FUND TOKENISATION

Mind the Gap
Operational Considerations for the
Tokenisation of Irish Domiciled Funds

if irish funds

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FOREWORD

Irish Funds initiated Project Springboard to develop a structured analysis of the core concepts for a tokenised fund domiciled in Ireland.

This initiative involves an examination of the key technology features, operational process implications, and importantly, the potential benefits that technological innovation can deliver to the funds ecosystem.

The objective is to provide a foundation for informed dialogue, enabling firms to identify and assess the key considerations necessary before embarking on a tokenisation strategy within the Irish regulatory and market context.

This work aligns with broader European efforts to modernise capital markets. The European Commission's Savings and Investment Union (SIU) strategy highlights the transformative potential of distributed ledger technology (DLT) in enhancing competition and efficiency across EU financial services. DLT is recognised as a key enabler for reducing operational inefficiencies, lowering transaction costs, fostering innovation, and increasing access for European investors. The Commission's targeted consultation on integration of EU capital markets[1] further explores DLT's implications for competition, legal certainty, interoperability, and the adequacy of existing regulatory frameworks. Through a harmonised approach to DLT adoption, the SIU aims to cultivate a more inclusive and dynamic financial ecosystem.

In parallel, both the Central Bank of Ireland (the Central Bank) and the Department of Finance have acknowledged the strategic importance of DLT and tokenisation. The Central Bank has emphasised the opportunities these technologies present for improving transparency, accelerating settlement, and enhancing operational efficiency, while underscoring the need for robust governance and risk management.[2] The Department of Finance, through its "Funds Sector 2030 Report" and the "Ireland for Finance"[3] strategy has signalled its commitment to fostering a regulatory environment that supports innovation and aligns with EU standards.

Ireland is a leading EU domicile for fund products notably in the money market funds (MMFs) space, in private asset strategies and has been at the forefront of innovation for exchange-traded funds (ETFs). Ireland offers a robust regulatory framework, global distribution reach, and operational expertise. Tokenisation, through the use of DLT, presents a transformative opportunity for funds by enabling faster settlement, enhanced transparency, and unlocking innovative and new functionality opportunities. For ETFs, tokenisation can streamline trading and improve liquidity, MMFs may benefit from real-time cash management and automated compliance, while private asset funds can unlock greater liquidity of traditionally illiquid assets and all may benefit from future expanded utility.

Tokenised fund offerings have gained momentum in recent years, evolving from pilots and proofs of concept to actual market adoption. In 2025, global tokenised real world assets (RWA) exceeded $36 billion[4], up from near-zero just a few years prior. This growth was driven by major asset managers launching tokenised products, primarily MMFs. Boston Consulting Group ("BCG") estimates that tokenised fund assets under management (AUM) could reach 1% of global mutual funds and ETF AUM in just seven years. This would imply an AUM of more than US$600 billion by 2030[5] .

1. Targeted consultation on integration of EU capital markets 2025 - Finance
2. Regulatory & Supervisory Outlook Report 2025
3. 2. Update to Ireland For Finance AP 2025 web.pdf
4. RWA.xyz | Analytics on Tokenized Real-World Assets
5. According to BCG Exchange-traded funds (ETFs) reached about 1% of total fund AUM within 7 years of the launch of the first one in 1993. With features rivalling ETFs, tokenised funds could potentially reach 1% of total AUM by 2030, implying more than US$600 billion in AUM. Tokenized funds could scale even higher if clear and low-friction conversion pathways are established for converting (tokenizing) existing mutual funds and ETFs
6. JPMorgan Debuts Tokenized BlackRock Shares as Collateral with Barclays

Ireland has emerged as an active participant in this trend. BlackRock and Fidelity International piloted projects in the tokenisation of their Irish domiciled MMFs for the use of collateral[6][7] on JP Morgan's Kinexys (previously Onyx) platform. Digital Platforms such as Archax, which offer tokenised access to Irish domiciled MMFs from firms such as BlackRock, State Street, Fidelity International, Legal & General Investment Management (LGIM) and Federated Hermes have made these products available to professional and institutional investors.

Tokenisation activity spans multiple regions. Franklin Templeton launched its first European tokenised MMF[8]. Firms have partnered with FinTech platforms to bring funds onto distributed ledger infrastructure in Asia, US and Europe. Global banks and custodians were also engaged, supporting tokenisation services and distribution via proprietary networks.

The broader tokenised RWA market grew an estimated 85% year-over-year. Despite this momentum, tokenised fund AUM remains a small fraction of the $7 trillion U.S. money fund sector[9], underscoring its early but rapidly evolving stage of adoption.

As the future state of fully onchain funds continues to evolve, it will require advancements in legal frameworks, regulatory clarity, technology, and market infrastructure. Accordingly, the content presented herein is offered as a thought leadership piece, intended to inform, educate, and support the transition from today's practices to tomorrow's possibilities. This analysis is not intended as legal, financial, or investment advice, but rather as a contribution to the ongoing conversation shaping the future of fund innovation in Ireland and beyond.

6. JPMorgan Debuts Tokenized BlackRock Shares as Collateral with Barclays
7. Fidelity International Tokenizes Money Market Fund on JPMorgan's Blockchain
8. Franklin Templeton launches tokenized fund in Luxembourg - Ledger Insights - blockchain for enterprise
9. Release: Money Market Fund Assets | Investment Company Institute

BLOCKCHAIN AND DLT

Fully functioning blockchain technology emerged in 2009 with the creation of the Bitcoin blockchain, with the pseudonymous creator Satoshi Nakamoto having solved an ongoing prior technical problem of double-spend, which had previously impeded its full realisation. The solution enabled security and trust in a trustless environment via cryptography, a crucial step in moving the practical implementation of the technology forward. Blockchains represent types of databases which store data in cryptographically linked blocks making them tamperproof and immutable, by design they are decentralised (but do not have to be) and are extremely valuable for tracking ownership, a highly applicable feature set in the asset and fund management spaces.

Blockchain represents a type of implementation of a generic data structure referred to as a decentralised form of DLT while it is important to note that *all blockchains are DLTs but not all DLTs are implemented as blockchains*. The key difference lies in how data is structured and managed. However, blockchain and DLT share many of the same valuable features. Ultimately, as pieces of sophisticated software, they are subject to change and do not remain static but undergo refinement and development over time. Changes to a blockchain that are backward compatible i.e. still aligned with earlier versions, are called soft forks. New software versions that are not backward compatible are referred to as hard forks i.e. earlier versions of the blockchain software will not be able to run later upgrades of the software, this constitutes a risk from a fund and asset management perspective. Understanding these aspects is critical to tokenisation on any specific chain – hard forks, on public blockchains, can lead to two distinct DLTs with a shared history up to a certain point but diverge after such a point. This potentially leads to a position where two DLTs emerge from one, purely driven by a software deployment change.

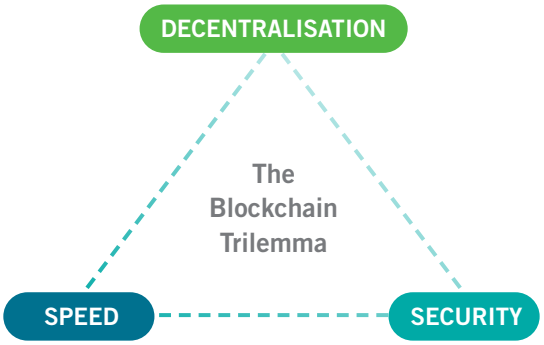
> *" You cannot step into the same river twice."*
> **– Heraclitus**

CATEGORY	BENEFIT	DESCRIPTION
Immutability & data integrity	**Tamper-proof records**	Once a transaction is recorded on the blockchain, it is nearly impossible to alter or delete. This creates a highly secure and verifiable record.
	Reliable verification trails	The permanent and unchangeable nature of the ledger simplifies verification or auditing processes and ensures the integrity of financial records and asset history.
Decentralisation & trust	**Trustless transactions**	Participants can transact directly with each other without needing a central intermediary, as the network's consensus mechanisms validate the transaction.
	Reduced counterparty risk	The elimination of middlemen and the automation of agreements via smart contracts lower the risk of one party not fulfilling its obligations.
	Distributed network	With data spread across many computers, the network is highly resilient to failures and cyberattacks, as there is no single point of failure.

Transparency & security	**Enhanced transparency**	All authorised network participants see the same shared, identical record of data in real-time, which increases accountability and discourages fraud.
	Advanced security	The data is secured with advanced cryptography, making it extremely difficult for hackers to breach the network and alter records.
	Fraud prevention	The transparency and immutability make fraudulent activities, such as counterfeiting products, much more difficult to get away with.
Efficiency & speed	**Faster settlements**	Transactions can be processed and settled in minutes or seconds, significantly faster than traditional financial systems that can take days. It is important to note that this benefit may be dependent on the chosen blockchain.
	Increased efficiency	By automating and streamlining processes that traditionally involve extensive manual verification and paperwork, blockchain dramatically increases operational efficiency.
	Reduced costs	Eliminating intermediaries and automating workflows leads to lower administrative, processing, and transaction fees.
Automation & innovation	**Smart contracts**	These self-executing contracts automatically enforce and carry out the terms of an agreement once predefined conditions are met, removing the need for manual oversight.
	Unlocking new functionality and possibilities	Tokenising traditional funds and assets enables those financial instruments to be used in new innovative ways. They can be traded, transferred, or lent instantaneously onchain. This makes it possible to create or unwind contractual arrangements in an instant, where tokens can be used in product layering, or aggregation, or fractionalised in new ways.
	Improved data sharing	Blockchain provides a secure and unified framework for sharing sensitive data among authorized parties, improving coordination and decision-making.
	Protection of intellectual property	A blockchain can create a timestamped, unchangeable record of an intellectual property asset's existence and ownership, helping creators prove their rights and fight piracy.

