Transforming Global Payments: The Role of Tokenized Money & Funds in Cross-Border Transactions

Interim Report: e-HKD Pilot Programme Phase 2

In collaboration with

Introduction:

e-HKD Pilot Programme Background

Hong Kong stands as a global financial and commercial hub fostering trade between East and West. With a stock exchange capitalized at USD 6.1 trillion and the 8th busiest container port in the world[1], Hong Kong has positioned itself as a 'super-connector' and 'value-adder', Hong Kong plays a unique role in attracting and connecting businesses and investments from overseas and mainland China.

Since 2017, the Hong Kong Monetary Authority (HKMA) has led various initiatives to explore new forms of digital money, encompassing Central Bank Digital Currencies (CBDCs) and tokenized deposits. Its exploration of cutting-edge payment infrastructure aims to reinforce Hong Kong's status as a leading and efficient transactional environment. Its efforts reached a significant milestone in November 2022 with the launch of the Phase 1 of the e-HKD Pilot Programme, testing innovative applications of a hypothetical e-HKD and their potential to become a prospective means of payment for residents and businesses in Hong Kong.

e-HKD Pilot Programme Phase 1

Phase 1 of the e-HKD Pilot Programme involved pioneering firms, including Visa, from the financial and technology sectors exploring e-HKD use cases. The HKMA found three key areas where the e-HKD could add unique value to consumers and businesses:

1. Programmability - Automating complex transactions through smart contracts
2. Tokenization - Enhancing liquidity and facilitating secure asset transfer
3. Atomic Settlement - Ensuring near real-time simultaneous transaction settlement, eliminating counterparty risk

e-HKD Pilot Programme Phase 2

In September 2024, Project e-HKD was renamed to Project e-HKD+, expanding its scope beyond e-HKD, including tokenized deposits, and launched the e-HKD Pilot Programme Phase 2 (Phase 2) to show its commitment to explore even more transformative applications of new forms of digital money. Phase 2 explores use cases across 3 themes: settlement of tokenized assets, programmability and offline payments. Visa, Australia and New Zealand Banking Group (ANZ), Fidelity International (FIL) and China Asset Management (Hong Kong) Limited ("ChinaAMC (HK)") (collectively, the Pilot Participants) are one of the 11 consortia participating in the pilot and will be focusing on programmability and the settlement of tokenized assets.

The use case explores cross-border transactions in between new forms of digital money and a tokenized money market fund (MMF). The Pilot Participants will test how Australia-based investors can purchase tokenized fund units from Hong Kong asset managers using either e-HKD, or tokenized deposits. The process is two-fold. First, the investor will acquire e-HKD via their bank (ANZ) and secondly, will acquire an interest in a Hong Kong-based MMF using new forms of digital money. These transactions are designed to be near real-time and simultaneous, to test the reduction of settlement related counterparty risk.

Pilot Participants:
A Brief Introduction

Bank: Australia and New Zealand Banking Group (ANZ)

ANZ provides banking services to over 8.5 million retail and business customers across more than 29 markets and is consistently rated as Australia's leading institutional bank. Embracing a 'test and learn' approach, ANZ is actively exploring digital assets through various projects in its home market Australia, and the regional hubs of Singapore, and Hong Kong.

ANZ was the first commercial bank to issue an AUD-referenced stablecoin (A$DC) on a public blockchain and the first Australian bank to join Monetary Authority of Singapore (MAS) Project Guardian[4]. ANZ has also issued and traded Australian Carbon Credit Units (ACCUs) on a public blockchain mainnet in collaboration with Grollo Carbon Ventures (GCV).

ANZ is pleased to join the programme, viewing it as a valuable opportunity to enhance interoperability and foster collaboration among stakeholders in the digital asset space.

> Tokenized asset markets are still highly fragmented, with assets and related services being developed across a range of blockchains that lack native interoperability. As part of our ongoing commitment to advancing the digital asset ecosystem, we are actively exploring interoperability solutions. We look forward to testing various forms of tokenized money—including tokenized deposits, the e-HKD, and ANZ's A$DC—in collaboration with Visa and our Hong Kong-based asset management partners, ChinaAMC (HK) Hong Kong and Fidelity International.

Nigel Dobson, ANZ Banking Services Portfolio Lead

Asset Manager 1: China Asset Management (Hong Kong) Limited ("ChinaAMC (HK)")

ChinaAMC (HK) is at the forefront of tokenization and has engaged in several initiatives such as Hong Kong's Project Ensemble launched in 2024. More recently, the asset manager has issued Asia's first tokenized MMF aimed at retail investors.

