



DTCC

MAY 2020

PROJECT WHITNEY

CASE STUDY

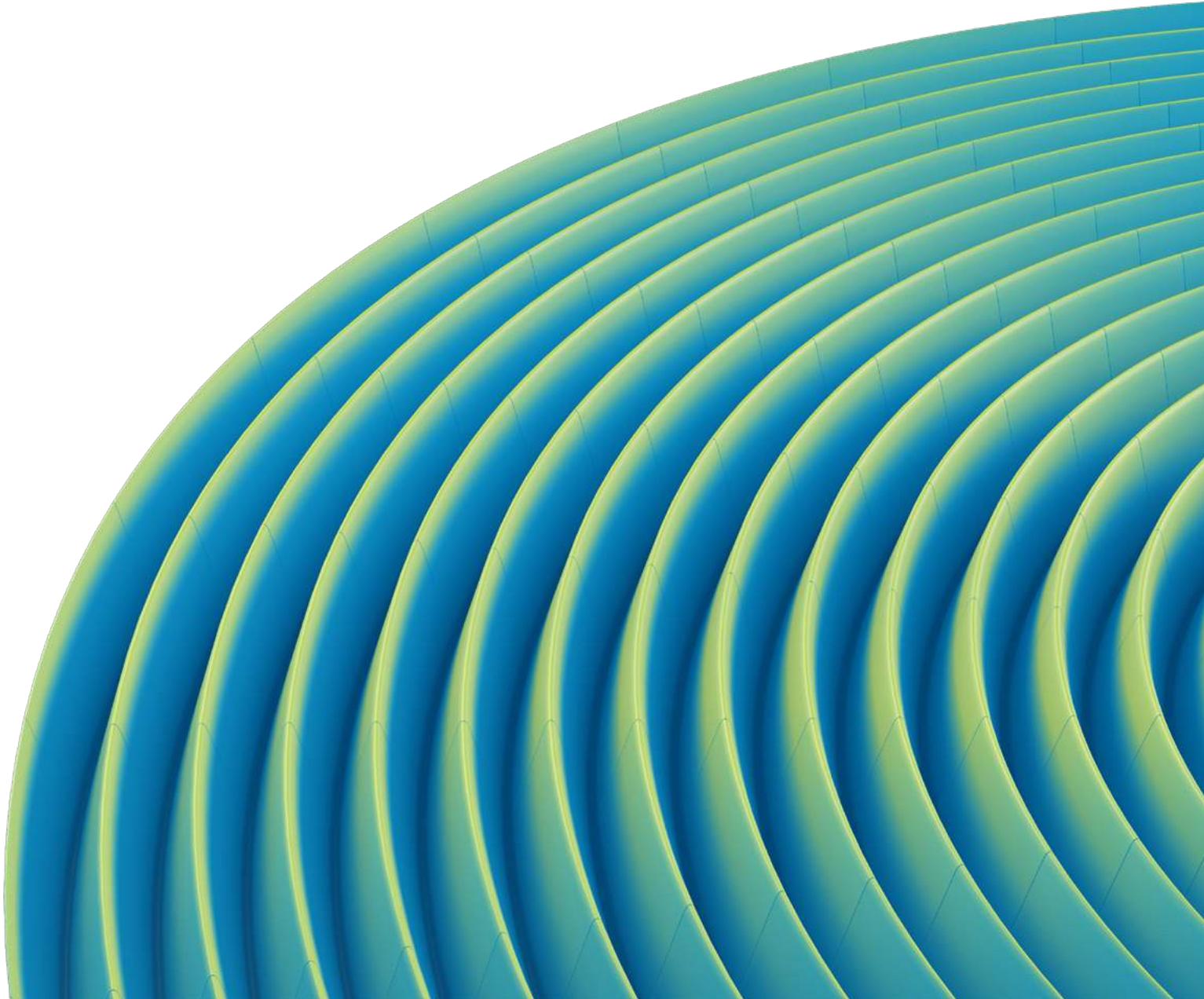


TABLE OF CONTENTS

Introduction.....	1
Case Study Overview.....	3
Phase 1: Prototype Build	5
How the Prototype Works – A Hypothetical Case Study.....	6
Findings & Next Steps	9
Glossary of Terms	10
Acknowledgments	10

INTRODUCTION

The financial industry is in a constant state of change and the speed and pace of this evolution continues to accelerate. Advancements made in software, communications and encryption technology provide opportunities to construct the single best solution to satisfy an unmet customer need. This technology evolution enables more efficient workflow and communication, in addition to faster and more secure processing.

