Whitepaper

Token Enabled Negotiability of the Electronic Bill of Lading

2Tokens

Dutch Blockchain Coalition

connect and create

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Executive Summary

Negotiable Electronic Bill of Lading (eBL) – The TradeTrust Token

On 31st March 2020, *TradeTrust* enabled the world's first interoperable and paperless transfer of ownership of a negotiable electronic Bill of Lading (eBL). Utilizing blockchain technology, the TradeTrust Token has been developed & designed to ensure irrefutable digital proof-of-ownership of a negotiable eBL across supply chain platforms independent of their underlying technology. The eBL has significant backing and support from many organizations, including:

- Singapore Maritime Port Authorities (MPA)
- Singapore maritime, trade and banking community
- Dutch Ministry of Economic Affairs and Climate Policy
- Infocomm Media Development Authority (IMDA)
- Port of Rotterdam (PoR)
- ĐΞLIVΞR®
- ICTU
- Blocklab
- UN/CEFACT
- Spark! Living Lab
- Dutch Blockchain Coalition
- InterWork Alliance
- 2Tokens Project

The Current Role of the Bill of Lading

A Bill of Lading is a time-honored document which includes all necessary cargo & ship details and acts as contract of carriage, proof of receipt of the goods & entitles the owner to claim the cargo with the carrier. In its current paper-only form, it is subject to fraud & inefficiency, as data is entered manually into the various systems and lacks a smooth transfer protocol and standardized data exchange. It can involve multiple parties, trustworthy or otherwise, travelling between multiple ports which leads to mass human-to-human interaction. This is a health concern during the current and any future pandemics. Furthermore, in many countries, including the Netherlands, digital transfer of ownership of the Bill of Lading (BoL) is not allowed under statute law. This currently prevents the use of the eBL as collateral when trade is financed by means of a Letter-of-Credit (LoC).

Introducing a secure and digitized Bill of Lading removes the human trust element. The underlying blockchain technology replaces the Trusted Third Parties (TTP), ensuring the carrier can confidently release the goods to the rightful owner of the eBL.

Why a blockchain-based eBL?

A blockchain based eBL ensures the trading process is streamlined, saving the substantial sums lost to delays annually. Removing inefficient paper flows and adopting the eBL will reduce idle time in the physical movement of goods, increasing supply-chain reliability. This is essential, even more so for highly perishable goods, where a 24-hour delay can result in a 10 to 15 percent drop in cargo value. Furthermore, the cost of doing international trade will be significantly reduced by removing the wasteful "paper-to machine-to paper" processes that even today are still the norm in international supply chains. *The Digital Container Shipping* Association estimates that, if 50 percent eBL adoption is achieved, the resulting efficiency increase could save the shipping industry alone an estimated $4 billion annually.

TradeTrust removes the need for the paper BoL to transfer the ownership and is therefore a necessary condition for deeper cargo validation, immediate yet private and secure confirmation of credentials, and hitherto unseen levels of process automation.

TradeTrust Token

Trade Trust is a digital infrastructure with a predefined set of standards and governance & legal frameworks. It works by separating the responsibility of tracking legal ownership from the content of the document. While the digital document and its underlying data are stored off-chain under the strict control of the original data owner, the ownership thereof is securely managed on a distributed ledger (in this case Ethereum). Users are free to decide on how they want to digitally exchange the BoL data (e.g. email, sftp). Anyone in possession of a digital copy of the document can verify the integrity and ownership of the document on the public blockchain. Each document can be identified uniquely by a document hash. A hash acts like a fingerprint of a piece of data: every hash is unique; it is impossible to get back the original data from only the hash and hashing the same data always creates the same hash. Furthermore, any eBL can be serialized and is not restricted by data standards, ensuring integration with any existing eBL data exchange formats.

TradeTrust tracks the ownership of assets using a smart contract. This smart contract adheres to the ERC721 Token Standard which defines a common software interface for handling ownership of a non-fungible token; a token that is not interchangeable as it is unique, just like any eBL is unique. According to TradeTrust's Singularity Principle, so long as the token framework is properly implemented, it is "practically impossible" for a hash - and therefore the reference to a document - to be duplicated. This is partially due to Ethereum's necessity for smart contracts to have unique addresses, and partially due to the smart contract itself guaranteeing that a hash can only be registered once in the registry.

