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Distributed Ledger Technologies Interoperability Case Study
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ENTERPRISE ETHEREUM ALLIANCE

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ABOUT

This document describes a case study implementation showcasing how using the Enterprise Ethereum Alliance (EEA) Distributed Ledger Technologies (DLT) Interoperability Specification can facilitate seamless communication and transaction capabilities between distinct DLT platforms. By adhering to this specification, organizations can overcome the interoperability challenges, allowing for a more integrated and efficient global financial system that leverages the full benefits of DLT.

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Introduction

The growing adoption of distributed ledger technology (DLT) and digital assets in global financial markets has made the need for interoperability standards clear to market participants.

The Enterprise Ethereum Alliance (EEA) recognizes the need for collaboration among stakeholders, including financial institutions, technology providers, and regulatory bodies, to drive standards development. This collaborative approach is essential for creating a seamless, secure, and efficient ecosystem that can support the diverse needs of the global financial system. The development and adoption of these standards will facilitate greater innovation, reduce operational risks, and enhance the scalability of blockchain-based solutions, ultimately contributing to the broader acceptance and integration of digital assets in traditional financial infrastructures.

The EEA Cross-chain Interoperability Working Group is dedicated to standardising interoperability, one of the most important areas in blockchain and distributed ledger technologies (DLT).

It defines DLT interoperability as the ability to transfer digital assets from one DLT network to another, send and receive messages across DLT networks, and initiate actions across DLT networks. This group's primary goal is to develop specifications, guidelines, and best practices frameworks that support interoperability between EVM-compatible networks (including Ethereum Mainnet, consortium blockchains, optimistic rollups, and zk-rollups) and non-EVM blockchain networks.

About the EEA DLT Interoperability Specification

The Enterprise Ethereum Alliance (EEA) Distributed Ledger Technology Interoperability Specification aims to establish a secure and efficient framework for interoperability between different blockchain networks, focusing on enterprise applications. This specification addresses the need for various blockchain platforms to interact and transact seamlessly, especially in complex and regulated sectors like financial services and supply chain management. The specification includes architectural guidelines, protocol stack, and interface definitions, crucial for asset and data exchange across different blockchain systems, enhancing their functionality and utility.

It is designed to support enterprise blockchain networks using diverse underlying technologies (for example, EVM and non-EVM networks), facilitating complex multi-chain ecosystem deployments involving assets, payments, and securities transactions. The open standard prevents fragmentation across different vendor implementations. Use cases include currency exchanges between blockchains with different tokens, coordinating securities transfers with payment transfers on different chains, and atomic swaps/transfers of assets. The specification aims to support regulated enterprise use cases that require interoperability between multiple blockchains with secure guarantees.

Primary stakeholder groups:

This specification is relevant to three primary stakeholder groups:

Developers, Architects, and Integrators: The specification provides interfaces to accelerate the development of interchangeable components for connecting heterogeneous distributed ledger technologies and blockchain networks. It is relevant to professionals seeking to implement interoperability solutions across various DLT platforms, building or incorporating them into their solutions and applications.

Decision-makers and IT executives: Executives and decision-makers in regulated industries such as finance, healthcare, and supply chain will find this specification crucial for unlocking new business models and value streams through interoperable blockchain solutions. Executive in corporations exploring or already using DLT technologies in their operations are key beneficiaries of this specification.

Regulators and Standards Development Organizations (SDOs): By setting a precedent for interoperability standards, this document aids regulators and SDOs in understanding the technical complexities and potential regulatory considerations of crosschain communications. It aims to foster a collaborative environment where regulatory frameworks can evolve with technological advancements, ensuring a balanced approach to innovation and regulations.

How to access the EEA DLT Interoperability Specification

The Enterprise Ethereum Alliance Distributed Ledger Technologies Specification is available here: https://entethalliance.org/technical-specifications/.

Case Study

The context of this case study is a Delivery versus Payment (DvP) use case involving a basket of securities traded between two banks and settled via HQLA^X, Fnality International and Adhara[1], leveraging Corda and Ethereum DLT technologies. The delivery leg of the trade is managed by HQLA^X, which operates on a private permissioned Corda network. The payment leg of the trade is managed by the Fnality Payment System (FnPS), which runs on a private permissioned Ethereum network.