With the emergence of digital platforms and an increased focus on digital transformation across the industry, practical product/service experimentation of use cases is critical to adapt and embrace new technologies and to demonstrate new ways of transacting and collaborating with clients to assess how solutions meet their needs.

Private markets and alternative assets have emerged as a space with significant headwinds poised for a digital paradigm shift. Private markets are on the rise as U.S. companies are increasingly staying private longer, resulting in a significant decline in the number of companies going public.¹ One of the outcomes of this shift is that “Main-Street” investors have limited access to the capital formation associated with growth stage companies.

Technology solutions that support private markets to date have been geared primarily toward serving the needs of late stage pre-IPO companies, leaving early-stage companies and their investor base on the sidelines. Tokenization – the digital representation of assets, such as securities on a blockchain – has emerged as an attractive option for issuers. Blockchain infrastructure specifically appeals to early-stage companies, due to its open and globally accessible infrastructure and the potential to facilitate more efficient and truly digital processing.

Across the industry, interest in digitalization is rising. Startups are developing Software-as-a-Service (“SaaS”) based solutions that enable early-stage companies and funds to issue and manage security tokens on public blockchains. Central banks and regulators are assessing the impacts of tokenization as a potential new method of transferring value, and leading financial institutions are increasing activity in the tokenization space, either through investment or direct product launch.

DTCC has a long history of driving innovation to strengthen post-trade processes and delivering upon its mission to provide a resilient, secure and efficient post-trade infrastructure for the industry. DTCC has provided economies of scale to the industry through its platforms and ensured the safety and soundness of securities trade processing through periods of extreme volume and systemic market shocks.

DTCC’s Innovation Team, responsible for defining the firm’s strategy for new and emerging technology innovation, is leading

- DTCC believes the digitalization of traditional assets shows promise for a more efficient capital markets ecosystem. However, markets are unpredictable and reliable demand for these assets may take time to emerge.

¹ <https://www.mckinsey.com/industries/private-equity-and-principal-investors/our-insights/mckinseys-private-markets-annual-review>

multiple efforts related to the exploration and experimentation of digitalization and working with colleagues and the industry to advance dialogue on key topics.

DTCC believes the digitalization of traditional assets shows promise for a more efficient capital markets ecosystem. However, markets are unpredictable and reliable demand for these assets may take time to emerge. Considerations need to be addressed, including the cost benefits of changing existing high performing marketplaces and the complexities involved in migrating those marketplaces. DTCC believes that in its current state, digitalization can best be applied to opportunities in new markets or underserviced assets with limited existing automation, such as the U.S. private markets.

Recognizing the trends driving companies to stay private longer and investors' growing interest in private markets, DTCC developed a prototype designed to support private market assets throughout their lifecycle (e.g., issuance, distribution and secondary transfer). The goal of the prototype is to engage in practical experimentation with key industry participants to build acumen around natively issued tokens and assess the value proposition of a platform-based digital infrastructure for the private markets.

CASE STUDY OVERVIEW

With the emergence of a handful of regulatorily compliant “Security Token Offerings” in 2019,² the tokenization of private market securities has shown promise but comes with its own set of unique challenges yet to be fully resolved. Ongoing questions about the legal enforceability of financial transactions on public blockchains, and the ambiguity of their governance has removed these platforms from consideration for many regulated financial institutions. In framing the key challenges and pain points, DTCC evaluated private markets as they work today, as well as the business models employed for security token offerings to date.

The following table summarizes the challenges DTCC has observed across private markets, as well as some proposed tokenization solutions.