ChinaAMC (HK) believes in the potential of retail CBDCs to streamline subscription, redemption, buying, selling and settlement processes while enhancing operational efficiency and market transparency. They continue to focus on advancing the adoption of new forms of digital money across fund management, tokenized assets, and cross-border transactions, thereby reinforcing Hong Kong's position as a global leader in digital finance.

> ChinaAMC (HK) remains at the forefront of innovation in the asset management industry. Through the e-HKD Pilot Programme, we are collaborating with ANZ and Visa to utilize tokenized bank deposits for purchasing tokenized funds. This initiative shows how new forms of digital money can potentially enhance the efficiency and transparency of fund unit issuance and circulation. This pilot marks a significant milestone in our digital asset strategy and a crucial step toward shaping the future of fund management.

Thomas Zhu, Head of Digital Assets and Head of Family Office Business.

Asset Manager 2: Fidelity International (FIL)

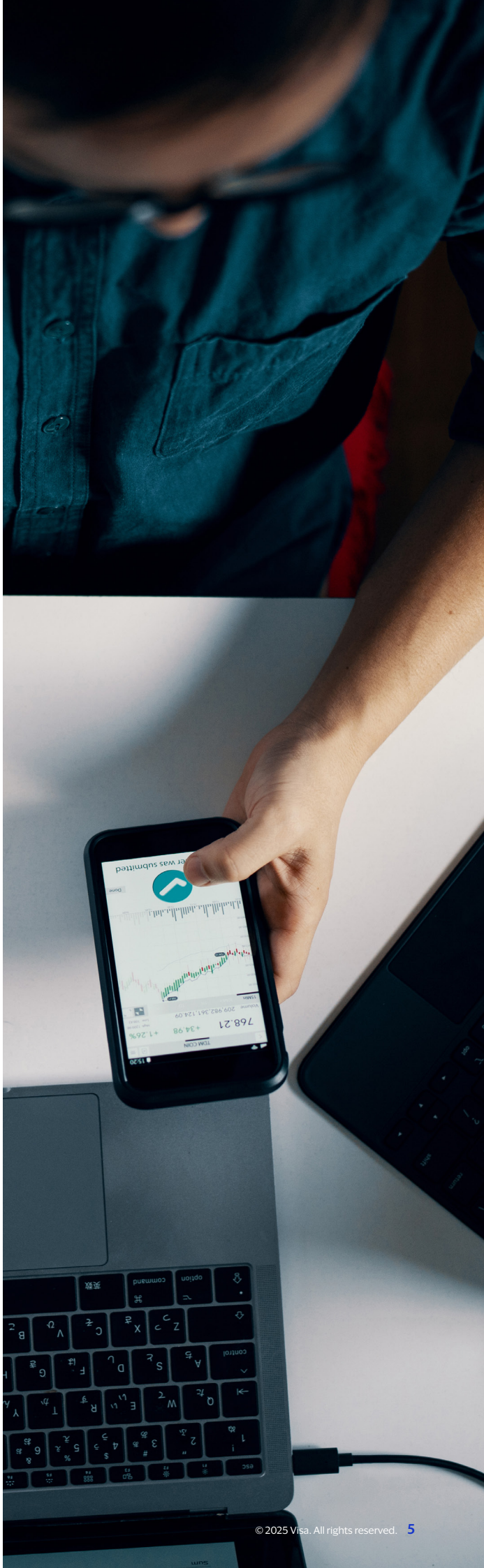
Since 2022, Fidelity International (FIL) has explored the practical applications of asset tokenization, viewing distributed ledger technology as a transformative force in democratising financial services, improving access to alternative investments, and diversifying risk exposures to asset managers.

FIL has embarked on multiple tokenization initiatives, beginning in 2023 with its participation in the global issuance of the first tokenized green bond under HKSAR, and joining Project Guardian to test tokenized Foreign Exchange (FX) swaps and trading of MMFs with Citi Bank. FIL's engagements continued in 2024 with the tokenization and on-chain distribution of its Fidelity Institutional Liquidity Fund (ILF) in collaboration with Sygnum Bank and JPM Kinexys' Tokenized Collateral Network.

Additionally, FIL has been proactive in regulatory efforts, contributing to industry development. It joined the Asset and Wealth Management working group for Project Guardian, and is actively engaging with regulators in Asia and Europe.