TradeTrust & Identity

Authentication of parties and authorization of actions in the existing paper-based process happens through handwritten signatures. Companies and their employees who are involved in the process will usually have been verified in a KYC process and are often known through long-lasting business relationships. The authenticity and correctness of the information contained in the BoL and the signatures are manually verified through large trade-finance teams at the involved banks by looking for any inconsistencies. Although this system has proven itself over the years it is far from efficient and secure. The move to a digital document also allows for improvements of identity verification and "compliance by design".

As TradeTrust is designed with interoperability in mind, it should not come as a surprise that an important design principle is TradeTrust's compatibility with multiple identity frameworks, independent of their technical implementation, centralized or not. However, in line with the principles of decentralization, verification should be possible without involving a third party. In other words, the shipper's employee should simply be able to prove to the issuer who he is in a privacy preserving way. This is possible using Decentralized Identifiers (DID) and Verifiable Credentials (VC), two identity specifications published by the W3C.

Token Taxonomy Framework & Standards

The Inter Work Alliance (IWA) is a non-profit custodian of the Token Taxonomy Framework whose members include Accenture, IBM, Microsoft, Nasdaq, and R3. It is an independent, technology-neutral, cross-industry association determined to tear down data siloes by simplifying and standardizing how multi-party interchanges are accomplished amongst disparate technology platforms through the use of digital tokens, across use cases such as global sustainability, supply chains, healthcare and more.

This summer, the IWA in partnership with 2Tokens, launched a Business Working Group that will focus on Global Trade and Supply Chain. By developing technology-neutral standards for tokenizing business use cases within in Global Trade, the IWA can dramatically accelerate the implementation and interworking of these markets using distributed ledger techniques.

The Global Trade & Supply Chain Business Working Group (GTSC) will actively pursue further development of frameworks and apply those to actual use. The GTSC will support the legal and regulatory alignment of the framework to create a more regulator-friendly ecosystem that encourages participation from regulatory bodies to ease the regulatory burden. The initial scope will be the electronic bill of lading (eBL) but will later be expanded as more members join and present new use cases.
Another way to classify tokens is by means of the International Token Standardization Association (ITSA) Framework in which tokens are assigned a unique nine-digit identification number using the standardized International Token Identification Number (ITIN) system. This framework complies with the International Token Classification system (ITC) that has already been applied to more than 800 cryptographic tokens.

Final word

Already achieving significant backing from many major organizations such as the Ports of Rotterdam and Singapore, an eBL is no longer a question of "if", but a question of "when". With the prospect of the maritime industry alone saving $4 billion annually, the ability to transfer ownership with a digital token, using established legal frameworks, supported by a secure permissionless blockchain, it becomes clear why an eBL is the next logical step in Global trade. Many throughout society and various industries argue we are living through the next industrial revolution, and so just as the steel mill replaced the windmill, the eBL shall replace the BoL.

Interested in evolving the BoL and becoming part of a landmark international-trade evolution? We invite you to read our in-depth analytical whitepaper.

If you have any questions, please do not hesitate to get in touch.

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Introduction

This whitepaper describes the underlying motivations and technology stack choices of the Electronic Bill of Lading (eBL) project (i.e.TradeTrust). After outlining the significant inefficiencies present in the use of the Bill of Lading as a maritime and trade document, we present the business case for digitization and tokenization of this document. Finally, we present a high-level overview of the TradeTrust framework.