PRIVATE MARKETS TOKENIZED ASSETS	CHALLENGE	PAIN POINTS
	MANUAL PROCESSES	<ul style="list-style-type: none">• Paper-based transfer of ownership• Costly, error prone, slow
	MARKET FRAGMENTATION	<ul style="list-style-type: none">• Siloed solutions = ‘walled gardens’• Lack of industry standardization
	INEFFICIENT SUITABILITY	<ul style="list-style-type: none">• Bespoke and issue-specific compliance and suitability rules• Reactive compliance enforcement
	PUBLIC BLOCKCHAINS	<ul style="list-style-type: none">• Nascentcy of smart contracts• Limited performance / throughput
	REGULATORY UNCERTAINTY	<ul style="list-style-type: none">• Low confidence in public blockchains• Risk of private key loss or theft
	TRUSTED PROVIDERS	<ul style="list-style-type: none">• Entrants with limited experience running regulated services• Lack of institutional grade infrastructure

Based on its market research, and with client support, DTCC identified an opportunity to leverage the tokenization of traditional assets to create a standard, modern, operationally efficient and secure approach to Issuer Services across primary and secondary private markets, including compliance enforcement of eligible tokenized securities, an authoritative stock record and asset lifecycle management.

Project Whitney, led by DTCC’s Innovation Team, is a multi-phase project designed to evaluate the practical and commercial viability and value of a digital infrastructure supporting private market securities.

The three phases include: Phase 1: Whitney Prototype Build; Phase 2: Participant Testing; and Phase 3: Prototype Expansion.

² See also, Paul Vigna, SEC Clears Blockstack to Hold First Regulated Token Offering, Wall Street Journal (July 10, 2019), available at <https://www.wsj.com/articles/sec-clears-blockstack-to-hold-first-regulated-token-offering-11562794848>

A precursor to these phases focused on ensuring the appropriate governance structure was in place and included vetting and approval by internal management at the highest levels.

The prototype is based on a business model that addresses both legacy industry challenges in private markets, as well as new considerations resulting from tokenization of assets on public blockchains.

The main objectives of the prototype scope and technical architecture include:

- Prioritizing the validation of macro concepts over production level details.
- Developing a functional platform that could be used for client and partner experimentation.
- Defining the problem statement by market segments and associated solution.
- Building technical acumen.
- Alleviating potential regulatory concerns and challenges in the business model design.

DESIGN DECISIONS				
Target Regulation D (SEC Exemption) Equity as Initial Asset Type	Enable Integration with Multiple DLT Platforms – Both Public and Private	Enforce Trust by Building Critical Capabilities Off-Chain	Employ a Flexible and Transparent Rules Engine for Compliance and Suitability	Leverage APIs for Off-Chain Processes

The project team focused on Smart Contract Development, Off-Chain Infrastructure and API Integrations while iterating quickly and timeboxing the development of the prototype.

Following a 12-week exercise, the modular prototype is available for potential participants to collaborate with DTCC, validate the design concepts, test workflows and integrations and provide feedback.

PHASE 1: PROTOTYPE BUILD

Designed with an institutional user base in mind, the Whitney Platform was built as a modular service-based platform to support the tokenization of assets throughout issuance, distribution and secondary transfer.

The prototype introduces the following key features:

- Standard and operationally efficient approach to compliance and suitability enforcement.
- Authoritative stock record maintained off-chain across all issuances.
- API interfaces for off-chain processes and integration points.

While the prototype mints tokens and records asset transfers on the Public Ethereum network, it maintains an independent digital record of security ownership and performs real-time compliance and suitability checks off-chain. Additionally, the core infrastructure is architected to enable integration into additional distributed ledgers (Hyperledger Fabric is complete, R3 Corda is underway) based on market demand.

- While the prototype mints tokens and records asset transfers on the Public Ethereum network, it maintains an independent digital record of security ownership and performs real-time compliance and suitability checks off-chain.

Core Capabilities

Stock Record: An AWS Quantum Ledger Database (QLDB) leveraged to house a transparent, immutable and cryptographically verifiable record of security ownership across all issuances.