Blockchain is synonymous in people's minds with Bitcoin and Ethereum which are cornerstones of the public blockchain space. However new, purpose-built, layer one and layer two blockchains are being developed and brought to market on a regular basis with certain chains tailoring their design to financial service use cases.

A concept known as the blockchain trilemma exists in the industry where transaction speed, decentralisation and security need to be traded off against each other as part of the blockchain design process. This is important when it comes to choosing a blockchain for a specific use case and may incline the preference of one DLT over another. It is worth bearing in mind that as software, DLTs are subject to cyber security risk. In light of this, the longer a public DLT has been in existence the greater the amount of time it has been subject to attack and the more time it has had to shore up any weakness, this is referred to as "battle hardening".



Blockchain technology is important as it has significant potential from a market structure perspective *and* from a product delivery perspective. Tracking ownership of assets is a vital part of what the funds industry is built on; managing this in a risk-effective and trusted way is indispensable part of the value-add for the industry. DLTs can materially improve the efficiency, mobility, and availability of assets.

Gas fees: gas is a concept in blockchain related to the cost of having an action undertaken by the blockchain. Gas is paid in the native "currency" of the blockchain which can be earned by participating in the consensus mechanism of a chain. The more complex the transaction the higher the resultant gas fee. On certain blockchains users can adjust their submitted gas fee to increase the likelihood of their transaction being included in the next block.

Types of Blockchains

The choice of blockchain is a critical design decision that impacts a fund's governance, performance, and regulatory compliance. There are three main types, each with distinct characteristics.

Blockchain Type	Description	Potential Benefits	Potential Challenges
Public Permissionless	Open to anyone; no access restrictions. Examples: Ethereum, Bitcoin.	Global accessibility and liquidity, high transparency and strong decentralisation	Privacy concerns – all transaction data is publicly readable.
Public Permissioned	Open network with restricted validation rights. Examples: Hedera, Casper.	Controlled governance with public visibility and moderate decentralisation	Potential centralisation risks, integration complexity
Private Permissioned	Restricted access: only approved entities can participate. Examples: Hyperledger Fabric, Quorum.	Strong privacy and data control, customisable compliance and efficient performance.	Limited interoperability, reduced transparency, lower liquidity, and network effects

The Importance of Interoperability

As fund tokenisation expands across blockchains and wider DLT infrastructures, effective and secure cross-chain interoperability becomes essential to benefit from the efficiencies and value proposition. While this creates some level of technical complexity, for example ensuring that a token representation on one chain is "locked" if it is recreated on another chain, "bridges" have been created which act as an abstraction layer facilitating the transfer of tokens across bridges. These can be implemented in a number of different forms via relays, trusted bridges, atomic swaps etc. in a centralised or decentralised manner. It is imperative in any bridging solution that token information and standards and any necessary restrictions on access to the token are carried to the destination blockchain i.e. the token does not lose any of its attributes as part of such a bridging exercise.

Blockchain Governance

As noted above different blockchains have differing degrees of decentralisation which leads to the potential of decentralised governance. Certain blockchains are run by decentralised autonomous organisations (DAOs) which use developer input, user community input, and token holder mechanisms for making changes to the software or strategy of the blockchain. By implication then there is no centralised authority which is responsible for owning decisions around changes to such a fully decentralised blockchain nor its functionality, and not all parties will agree on any development. However, a consensus is usually found. If a consensus is not found it is possible that a hard fork emerges.

What questions do you need to ask yourself when considering a blockchain for deployment in a tokenised fund:

- Does our use case support a private chain over a public chain?
- What is the consensus mechanism used on the blockchain and how is it secured?
- How does a specific blockchain address the blockchain trilemma in its design balancing decentralisation/speed/security?
- Has the DLT experienced down time – if so, how long and what remediating action needed to be taken?
- What level of decentralisation exists for validators on the chain? How secure is it believed to be?
- Has the blockchain successfully been exploited? Have lessons been absorbed?
- Does the blockchain have a history of hard-forking?
- How would we integrate the chosen blockchain into existing systems?
- Do we have a business continuity plan (BCP) how does our blockchain strategy integrate into our BCP strategy?
- Do we have a cyber security policy and how does our blockchain strategy integrate into this policy?
- Can we continue to be operationally resilient and what source of new risk(s), if any, to our operational resilience, does the use of blockchain introduce that can impact how we are able to respond and adapt, if such risks crystallise?
- Digital Operational Resilience Act (DORA) has increased the responsibility on firms to be able to be held accountable how would we address this requirement with the use of a public chain?
- Will keeping control over our internal information still be important is we run a parallel internal blockchain to replicate onchain activity?
- Ordering of trades – does the DLT support chronological ordering of trades in the creation of blocks?
- How are gas fees managed on the blockchain?
- What level of detail about the shareholder register will we be displaying onchain – in the knowledge that public chains facilitate data visibility.
- How is the blockchain governed? Is there a foundation overseeing its growth and development?
- Is there a DAO responsible for managing the chain? Would we as users of the chain propose to input into its governance process?

Smart contracts: a smart contract is a piece of code which sits on a distributed ledger and is self-executing when certain events are triggered or can be called as a function of other smart contracts. Such trigger events may originate onchain or be from an external source or a real-world event.

Digital Wallet: A wallet is a cryptographically secured interface – software, hardware, or hybrid – that stores a user's private keys and public addresses, enabling the user to send, receive, and view any tokenised asset (traditional assets, cryptocurrencies, utility tokens, non-fungible tokens (NFTs), security tokens, or other blockchain based representations of value) that are recorded on supported distributed ledger networks. The wallet aggregates balances per asset, while allowing the user to sign transactions and interact with smart contracts that govern those assets.

Fund tokenisation generally refers to the digital representation of fund units or shares via tokens using blockchain or DLT, enabling investors to access traditional investment products through tokenised formats. According to the European Fund and Asset Management Association (EFAMA), *Fund tokenisation is a way to offer investors who are keen to invest via blockchain, a means to diversify their investments from pure crypto and get access, through the same investment channels and via their wallet, to other less volatile investment products such as money market funds*[10].

The means by which users interact with blockchain is predominantly via software wallets.

Wallets display the number of tokens allocated to a specific address on the blockchain and are used when interacting with a decentralised or centralised application. Tokens can be transferred between wallets i.e. "swapping" of one token for another, buying and selling tokens either on a peer-to-peer basis or via decentralised exchanges (DEXs). They can be used to pledge assets, they can integrate into decentralised platforms and a number of other possibles uses, only limited by what can be designed for the use of the tokens and the type of token represented. Wallets come in two distinct variants, hot wallets, and cold wallets.

Hot wallets are continuously connected to a network/internet (e.g., desktop apps, mobile apps, or browser extensions) and can send or receive funds instantly.

Cold wallets remain offline except for a short, intentional connection to a network/internet **solely to sign a transaction**; after signing, they are disconnected again.

Cold wallet storage is considered to be more secure. There are also hardware wallets and multiple different variations on how to securely store, split and manage private keys and wallet infrastructure, which are beyond the scope of this document, but each are important aspects when considering wallet infrastructure and management in a given use case.

Token balances i.e. the quantities of a given token recorded onchain for a particular address, are

10. tokenisation-a-buyside-practitioner-s-guide.pdf

intended to track onchain ownership for a wide range of assets including funds, cryptocurrencies, utility tokens, stablecoins, bonds, equity, derivatives contracts and a multitude of instruments, securities and assets. When assets are tracked via tokens on a blockchain they gain a number of attributes which make them more easily incorporated into automated processes.

We are focused on the tokenisation of existing shares classes i.e. bringing current share classes, whose shareholder register is tracked by the transfer agent (TA), onchain, where the shareholder register would be recorded on a blockchain alongside full or partial traditional methods of record keeping, or alternatively, where shares are initially issued via blockchain-based shareholder register. It is an important distinction, but the former refers to taking an existing class and bringing it onchain and speaks to either a digital twin model or a specific share class of a traditionally tracked shareholder register, the latter refers to a share class only ever intended to be issued via a blockchain.

The hybrid or digital twin model supports a phased approach to tokenisation. Shares are issued and transferred in the conventional manner, but they are also represented on the DLT as a "digital twin" register (an onchain replica) to track tokenised unit ownership. This model allows funds to leverage DLT's benefits with a view to seeking to comply with the current regulatory environment. This transitional structure is designed to enable real-time updates and automated processes while ensuring the offchain ledger remains the definitive source of truth for legal ownership. The level of benefit in this model is limited to the functionality and speed of the primary means of tracking and updating the traditional shareholder register.