Section 1: The Current Role of the Bill of Lading

1.1. What is a Bill of Lading?

A Bill of Lading (BoL), simply put, is "a document of title, a receipt for shipped goods, and a contract between a carrier and shipper".[1] It is issued by a carrier (or its agent) and passed to the shipper when the goods are loaded. As such it functions as a receipt of the goods described in the BoL by the carrier. This role even predates the Middle Ages; as early as Roman times this was common practice. Between ports it serves as a contract of carriage for the goods being transported, before being presented at its destination port in order for delivery to occur. A BoL must include consignor's (i.e. the entity or person sending the goods) and consignee's (i.e. the entity or person receiving the goods) name, the departing and destination ports, the vessel's name, departure and planned arrival dates, an itemized list of goods, identifying marks on the packaged goods, the weight of said goods, and the freight rate. Furthermore - and most importantly for this project - the BoL can serve as *proof of ownership* of the cargo at each stage of the transit process. If the BoL is made out "to order" than the BoL becomes negotiable. When this is the case the original consignee, by endorsing (signing) the back of the BoL, transfers title of the goods to another party who then becomes the new consignee. This *proof of ownership* is the focal point of the TradeTrust project.

1.2. What is the current process?

When transferring ownership of a BoL from one consignee to the other the following "proofs" are needed:

- Proof of Ownership: is the organization or person claiming to be the rightful owner of the goods, really
- the rightful owner? In the current paper-based system this is ensured through physical possession of the original (paper) BoL.
- Proof of Integrity: is the original (paper) BoL really the original? In the current paper-based system this is ensured through physically checking the original (paper) BoL on its authenticity.
- Proof of Origin: has the original (paper) BoL really been issued by the carrier? In the current paper-based system this is ensured through physically checking the original (paper) BoL on its authenticity.
- Proof of Existence: does the (paper) BoL represent a real physical transaction? In the current paper-based system this is ensured through physically checking the original (paper) BoL on its authenticity. Proof of Existence is further provided by supporting documents such as commercial invoice, packing list, customs declaration and certificates-of-origin.

[1] https://www.investopedia.com/terms/b/billoflading.asp

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Consequently, the information on a BoL requires validation each time a transfer of ownership takes place. A process that is both unwieldy and time consuming, often relying on inefficient 'paper to computer to paper' data processing and manual due diligence of the BoL details, such as date of shipment, vessel name and description of the cargo.

Both the process of transferring and authenticating a BoL - as well as the necessity for such a document - has easily recognizable roots in business practices that arose in the 17th Century, where it acted as evidence that which goods would be delivered where, and when.[2] By laying out the protocol for how parties in a business transaction would interact, the issue of those parties having to trust that the other fulfill their respective aspects of the cargo transfer was able to be mitigated. By treating the BoL as proof of ownership of the goods, the carrier at each stage of the process becomes what is referred to in 'blockchain terms' as the Trusted-Third Party (TTP). The seller trusts the carrier not to release the goods to an unauthorized entity or before the seller has received payment, while the buyer can be sure that upon presenting a full set of original BoL he will be granted possession of the goods.

A technological solution to the issue of trust (or lack thereof) is one that is common to blockchain practitioners. Just as blockchain technology is used to mitigate the need for trusted financial parties such as banks and financial institutions, a BoL is used - in theory - to mitigate potential issues of trust arising between parties in a supply chain.

1.3. Pain points & bottlenecks

There are, however, several issues with this existing model. First of all, the reality of global international supply chains means that information processing and the validation of the BoL is not actually as smooth as it is represented in the high-level overview outlined above; transactions never involve a single one of the above different parties, nor does it involve a simple transferal of goods from point A to point B. In reality, transactions often involve multiple parties who are mutually distrustful of each other, with goods travelling between multiple ports.

Secondly, the sort of validation involved in the above outlined process doesn't "go very deep",[3] with data travelling 'between silos' controlled and owned by the companies involved in the transaction, and the validation itself only involving "some form of referencing with existing master-data such as addresses, product codes, quantities and checking whether the data transfer meets the data exchange message definition in terms of mandatory fields filled, field length, and whether the data in the fields is of the right type".[4] Furthermore, the individual systems that each company uses, cannot be easily made interoperable, as there's currently no common standards for data exchange[5].