In a nutshell, securities are managed on a private permissioned Corda network, and cash is managed on a private permissioned Ethereum network. Settlement is coordinated between HQLA^X and the FnPS using the crosschain function call protocol described in the Enterprise Ethereum Alliance (EEA) DLT Interoperability specification.

This document outlines the elements underpinning the connectivity between HQLA^X and the FnPS, as tested in the Ecosystem Testnet (hosted by Adhara) and as they will be implemented in production (subject to appropriate regulatory approval).

Delivery versus Payment (DvP)

BIS Definition - Delivery versus payment (DvP): Securities settlement mechanism that links a securities transfer and a funds transfer in such a way as to ensure that delivery occurs if and only if the corresponding payment occurs.

Source: https://www.bis.org/publ/qtrpdf/r_qt2003c.pdf

[1] In the context of this DvP work, Adhara is Fnality International's Smart Contract Development Partner.

Adhara hosts the Fnality ecosystem testnet, where use cases are tested for the first time, ahead of getting towards production. Adhara is also actively involved with the EEA to build an ecosystem based on common standards and protocols, a vision that Fnality International shares.

The implementation of Delivery versus Payment (DvP) using Distributed Ledger Technology (DLT) for securities management and for payments offers several benefits to primary parties such as banks and asset managers compared to traditional non-DLT systems. The advantages include:

Real-Time Settlement: DLT can significantly reduce the settlement time for securities transactions. Traditional systems often require several days for clearing and settlement, whereas DLT enables near real-time settlement, improving liquidity and reducing counterparty risk.

Improved Efficiency and Lower Costs: DLT can reduce the need for intermediaries by automating and streamlining the settlement process, leading to lower transaction costs and higher operational efficiency.

Reduced Reconciliation Costs: In a DLT-based system, all parties can access a shared ledger that updates in real-time. This shared truth reduces the need for costly and time-consuming reconciliation processes common in traditional systems.

Reduced Counterparty and Settlement Risk: The simultaneous exchange of securities and payment in a DvP model minimises the risk that one party will fail to deliver the security or the payment. DLT further enhances this by ensuring that transactions are executed at precise moments in time and only when both parties meet their obligations.

Digital representation of Assets: DLT allows for the digital representation of cash, securities, and physical assets, as well as ownership of these assets, making them easier to divide, transfer, and trade on digital platforms. This opens up new markets and investment opportunities.

These benefits, derived from DLT's inherent properties, present a compelling case for banks and other financial institutions to adopt this technology for securities transactions and payments. It offers a more efficient, secure, and cost-effective alternative to traditional systems.

However, it is important to recognize that the full spectrum of benefits offered by DLT for the financial sector can only be realised through a commitment to interoperability and the adoption of open standards for implementation. Interoperability ensures that different DLT systems can communicate and transact with one another seamlessly, which is crucial in a global financial landscape characterised by a multitude of platforms and technologies. Open standards, on the other hand, provide the foundation for this interoperability by establishing common protocols and formats that ensure different systems can understand and engage with

each other. Without interoperability and open standards, DLT systems are isolated silos unable to meet the needs and requirements of the financial services industry.

Overview

Summary	Delivery versus Payment (DvP) settlement between two banks, where securities are managed on a private permissioned Corda network by HQLA^X, and payments are handled on a private permissioned Ethereum network by Fnality. The coordination of settlement necessary to achieve DvP across the two DLT networks is facilitated by smart contracts compliant with EEA DLT Interoperability Specification.
Target Customers	Banks, Financial Institutions
Technology	R3 Corda, Hyperledger Besu
Product Type	DLT Interoperability solution
Launch Date	H2 2024[2]
Production Phase	Pre-production
Notable Partnerships	Fnality Adhara HQLA^X EEA
Next Steps	Production

[2] Subject to UK regulatory approval.

Leveraging the EEA DLT Interoperability Specification

The DvP implementation focuses on a settlement process where the delivery of securities occurs on a private permissioned Corda network if, and only if, the corresponding payment was made on a private permissioned Ethereum network. This is based on a leader-follower approach in which Corda is the leading network. Technically speaking, this could also be done with the Ethereum network as the leading network.

