC-based wallet solutions.

Fireblocks operates on a SaaS model and recently reached the USD 100m mark in ARR in 2022, growing from 150 to 1500 customers over 2021-22 with a target to reach 1,800 clients by 2023. Since 2020, Fireblocks have raised a total of USD 1B. The firm raised USD550m in a Series E valuing the company at an USD8b in Dec-21 or 80x its ARR.

The technology provider signed partnerships notably with BNP Paribas, Six Digital Exchange, ANZ Bank, FIS, Checkout.com, MoonPay, Animoca Brands, and Wire.

Taurus is a Swiss company founded in 2018, and operating out of Geneva. It operates as a digital asset service provider which offers an end-to-end technology stack for digital asset issuance, custody, and trading. Taurus' activity revolves around 3 verticals:

• Issuance & Management: Taurus offers a platform that enables the issuance, digitization, and lifecycle management of tokenized assets.

• Storage & Transfer: Taurus offer hot, warm, cold custody solutions via on premise or SaaS to institutional clients, in particular to banks. They also provide APIs enabling the connection between different blockchain protocols to transfer assets and manage counterparty risk for tokenized assets.

• Exchange & Trading: Taurus also provide a regulated digital asset marketplace to trade and manage digital assets or tokenized securities.

Taurus has established numerous partnerships to provide the infrastructure with large banks offering digital asset solutions in Switzerland.

The Swiss firm raised over CHF10m in 2020.

Taurus serves the likes of Credit Agricole, Temenos, Caceis, Swissquote, SEBA Bank, Vontobel, and Arab Bank.

METACO is a Swiss company that provides mission-critical software infrastructure enabling large financial institutions, banks, asset managers, and corporates build their digital asset operations.

METACO's custody orchestration platform, Harmonize™, is built in partnership with Tier-1 banks, for Tier-1 banks' complex use-cases and regulatory requirements, underpinned by the market's highest rated security model.

The platform is built around future-proof principles: custody-technology-agnostic, asset-agnostic, use case-agnostic, fully configurable governance frameworks, 100% API-ready with flexibility to independently integrate or build on top, deployable on-premise or consumed from private/public clouds.

The platform is built for a two-sided market: it enables asset servicers (e.g. custodians, securities services) to create a digital asset servicing business, while also enabling consumers of these services (asset managers, corporates) to aggregate and access these services, creating the network to facilitate the flows of digital assets seamlessly.

GMEX is a market exchange infrastructure vendor and consultant for electronic exchanges providing multi-asset trading, exchange matching engine and post-trade solutions.

GMEX recently acquired Pyctor, a post-trade market infrastructure technology providing secure digital asset custody and transaction network services for digital assets. Pyctor was created in partnership with ING, in collaboration with major financial institutions and regulators.

Copper is a London-based company which provides custody, trading, and settlement solution across crypto assets to institutional investors. Copper enables its clients to trade without moving its assets to exchanges through its ClearLoop network, which reduces risk of hacked, frozen, or misappropriated assets. Copper's secure wallet architecture is deemed as one of the safest on the market for custody – They have recently been selected to building a bespoke platform for State Street.
Copper is different from the pure technology provider as they are custodian which offers insurance against theft and hacking. They offer hot, warm and cold custody solutions.

The group raised USD50 million in a series B in March 2021.

Coper is a technology provider to State Street, Hehmeyer and FTX.

Landmark deals

Disclosed funding activity by financial market intermediaries (FMIs), Banks, Exchanges & Payment Providers

copper
Digital asset custody
USD196m
2022
BARCLAYS
TIGERGLOBAL

METACO
Digital asset custody
USD17m
2020
scventures
SWISS POST
avaloq
swisscom
Zürcher Kantonalbank

Fireblocks
Digital asset custody
USD1b
2021
BNY MELLON
SEQUOIA
COATUE
swisscom

curv
Digital asset custody
c.USD200-300m
Acquired in 2021
PayPal

TAURUS
Digital asset custody
USD10.9m
2021
LOMBARD ODIER
ARAB BANK

CONSENSYS
Blockchain solution
USD725m
2022
J.P.Morgan
UBS
HSBC
mastercard

BLOCKDAEMON
Digital asset custody
USD431m
2022
Goldman Sachs
TIGERGLOBAL
J.P.Morgan
citi VENTURES