> Distributed Ledger Technology holds immense potential in democratising financial access. By leveraging fund tokenization, we strengthen the trusted connection between traditional finance and the emerging digital assets economy, while expanding our client base. As this technology progresses and becomes further integrated into market infrastructure, a scaling adoption would lead to new distribution channels, investment opportunities and operational advantages.

Emma Pecenicic, Head of Digital Proposition and Partnership, Asia Pacific ex Japan



Technology Provider: Visa

Visa's exploration of tokenization began in 2021, with over 40 different engagements with Central Banks, such as the Brazilian Central Bank's Drex Pilot and Singapore's Global CBDC Challenge. Visa was the winner of the "best ecosystem" award by the HKMA for their Global CBDC Fast Track Programme in 2022. Visa also participated in Phase 1 of the HKMA's e-HKD Pilot Programme alongside HSBC and Hang Seng Bank to test property payments and acquirer-merchant settlement using tokenized deposits.

As the technology provider of the use case, Visa features the Visa Tokenized Asset Platform (VTAP) – a sophisticated suite of APIs designed to empower banks with the capability to mint, burn, and transfer tokens seamlessly across both permissioned and public blockchains. VTAP will showcase tokenization of assets capabilities and the deployment of smart contracts to swap tokenized deposits and MMFs.

> We are extremely excited about the future of tokenization for payments. Visa's long-term collaboration with the HKMA and our partners for two consecutive years has provided us with many valuable insights around tokenization technology and new business flows. We are excited to work with our partner banks to bring to life real-world applications of tokenization to the region.

Catherine Gu, Head of Institutional Client Solutions, Visa Crypto

Target Learnings of Use Case

Reduction in settlement-related counterparty risk

Foreign exchange (FX) and securities markets are vulnerable to settlement-related counterparty risk, where failure to deliver owed assets may cause significant financial losses. The use case explores using smart contracts for atomic settlement, which enables simultaneous exchange of tokenized money and assets to mitigate settlement-related counterparty risk.

In the securities market, 8% of transactions and 4% of bond trades are at risk, primarily due to insufficient asset availability for settlement and reliance on manual processes in bank back offices. Similarly, in 2022, $2.2 trillion was at risk in the FX market, an increase from $1.9 trillion in 2019. Hong Kong exemplifies technological leadership to mitigate these challenges with its real-time settlement infrastructure, the Hong Kong dollar Real Time Gross Settlement (RTGS) system, that was launched in 1996. CHATS facilitates real-time interbank DvP and PvP settlements, but is currently limited to nine currency pairs and financial institutions located in Hong Kong, Indonesia, Malaysia, and Thailand.

Pilot Participants aim to test the potential of blockchain technology to drive further near real-time settlements between new forms of digital money and tokenized assets, such as tokenized MMFs.

Interoperability between public and permissioned blockchains

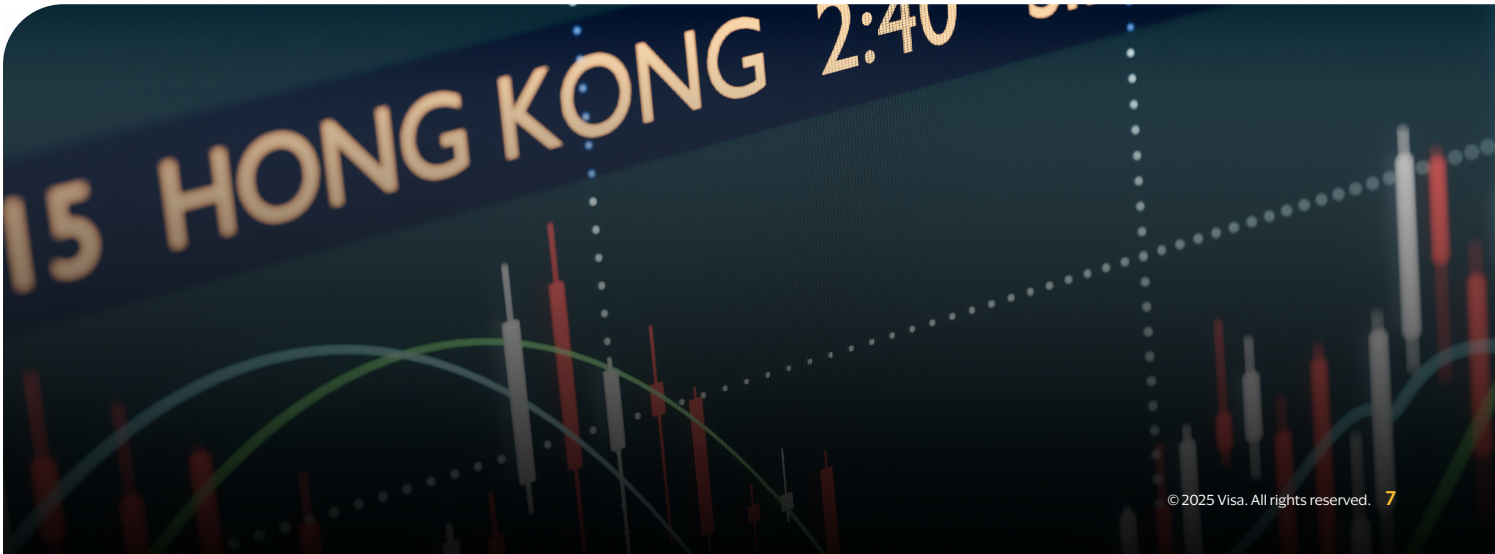
Interoperability between public and permissioned blockchain networks may allow financial institutions to maintain private internal operations while actively participating in the broader ecosystem. Financial institutions can leverage permissioned chains to verify and manage client relationships within an environment designed to be controlled, compliant, and private. Concurrently, public networks can be accessible and may offer superior distribution, avoiding the complexities of onboarding to multiple permissioned networks and asset market fragmentation.