[2] https://www.freightwaves.com/news/2017/12/8/can-blockchain-revolutionize-the-bill-of-lading

[3] See 'Blockchain and the Supply Chain: Concepts, Strategies and Practical Applications 1st Edition' by Nick Vyas, Aljosja Beije, Bhaskar Krishnamachari

[4] Ibid.

[5] While various standards exist, the interoperability of these standards is limited. Recently we have seen a renewed push towards eBL standards, for example by DCSA (The Digital Container Shipping Association) and IPCSA (International Port Community System Association).

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Thirdly, the limitations of the current process have become glaringly visible in the recent COVID-19 crises. Finance of international trade relies heavily on paperwork and manual processes as a way to provide proof of existence or ownership. Warehousing receipts, letter-of-credits and BoL depend on courier services for transfer between participants in a transaction. This was already an issue in the pre-COVID-19 era, but the cancellation of flights and consequent disruptions in courier services has made supply chain members painfully aware of the lack of digitization efforts[6]. Adding insult to injury was the fear of physical contact further obstructing the highly physical paper-based process.

Fourthly, the transfer of title and in particular the consequent use of the BoL as collateral in trade finance is a strict "paper-only" process owing to statute law (e.g. the Dutch Civil Code) requirements in most countries. This has limited the application of existing eBL solutions, such as Bolero and essDOCS, which rely on all users to contractually agree on the conditions under which to transact, to trade between trusted entities, such as intercompany transactions. In a trustless environment however, European banks for example, still require a collateral in the form of the original paper BoL. Furthermore, the process of paper-based transfer of ownership is far from secure. A well-publicized fraud case involving warehousing receipts that act as transferable documents of title led to combined losses of over a billion USD and a combined total potential exposure of three billion USD[7].

The impact on global supply chains of the inefficient nature of this document validation and transferal process is significant; although "a container takes approximately 36 hours to physically get from Singapore to Jakarta, Indonesia [...] information and financial settlement can take up to 7 days."[8]

[6] See S. Wass in the Financial Times. 'Trade finance digitization faces 'tipping point' amid coronavirus lockdowns, March 2020

[7] https://www.gtreview.com/news/asia/qingdao-fraud-probe-ends-with-jail-term/

[8] Ibid.

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Section 2: The rationale behind a blockchain based electronic negotiable BoL

2.1. The Business Case

Contained within the outlining of these issues there is an implicit business case involving the digitization of the validation and transferal process in an open and audited code environment. The digitization of the negotiable BoL, the so-called negotiable eBL lead to a more resilient supply chain, reducing idle time in the physical movement of goods as a result of inefficient paper information flows. For highly perishable goods, such as fresh produce, a 24-hour delay can result in the value of the cargo diminishing by 10 to 15 percent.

Also, digitization can bring significant efficiency gains. The Digital Container Shipping Association estimates that the that the industry could potentially save more than $4 billion per year if just 50 percent eBL adoption is achieved[9].

The business case for the negotiable eBL, the focal point of TradeTrust, is very much linked to its role as collateral for banks when issuing a so-called Letter-of-Credit (LoC). A LoC is basically an IoU issued by a bank to the seller's bank guarantying payment in case of buyer insolvency. Issuing a LoC results in the creation of an off-balance sheet item for which they need to provide backing in the form of a certain percentage of the nominal value. This percentage, in the European Union at least, is dependent on the risk associated with the LoC. In case there's collateral in the form of a (paper only!) BoL the transaction is considered to be of medium/low risk, a bank only needs to put up 20% of the nominal value. When there's no such collateral this percentage goes up to 50%[10]. As in most countries, including the Netherlands and Singapore, the eBL is not considered to be a valid collateral, trade finance transactions based on LoCs rely on paper BoL, significantly increasing the cost of doing international trade. Finally, we expect that for as long as the most important international shipping document remains paper-based, the industry and consequently international trade, will remain paper-based.