In either instance the process of creating tokens on the chain is referred to as "minting" and the process of destroying tokens is known as "burning." From the perspective of a fund share class which has been tokenised this would mean issuing new tokens "owned" by a specific wallet for a buy order and redeeming said tokens "owned" by said wallet, by burning them in the event of a sell. Minting and burning also play a part when considering moving tokens across compatible or noncompatible blockchains, a process known as bridging.

The token has a level of data payload, and/or transaction related metadata, which it can carry with it, which varies by blockchain and by token standard (the rules that define what a token of a specific type looks like and what it can and cannot do). This makes tokens incredibly useful and provides for the ability for greater reference data clarity for example, tokens carrying or linking to onchain storage, which provide information about their issuers, latest prices, latest available financial data, latest ESG scores, prospectus, KID document, factsheets etc.

Numerous types of tokenisation standards exist on the Ethereum blockchain for instance, each of which provide certainty functionality depending on requirements. New standards can be, and are, agreed by the community to be adopted over time depending on any bespoke requirements or functionality that is viewed as beneficial.

Of the various different standards available for implementing tokens on Ethereum not all are applicable to fund tokenisation, however, for illustrative purposes, a subset are included in the table below. Further investigation would be needed as to the most appropriate standard applicable to a given tokenisation issuance and would be blockchain dependant.

Standard	Token Type	Primary Use Cases
ERC-20	Fungible (identical and interchangeable)	**Currencies and utility tokens:** Used for standard digital money, in-game currencies, and voting rights in DAOs. **Decentralised Finance (DeFi):** Acts as the backbone for lending, borrowing, and swapping on DEXs. **Stablecoins:** Support asset-pegged cryptocurrencies like USDT and USDC.
ERC-721	Non-Fungible (unique and indivisible)	**Digital art and collectibles:** Enables the creation and trading of unique digital items, such as the NFT seen in projects like CryptoPunks and Bored Ape Yacht Club. **Virtual real estate:** Represents unique parcels of land in metaverse platforms like Decentraland. **Gaming assets:** Provides true ownership of unique in-game items like weapons or characters. **Certificates and identification:** Can be used to create and verify unique digital identities or tickets.
ERC-3643	Permissioned Fungible and Non-Fungible	**Real-World Asset (RWA) tokenisation:** Facilitates the compliant tokenisation of regulated, real-world assets like real estate, securities, and private equity. **Identity and compliance:** Enforces identity verification (Know-Your-Client (KYC)) and transfer restrictions directly in the token, ensuring only eligible, verified participants can own or transfer the tokens. **Regulated finance:** Provides the framework for managing the lifecycle of security tokens from issuance to transfer in a compliant manner. Of the subset, this standard appears to be the most aligned with the tokenisation of fund shares.

ERC-1155	Multi-Token Standard (can include fungible, non-fungible, and semi-fungible tokens)	**Gaming and metaverses:** Highly efficient for managing a wide range of game assets, such as fungible in-game currencies and unique, non-fungible items like special weapons. **NFT marketplaces:** Allows for the creation of collections with both unique pieces (NFTs) and multiple editions of the same work. **Semi-fungible assets:** Supports tokens that can change fungibility, such as a concert ticket that is interchangeable before the event but becomes a unique collectible afterward. **Batch operations:** Its batch transfer functions significantly reduce transaction costs and complexity compared to ERC-20 or ERC-721.

Tokenising of share classes does not lead to the ceding of any control. Between the token standards themselves, smart contracts, and the whitelisting of participants an extremely high degree of control remains with the token issuer. When a share class is tokenised on a DLT it is not "in the wild" for anyone to interact with or control, it is very much restricted to those who have been granted access and proven their eligibility to, hold, interact or instruct on said token.

Potential Models for Tokenisation of Fund Share/Unit Classes

The primary ways that that tokenisation is envisaged by the industry hinges currently on three distinct solutions:

- Distributor level or sub register tokenisation: in this model an entity external to the fund, for instance a distributor, intermediary or nominee, purchases shares/units in the fund. The token issuance is then performed by the distributor not the fund. There are limitations with this model, and it creates added operational layers, albeit from both a governance and regulatory perspective, it is the most straightforward for making a tokenised share class available. In this model, the tokenisation is independent of the manufacturer, and we will not reference this example in further detail. An example would be a centralised digital exchange purchasing units in their account and tokenising such units in order to make them available on their platform to investors[11].
- Hybrid or digital twin model: this model sees a dual-register setup wherein the traditional register, which primarily uses traditional databases to track ownership, and method of instruction via platforms or other acceptable instruction format, existing alongside the blockchain shareholder register. In this model the primary ownership record remains the traditional register. The blockchain register via the wallet can be used to instruct orders but the traditional register retains primacy. There is an added layer of reconciliation required as the blockchain record needs to be synchronised, as close as possible to real-time, to the traditional record set. Therefore, the interoperability of the blockchain register with existing technology is of crucial importance for this model. This transitional structure is designed to enable real-time updates and automated processes while ensuring the offchain ledger remains the definitive source of truth for legal ownership.
- Onchain native TA model: under this model the primary shareholder register is the blockchain record, the authoritative register regarding legal ownership of a token. Investors interact

11. Live examples would include Irish MMFs made available on FCA regulated digital platform Archax - Archax: Invest in Funds & Start-ups Today

via a platform which could use application program interfaces (API) to abstract away wallet functionality or uses a wallet to interact with the issuer (directly or perhaps to an aggregating intermediary). Under this model the additional factors are introduced which need to be considered namely, how to apply the value of the tokenised share class, into the blockchain. Additionally, while the blockchain is the primary record of legal ownership of a token, it is prudent to have backup for BCP and DORA purposes. This could be in the form of a data snapshot taken from the block explorer on a regular basis, or it could be a parallel internal blockchain or layer 2 internal blockchain. It is advisable that a point-in-time alterative data record should be available independently of the blockchain.

Future developments in respect of blockchain integration may involve an onchain digitally native model with end-to-end digitalisation of fund operations where all fund units are natively issued as tokens, investor interactions are automated via smart contracts, and regulatory compliance is embedded into the technology stack. In this model, as a future state, we intend to examine this in more detail in the "Future Developments and areas of further investigation" chapter.

What initial questions do you need to ask yourself when considering tokenising funds for distribution to investors:

- What token standard will be used?
- What blockchains do we intend on deploying on? Are they compatible as a group?
- What will the investor be able to do with the tokenised share class?
- How much functionality will our wallet provide for?
- What is the process for cancelling and reissuing tokens to an investor in the event of a loss of wallet access?
- Does our smart contract and/or token standard provide for remediation?
- Is there an existing token standard which covers all of our requirements?
- Do we have an understanding of what the token standard allows and how/if it might change in the future?

Appendix 3 explores further questions which would provide a more expansive risk assessment matrix to help serve as a high-level guide for firms when considering compliance, operational bottlenecks, or investor experience issues.

Fund Discovery and Selection – Data Availability

A key feature of a blockchain is the high level of data availability. This feature could become a useful attribute to help investors meet their specific investment needs when investing in tokenised funds. All fund manufacturers may not display the same level of data or linked metadata onchain; however, those who do provide more information onchain will be providing a useful service to their prospective investors.

High data availability should enable potential investors to view a broad range of competing products through onchain scanners. This will enhance the comparability of products and allow investors to produce sophisticated screeners on a broad range of data from a fund's attributes to its performance and potentially modelling a portfolio using the available data.

Hence, DLT could serve as the foundational infrastructure for a new wave of transparent, secure, and accessible investor financial information. By enhancing the financial planning process, it can encourage retail investors to engage more actively with investment decisions, ultimately leading to a greater allocation of assets into the market. Providing investors more tools built on blockchain that can simulate investment scenarios, helping users understand risk, diversification, and portfolio dynamics, encourages further education and ultimately helps investors to make more informed investment decisions.

Onboarding and Identity Verification

How wallets interact with tokens and the issuance and sale of tokens is an area that needs to have particular attention from fund manufacturer's perspective. The wallet must be linkable to an identifiable natural person or entity. This is a fundamental requirement for funds to ensure they know who their investors are or have delegated that function with adequate oversight to a party that can establish same.

Under the current model potential investors are identified by providing supporting documentation to prove they are who they say they are. This is done via identification (ID) submission, proof of address and source of funds, with additional documentation being required depending on the level of risk associated with the investor type or their location. Likewise for institutional investors, the burden of documentation is dependent on their location, organisation type, and risk profile. In the near term this exercise will not be impacted by tokenisation, there may be technology-based solutions that ease the process, such as Optical Character Recognition (OCR) scanning of documents and reference APIs into corporate information listing databases. However, there is a point at which the result of such investor verification needs to be married to a means of tracking ownership on the blockchain namely, this means we need to associate a wallet with a known a verified entity from a KYC perspective.

The EU is transforming how digital identity is managed across Member States, with the concept of a Digital Identity Wallet progressing from abstract policy to imminent rollout. The means by which this is being progressed is the Electronic Identification, Authentication and Trust Services (eIDAS) framework updated as eIDAS2 in 2024.