Nevertheless, adequate interoperability solutions are essential to support the transfer of data and value across multiple blockchains, preventing double spending and enabling cross-chain atomic transactions. Thus, ANZ and FIL will test Chainlink's Cross-Chain Interoperability Protocol (CCIP) to connect ANZ's DASChain and Ethereum in a test environment. The goal is to explore the challenges and infrastructure needed for financial institutions to efficiently access both permissioned and public blockchains, reducing market fragmentation and supporting tokenized asset adoption.

Market requirements for token standards

Token standards are key to ensuring interoperability between independent financial institutions, providing regulatory clarity, and setting industry best practices. Prevalent smart contract standards in the industry, such as ERC-721, ERC-20, and ERC-3643, have enabled actors to issue tokens and build applications in a composable manner.

As traditional financial actors and other regulated institutions adopt blockchain technology, token standards have emerged as an important consideration. This pilot is an opportunity to explore standards that enable interoperability, evaluate their requirements, and potentially establish industry best practices.



Potential to accelerate digital asset adoption via distribution through new platforms and new customer segments

The landscape of fund vehicles has evolved from mutual funds to ETFs, and now to the potential era of tokenized fund. Tokenized market capitalization, excluding cryptocurrencies, is projected to reach approximately $2 trillion by 2030, driven by the adoption of tokenized mutual funds, bonds, securities, and exchange-traded notes.

Tokenized assets have garnered interest from 50% of financial institutions, driven by three key potential benefits. First, tokenization facilitates fractionalisation, enabling investors to implement tailored investment strategies. Second, tokenized funds can now be distributed to a broader spectrum of investors, encompassing both traditional entities (e.g. banks, financial institutions, and family offices) and non-traditional entities (e.g. digital asset banks, stablecoin issuers, and crypto platforms). This expanded distribution network significantly widens the potential customer base for these funds. Lastly, blockchain technology enhances operational efficiency by reducing manual processes and lowering transaction costs.

This pilot aims to understand market demand and use cases for potential investors, particularly in cross-border tokenized fund distribution. It targets private bank or corporate clients who may not currently have access to Hong Kong-domiciled funds, institutional MMFs in other jurisdictions, or HKD-denominated fund units for cash investments or portfolio diversification. The added benefits of on-chain transparency and reduced settlement time make fund tokenization an attractive value proposition. ANZ and FIL test Chainlink's Digital Transfer Agent offering, which streamlines multi-chain fund operations through smart contracts, secure infrastructure and Chainlink services.