2.2. Why blockchain?

More specifically, an environment utilizing blockchain technology in order to create a technological TTP: a distributed, secure database layer with easily modifiable and public Access Control Layer (ACL). The digitization of the BoL allows for a significantly 'deeper' validation to occur by enabling the checking of "time-stamps of the transactions and validation of multi-party transaction data within the extended supply-chain".[11] Furthermore, the inclusion of a blockchain layer into this technology stack means that the data that is being validated, as well as the transaction validating this data, is all contained in the same place:

[9] See https://www.maritime-executive.com/article/research-highlights-4-bil-savings-from-ebl-calling-for-collaboration-1

[10] EU's Capital Requirement Regulation 2013 (CRR) – Article 111 (1)

[11] Ibid.

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the blockchain enables the creation of a 'single source of truth' containing all relevant information such as the current owner of the BoL, validated transitions, and the transactions themselves. This digitization also allows for the easy and transparent transferal - and therefore tracking - of the BoL within a cryptographically secure environment. This database will be accessible by all relevant parties without making public any sensitive information.

Of course, the question arises: why use a blockchain at all when creating a digital solution? A blockchain - given its distributed nature - allows a digitization solution to sidestep the issue of trust by replacing the TTP with verifiable software, requiring no trust to be placed in any additional parties. Furthermore, utilizing blockchain technology allows for the inclusion of tokenization into any technology solution - a solution that will be discussed below. Before discussing this however, a broader point must be made regarding tokenization as an approach. Tokenization - the creation of an abstract representation of an asset - is often associated with a particular blockchain. Given the nascent status of blockchain technology, this is to be expected: each blockchain developed its own token framework independently. As such, each is suited to different environments and has a completely different taxonomy. Therefore, this means committing to a blockchain technology as well - an entire layer of the technology stack - very early on in a project, which can also be prohibitively restrictive over the course of a project's lifespan. Even agreeing on a definition of what constitutes a token is difficult. It is for this reason that 2Tokens joined the InterWork Alliance (IWA) in order to continue the work on token-enabled system interoperability. IWA and its Token Taxonomy Framework is explained in more detail in chapter 4.

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Section 3: TradeTrust

3.1. Introduction

The TradeTrust project envisions the creation of a sandbox environment in which the first legally binding, interoperable, paperless transfer of ownership of an eBL can be conducted on a live shipment. The project kick-off was in April 2019 in Singapore, when delegates from the Maritime Port Authorities (MPA) and the Infocomm Media Development Authority (IMDA) together with the Port of Rotterdam (PoR) and Blocklab hosted a two-day workshop with members from Singapore's maritime, trade and banking community. In October 2019 a technical deep dive was organized around token enabled digital transfer of ownership. On 31st of March 2020, the first TradeTrust enabled transfer of ownership of an eBL was performed[12]. Since December 2019, the project is actively supported by the Dutch Ministry of Economic Affairs and Climate Policy, ICTU and the 2Tokens project. Interoperability with DELIVER®, an open and neutral blockchain platform for international trade and supply chains jointly being developed by ABN-AMRO, Samsung SDS and Port of Rotterdam, was achieved in June 2020. TradeTrust is an actual implementation of the UNCITRAL Model Law on Electronic Transferable Records (MLETR)[13] and is an active project under UNCEFACT.

3.2. High-level architecture

TradeTrust is "a set of Governance & Legal Frameworks, Standards and future-ready Digital Infrastructure", facilitating "the interoperability of electronic trade documents[14] exchanged between different digital ecosystems".[15] It does so by separating the responsibility of tracking legal ownership from the content of the document. While the digital document is stored off-chain under the strict control of the original data owner, the ownership thereof can securely be managed on a distributed ledger (in this case Ethereum). Users are free to decide on how they want to digitally exchange the BoL data (e.g. email, sftp). Anyone in possession of a digital copy of the document can verify the integrity and ownership of the document on the public blockchain. Each document can be "identified uniquely by a Document Hash".[16] [17] TradeTrust documents are based on the OpenAttestation[18] specification, with each document containing "information on the schema type, certificate data, hidden data (from privacy filter) and a signature"[19]. TradeTrust Documents can be serialized to a (.tt) file which is simply a JavaScript Object Notation (JSON) file that conforms to this specification. TradeTrust is payload agnostic, in other words, there are no restrictions on how the document's content is formatted. In this way interoperability with any existing BoL data exchange formats is ensured. The project is open-source and can be used by anybody under the Apache 2.0 license.