The cornerstone of the evolution of this framework is the European Digital Identity Wallet – a secure mobile app that allows EU citizens and businesses to store, manage and share digital credentials such as ID documents, professional certificates and business licenses. By the end of 2026, each Member State must make at least one Wallet available, and all public and semi-public organizations must accept it. By December 2027, certain regulated industries, including banks, credit institutions, e-money institutions, payment service providers, will be required to accept them as a way for citizens to verify identity and other credentials.

Wallet Creation and Whitelisting

Should an investor elect to engage with a fund via a wallet, the TA will need to ascertain the wallet address of the investor. For example, the investor will need to provide their wallet address which generally comes in the form (depending on the DLT in question) of multiple characters that together are relatively meaningless to the human mind, such as *2aB7eC4a1F3b9dE8C7A1f9B2cD4e5F6A7B8C9* to the TA. There may then be an additional step to ensure that the investor who has provided the wallet address is in control of the wallet in question by requesting they send a random, pre-agreed, non-material amount (most tokens are rounded to 18 decimal places) to ensure the person who has been identified is in control of said wallet and has not for example introduced a typo. This is sometimes referred to as a "Satoshi test".

With this activity complete we can now whitelist the investor's wallet. This is to say that we can instruct tokens to be applied to said wallet. The wallet address will be associated with other on-file client records so that the investor can instruct buys, sells and transfers (only to another whitelisted wallet) and begin to open up further potential utility of having their ownership record stored onchain.

In the future it is likely we will see an evolution of onchain identity becoming a self-sovereign mechanism wherein an investor has had their KYC/anti-money-laundering (AML) process undertaken once, which is then portable across different providers. This is not without its own trust consideration. Research is underway to examine how such an investor's own, portable ID would be managed in a compliant manner onchain.

What initial questions do you need to ask yourself when considering tokenising funds for distribution to investors:

- Who would fulfil the tokenisation role process? For a hybrid tokenisation model this may be the fund's current TA, or we may see the evolution of dedicated tokenisation agents in the future.
- Can a single investor have multiple linked and whitelisted wallets depending on business need?
- How is oversight of tokenised activities catered for?
- How do we deal with instances of fraud?
- How is an investor's identity established via traditional means and by whom?
- How will we verify an identified investor's ownership of a wallet?

Appendix 3 focuses on the wallet and KYC *lifecycle*: from legal classification, KYC/AML, and tax reporting, through technical key management and smart contract governance, to investor experience and exit strategies.

As an alternative to the moving of actual funds a request can be sent to a wallet-driven message, that when signed by the wallet owner, proves control of the private key without moving funds, optionally complemented by an onchain zero value transaction for an immutable anchor.

Special wallet types (custodial, multisig, hardware air gap) need tailored workflows, but the core principle remains: *cryptographic proof of control + documented KYC linkage*.

Implementing a multi step workflow similar to the above will give a prudent process for onboarding token holding investors while still offering a smooth user experience for the retail audience.

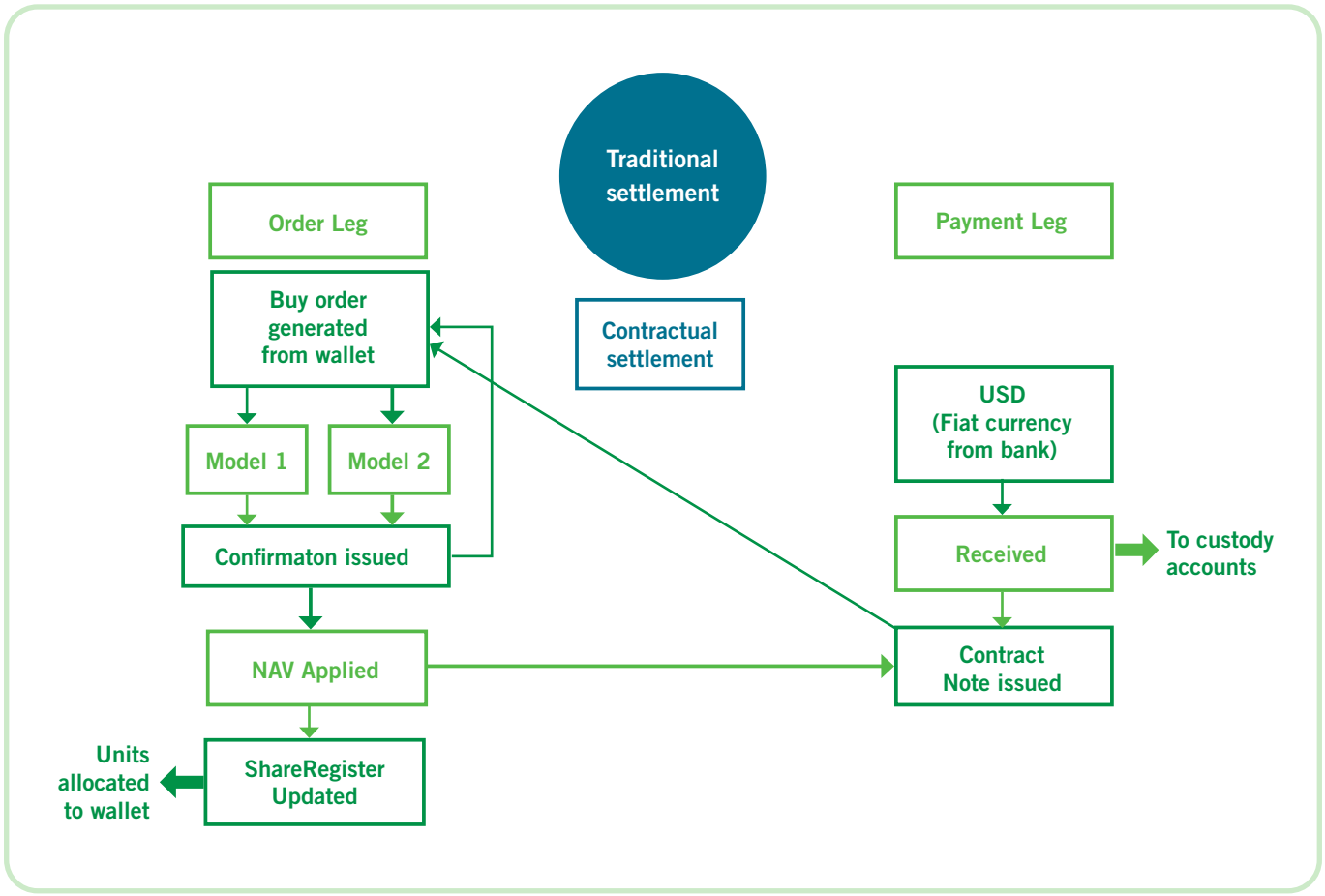
Subscription / Trade Instruction

When an investor has been, verified from a KYC and AML perspective, has a wallet setup, the wallet has been whitelisted, and we are now ready to move forward with an investment we reach a point of branching, regardless of whether the fund is in hybrid or onchain native model. The reason for this branching is due to the cash leg processing of a given transaction and optionality that exists around same.

Option1: Hybrid/Digital Twin or Onchain model – Traditional Cash Settlement

An investor wishes to subscribe for the share class of a fund directly with the issuer via their TA paying with fiat money.