Issuer & Investor Registries: Store issuer, investor, and Security Master data that enables the issuance and ongoing management of securities.

Compliance Oracle: Dynamic rules engine that enables issuers and investors to maintain compliance throughout a securities lifecycle by approving / rejecting transactions. When a transaction is approved, the stock record is updated, and the movement of tokens on-chain occurs. Can be called through an on-chain transfer or via API.

Ethereum Network: Initial DLT integration where tokens will be 'minted'. Deployed Token Contracts follow the Whitney Token Standard, an ERC-20 compliant standard that ensures transfers can only occur if approved by the Compliance Oracle.

API Connectivity: REST API interfaces that enable platform parties (e.g., trading venues, placement agents, etc.) to perform operation such as investor registration and off-chain transfer requests.

Future DLT: Represent a host of DLT platforms which future phases of the Whitney Platform will integrate with to enable tokenization across multiple networks.



HOW THE PROTOTYPE WORKS – A HYPOTHETICAL CASE STUDY

The case study is split into two sections. The first illustrates the journey of an issuer, Apollo Labz, which issues and distributes a security to investors in the primary offering. The second illustrates how investors trade shares of Apollo Labz in the secondary markets.

Issuance & Primary Distribution

Apollo Labz, a San Francisco-based tech startup, decides to raise capital through an equity offering to investors to acquire the funds necessary to deliver its product roadmap. Apollo Labz wants its equity offering to be widely accessible to investors in the secondary market and selects a placement agent that is a member of the Whitney Private Market Network to assist in the capital raise.

REGISTRATION WITH WHITNEY

Apollo Labz is offering its securities as Reg D (506(c)) and drafts the Private Placement Memorandum in conjunction with its placement agent and legal counsel. The placement agent uses an API integration to the Whitney Platform to begin the registration process.

- Placement agent registers Apollo Labz, transmitting issuer data and creating an Issuer Profile to associate with all future issuances.
- Registration triggers a new Security Record in the Security Master File and generates a Tokenized Security Identification Number (TSIN) that is the unique identifier associated with the issuance.
- Placement agent selects, via API or Web GUI, the compliance and suitability rules to be enforced for the security. Available rules include required SEC rules based on the exemption (e.g., accreditation status, lockup periods) and any bespoke rules outlined in the offering memorandum.

BOOK BUILDING & TOKEN MINTING

Once Apollo Labz's security is registered with the Whitney Platform, the placement agent identifies investors for primary issuance.

- As investors are identified, the placement agent performs the necessary Know Your Customer (KYC) and accreditation checks and submits the investor record to the Whitney Platform Investor Registry.
- The placement agent 'builds the book' via API by adding investors and the corresponding shares they agreed to purchase to the Stock Record.
- The Compliance Oracle validates that each investor meets Apollo Labz's compliance and suitability rules.
- Finally, upon closure of the book, the Whitney Platform will "batch mint" tokens by distributing them to the public addresses associated with each verified investor.

WHITNEY SOLUTION BENEFITS

- Managing compliance and suitability rules off-chain enables more robust and complex rules to be enforced than a simple on-chain whitelist would allow.
- Prevents the need for bespoke smart contract creation, which saves time and cost.
- Integrating the Compliance Oracle into the book building process ensures Apollo Labz remains in compliance even prior to secondary market activity.
- Leveraging the centralized Investor Registry alleviates the need to register and whitelist investors who have taken part in previous transactions in the Whitney Private Market Network.

Secondary Markets

Following token issuance and an initial “lock-up period,” investors are now free to search for buyers in the secondary market, if they wish to liquidate some or all their holdings. Because Apollo Labz tokens are based on the Whitney Token Standard, investors Alice, Bob and Charlotte can transact on a peer-to-peer basis, leveraging their own wallets or through a trading venue such as an Alternative Trading System (ATS).