[12] https://www.portofrotterdam.com/en/news-and-press-releases/succesfull-proof-of-concept-electronic-bill

[13] https://uncitral.un.org/en/texts/ecommerce/modellaw/electronic_transferable_records

[14] Other examples of transferable documents and instruments include warehouse receipts and cheques. What constitutes a transferable document is defined by national law and will therefore change from country to country. The BoL is however a globally transferable document.

[15] https://docs.tradetrust.io/

[16] https://docs.tradetrust.io/integration#l-1-document-format

[17] A hash is the product (the output) of a hash function, a function that maps arbitrary data to a fixed-size value which is itself determined by the data that is hashed (the input). It is common practice for secure document storage and data management systems. Find an online hashing playground here: https://www.fileformat.info/tool/hash.htm.

[18] https://github.com/Open-Attestation/open-attestation

[19] https://docs.tradetrust.io/creating-documents

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Figure 1 provides a schematic overview of a TradeTrust Implementation.

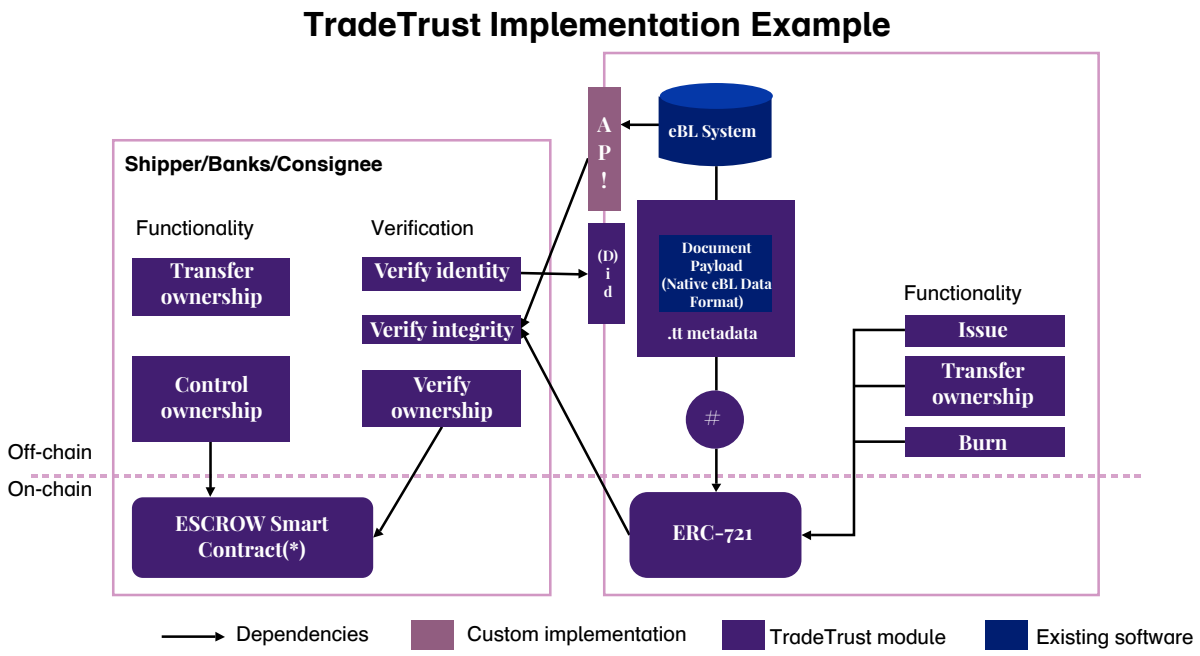

Figure 1 TradeTrust Implementation Example

3.3. Token interaction

TradeTrust separates the ownership of an item that a document of title represents from the content of the document. Ownership can be tracked on the blockchain in a secure fashion without having to also publicly store the documents data on the blockchain.