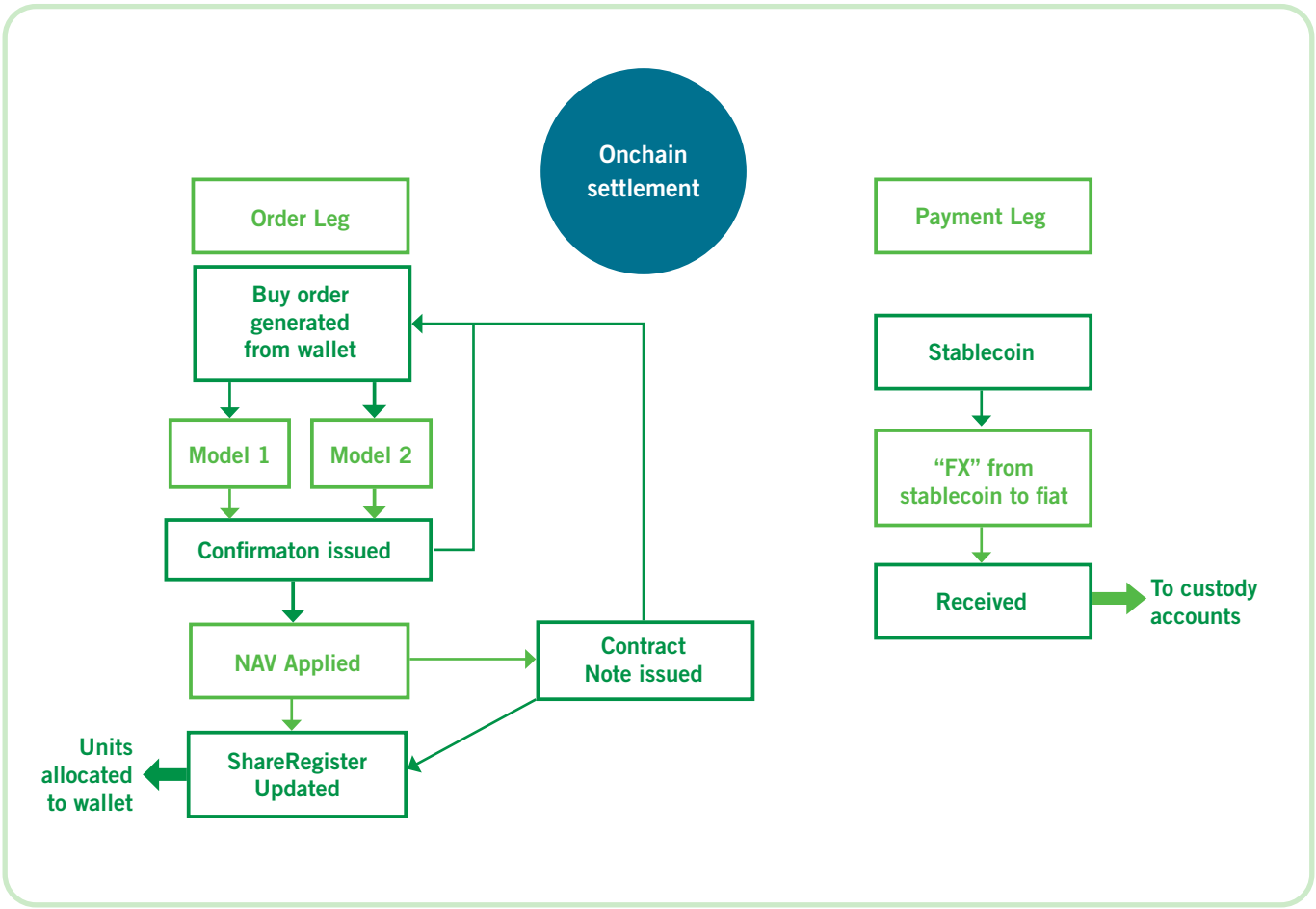
1. Order is generated by a whitelisted wallet and sent to the TA.
2. TA confirms receipt of order for specific trade date.
3. Confirmation of order receipt is issued to the investor.
4. Primary offchain shareholder register and the blockchain "twin" register update to reflect the issuance of shares/units.
5. The payment leg in this instance is in fiat currency hence the standard banking ecosystem is used, and the investor sends their monies to the necessary collection account.
6. A contract note is then issued to the investor.
7. Cash is received to the fund's custody accounts for deployment.



Option 2: Hybrid/Digital Twin or Onchain model – Onchain (Digital) Cash Settlement (where permissible from a regulatory perspective)

An investor wishes to subscribe for the share class of a fund directly with the issuer via their TA paying with stablecoins.

1. Order is generated by a whitelisted wallet and sent to the TA.
2. The payment leg in this instance is in stablecoins and does not use the standard banking ecosystem. The order leg and the settlement leg can be simultaneous and included in a single block record. The transaction is said to be atomic.
3. TA can now confirm the receipt of order for the specific trade date.
4. TA can immediately issue a contract note after the striking of the day's NAV.
5. Blockchain register updates to reflect the issuance of shares/units (a secondary offchain shareholder register may also be asynchronously updated depending on solution implementation).
6. The stablecoins received into the collection account wallet need to be exchanged (we will nominally refer to the process as FX herein) into a fiat currency that the fund can use (this may change in the future if a fund can accept stablecoins as subscription monies). It is then sent to the custody account for deployment.



Funding and settlement - Cash Leg Options

Fiat money: USD/EUR/CHF etc the investor chooses to settle their trade by instructing cash from their bank account to the fund's collection account.

Tokenised deposits/deposit tokens: tokenised deposit are deposits held in bank accounts which are locked and reflected on a blockchain for transactions. Deposit tokens are bank balances issued and tracked specifically onchain. The current implementation of these types of onchain cash tends to be specific to a given bank i.e. as yet they have limited to no interoperability outside of a given bank's internal, onchain ecosystem. While this is likely to be solutioned in the longer term, they are unlikely to be viable, near-term, solutions to fund structures with a diverse investor base.

Stablecoins: stablecoins come in a variety of formats however the goal shared across their implementations is for a coin to be pegged to a reference asset. The reference asset to which most stablecoins are currently pegged is the US dollar.

Asset Backed/Asset Referenced: asset backed stablecoins reference a fiat currency and they are generally backed 1:1 with reserve assets of high-quality liquid assets (HQLA). The intention here is that the onchain cash representative of a fiat currency is fully backed by real world near-cash assets. It is worth bearing in mind that there are a number of other permutations of reserve collateral which could be used in the future.

Over-collateralised: this form of stablecoin is a type of cryptocurrency that is backed by collateral worth more than the value of the stablecoin itself, providing a buffer to maintain price stability even during market volatility. Should the collateral begin to move in a negative direction the collateral will be liquidated for the stablecoin thus retaining the overall balance in the protocol's pool of stablecoin issuance versus available collateral.

Algorithmic: this implementation of a stablecoin can use sophisticated derivative strategies, rebasing mechanisms, arbitrage reference assets, and a number of other potential mechanisms to retain their peg. In general, they have been less successful than the other forms of stablecoins however newer algorithmic stablecoins have come to the market and have maintained their peg in stressed market conditions.

CBDC: Central Bank Digital Currency (CBDC) – there are a multitude of CBDC trials in progress globally and the European Central Bank (ECB) has announced plans to issue a wholesale (i.e. non-retail) CBDC in the near future. CBDCs are not onchain native by definition (they could and can be tracked by traditional means) but do lend themselves to onchain issuance. It remains to be seen whether central banks will allow for (a somewhat confusing acronym) wwCBDC meaning a *wrapped wholesale Central Bank Digital Currency* i.e. wholesale CBDC in a tokenised wrapper, to be brought onchain or central banks could issue a portion of their CBDC directly onto a DLT.

Settlement possibilities: Of the above range of potential payment solutions for the investor's subscription we will discount all of the options except fiat and HQLA asset-backed stablecoins. The reason for this is that algorithmic stablecoins carry a higher risk of de pegging, and CBDCs have not yet reached onchain maturity, making both impractical in the near to intermediate future.

This then leaves us with two settlement options fiat or HQLA-asset-referenced stablecoin.

For the former the process is familiar, an investor would pay for their share tokens using the currency of their choice as accepted by the fund. This process would use traditional banking infrastructure, and a contract note issued directly to the investor's wallet or via email/standard method, would be used. At this point, the investor could access their tokens i.e. send them to another whitelisted wallet they control, or redeem, or in the future send them to an exchange, a peer-to-peer compliant order matching facility or some other KYC/AML/countering financing terrorism (CFT)/sanction-checks approved onchain application.

In the event that an investor wishes to pay for their subscription using an onchain cash option, which given the onchain nature of tokenisation

is a possibility that should be given serious consideration by tokenised fund operators, then, in the Irish context a conversion mechanism will need to be deployed. This conversion mechanism would, until such time as an Irish fund can accept non-fiat currency as part of its dealing proceeds, be carried out externally to the fund. Notwithstanding this, the concept is analogous to a USD investor investing in a GBP class currency in a multicurrency dealing fund. The USD on receipt needs to be FX'ed into GBP to affect the settlement of the order. In our stablecoin example we then need to find a party (be it internal or external) to "FX" the USDC (for example) into a fiat currency accepted by the fund e.g. GBP. While the exchange rate tends to be pegged there are deviations between asset backed stablecoins and their fiat counterpart. In any event, the investor would likely take on this deviation risk as part of their subscription (and redemption). Again, at this point the investor could access their tokens i.e. send them to another whitelisted wallet they control or redeem or in the future send them to an exchange, a peer-to-peer compliant order matching facility or another KYC/AML/CFT/sanction-checks approved onchain application.

Holding, Management & Income

In a passive buy and hold portfolio, holding a token should not lead to any additional complications however any fund manufacturer at the very least will need to communicate to their clients on occasion. Notifications could potentially be sent directly to an investor's wallet; however, consideration of compliance with any legal or regulatory obligations regarding the format of investor notifications would need to be borne in mind.

Funds are not by their nature static; they have qualities that allow them to be refined and changed, as markets change impacting investment theses behind a fund's mandate. This means that parties issuing fully onchain native share classes should spare a thought for future eventualities such as a liquidation, name changes, mergers between two tokenised funds and a non-tokenised and a tokenised fund etc. While not all fund events would impact the tokenisation aspect of a fund, it is prudent to entertain future possibilities.

An event that is guaranteed to occur on distributing tokenised share classes is the distribution of income. Tokenisation provides interesting possibilities with regard to the income and frequency of dividend payments which can be automated in a tokenised scenario. While similar in practice to a dividend reinvestment, an investor can be paid in more tokens of the same share class and have them delivered to their wallet. It could be possible to pay an investor in tokens of another fund or another share class if a suite of tokenised share classes were offered. This could be possible to implement in a low overhead way given the automation made possible by tokenisation.

- An investor could choose to be paid in fiat currency or in the stablecoin in which they subscribed.
- We could see distributions being made directly as stablecoins to an investor's wallet, again the investor would need a foreign exchange (FX) solution to fulfil this function.
- Another intriguing possibility is streaming payments hence investors could be paid interest on a quite granular basis i.e. per hour, materially reducing an investor's reinvestment risk but there would be a challenge in aligning such a payout schedule to the income accrued and cash received at the portfolio level, albeit this is not an intractable problem today. The FX costs would also be an important consideration.