ANCHORAGE
Digital asset custody
USD487m
2021
Goldman Sachs
KKR

PAXOS
Digital asset solution
USD539m
2021
BANK OF AMERICA
PayPal

polysign
Digital asset custody
USD158.2m
2021
COWEN
BREVAN HOWARD

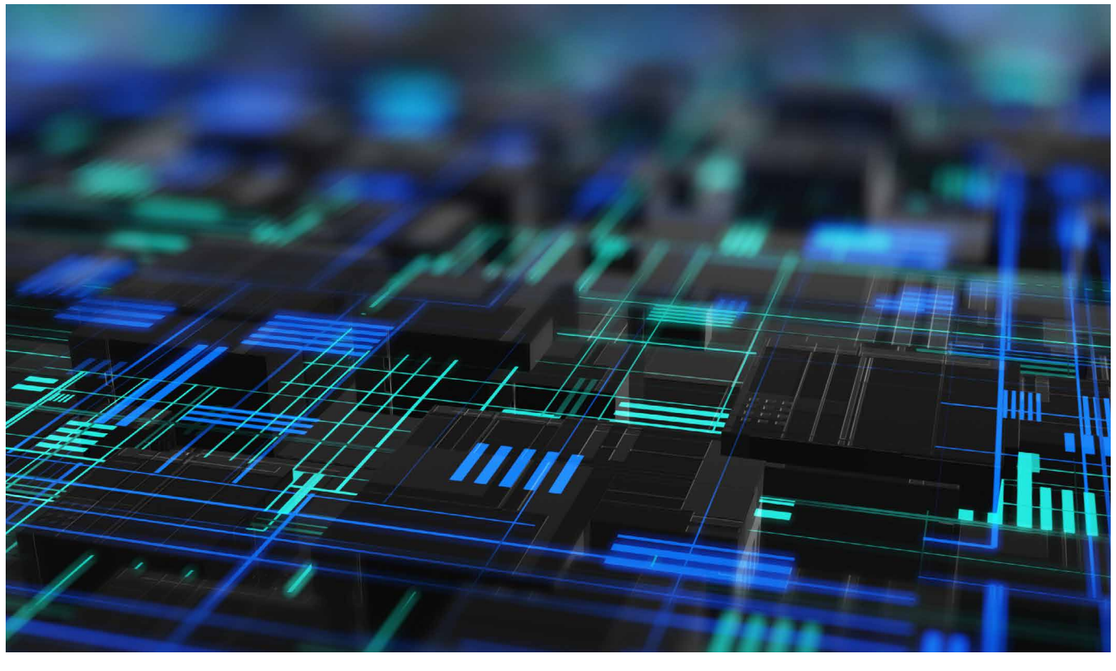
zodia
Digital asset solution
Unknown
2021
scventures
NORTHERN TRUST

NYDIG
Blockchain solution
USD1.4B
2021
affirm
FIS
fiserv.
Morgan Stanley

FNALITY
Digital asset solution
USD66m
2021
ING
UBS
CREDIT SUISSE
LLOYDS BANK
COMMERZBANK
KBC
Santander
BARCLAYS
Nasdaq
STATE STREET
BNY MELLON

LEDGER
Digital asset custody
USD468m
2021
CATHAY INNOVATION
DRAPER ASSOCIATES
10T

r3.
Distributed ledger
USD112m
2017
BNY MELLON
BARCLAYS
HSBC
UBS
TD Bank
BNP PARIBAS
MUFG
ING
NOMURA
WELLS FARGO