TradeTrust tracks the ownership of assets using a Smart Contract. This smart contract adheres to the ERC721 Token Standard,[20] which defines a common software interface for handling ownership of non-fungible token. A token is simply a large, globally unique number that represents a digital or real-world entity, in this case a document of title like the Bill of Lading. At the core, an ERC-721 compatible contract simply maps token identifiers, or the asset they represent, to the Ethereum address which owns the token and therefore the asset. Each document in TradeTrust is linked to a non-fungible token on an ERC-721 contract. The link between token and document is created through the hash[21] of the documents content (the .tt file). The hash is a very large, globally unique number and can be used as the token identifier. A hash acts like a fingerprint of a piece of data: every hash is unique; it is impossible to get back the original data from only the hash and hashing the same data always creates the same hash. Token interaction between the various users is depicted in Figure 2.

[20] More specifically, TradeTrust utilizes OpenZeppelin's ERC721 token standard, the audited code for which can be found here: https://github.com/OpenZeppelin/openzeppelin-contracts/tree/master/contracts/token/ERC721

[21] Which, in the case of TradeTrust, is the 256-bit ID specified in the ERC721 specification, in the form of the keccack256 hash that is the Merkle root of the OpenAttestation document containing the eBL data.

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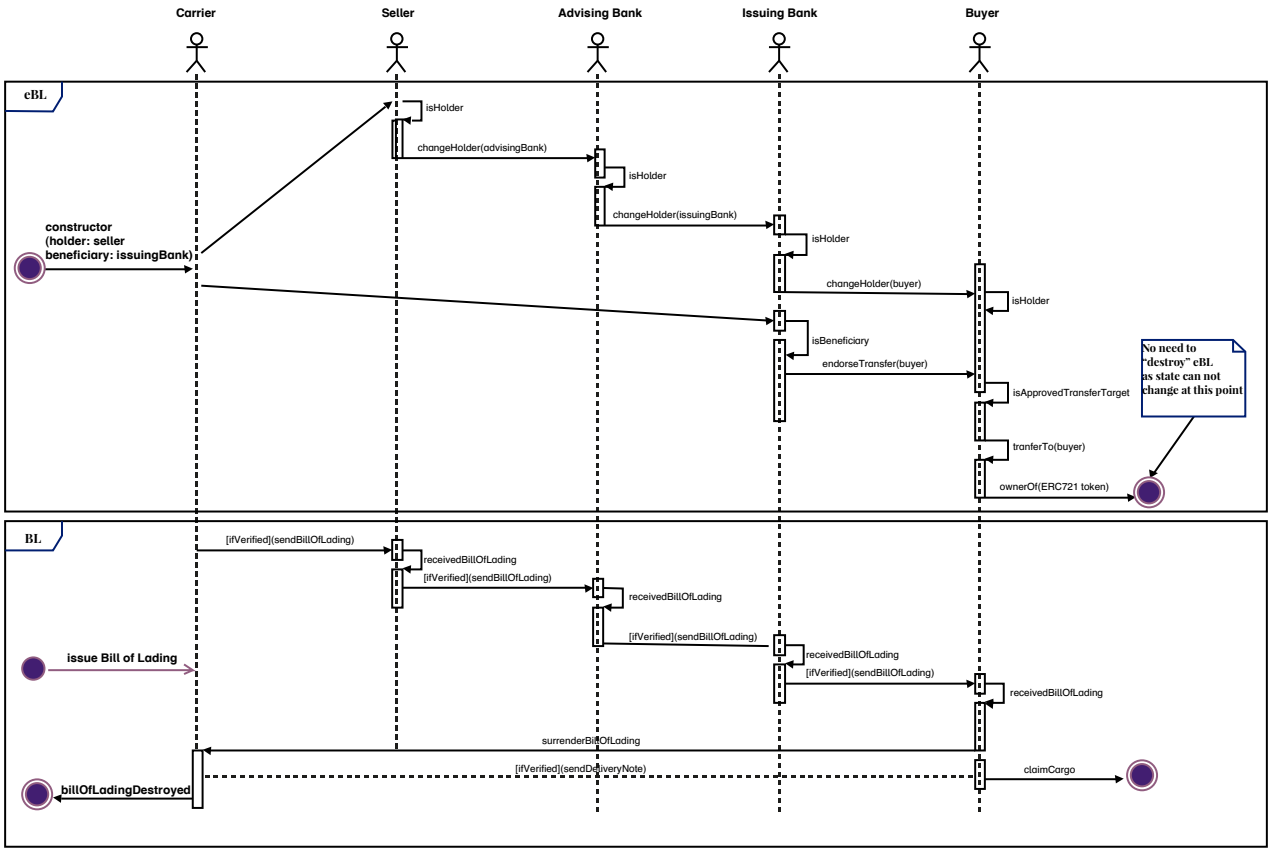