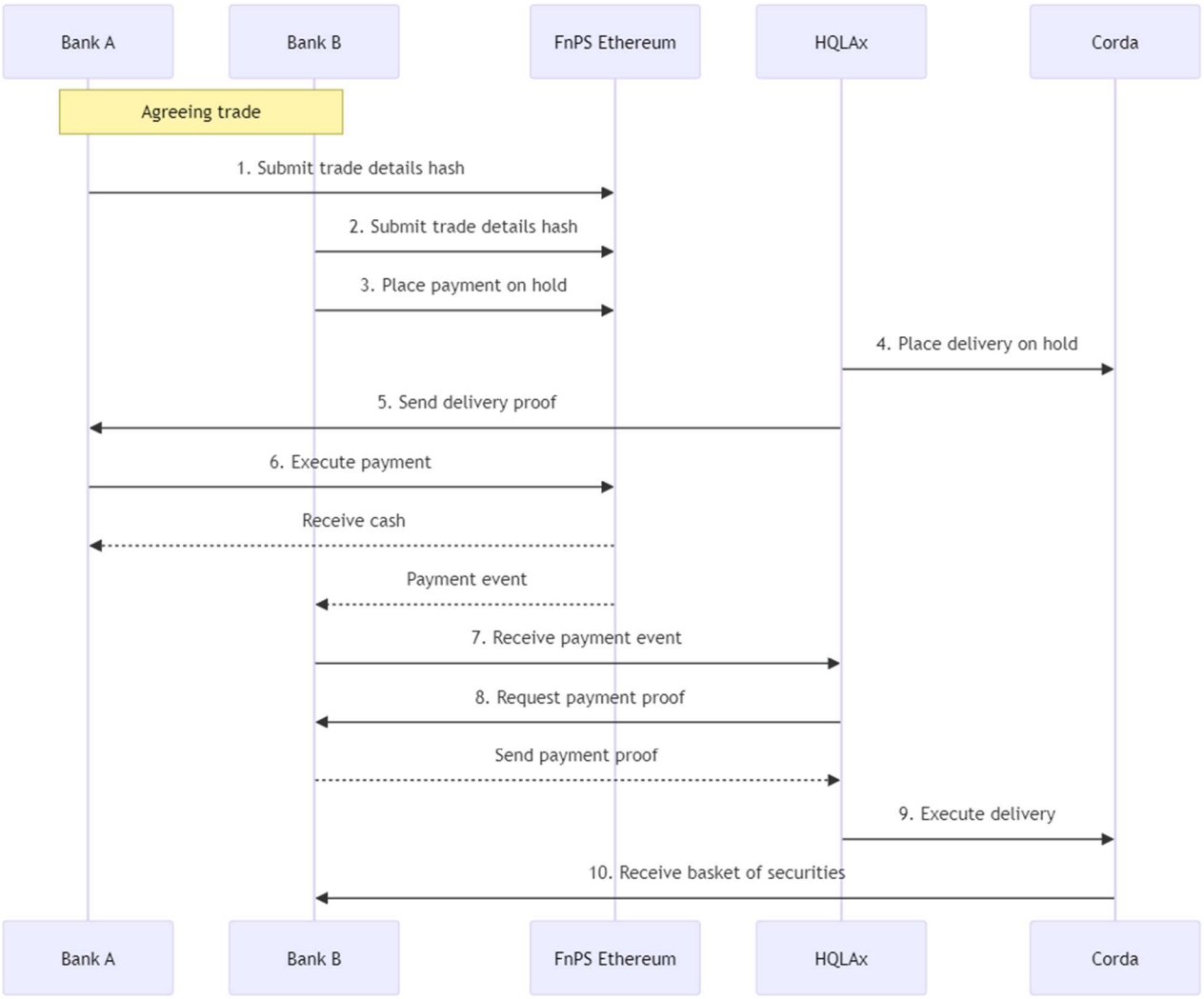
The DvP intraday repo trade settlement process makes use of earmarks. Assets are placed on hold with the intent to transfer them to the receiving entity for which they were earmarked. This only happens after receiving sufficient proof that a previous step in the DvP flow was executed correctly.

Fnality Access[3] is used directly by banks to manage their assets on the FnPS private permissioned Ethereum network. DvP cash holds are placed by the banks through Fnality Access.

The HQLA^X CorDapp[4] is used indirectly by banks to manage their assets on the private permissioned Corda network via HQLA^X. DvP security holds are placed by HQLA^X on behalf of the banks.