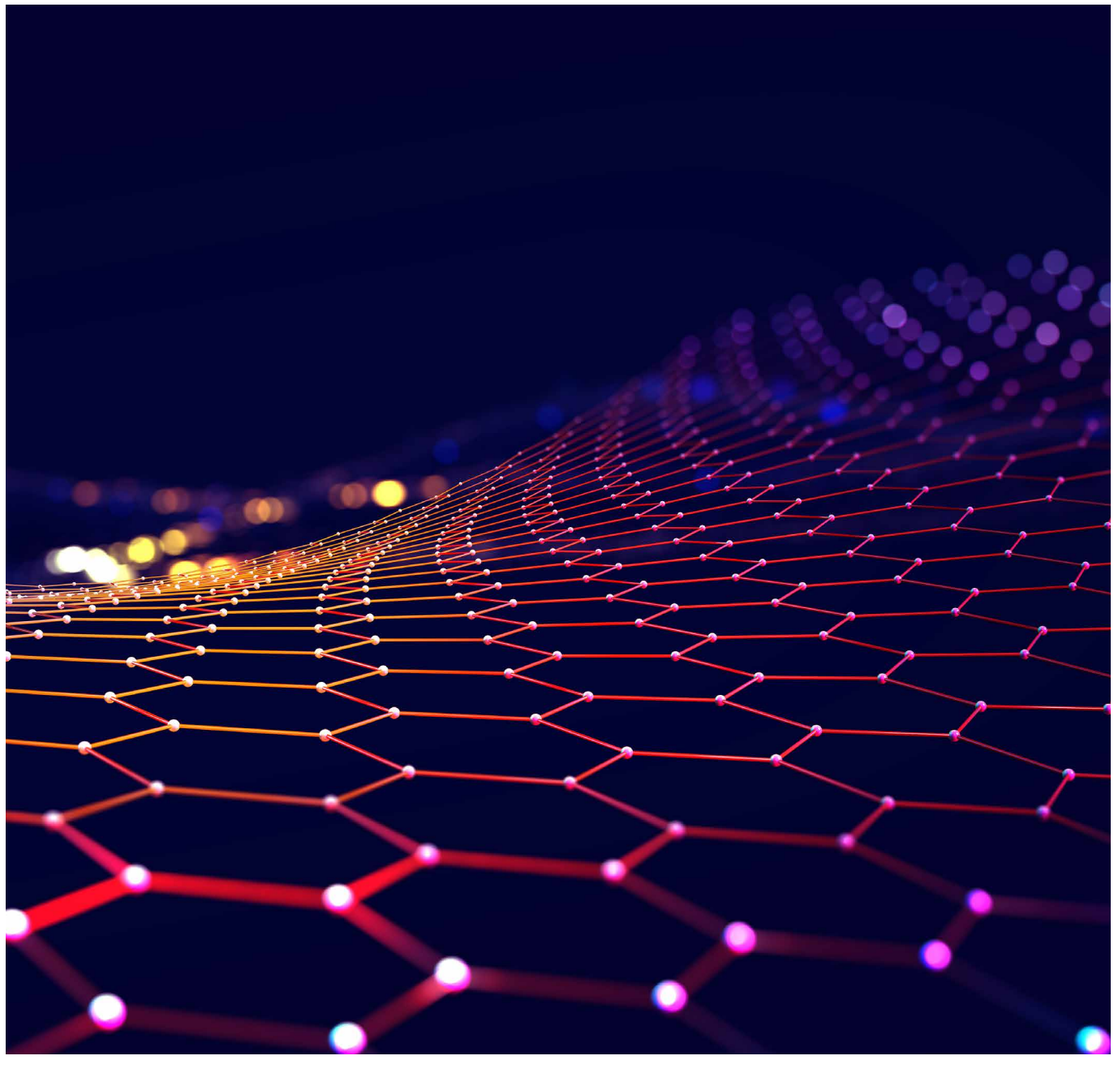


Appendix: Digital assets custody and Post Trade services Past Transactions

Date	Target/Investee	Country	Market	Description	Acquirer/investor	Deal Type	Financing Round / M&A rationale	Valuation	Size
Jul-22	pyctor	NE	B2B	Custody technology provider and transactional network services for a broad range of digital assets.	ING	M&A	Acquisition	Unknown	Undisclosed
May-22	copper	UK	B2B	Provider of a digital asset platform offering custody, prime brokerage, and settlements services on SaaS or on-premise. White-label solutions for financial institutions to deal with professional custody and execution services.	TIGERGLOBAL, BARCLAYS, ACCEL PARTNERS	PP	Series C		$500.0m
Apr-22	DFNS	FR	B2B	Provider of security technology for digital assets. Solutions consist of private keys sharding across a peer-to-peer network.	WHITE STAR CAPITAL, ABN·AMRO	PP	Series A		$13.5m
Apr-22	TANGANY	DE	B2B	white-label of hot and cold Wallet as a Service for secure storage for digital assets.	NAUTA CAPITAL	PP	Series B		$7.0m
Mar-22	Hex Trust	HK	B2B/B2C	Hex Trust is a fully-licensed provider of bank-grade custody for digital assets. They deliver custody, DeFi, Brokerage and financing solutions for financial institutions, and retail clients across Asia.	MORGAN CREEK CAPITAL MANAGEMENT	PP	Series B	Unknown	$88.0m
Jan-22	Fireblocks	US	B2B	Largest digital asset infrastructure provider with $2 trillion in digital assets transferred.	D1 CAPITAL PARTNERS, SPARK CAPITAL	PP	Series E		$550.0m
Jan-22	zero hash	US	B2B	B2B digital-asset-as-a-service infrastructure provider offering turnkey solution to allow any platform the ability for their customers to buy/sell, send/receive, reward, earn and stake digital assets	BainCapital PRIVATE EQUITY, POINT72 VENTURES	PP	Series D	c.$500m	$105.0m
Dec-21	NYDIG	US	B2C	Delivers Bitcoin products across industries, from banking and insurance to fintech and nonprofits.	WESTCAP, Morgan Stanley	PP	PE growth	$7,000.0m	$1,000.0m
Dec-21	ANCHORAGE	US	B2B/B2C (Mainly)	Federal bank charter owner and custody solution provider for institutional clients. Digital asset services and exchange platform providerfor retail clients.	KKR, THOMABRAVO, Goldman Sachs	PP	Series D	$3,000m	$350m
Dec-21	CRYPTO FINANCE, DEUTSCHE BÖRSE GROUP	CH	B2B	Digital asset trading/brokerage infrastructure provider. Also provides in-house custody, tokenisation and blockchain infrastructure solutions for institutional clients.	DEUTSCHE BÖRSE GROUP	M&A	Acquisition	Unknown	$109m
Jul-21	coincover	UK	B2B	Insurance provider for digital asset custodians (hot wallets) against theft or lost keys.	DRW VENTURE CAPITAL	PP	Series A		$11.6m
Jun-21	mercuryo	UK	B2C	Digital asset infrastructure provider notably through its digital asset payment gateway.	Target Global	PP	Series A		$7.5m