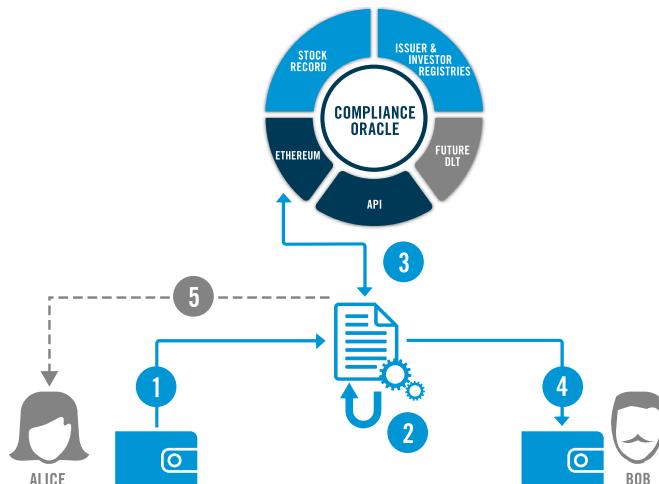
PEER-TO-PEER TRANSFERS

Scenario: Alice is transferring all 150 Apollo Labz tokens in her wallet to Bob

- Transfer type is free of payment.
- Alice uses a personal wallet connected to the Public Ethereum blockchain to initiate the transfer.
- Bob has an existing Investor Profile in the Investor Registry.

.....

1. Alice initiates transfer of 150 Apollo Labz tokens to Bob's public address.
2. The Apollo Labz Token Contract moves tokens into “lock-up” to prevent double spend.
3. Compliance Oracle is notified of pending transaction and runs the request through the validation rules to assess if the transfer passes the compliance and suitability rules associated with Apollo Labz.
4. If approved, the off-chain Stock Record is updated, and tokens move on the Ethereum blockchain from “lock-up” to Bob's wallet.
5. If rejected, tokens are released from “lock-up” and credited back to Alice's wallet.

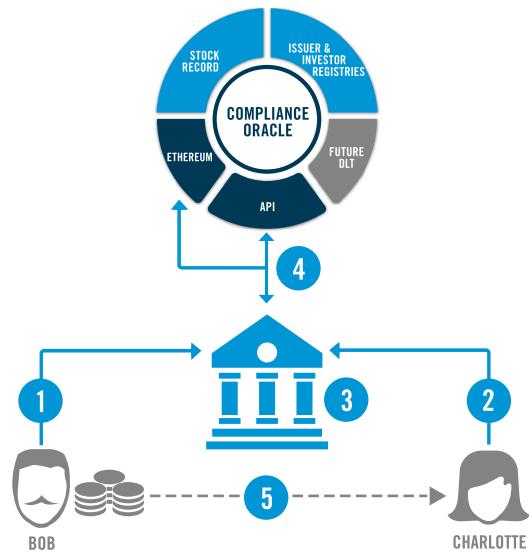


SECONDARY TRANSFERS VIA ATS

Scenario: Bob is selling 100 Apollo Labz tokens on a Regulated ATS

- Regulated ATS listing Apollo Labz tokens is a partner of the Whitney Private Market Network.
- Bob has an open account with the ATS.
- Charlotte, an investor, opens an account with the ATS.
- ATS transmits Charlotte's investor data, leveraged to create an Investor Profile via API to the Investor Registry.

1. Bob submits a sell order on the ATS Platform.
2. Charlotte submits a buy order on the ATS Platform.
3. The ATS matches the orders and sends the details to the Whitney Platform either by:
 - a. Using the allowance functionality of the Whitney Token Standard to propose a transfer from Bob's public address to Charlotte's public address; or
 - b. In a custodial model where tokens are held in omnibus on the investor's behalf, the ATS can call the Compliance Oracle via API.
4. Compliance Oracle is notified of the pending transaction rules to assess if the transfer passes the compliance analysis.
5. If approved, the off-chain Stock Record is updated, and in the case of a custodial model, remain in omnibus.