[3] Fnality Access is the software used by banks to connect to the FnPS and submit transactions to the underlying private permissioned Ethereum network through the use of the Blockchain Gateway component, maintained by Adhara.

[4] The HQLA^X Corda Distributed Application is a software developed by HQLA^X to facilitate atomic transactions on a Corda network where securities reside at multiple custodians.



In this diagram:

1. **Agreeing trade:** Bank A and Bank B agree to settle a DvP trade via off-chain orchestration.
2. **Bank A submits details:** Bank A submits a hash of the trade details to the DvP contract on the FnPS Ethereum network.
3. **Bank B submits details:** Bank B submits a hash of the trade details to the DvP contract on the FnPS Ethereum network.
4. **Bank B places payment on hold:** Bank B verifies the trade details and places the payment leg cash on hold for Bank A, marking the DvP contract as notary, on the FnPS Ethereum network.
5. **HQLA^{X} places delivery on hold:** HQLA^{X} verifies the trade details and places the delivery leg securities on hold for Bank B, on behalf of Bank A, using a Corda transaction that is signed by Bank A, Bank B, the custodian and a notary.
6. **HQLA^{X} proof generation:** HQLA^{X} constructs a transaction attestation proof, of the delivery leg hold on the Corda network, that is translated into a EEA-compliant crosschain function call, which is sent to the FnPS through Bank A.

7. **Bank B executes payment:** Bank B executes a crosschain function call on the FnPS Ethereum network, to execute the payment leg hold after successful verification of the proof, and to emit an event containing an EEA-compliant crosschain function call to execute the delivery leg hold. Bank A receives the cash on the FnPS Ethereum network.
8. **HQLA^X receives payment event:** HQLA^X receives the event once the crosschain function call is successfully executed by the crosschain messaging protocol. This is done via the Fnality Access event subscription service running at Bank B.
9. **HQLA^X requests payment proof:** HQLA^X requests an event attestation proof of the payment leg execution on the FnPS Ethereum network, that is translated into an EEA-compliant crosschain function call, from the FnPS. This is done via the Fnality Access service running at Bank B.
10. **HQLA^X executes delivery:** HQLA^X executes the crosschain function call on the Corda network, after successful verification of the proof, to execute the delivery leg

This DvP implementation describes a securities settlement process where the delivery of securities occurs on a Corda network if, and only if, the corresponding payment is made on the FnPS Ethereum network. HQLA^X takes on the role of a centralised party for the securities, ensuring that the securities are earmarked and then transferred to the new owner once payment on the FnPS is verified. The actual securities do not move between networks; rather, their ownership is transferred on the Corda network, while the corresponding cash transfer happens on the FnPS, with both processes being coordinated to ensure settlement finality.

Trade cancellations mitigate against the risk of one party not fulfilling their part of the agreement. For example, if a hold was placed on the securities, but the hold on cash was not placed, and cannot be placed, then the settlement process must allow for the hold on the securities to be cancelled. This is only allowed if the trade itself is cancelled. The same holds true for when the hold on cash needs to be released because the hold on the securities was not placed.

The application layer DvP implementation ensures that:

a) both the security transfer and cash transfer go through successfully, or
b) neither of them do,

therefore ensuring the definition of atomic settlement as stated by the Bank for International Settlements (BIS) can be fulfilled.

BIS Definition - Atomic settlement: The use of a smart contract to link two assets to ensure that the transfer of one asset occurs if and only if the transfer of the other asset also occurs (e.g. to achieve delivery versus payment in a securities transaction or payment versus payment in a foreign exchange transaction).

Source: https://www.bis.org/publ/qtrpdf/r_qt2003c.pdf

Key Takeaways

Interoperability between two DLT networks

- The case study demonstrates a successful implementation of DvP using two different DLT networks: Corda for securities and Ethereum for payments.
- Crosschain interoperability is made possible via an EEA-compliant crosschain function call protocol, including cryptographic proofs, to enable a secure DvP settlement flow across the two networks.
- This highlights the importance of open interoperability standards in realizing the full potential of DLT in the financial sector.

Benefits of DLT in securities transactions

- DLT offers several advantages over traditional systems, including real-time settlement, improved efficiency, lower costs, reduced reconciliation costs, and minimized counterparty settlement risks.
- The digital representation of assets enabled by DLT opens up new markets and investment opportunities.

