

DTCC

May 2024

Smart NAV Pilot Report: Bringing Trusted Data to the Blockchain Ecosystem

A Pilot Report



Executive Summary

As a trusted Financial Market Infrastructure (FMI) and partner to financial market participants for over 50 years, DTCC is well positioned to support the industry's ongoing exploration of digital assets and their application in financial services.

As part of this exploration, DTCC developed a new pilot, Smart NAV, which leveraged DTCC's digital asset capabilities, as well as Chainlink, a leading technology platform for cross-chain interoperability, and blockchain abstraction. The pilot was designed to explore an extension of a DTCC service, [Mutual Fund Profile Service I](#) (MFPS I), the industry standard for transmitting "Price and Rate" data (referred to as "NAV data.") In recognition of increased industry attention on mutual fund tokenization, DTCC identified an opportunity for on-chain price and rate data that can serve as a key enabler to the exploration of new initiatives. Taking a 'chain-agnostic' approach (i.e., the ability to disseminate the NAV data across (virtually) any blockchain) would be key to enabling other use cases to build atop Smart NAV's foundations.

We invited asset managers, service providers, and distributors to a series of collaborative workshops to discuss the pilot and evaluate benefits. Participants included American Century Investments, BNY Mellon, Edward Jones, Franklin Templeton, Invesco, JP Morgan, MFS Investment Management, Mid Atlantic Trust d/b/a American Trust Custody, State Street and U.S. Bank.

KEY TAKEAWAYS:

Together, DTCC, along with market participants and Chainlink, found that by delivering structured data on-chain and creating standard roles and processes, foundational data could be embedded into a multitude of on-chain use cases, such as tokenized funds and "bulk consumer" smart contracts, which are contracts that hold data for multiple funds. This capability can support future industry exploration and can power numerous downstream use cases as well, such as brokerage portfolio applications. Additional benefits include real-time, more automated data dissemination and built-in access to historical data.

SPECIFICALLY, THE SMART NAV PILOT:

- Validated a model for user interfaces and applications that leverage on-chain data
- Established automation of data routing through smart contracts to create dynamic data management across the lifecycle of assets
- Promoted a model that prevents future fragmentation through the use of Chainlink's Cross-Chain Interoperability Protocol (CCIP)
- Limited impact to existing market practices and client-driven processes by enabling clients to leverage the same channels they do today
- Enabled clients to retrieve historical price and rate data without manual recordkeeping
- Simplified the downstream relay of price and rate data through new interfaces for data consumption
- Provided clients with an API solution to receive price and rate data

Overview

BUSINESS PROCESS EXPLORED:

Smart NAV explored a digital extension to DTCC's Mutual Fund Profile Service (MFPS I), the industry standard for disseminating price and rate data, leveraging DLT for data dissemination and data consumption

GOAL

To evaluate the feasibility and industry value of delivering a DLT-based price and rate dissemination solution that can enable new benefits and support experimentation in the asset management space

STRUCTURE

Conducted by DTCC, 10 industry participants, and Chainlink

DTCC



PARTICIPATING FIRMS:



How it Works

BACKGROUND ON MFPS I

DTCC's Mutual Fund Services business currently operates **Mutual Fund Profile Service I** (MFPS I), an industry standard that provides fund companies with an automated solution for delivering prices and daily distribution rates to their intermediaries. Every day, the service oversees the transmission of price and rate data across 1,000+ clients for tens of thousands of mutual fund securities.

In the current process, DTCC links funds/service providers and distributors (or other interested parties), collecting price and rate data via its message queue (MQ) and file-based methods, aggregating and disseminating at regular intervals.

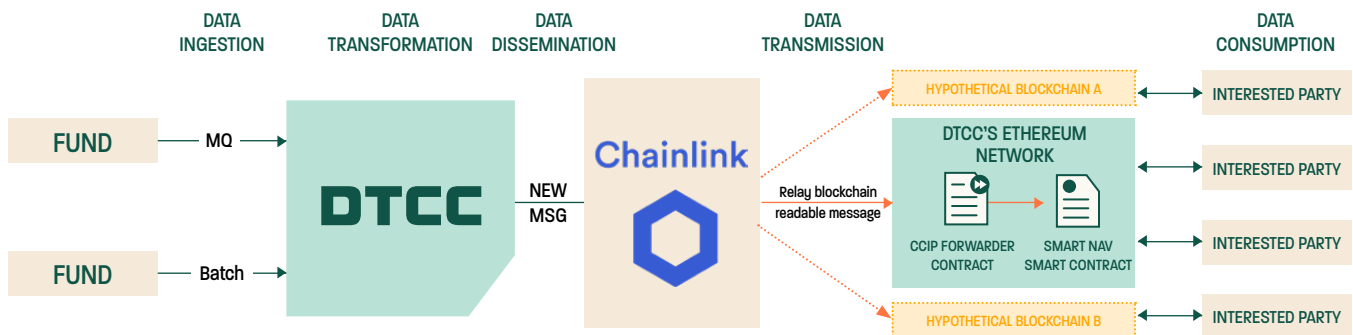
CURRENT PROCESS



The Smart NAV Pilot was designed as a digital extension of the existing MFPS I service, seeking to extend and complement its current capabilities. In practice, the initial portions of the workflow – where price and rate data is calculated by funds and their service providers – remain unchanged to minimize impact to existing processes.