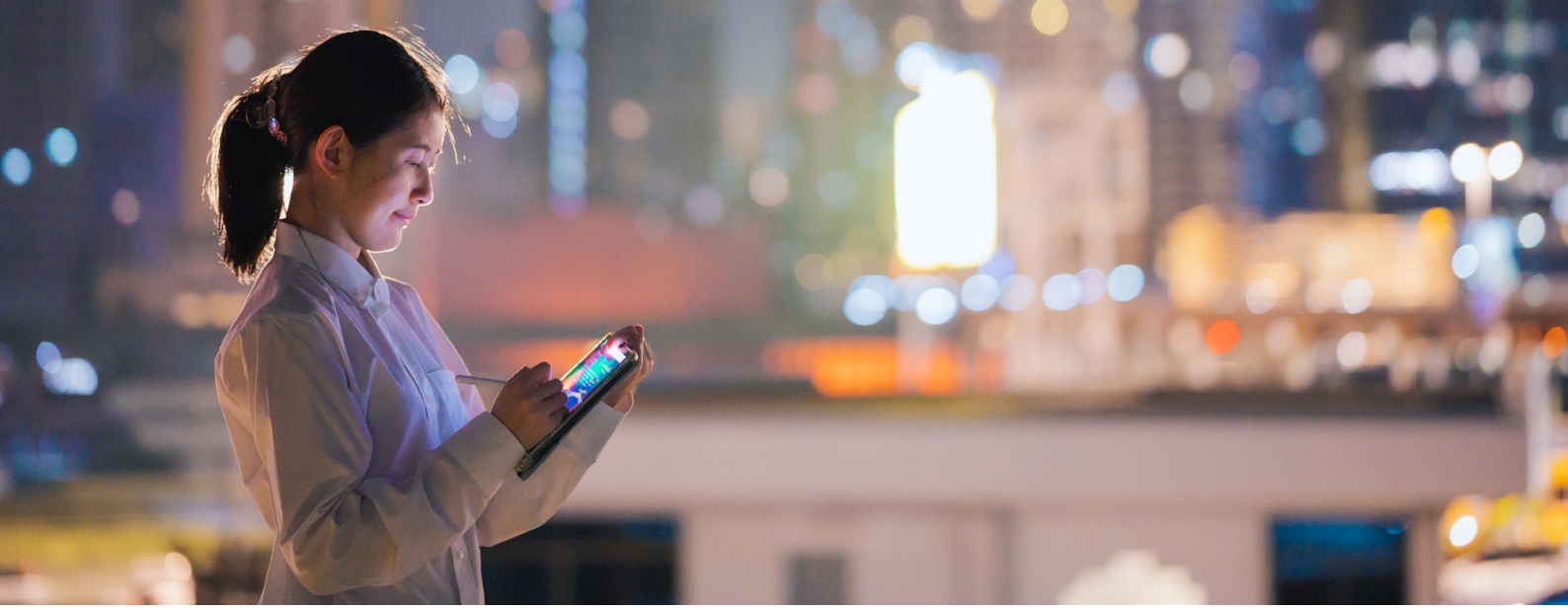
Tokenized Fund subscriptions:

With 93% of fund services firms yet to automate key fund administration workflows, traditional fund subscription and redemption processes are subject to time-intensive manual interventions, incur frequent settlement delays, and lack real-time transparency. These persistent challenges—which stem from fragmented legacy systems, cross-border regulatory complexities, and the lack of a single source of truth for critical asset data—continue to limit the efficiency and ultimately profitability of the $132 trillion global asset management industry.

Today, proven blockchain technologies provide the opportunity to streamline fund administration processes through secure, compliant automation, enhancing transparency, reliability, and security while enabling a significant reduction in operational costs. According to BCG, if all mutual funds were tokenized globally, mutual funds could realize an additional $100 billion in annual investment returns. However, institutions operating across multiple jurisdictions must ensure that transactions involving tokenized assets adhere to a wide range of regulatory requirements, including investor eligibility, data privacy, jurisdictional restrictions, and auditability.

Reduction in settlement time via 24/7 availability

While this pilot tests blockchain's settlement capabilities on a limited scope of transactions, participants recognise that blockchains inherently support near real-time continuous settlement, operating 24/7, including weekends and public holidays. Continuous near real-time settlement is not directly tested in this pilot; however, it encourages regulators and industry leaders to consider implementing such systems, which could significantly impact financial institutions' cash flow management and corporate liquidity. This stands in contrast to traditional banking systems, which are limited by fixed operational hours and experience delays for transactions outside these times and across time zones. For example, traditional funds settle in T+2-3, while FX transactions, depending on the currency corridor, settle within T+1-2.