WHITNEY SOLUTION BENEFITS

- The purpose-built Whitney Token Standard allows investors to leverage a wide set of wallet / custodial solutions while maintaining compliant transfers.
- The off-chain Stock Record provides issuers (or their agents) a real time view of ownership easily accessible via API or Web GUI.
- A simple API provides integration for registered trading venues across all issuances in the Whitney Ecosystem.
- The ability to instruct off-chain transfer (via trading venue API) alleviates much of the unpredictable time and transaction costs associated with settlement finality on the Public Ethereum Network.

FINDINGS & NEXT STEPS

In 12 weeks, the Project Whitney Prototype was developed with a modular component-based architecture. We believe this model will enable the platform components to be reused as the prototype evolves and expands to include private DLT integration.

While the project team was aware of challenges with the Public Ethereum Network at the onset of the project, the decision to leverage Public Ethereum for the initial phase was driven by the following:

- Desire to build hands-on technical acumen around public blockchain infrastructure.
- Observation of U.S. private markets tokenization efforts to date.
- Access to open source tooling.
- Opportunity to test the enforcement of key operational processes off-chain.

NEXT STEPS

- **Phase 2: Participant Testing** – Validate key concepts and flows with potential client and partner firms and provide the option for API integration for those who wish to test on the platform.
- **Phase 3: Prototype Expansion** – Iterate the prototype design to incorporate Phase 2 feedback and expand integration to additional DLT Networks, beginning with Hyperledger Fabric followed by R3 Corda.

TECHNICAL OBSERVATIONS WITH PUBLIC ETHEREUM

- Despite utilizing a tool to help determine the optimal gas limit for on-chain transactions, large time variances were observed for certain processes such as batch minting tokens, which at times took as little as seconds, but during periods of high network activity could take 15 minutes or longer.
- Similarly, during times of high network activity, transaction costs were highly variable, posing potential risks for financial institutions that need to be able to estimate and budget their cost to operate, especially during times of high volatility.
- While users of the Ethereum network benefit from the widespread availability of open source tooling, we found that many of the solutions are not fit for use in an institutional setting.

Interested in learning more? If you would like to discuss this initiative with DTCC's Business Innovation Team and understand more about the Project Whitney Prototype, email Innovation@DTCC.com.

GLOSSARY OF TERMS

Alternative Trading System (ATS) – *Trading venue operated by a broker-dealer that seeks to match buyers and sellers in securities transactions.*

Gas limit – *The maximum value you are willing to spend on any given transaction on the Ethereum Network*

Investor – *The individual who participates in the primary offering, or a secondary offering of a security.*

Issuer – *The private company looking to raise capital through the offering of their equity security.*

Placement Agent – *An entity (usually a broker-dealer) that assists private companies in structuring and raising capital for an exempt security offering.*

Token Contract – *A smart contract deployed on the Ethereum Network that manages token balances and the methods by which token transfers can be invoked. All Token Contracts created by the Whitney Platform follow the Whitney Token Standard – ensuring transfers can only occur if approved by the Compliance Oracle.*

ACKNOWLEDGMENTS



For more information on our products and services, visit [DTCC.com](https://www.dtcc.com)

For information on careers at DTCC, visit careers.dtcc.com



Follow us on Twitter: [@The_DTCC](https://twitter.com/The_DTCC)



Find us on LinkedIn: [LinkedIn.com/company/dtcc](https://www.linkedin.com/company/dtcc)



Like us on Facebook: facebook.com/thedtcc



Watch us on YouTube: youtube.com/c/thedtcc1973



Australia • Belgium • Canada • England • France • Germany • China • India • Ireland • Japan • Korea • Philippines • Singapore • Sweden • USA • Wales

© 2020 DTCC. All rights reserved. DTCC, DTCC (Stylized), ADVANCING FINANCIAL MARKETS. TOGETHER, and the Interlocker graphic are registered and unregistered trademarks of The Depository Trust & Clearing Corporation.

The services described above are provided under the "DTCC" brand name by certain affiliates of The Depository Trust & Clearing Corporation ("DTCC"). DTCC itself does not provide such services. Each of these affiliates is a separate legal entity, subject to the laws and regulations of the particular country or countries in which such entity operates. See www.dtcc.com for a detailed description of DTCC, its affiliates and the services they offer.