With Smart NAV, the extension of capabilities effectively begins at the point of data dissemination, where in addition to being sent out through existing channels, the data is transformed so that it can be disseminated across virtually any blockchain, private or public, via Chainlink's Cross-Chain Interoperability Protocol (CCIP), an open blockchain interoperability standard.




DIGITAL EXTENSION – SMART NAV



Upon ingesting inbound data:

1. Inbound data is transformed from legacy file-based formats to a modern data structure (JSON-based)
2. Newly formatted data is wrapped into a blockchain transaction and signed by DTCC's private keys – EIP-712 pattern was leveraged (which is validated on-chain in the CCIP Forwarder Contract)
3. The blockchain transaction is then routed to CCIP. The CCIP Relay is responsible for transmitting the message to relevant blockchain networks (See Appendix)

4. Once transmitted to DTCC's private Ethereum network, a CCIP Forwarder smart contract forwards the data to the Smart NAV-specific smart contracts responsible for validating permissions of the publisher (i.e., DTCC), storing the data and managing permissions of clients. Though DTCC's private Ethereum network was the only network leveraged for this pilot, the solution design allows this process to occur across many blockchains in parallel
5. Data is available for consumption by clients through a variety of new methods. These methods are illustrative of the "smart" capabilities of Smart NAV and how it can power additional use cases (As detailed in the Appendix)

| | | |
|---|---|--|
|  <p>Real-time API Service Upon new data becoming available in the smart contracts, the API service 'pushes' the data to systems that are integrated to the API.</p> |  <p>Single Fund Consumer Smart Contract Upon price and/or rate data becoming available for a fund (identified by ISIN), the single fund contract is instantly enriched with the data for that fund.</p> |  <p>Bulk Consumer Smart Contract Upon price and/or rate data becoming available for a set of specified funds, the Bulk Consumer contract is instantly updated with the data for those funds.</p> |
|---|---|--|

The process above occurs continuously as new inbound data is received by DTCC, enabling near-real-time consumption downstream.

The Path Forward

In its simplest form, Smart NAV centers around providing the capability to make trusted, verifiable data available on (virtually any) blockchain network(s) to support the use of that data in business workflows. DTCC served as the provider, or sourcer, of that data, as well as the governor of the on-chain solution that stores that data, while CCIP served as the interoperability layer. The core capability explored is applicable across endless use cases that could ultimately power more streamlined and efficient operational processes.

Based on these findings, we see an opportunity to potentially expand the scope of the pilot to explore how the technical capability leveraged in the pilot could power a broader range of use cases beyond the dissemination of price and rate data and across a greater number of blockchains. Thus, the Smart NAV Pilot provides the foundation for a number of future explorations, including:

- Leveraging a similar dissemination model with expanded datasets (e.g., key reference data)
- Powering workflow automation across blockchains triggered by the disseminated dataset (e.g., portfolio rebalancing triggered by NAV)
- Expanding smart contract governance capabilities used in Smart NAV to enable data capture directly from submitters (versus centralized dissemination point)

Appendix / Other Resources to Explore

CHAINLINK AND THEIR ROLE IN SMART NAV

What is the Chainlink platform?

[Chainlink](#) is the leading technology platform for onchain data, cross-chain interoperability, and blockchain abstraction that is enabling financial institutions to develop customized, compliant, and future-proof blockchain applications and tokenized assets. Chainlink powers tokenized assets through their entire lifecycle, enriching them with real-world data (e.g., NAV, AML/KYC, proof of reserve), providing secure interoperability between any private or public blockchain to increase liquidity, and synchronizing asset data across blockchains and existing systems to maintain a unified golden record. Chainlink has securely enabled over \$10 trillion in transaction value and delivered more than 12 billion onchain data points across the blockchain ecosystem.

Chainlink's [Cross-Chain Interoperability Protocol \(CCIP\)](#) is the industry standard for securely integrating existing systems across any blockchain. Using CCIP, financial institutions can transfer data and assets across any public or private blockchain in a single atomic transaction, as well as transact across the multichain ecosystem from their existing infrastructure through a single point of integration. CCIP is the only cross-chain protocol that offers defense-in-depth security and a way to manage various global policies through the Risk Management Network, which enables institutions to apply predefined controls around transactional activity to help ensure regulatory and organizational compliance. Major market infrastructures and institutional banks such as [Swift](#), [ANZ](#), and many others have successfully used Chainlink to demonstrate that financial institutions can use existing infrastructure and messaging standards to interact with tokenized assets across blockchains through CCIP's blockchain abstraction layer.