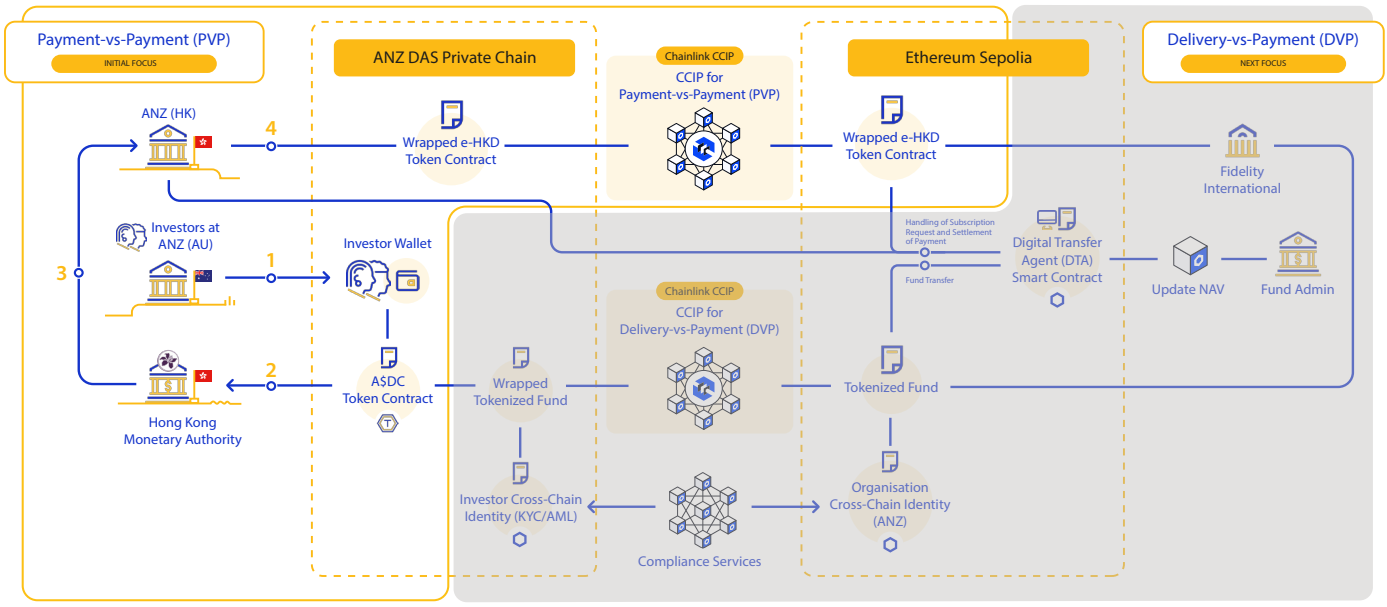


First phase of testing and initial considerations based on technical feasibility

In the first phase of the use case, Pilot Participants will test a simulated process of foreign exchange and minting of new forms of digital money, including e-HKD and tokenized deposits. In the final paper, participants will demonstrate the end-to-end process of the simulated transaction that allows an Australian investor to purchase a tokenized asset in Hong Kong.

The following diagrams demonstrate the first phase of the simulated use case:

Exchanging an Australian Stablecoin (A$DC) against a Hong Kong CBDC (e-HKD) using Chainlink CCIP : ANZ and FIL