In providing reporting and other information to investors, data can be taken from the blockchain record and synthesised into a reporting format that is acceptable to them or in line with the manufacturer's preferences. Another interesting possibility would be for the fund manufacturer to create an app to which an investor connects their whitelisted wallet. The app then can be used to create a pre-prepared number of aforementioned reports, or the investor can themselves use the raw data to create bespoke reports for their own requirements.

Redemption and sale

The redemption process is largely a mirrored reflection of the subscription process. Giving the investor the options to receive proceeds

in the form of stablecoins, if permissible from a regulatory perspective in the future, and facilitation for atomic (i.e. instant) settlement will need close consideration. As monies in a redemption scenario are leaving the funds, it is critical to ensure that funds leaving by fiat currency (if invested via stablecoins) are going to a bank account of an identified person. If funds are leaving by stablecoin (if initially invested via fiat currency), it is critical to ensure that funds leaving are being sent to an identified whitelisted wallet and not to a third party.

What questions do you need to ask yourself when considering tokenising funds for distribution to investors in the context of settlement arrangements:

- Will we accept an onchain cash solution?
- If so what forms of onchain cash solutions will we accept and what will the conversion mechanism be?
- Who would do the conversion?
- What level of functionality will be given to the wallet?
- Will we allow investors to redeem to stablecoin?
- How will the mismatch in liquidity offered via instant settlement be offset against the limitations of the current speed of liquidating the underlying portfolio?
- Is the stablecoin you plan to accept licensed under a relevant regime?
- Do we need to hedge our positions or cashflows against a stablecoin de-pegging event? Where is this risk evident and who holds it?
- Will the fund hedge stable coin de pegging risk (e.g., via futures, options, or a basket of fiat backed assets)?
- Who holds the hedge position (the fund's treasury, a third-party insurer, a market maker)?
- How is the cost of the hedge allocated (absorbed by the fund, passed to investors via a fee, or absorbed by the conversion provider)?
- Does the smart contract reject the transaction if the stablecoin amount does not match the required subscription amount (including fees)?
- Which settlement finality level is required before the TA can issue a contract note (e.g., 12 Ethereum confirmations, or instant finality on a permissioned DLT)?
- How are transaction fees (gas, network fees, conversion spreads) allocated – to the investor, the fund, or shared?
- What is the fallback plan if the chosen blockchain experiences a prolonged outage (e.g., network halt, hard fork)?
- Is there insurance covering loss of funds due to smart contract bugs, key compromise, or stablecoin de pegging?

Other Operational Implications

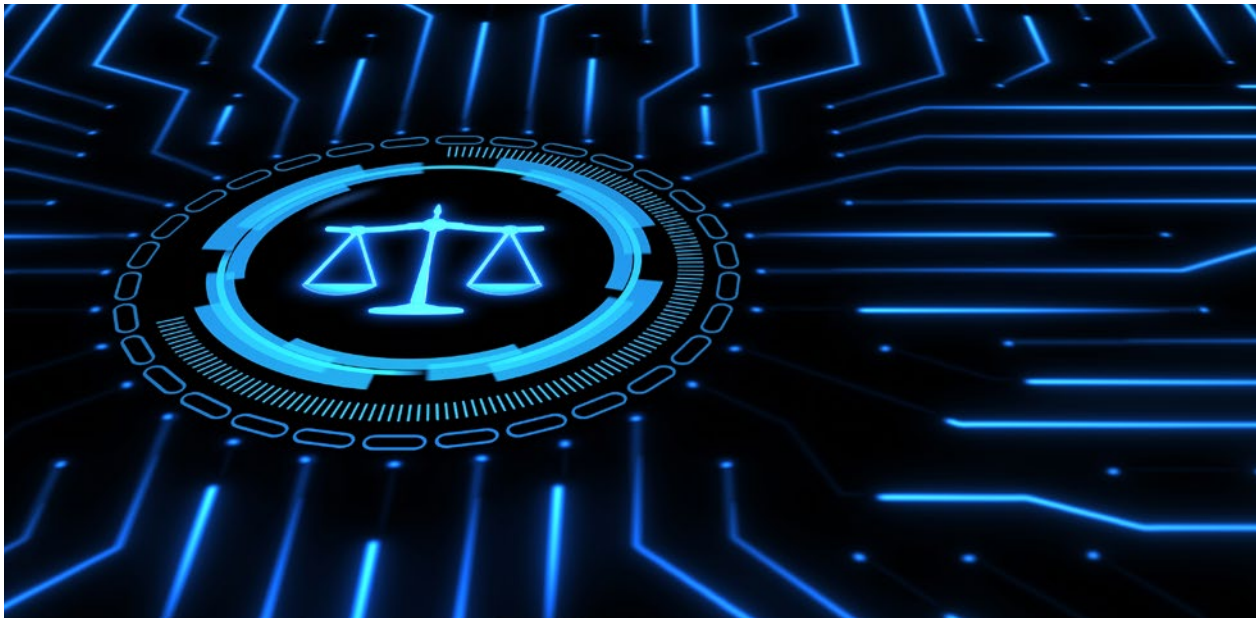
TA activities do not of course operate in a vacuum and are part of the integrated process involving multiple actors coming together to support the running of fund structures. If we tokenise the fund wrapper for distribution what are the impacts to other functions within this process? Albeit not within the remit of this exercise it is important for a fund manufacturer to consider these implications. One of the benefits of having data on a blockchain is a greater degree of data availability that results from same. While various non-TA processes themselves do not change, where they send or take data from may change depending on the level of blockchain integration used. Below are examples of some very high-level potential impacts:

Fund Accounting:	• Applying NAV pricing to capital stock activity possibly via an oracle • Analysing flows and ensuring hedge ratios are applied/maintained • Data flows to and from the distribution calculation engine
Depositary:	• Monitor ownership possibly via blockchain ledger or smart contract registry • Oversight of subscription and redemption processes
Custody:	• Reconciliation of positions held by other funds, of tokenised share classes, will need to be tracked
Performance Measurement:	• A higher level of data availability via the blockchain should make this process for the tokenised share class more streamlined
Financial Reporting:	• Aggregation and data related to flows and investor activity as required should be eased by greater data availability
Pricing:	• A higher level of data availability via the blockchain should make this process for the tokenised share class more straightforward
Front Office, Investment Risk, and Investment Compliance:	• Expected impact to be minimal with the exception of holdings in other funds tokenised share classes. • Does not impact the process design directly
Regulatory Reporting:	• Access to data can be enhanced. • The regulator can get a real time view of capital activity and holdings

Oracle: an oracle is a means by which "real world" information is injected into the blockchain i.e. think of the latest market price of a leading equity. An oracle plays an important part of DeFi and a core enabler for sophisticated smart contracts. An oracle would be a data delivery service that imports verifiable, signed information from an external, licensed source (e.g., market price vendor, NAV valuation committee, central bank rate) onto a blockchain. The oracle publishes the data as an immutable on chain event (or state variable) that can be read by the fund's smart contract, which then executes the fund specific logic (subscription pricing, redemption eligibility, dividend distribution, collateral valuation).

What Does Not Change?

As noted to a large extent to date, the tokenisation of a share class does not necessarily lead to wholesale change outside of the TA function but rather data sourcing changes for functions that send data to, or take data from, the shareholder register, and TA related activities. What does not lessen are the oversight and legal and regulatory obligations a fund and a service provider have, they still need to ensure they have adequate oversight on any and all activities and processes, regular reporting and remediation, and have the necessary BCPs in place to ensure rollbacks and remediation can be applied in the event of say a NAV error, or a means to remediate any aspect of the process that has been made in error. Needless to say, adequate due diligence and internal expertise is advisable when taking into account the choice of tokenisation partners. Many of the traditional IT due diligence and information security requirements will be applied in addition to all of the standard business verification steps that would be undertaken in the event of onboarding a service provider of any description.



Regardless of the technology used or the form of fund tokenisation model, funds and their service providers will need to ensure that the use of such technology that is deployed as part of a selected fund tokenisation model complies with existing legal and regulatory requirements. This paper's key focus is to inform readers on the core concepts and operational considerations. However, this section provides a high-level insight into some of the key legal and regulatory considerations for fund tokenisation.

Data Protection Considerations

One of the core elements of blockchain technology is that it is immutable. While this can offer benefits already outlined in this document, this aspect needs to be considered in the context of compliance with the Irish Data Protection Acts 2018 (as may be amended) which incorporated the provisions of Regulation (EU) 2016/679 (the General Data Protection Regulation (GDPR)) (Data Protection Acts). Compliance with the Data Protection Acts will need to be considered where there is processing of personal data. While compliance with the Data Protection Acts in full will need to be considered, some of main matters to bear in mind, particularly for controllers of personal data are:

Identifying a "controller" of the personal data that is processed on the blockchain. A controller in essence is a natural or legal person, public authority, agency, or other body which, alone or jointly with others, determines the purposes and means of the processing of personal data.

Identifying a lawful basis for processing. All processing of personal data must be lawful. This includes identifying a legal basis from Article 6 of the GDPR.