What is the value of Chainlink to the Smart NAV use case?




At its core, the Smart NAV use case is about getting data to where it needs to be. Tokenized assets are empowered by the accessibility of such data on a dynamic basis. While this would be relatively simple to accomplish if we knew all mutual funds would ultimately reside on a single blockchain, the practical reality is that they are likely to span many blockchains. This ability to continue to update the data irrespective of which chain the smart contract resides on over its lifecycle is crucial to its ability to preserve and optimize its automation.

The notion of DTCC directly connecting to every blockchain network where our clients conduct business is not practical given the costs and operational burden that would result from integrations, managing nodes, and accounting for the technical nuances between chains. The Smart NAV pilot demonstrated CCIP's ability to serve as an abstraction layer between DTCC and the potentially infinite number of blockchains we may need to integrate to at some point in the future. Rather than building bespoke connections, we were able to validate an approach where DTCC systems integrate to a single CCIP endpoint which can then relay the data to virtually any destination blockchain.

While this abstraction capability is highly relevant to the Smart NAV use case in that it supports the notion that mutual fund 'consumers' will exist across many blockchains, the broader technical capability that was validated has the potential to apply to countless other use cases that will be relevant to DTCC in the future.

DATA CONSUMPTION METHODS

Due to Smart NAV’s client focus, a large emphasis was placed on how clients can consume price and rate data via new methods, such as APIs and smart contracts. The following table highlights the consumption methods that were built for the pilot:

|  REAL-TIME API SERVICE |  “SINGLE-FUND CONSUMER” SMART CONTRACTS |  “BULK CONSUMER” SMART CONTRACT |
|---|---|--|
| <p>This API-based service sits off-chain and is ‘watching’ the activity on-chain at all times. Upon new data becoming available in the smart contracts, the API service ‘pushes’ the data to systems that are integrated to the API. Additionally, the API can be leveraged to query historical data – a feature not available to existing users of MFPS I.</p> <p>Ultimately, the Real-time API service abstracts away all aspects of the blockchain for any party that integrates to it – this is key to demonstrate that while blockchain-based, the Smart NAV solution can benefit participants who are not yet exploring tokenization in that it can provide faster data dissemination (shifting from batch files to real-time APIs) and historical data access.</p> | <p>The “Single-fund Consumer” feature of Smart NAV allows participants to permission a simulated tokenized fund to act as a consumer of its own NAV data from the Smart NAV-specific smart contracts. For the purposes of the pilot, ERC-20 contracts were deployed to simulate tokenized mutual funds. Upon price and/or rate data becoming available for that fund (identified by ISIN), the tokenized fund is instantly enriched with the data.</p> <p>This consumption method illustrates the “Smart” capabilities of Smart NAV and demonstrates the broader potential for digital asset securities. Rather than needing to store NAV data in a separate database that references the identifier of a fund (to be consumed by a series of downstream systems), the NAV data becomes part of the fund itself allowing any holder to simply “query the asset” they are holding in their wallet.</p> | <p>Conceptually similar to the Single-fund Consumer, the “Bulk Consumer” feature allows participants to deploy a smart contract which specifies a series or grouping of funds (identified by CUSIP/ISIN). Upon price and/or rate data becoming available for the relevant funds, the Bulk Consumer contract is instantly updated with the data.</p> <p>Bulk Consumers can power a series of additional use cases based on how they are implemented. For example, the grouping of funds included in a given Bulk Consumer could be representative of a ‘Fund of Funds’ product and thereby derive its own NAV (based on the individual NAVs it contains). Another use case would be for a Bulk Consumer to be setup to represent the funds in a ‘Model Portfolio’; this would enable the Bulk Consumer to assist in the automated rebalancing of investor portfolios – a concept explored in recent industry pilots. (Note: Some reports acknowledge the need for a smart contract-based NAV solution like Smart NAV to support automated rebalancing use cases going forward.)</p> |

Web3 Standards used by Smart NAV: EIP-712 and EIP-2771

EIP-712

- A procedure for hashing and signing typed structured data as opposed to just bytestrings
- Simplify off-chain message signing for efficient on-chain verification
- Encodes data along with its structure, which allows users to verify message contents on signing
- EIP-712 serves as a “wrapper” for the JSON structure that encodes the data and provides a message for verification when signing

EIP-2771

- A “wrap” for native meta-transactions that aims to enhance the user experience by abstracting away the need for users to hold and manage the native gas token solely for transaction fees
- Generates a human-readable message instead of a hash
- Signature verification is performed by the smart contract, not the blockchain

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