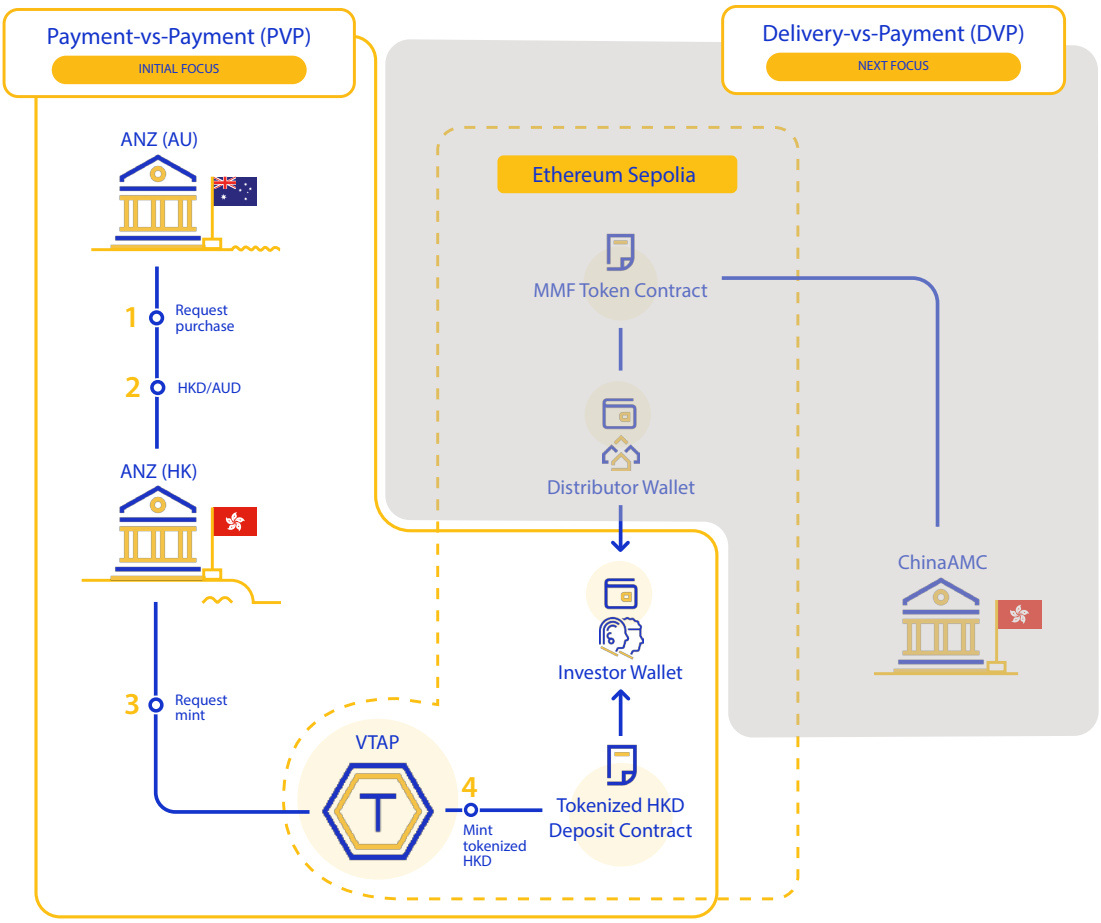
Identity verifications

1. Chainlink Compliance Services or a similar module at ANZ reads investors' identity information from ANZ's off-chain identity registry and provides a verification onchain in the form of Cross-Chain Identity ("CCID").

Payment-vs-Payment flows

1. Investors from ANZ in Australia deposit AUD and receive A$DC into their wallets on the ANZ DAS Chain.
2. Subject to the ANZ internal reserve module for the foreign exchange transaction, ANZ purchases e-HKD from the HKMA.
3. The HKMA records the e-HKD transaction and returns it to ANZ for confirmation.
4. Upon the successful transaction above, ANZ Hong Kong mints wrapped e-HKD on the ANZ DAS blockchain.

Exchanging Australian Dollars (AUD) against Tokenized Deposits in HKD denomination: VISA, ANZ and ChinaAMC (HK)



Wallet Onboarding

1. Investor is an ANZ customer who has already been KYC'd. When creating the customer wallet, VTAP adds customer wallet address to the Identity Registry for the Tokenized HKD Deposit Contract.

Payment-vs-Payment flows

1. Investor who is an ANZ customer in Australia requests to purchase Hong Kong MMF using their deposits at ANZ.
2. Using Investor's deposits, ANZ conducts a foreign exchange transaction of AUD to HKD internally.
3. ANZ calls the VTAP APIs to request minting of equivalent amount of tokenized HKD deposits.
4. VTAP mints tokenized HKD deposits to Investor's wallet on Ethereum Sepolia.

Preliminary design and implementation considerations

Different requirements to issue tokenized deposits and e-HKD

Pilot participants are evaluating two types of tokenized money: e-HKD and tokenized deposits, each necessitating distinct infrastructure and requirements. Specifically, the reserve management processes for tokenized deposits and e-HKD differ. For a CBDC like e-HKD, the HKMA is responsible for managing the reserves and issuing the CBDC. In contrast, the reserves for tokenized deposits are managed by the commercial bank, ANZ, which also handles their issuance.

Currency token smart contract standards and features: ERC-20, ERC-3643

Currency token standards play a crucial role in the development of digital finance. These standards need to address several key concerns: (1) compatibility of tokens with each other and financial applications, (2) security measures to protect against fraud, hacking, or other misuse of funds, and (3) compliance with regulatory requirements. Within the context of the Ethereum public network, and other EVM-compatible networks, two prominent token standards that have been considered in discussions about tokenized money are ERC-20 and ERC-3643. In this pilot, participants have decided to test both standards by tokenizing e-HKD using ERC-20 and tokenized deposits using ERC-3643, to understand the mechanisms and requirements involved in each.