Jun-21	Ledger	FR	B2B & B2C	crypto assets hardware wallet provider.	CATHAY INNOVATION	PP	Series C	$1,500m	$380.0m
Apr-21	Finoa	DE	B2C	digital asset custody and financial services platform provider for retail clients.	Balderton capital	PP	Series A	Unknown	$22.0m
Apr-21	PAXOS	US	B2B/B2C	Regulated blockchain infrastructure platform provider. Technology solutions to tokenize, custody, trade and settle assets.	BANK OF AMERICA, FOUNDERS FUND, PayPal	PP	Series D		$300m
Mar-21	KOMAINU	UK	B2B/B2C	JV between Nomura, Ledger, and CoinShares. Compliant custody services for digital asset	NOMURA	PP	Series A		$25.0m
Mar-21	curv	ISR	B2B & B2C	leading provider of cloud-based infrastructure for digital asset cusotdy based in Tel Aviv, Israel.	PayPal	M&A	Acquisition		Undisclosed
Jul-20	METACO	CH	B2B	digital assets infrastructure technology provider for custody, trading, tokenization, staking and smart contract management for institutional clients.	Gieseke+Devrient, standard chartered	PP	Series A		$17.0m
Jul-20	Bitcoin Suisse	CH	B2B	crypto asset gateway provider for investing & institutional-grade crypto services.	Undisclosed	PP	Series A	$326.0m	$50.0m
Apr-20	TAURUS	CH	B2B	Enterprise-grade digital assets market infrastructure solutions based on DLT for financial services to institutional clients.	ARAB BANK	PP	Series A		$10.0m

LEXICON

SECTION 6



Blockchain: form of distributed data base capable of efficiently storing data in a decentralised manner.

Cryptocurrency: type of digital native asset which transactions are recorded on a DLT.

Digital asset: cryptographic asset which transactions are recorded on a DLT.

DAS (Digital Asset Service): array of financial and other services that can be offered leveraging DLT and digital assets.

DASP: Digital Asset Service Provider

DLT (Distributed Ledger Technology): distributed data base that can record transactions at different places simultaneously.

Ethereum: is the name of a blockchain, and Ether and is a cryptocurrency based on that network.

Mining: activity of validating a transaction in the framework of a PoW blockchain.

Minting: issuing a digital asset on a DLT.

Node: network or blockchain participant.

Public key: unique cryptographic identification code on a DLT.

Private key: decryption key associated with the public key that protects the digital assets.

Staking: committing digital assets to validate transactions in the framework of a PoS DLT.

Storage: safekeeping the private key protecting digital assets in either a hot, warm or cold environment.

Token: generic definition of DLT-based assets.

Tokenisation: process of transforming existing assets into tokens.

T2S (TARGET 2 Securities): European central settlement platform.