Compliance with the key principles under the GDPR related to the processing of personal data. These include, but are not limited to:

- Data minimisation and storage limitation;
- Purpose limitation; and
- Data accuracy.

Compliance with data subject rights. These include, but are not limited to:

- Right to rectification;
- Right to erasure; and
- Right to object.

Given the nature of blockchain technology, there may be challenges with ensuring compliance with the Data Protection Acts. As a result, it is important for funds implementing tokenisation and fund service providers involved in same to ensure this is addressed early in the engagement process to understand how requirements will be complied with.

Maintenance and Inspection of a Shareholder Register

Regard should be given to the requirements imposed under applicable laws, particularly those governing the legal structure of a fund, in respect of the use DLT generally. In particular, regard should be had to the location and format of the shareholder register where DLT is proposed to constitute the register of shareholders, i.e. a fund and its TA for example, will need to examine if it is permissible for the register of shareholders to be maintained in Ireland, and if it can be stored on DLT.

Certain requirements exist pursuant to domestic laws that require the shareholder register and other information to be available for inspection. The information displayed on the DLT will not be in a readable format. As a result, funds and their service providers may need to consider the use of blockchain reading technology, that in essence facilitates the translation of the blockchain into readable text, and if such technology can assist with achieving compliance with the requirement for the relevant content being capable of inspection.

Transfer of Tokens

One of the main benefits of the use of DLT as part of a fund tokenisation model is the speed at which transactions can occur. Therefore, regardless of the selected tokenisation model, funds and their manufacturers will likely want to pass this benefit on to investors to facilitate investors having the ability to transfer their tokens on the DLT to other existing or potentially new investors. This is especially relevant for funds and investors that deal daily or on an intra-day basis. If the intention is to transfer ownership of a unit in the fund, then certain domestic regimes, pursuant to which the legal structure of a fund is governed by, may require an instrument of transfer to be used to effect a transfer. As a result, if an instruction by an investor to transfer their token on the DLT is intended to be used as the instrument of transfer (rather than traditional instruments of transfer, such as for example, stock transfer forms) then the domestic laws that govern the legal structure of the fund should be reviewed to determine that an instruction to transfer on the DLT complies with the domestic requirements in this area.

Regulatory Framework Compliance

Where DLT is deployed as part of a fund's operations, the regulatory framework that the fund is authorised pursuant to (UCITS or AIFMD framework) will need to be reviewed to ensure compliance with the terms of such framework. While EU legislative acts on financial services are generally guided by the principles of same activities, same risks, same rules and of technology neutrality, there may be terminology included in such acts that may not have envisioned at the time of drafting, new technology such as DLT. Correspondingly, an assessment of existing UCITS and AIFMD framework provisions may need to be completed to understand if they can be interpreted to include DLT, as relevant.

Finally, funds and their service providers will also need to assess the impact of the chosen tokenisation model on compliance with other important areas such as AML/KYC/CFT requirements, treatment under and compliance with tax laws, beneficial ownership laws, treatment of tokenised shares in the context of insolvency or enforcement scenarios or the categorisation of tokenised shares in respect of property rights.

FUTURE DEVELOPMENTS AND AREAS OF FURTHER INVESTIGATION

While we are at the early stages of practical implementation of blockchains and tokenisation in the financial services provision process, in a regulated environment, it is a fast-moving space. Various global regulatory jurisdictions and providers are forging ahead with the development of the technology in a responsible and investor protecting manner and we are seeing use cases for tokenised share classes materialise. Some of the most promising areas:

- The use of tokenised MMFs (TMMF) as collateral needed in derivatives positions or for security lending. Principally composed of HQLA, using TMMFs would reduce the amount of churn in the system and particular would be useful in market stress events such as the LDI crisis in the UK, where additional sell pressure on underlying government securities could be reduced. Global Digital Finance has recently published "The Case for Collateral Mobility in Europe & The UK using Money Market Funds" to which Irish Funds contributed. This paper outlines the value proposition that *TMMFs offer qualities that are hard to replicate with other kinds of assets in the collateral use case (e.g., cash and stablecoins). Unlike cash, they accrue yield making them a more attractive form of posted collateral, particularly in a high-interest rate environment.*[12]
- Secondary market trading prompting the introduction of greater liquidity. This is composed of two core benefits from the perspective of daily traded funds (1) that there are intraday trading possibilities on exchanges supporting tokenised funds' share classes where eligible whitelisted investors can trade the products intraday and (2) introducing a greater degree of liquidity to less liquid funds with interval liquidity, again arriving at a point where investor's gain greater liquidity via secondary markets which adhere to necessary regulations and reporting standards in their relevant jurisdiction.
- Using tokenised funds in DeFi applications. As a greater number of assets and instruments become available onchain interaction between onchain digitally native assets and traditional finance (TradFi) types becomes more prevalent e.g. using a fund token as collateral to borrow against a stablecoin.
- Enhanced distribution opportunities via accessing a generation who are more digitally native and comfortable with the use of blockchain and delivery though online or web3.0 channels such a cohort are familiar with.
- Introduction of assets onchain joining liquidity pools increasing all round liquidity depth.

12. GDF_-UKEU_TMMF-_report.pdf

The technology continues to advance unabated, for example significant strides are being made in aspects of onchain identity and privacy. The former via self-sovereign identity as outlined earlier in the paper. It also follows the principle of data minimisation, whereby only the data needed for specific purposes is shared and no more. Zero knowledge proofs are also gaining traction, a cryptography enabled mechanism where is it possible to verify a piece of information being provided, without knowing the information itself, helping to ensure privacy preservation.

It's important to note that as the future state of fully onchain funds continues to evolve, advancements in legal frameworks, regulatory clarity, technology, and market infrastructure may be required.

Blockchain as part of the fund construction process

Blockchains are a relatively new type of database specifically useful for the tracking of value and acting as a single source of truth.

Hence, wherever we have databases which are co-ordinated among each other, that need to have a high degree of accuracy, we will find possible use cases for blockchains. The fund and asset management spaces abound with such siloed data stores, not solely across industry participants but even within firms.

As DLT continues to gain traction and the data availability that is onchain increases, we will see the possibility of having more actions being completed onchain. For example, if we envisage a fund of funds solely comprised of tokenised share classes, we can see how the fund accounting function might leverage smart contracts and oracles to begin to build the NAV construction process onchain. This is a very simple example but the more assets that can be held or are wrapped onchain the greater the degrees of smart contract utility that can be introduced, expanding the instances in which we could see advantages of blockchains, and tokenised assets increase dramatically.

CONCLUSION: A CALL TO ACTION

Irish Funds recognises that tokenising funds or share classes unlocks new opportunities to enhance the end-investor experience through improved utility and cost efficiency. To support this evolution, we have established a dedicated Digital Assets Working Group tasked with monitoring market developments and assessing both current and future implications for fund servicing and asset management in Ireland.

We believe it is essential that any firm considering the issuance of a tokenised share class carefully evaluates the innovative capabilities of DLT alongside the established regulatory and legal obligations that must be upheld.
A comprehensive review of the investor journey, from client onboarding and capital deployment to position management and redemption, must be undertaken to ensure operational integrity and investor protection.

It is important to acknowledge that not all components of fund construction or ongoing operations will be affected by a share class-level tokenisation initiative, whether implemented as a digital twin structure or a fully native onchain model. This distinction underscores the need for a nuanced understanding of the practical impacts and limitations of tokenisation.

The use of DLT for fund tokenisation could demonstrate real improvements, faster settlement, better transparency, automated workflows, and expanded functionality of fund shares. These benefits align well with the policy goals of more efficient and resilient market infrastructure. As this technology transitions from pilot initiatives to global adoption, it is crucial that Ireland, and Europe more broadly, continue to strengthen the supporting ecosystem and regulatory framework. Doing so will be essential to maintaining competitiveness and positioning the region as a leader in digital financial innovation.

APPENDIX 1 – GLOSSARY

The following glossary provides key word definitions drawn directly from the source documents, presented in a structured format for enhanced visual clarity.

Term or Acronym	Definition Derived from Sources
DLT (Distributed Ledger Technology)	A technology that offers a **decentralised data model** with powerful cryptography, which may serve to revolutionise the funds industry. **DLT** is a digital system for recording transactions and data across multiple locations simultaneously. Unlike traditional databases that are centralized, DLT spreads data across a network of computers (called nodes), ensuring that each participant has access to the same, up-to-date record. It acts as the **core infrastructure** for token issuance, trading, and ownership tracking in future state models.
Blockchain	Blockchain is a **type of DLT** where data is grouped into blocks and linked cryptographically. All blockchains are DLTs, but not all DLTs use blockchain structures.
Fund tokenisation	**Fund tokenisation** refers to the process of representing an investor's ownership of a share or unit in a collective investment scheme, such as a fund, as a **digital token** recorded on a blockchain or DLT.
Token	Depending on the fund tokenisation model selected and the legal structure of fund (corporate vehicle etc.), a digital representation of fund units or shares.
Gas fees	Gas is a protocol defined unit that quantifies the computational and storage resources a transaction (including any smart contract code it invokes) consumes on a blockchain. The sender specifies a gas limit and a gas price; the product of the two determines the fee paid in the blockchain's native cryptocurrency. This fee is awarded to the miner or validator who produces the block, thereby rewarding participants in the consensus mechanism. Because more complex transactions require more EVM (or other VM) operations, they consume more gas and therefore incur a higher fee.
Smart Contract	A piece of code which sits on a distributed ledger and is self-executing when certain events are triggered or can be called as a function of other smart contracts. Such trigger events may originate onchain or be from an external source or a real-world event.
Subscription Contract	A specific type of smart contract that **handles buy/sell orders** with built-in KYC/AML checks. The application form itself may be a Smart Contract.
Oracle	A smart contract responsible for external data feeds.
Atomic Settlement	A type of settlement that ensures the **simultaneous exchange of payment and asset tokens**. It ensures simultaneous token burn and payment execution.