Since 2015, ERC-20 has emerged as the baseline smart contract "interface" for fungible tokens, specifying basic functions, such as getting the token balance of a wallet address or transferring tokens between wallets. Its simplicity and widespread adoption have made it a popular choice for many token implementations. Many issuers implement additional controls on their ERC-20 tokens, such as allow listing or blocklisting, to control distribution.

Officially recognised in 2021 and finalised in 2024, ERC-3643 was developed with regulatory compliance in mind, building on ERC-20 to incorporate features that align with many requirements of regulated institutions. Its built-in identity management approach considers KYC/AML requirements and seeks to offer a unified way to onboard customers. Its modular and granular transfer restriction capabilities are informed by the control and oversight issuers need. Whilst ERC-20 compatible, ERC-3643 is more complex and potentially less flexible due to the inclusion of these additional features.

The suitability of either standard for tokenized money applications like CBDCs or tokenized deposits would depend on the specific requirements of each implementation. Factors such as the regulatory environment, desired functionality, scalability needs, and integration with existing systems would all play a role in determining the most appropriate approach.

Comparing interoperability approaches

Blockchain interoperability enables various blockchain networks to communicate, share data, bridge assets, and coordinate transactions, which is crucial for the wider adoption of blockchain technology. Pilot participants have considered various interoperability approaches which are available on the market.

Option 1:

Hash Time-Locked Contracts (HTLCs) utilise cryptographic hash functions and time locks to facilitate conditional transactions across different blockchains. In this method, the sender creates a 'hash lock' by generating a unique hash from a secret key and initiates a transaction, locking the assets with the hash lock and a time limit. HTLCs can offer cryptographic guarantees for cross-chain asset purchases in scenarios where the investment asset and tokenized fiat are issued on different chains. If the tokens cannot be bridged due to a constraint (e.g. if a token is only issued on permissioned networks and cannot cross to public blockchains due to AML/CFT concerns in a jurisdiction), HTLCs can be used to securely coordinate asset transfer taking place on the first chain and payment taking place on the second.

Option 2:

Issuer-Coordinator model, where the issuer of digital assets coordinates the minting and burning of assets across multiple chains to facilitate the flow of tokens across networks. While this presents an easy setup with trust assumptions, the model faces several challenges: it demands continuous intervention from the issuer rather than leveraging the programmability inherent to blockchain networks. Furthermore, it lacks transparency and verifiability compared to on-chain and decentralised solutions.

Option 3:

Cross-chain messaging protocols, such as Chainlink's CCIP, allow passing arbitrary data and value across multiple chains with institutional-grade cross-chain security. This unlocks new technical capabilities, such as securely bridging tokens to different blockchain networks. To coordinate these cross-chain actions, CCIP relies on decentralised oracle networks that verify and relay messages. CCIP provides an improved user experience by allowing institutions to conduct complex multichain transactions from their wallet on a single blockchain via Programmable Token Transfers. Moreover, the speed of transactions is performant given the mechanism requires 2 on-chain transactions.

For the purpose of this pilot, the consortium will test option 3, Chainlink's CCIP, which will connect ANZ's private permissioned DASchain and the public permissionless Ethereum network.

Blockchain considerations (public, private)

In this pilot, participants aim to test transactions across both private permissioned and public permissionless blockchains. This aims to benefit from the privacy and controlled environment of a permissioned network as well as the distribution effect and accessibility ensured by a public chain. ANZ will leverage their DASchain to simulate the minting of an AUD referenced stablecoin, A$DC.

The transaction, involving the purchase of the MMF, will be tested on the Ethereum testnet to understand how different participants integrate with a public blockchain, and which transaction design is the most efficient. Due to the fragmented nature of permissioned chains, public blockchains are ideal for exchanges involving multiple parties. This pilot provides a valuable opportunity for participants to consider all necessary security and compliance measures for successful transactions on public networks.

Next steps: completion of remaining pilot objectives

This pilot aims to explore how tokenization can develop the next generation of cutting-edge payment infrastructure. This includes understanding tokenization's role in facilitating transactions, while ensuring financial stability and compliance.

In the next stage of the pilot, the Pilot Participants will commence end-to-end testing of transactions, which will provide insights into how tokenization can reduce settlement-related counterparty risk. It is anticipated that this testing will assist the industry with further development of interoperability standards, token standards, token distribution, and the feasibility of 24/7 availability blockchain technology offers.

Pilot Participants look forward to the contribution this pilot may make to help unlock the e-HKD's full potential for Hong Kong and help shape global industry standards for digital assets.

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