Atomic settlement

- Atomicity of this settlement process removes counterparty (or Herstatt) risk from settlement, also ensuring settlement finality.

Ownership transfer without asset movement

- The actual securities do not move between HQLA^X's Corda-based network and the FnPS's Ethereum-based network; instead, asset ownership is updated on HQLA^X's and FnPS's networks, respectively.
- This demonstrates how DLT can enable efficient transfer of ownership at precise moments in time without the need for physical movement of assets.

Conclusion

In conclusion, this case study demonstrates the transformative potential of DLT in advancing securities transactions and payments. By leveraging the unique strengths of different DLT networks, such as Corda for securities and Ethereum for payments, and ensuring seamless interoperability through open standards like the EEA DLT Interoperability Specification, this implementation showcases a new paradigm for efficient, secure, and cost-effective financial transactions.

The successful execution of DvP in testing, in preparation for production in the second half of 2024 (subject to regulatory approval), using a private, permissioned Corda and Ethereum networks, facilitated by the collaboration between HQLA^X, Fnality, and Adhara, highlights the tangible benefits of DLT in action. From real-time settlement, and reduced counterparty risk, to improved operational efficiency, and lower reconciliation costs, this case study provides a compelling testament to the value proposition of DLT in the financial sector.

Moreover, this implementation underscores the critical importance of interoperability and open standards in realizing the full potential of DLT. By adopting common protocols and formats, different DLT systems can communicate and transact seamlessly, breaking down silos and enabling a more connected, efficient, and innovative financial ecosystem. The EEA DLT Interoperability Specification represents a significant milestone in this journey, providing a robust framework for enterprises to build and deploy interoperable DLT solutions.

As the financial landscape continues to evolve, embracing these standards and technologies will be crucial for institutions seeking to remain competitive, agile, and future-ready. By harnessing the power of DLT and committing to interoperability, financial organizations can unlock new opportunities, drive efficiency, and deliver enhanced value to their customers in an increasingly digital and interconnected world.

Case Study Participants

- Adhara are leaders in Digital Cash and DLT solutions for Commercial Banks and FMIs - designing solutions to consistently help clients engage with a variety of new digital settlement layers and business platforms, extracting structural benefit by driving cash and liquidity optimisation and opening up new revenue generating strategies. Adhara's anchor product, Digital Cash (DC) Commander, seamlessly integrates into new digital workflows and assists the transition to managing (and optimising) intraday funding for settlement of wholesale digital assets, including digital cash and securities. The recent addition of the Trade View delivers visibility into the status of Intraday funding instruments including Repos. Adhara is a member of the Enterprise Ethereum Alliance (EEA). www.adhara.io

- Founded in 2019, Fnality International is developing a series of regulated, DLT-based wholesale payment systems in key jurisdictions, each overseen by its home central bank. In each Fnality Payment System (FnPS), participants use settlement balances in an account directly at the central bank to make wholesale payments in real-time. These settlement balances are bankruptcy remote and backed 1-to-1 by central bank money in the relevant currency. FnPS offers banks a faster, safer, and more resilient system for managing digital payments, and supports the growing industry adoption of tokenised assets and marketplaces. In December 2023, the Sterling FnPS, previously recognised by HM Treasury as a systemically important payment system, connected to CHAPS, became the first holder of a BoE Omnibus Account, and commenced controlled live payments. Joining a handful of other regulated payment systems in the UK, it became the World's first regulated DLT-based wholesale payment system, settling in digital central bank funds, and part of the UK's recognised payments infrastructure. www.fnality.org

- HQLA^X is an innovative financial technology firm that leverages DLT to bring game-changing efficiencies to the securities finance and repo industry. Our core clients are banks and asset managers active in the global securities finance and repo markets, and our unique platform enables market participants to execute frictionless, precise, and real-time transfer of ownership of securities. www.hqla-x.com

CREDITS

Report prepared by QualitaX on behalf of the Enterprise Ethereum Alliance DLT Interoperability Working Group.

MEDIA CREDITS

Frontpage:

Photo by James Dant on Unsplash

Source: https://unsplash.com/photos/a-bridge-over-a-river-with-tall-buildings-in-the-background-b0MWZdru1lI

Description: A bridge over a river with tall buildings in the background.

https://entethalliance.org/