Term or Acronym	Definition Derived from Sources
DvP (Delivery versus Payment)	The process enabled by DLT-based forms of money that allows for **simultaneous, onchain exchange** of fund tokens and payment.
CBDC (Central Bank Digital Currency)	Central bank digital currency providing **direct sovereign money settlement**. This is seen as a **low-risk settlement asset** in DLT environments. CBDCs are not necessarily blockchain native by design. Retail CBDCs are designed for households and businesses to make payments for everyday transactions. Wholesale CBDCs are designed for financial institutions and operate similarly to central bank reserves.
Stablecoin	**Asset-backed tokens** like USDC or USDT used for stable value transfer.
Self-Sovereign Identity (SSI)	An architecture or automated self-certification process for investor verification. It leverages **Decentralised Identifiers (DIDs**) and **Verifiable Credentials (VCs).**
DIDs (Decentralised Identifiers)	**Blockchain-anchored identities** that investors control without relying on centralised authorities.
VCs (Verifiable Credentials)	**Cryptographically signed credentials** issued by trusted authorities (banks, government agencies) that prove identity attributes.
ZKP (Zero-Knowledge Proof)	A privacy-enhancing technology that allows investors to **prove compliance requirements without revealing sensitive personal information**.
Whitelisting	A process where an investor's wallet must **pass KYC/AML and accreditation** to be approved for token receipt and transfer. Wallet initiated actions are only authorised between whitelisted wallet holders.
Immutability (Blockchain)	A feature of distributed ledgers where **ledger entries are permanently recorded** once transcribed. Note that in regulated funds, this principle is supplemented by centralised controls (e.g., error correction).
Public Permissionless Blockchain	A fully open blockchain network where **anyone can participate without approval**. Users can read, write, and validate transactions. These networks are **decentralised**, transparent, and censorship-resistant, making them ideal for global accessibility and innovation. Examples include Ethereum and Bitcoin, which support trustless applications and tokenised assets without intermediaries.
Public Permissioned Blockchain	A blockchain network that is **publicly visible but restricts transaction validation to approved participants**. Anyone can access data, but only selected nodes can write to the ledger. This model balances transparency with governance control, making it suitable for regulated environments that require accountability, such as financial services or fund tokenisation.
Private Permissioned Blockchain	A network where access to read and write data is restricted to a**pproved, fully known, and vetted participants**. It is designed specifically for **compliance and control**.
Digital Twin Register	A transitional structure that is an **onchain replica of the official shareholder register**. It tracks ownership of tokenised units while the off-chainoffchain shareholder register remains the official legal record.

Term or Acronym	Definition Derived from Sources
Hard forking	A hard fork is a **permanent divergence in a blockchain protocol** that creates two incompatible versions of the network. It occurs when consensus rules change, requiring all nodes to upgrade. Hard forks can result in a split chain, often leading to the creation of a new cryptocurrency or protocol variant.
Fractionalisation	A process by which high-value assets (or shares) are **divided into smaller, tradable units**.
Final Settlement	The **irrevocable and unconditional transfer** of an asset or financial instrument, or the discharge of an obligation.

APPENDIX 2 – RISK ASSESSMENT QUESTIONS

Below are the main gaps and ambiguities in the checklist drafted, grouped by theme. Note that this is a non-exhaustive list.

1. Token Standard & Technical Architecture

- *Question*: "Do the selected chains share a common virtual machine such as Ethereum Virtual Machine or WebAssembly Virtual Machine and support the same token standard so that a single smart contract codebase can be deployed unchanged?"
- *Question*: "Is the contract deployed behind an upgradable proxy, and do we have a governance process for future standard amendments that complies with the UCITS/AIFMD framework amendment procedures?"
- *Question*: "Have any deployed smart contracts involved in delivery been independently audited, and do we have a bug bounty or insurance arrangement for post deployment vulnerabilities?"
- *Question*: "Which oracle provider will deliver the NAV to the blockchain, or will it be done internally, if external how will we guarantee data integrity, and what fallback mechanisms exist if the oracle fails?"

2. Operational & Custody Considerations

- *Question:* "Will the fund use a multi signature escrow (e.g., 2 of 3: management company, custodian, independent trustee) for the token issuer keys, and what SLA governs key loss recovery?"
- *Question:* "Will the wallet support only token transfer, or also voting, dividend claim, KYC/AML/CFT/ sanction-checks onboarding, and onchain compliance checks?"
- *Question*: "What interoperability is required to connect the DLT technology with the existing technology stack to bridge between the blockchain and traditional architecture?"
- *Question* "Will we list the token on a regulated DLT exchange, operate an internal order book, or rely on over-the-counter(OTC) bilateral trades, and how will price disclosure be aligned with the fund's NAV?"
- *Question*: "What is the block finality time on the selected chain, and does it satisfy the fund's risk management policy for settlement risk?"
- *Question*: "What educational material, help desk processes, and dispute resolution pathways will we provide to investors unfamiliar with private key management?"key management?

3. Governance & Change Management

- *Question*: "What onchain governance model (multisig, DAO, board approved admin) will control critical contract functions, and how does that map to the fund's internal governance procedures?"
- *Question*: "Do we have a documented migration pathway to revert to a traditional shareholder register, and what triggers would activate that plan?"
- *Question*: "How will we extract a regulator ready report (e.g., comma-separated values (CSV) file of token holder addresses, balances, and linked investor IDs) without breaching data privacy rules?"

4. Strategic & Business Model *Question*:s

- *Question*: "What is the projected return-on-investment (ROI) (reduced intermediaries, faster settlement, new distribution channels) versus the incremental operational and regulatory cost?"
- *Question*: "What are the upfront and ongoing licensing, transaction, and custody fees, and how are they reflected in the fund's expense ratio?"
- *Question*: "How will we handle conversion of legacy shares into tokens (mandatory or optional), and what rights will those investors retain during the transition?"

APPENDIX 3 – LIFE CYCLE CHECKLIST

- *Question:* "Who is carrying out the fund tokenisation (fund manager, TA, dedicated tokenisation service)?"
- *Question:* "Which jurisdiction(s) host the nodes and data?"
- *Question:* "At what frequency will we perform ongoing sanctions screening of onchain addresses?"
- *Question:* "How will tax residency be captured and reported (FATCA/CRS) for token holders?"
- *Question:* What distribution mechanism will be used for dividends/capital returns (fiat payout, stablecoin, onchain token)?
- *Question:* Who holds the token issuer private keys (multi sig custodial service, in house hardware security module (HSM), threshold crypto)?
- *Question:* What is the key loss / disaster recovery plan (backup shards, legal burn and re mint, court order)?
- *Question:*Are contract wallets or custodial wallets accepted? If yes, how will control be verified (signed message, custodial attestation)?
- *Question:* What governance process governs smart contract upgrades (proxy pattern, DAO vote, pre approved upgrade key)?
- *Question:* What audit regime (annual third party audit, internal controls) will cover both onchain code and offchain AML/KYC processes?
- *Question:* What wallet experience will be offered to investors (native app, web wallet, custodial service)?
- *Question:* How will lost wallet cases be handled for retail investors (social recovery, custodial fallback, legal process)?
- *Question:* Will the token be listed on a regulated DLT exchange, an OTC platform, or remain private? What listing criteria apply?

- *Question:* How will transfer restrictions (lock up, investor type limits, AML filters) be enforced?
- *Question:* What is the cost model for onchain operations (who pays gas for NAV updates, dividend distributions, token transfers)?
- *Question:* What dispute resolution mechanism applies to token related conflicts (arbitration, jurisdiction, admissibility of onchain evidence)?
- *Question:* Can a single investor hold multiple whitelisted wallets? How will the linkage be recorded and kept in sync with the AML/KYC record?
- *Question:* How will oversight of tokenised activities be organised (internal compliance team, external regulator liaison, reporting cadence)?
- *Question:* What is the fraud prevention & remediation framework (real time monitoring, token burn, compensation, legal recourse)?
- *Question:* How is investor identity established (documents, source of wealth)?
- *Question:* How will we verify wallet ownership (signed message challenge, sign in with Ethereum SIWE flow, custodial attestation) and store the proof in the AML/KYC dossier?
- *Question:* Are there any future proofing considerations (upgradeable token standards, modular oracle architecture, scalability to additional DLTs)?
- *Question:* What exit strategy exists if the tokenisation model proves unviable (migration back to paper certificates, conversion to traditional units)?

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