Just like light bulbs were not invented by candle makers, the future of digital asset services is unlikely to stem from legacy custodians. Indeed, we believe tech-savvy new entrants will strengthen their competitive edge on the back of a light and agile structure enabling powerful scale effects. Consequently, DASPs are likely to gain new partnerships and expand their market share as the digital asset opportunity keeps growing. If DASPs as technology providers are direct beneficiaries of the transition to a digital financial system, other stakeholders are set to take advantage of it too. Indeed, tokenisation technologies pave the way for a wealth of new applications.

The most direct and visible implication of the march to digitalisation is obviously the emergence of CBDCs, which could reshape the entire financial system in many ways. Being issued by monetary authorities, CBDCs are on track to become the safest asset for settling transactions, thereby erasing counterparty risk. Furthermore, the digital version of a legal tender could find plenty of applications in retail payment given its safety, liquidity and immediacy features that are perfect fit for value transfers. Besides these examples, tokenisation could completely reshuffle business models in the banking, capital market, legal, investment, custody or payment industries.

A successful implementation of DLTs by the financial industry could foster adoption at a greater scale in the entire economy, thereby unlocking new use cases and business opportunities for DASPs.

BRYAN, GARNIER & CO

Investment Banking for a Better Future

WHITE PAPER **AUTHORS**

JEAN-MALO DUPART
Managing Director
Paris
jmdupart@bryangarnier.com

BERK KIRCA
Director
Munich
bkirca@bryangarnier.com

PAUL CHARPENTIER
Associate
Paris
pcharpentier@bryangarnier.com

PAUL ROUVIERE
Intern
Paris
prouviere@bryangarnier.com

CORPORATE TEAM

THIBAULT DE SMEDT
Partner
Paris
tdesmedt@bryangarnier.com

STANISLAS DE GMELINE
Partner
Paris
sdegmeline@bryangarnier.com

JEAN-MALO DUPART
Managing Director
Paris
jmdupart@bryangarnier.com

JONATHAN BOHBOT
Managing Director
Paris
jbohbot@bryangarnier.com

MARC-ANTOINE JANNY
Managing Director
Paris
majanny@bryangarnier.com

BERK KIRCA
Director
Munich
bkirca@bryangarnier.com

ANTON SANDVALL
Vice President
Stockholm
asandvall@bryangarnier.com

INTERNATIONAL TEAM

FALK MÜLLER-VEERSE
Partner
Munich
fmullerveerse@bryangarnier.com

NICOLAS D'HALLUIN
Partner
New York
ndhalluin@bryangarnier.com

TOR BETHERLIUS
Partner
Stockholm
tberthelius@bryangarnier.com

ERIK FURNES
Managing Director
Oslo
efurnes@bryangarnier.com

MAURICE HARBISON
Managing Director
London
mharbison@bryangarnier.com

STÄLE SCHMIDT
Managing Director
Oslo
sschmidt@bryangarnier.com

HAKON BENJAMINSEN
Managing Director
Oslo
hbenjaminsen@bryangarnier.com

KRISTIAN MELANDSO
Vice President
Oslo
kmelandso@bryangarnier.com

ABHIJIT KUNTE
Vice President
London
akunte@bryangarnier.com

EQUITY RESEARCH TEAM

JOHN KLEIN
Head of Equity Research
Paris
jklein@bryangarnier.com

THOMAS COUDRY
Managing Director
Paris
tcoudry@bryangarnier.com

GREGORY RAMIREZ
Senior Equity Analyst
Paris
gramirez@bryangarnier.com

PAUL CHARPENTIER
Associate
Paris
pcharpentier@bryangarnier.com

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BRYAN, GARNIER & CO

Investment Banking for a Better Future

LONDON
16 Old Queen Street
London, SW1H 9HP
UK

T: +44 (0) 207 332 2500

Authorized and regulated by the Financial Conduct Authority (FCA)

PARIS
92 Avenue des Champs Elysées
75008 Paris
France

T: +33 (0) 1 56 68 75 00

Regulated by the Financial Conduct Authority (FCA) and the Autorité de Contrôle prudential et de resolution (ACPR)

MUNICH
Königinstrasse 9
80539 Munich
Germany

T: +49 89 2422 62 11

NEW YORK
750 Lexington Avenue
New York, NY 10022
USA

T: +1 (0) 212 337 7000

FINRA and SIPC member

STOCKHOLM
Nybrokajen 5
111 48 Stockholm
Sweden

T: +46 722 401 080

OSLO
Beddingen 8, Aker Brygge
0250 Oslo
Norway

T: +47 22 01 64 00

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