Figure 2 eBL Interaction

According to TradeTrust's Singularity Principle, so long as the token framework is properly implemented, it is "practically impossible"[22] [23] for a hash - and therefore the reference to a document - to be duplicated. This is partially due to Ethereum's necessity for smart contracts to have unique addresses, and partially due to the smart contract itself guaranteeing that an ID can only be registered once in the registry.

3.4. Advanced ownership constructs

ERC-721 smart contracts can be used to track ownership of assets by representing them as a token and assigning an Ethereum address as its owner. However, in many real-world applications, ownership is not always that binary.

Documents of title, specifically the Bill of Lading, confers legal asset ownership to a beneficiary. However, the beneficiary is not always the holder of the physical document. In order to claim the goods, the beneficiary also needs to be in possession of the physical document. So, while the holder does not actually own the assets represented by the document, it can be used as leverage or collateral. Banks often hold the physical documents as collateral, and many trade finance processes rely on this distinction.

[22] https://docs.tradetrust.io/token-registry#singularity-principle

[23] https://preshing.com/20110504/hash-collision-probabilities/

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The ERC-721 standard does not natively support such advanced ownership constructs. But it does allow other smart contracts to own tokens, as contracts are also represented by Ethereum addresses. TradeTrust has therefore developed the Title Escrow contract that adds the distinction between holder and beneficiary on top of the core functionality of the ERC-721 contract. This works as follows: When a BoL is issued, in blockchain terms this boils down to token being minted, the token is not own directly by the Ethereum address controlled by the beneficiary. Instead the issuer also creates a Title Escrow contract, in which the initial beneficiary and holder (their Ethereum addresses) are named. The token is then owned by the address of the newly created instance of the Title Escrow.

The Title Escrow contract allows the holder to transfer his rights as a holder to a new address. The holder further has the right to transfer the title to a new Ethereum address, which can again be a new instance of the Title Escrow contract. This title transfer has to be endorsed by the beneficiary though. The endorsement through the beneficiary is the equivalent of the beneficiary signing on the back of the paper BoL.

By handling token ownership in a smart contract many different ownership constructs are possible, allowing the digital solution to fulfill the requirements complex constructs that exist in the trade finance world.

3.5. The Role of Identity

Authentication of parties and authorization of actions in the existing paper-based process happens through handwritten signatures. Companies and their employees who are involved in the process will usually have been verified in a KYC process and are often known through long-lasting business relationships. The authenticity and correctness of the information contained in the BoL and the signatures are manually verified through large trade-finance teams at the involved banks by looking for any inconsistencies. Although this system has proven itself over the years it is far from efficient and secure. The move to a digital document also allows for improvements of identity verification and “compliance by design”.

Although users may want to be anonymous to the general public on the blockchain, the involved parties in an international trade transaction will want to identify and verify their counterparts in a transaction. For example, when an issuer mints a token (which is equivalent to printing the paper BoL) it is passed on to the *Address* of the shipper. The issuer will want to verify that the *Address* that he got from the contact (through email for example) is actually controlled by the Shipper (i.e. the company from where the goods are shipped from) company or even an authorized representative of that company. In the same way that the title transfer should be possible without depending on third parties, this verification should be possible without involving a third party. The Shipper’s employee should simply be able to prove to the issuer who he is in a privacy preserving way. This is possible using Decentralized Identifiers (DID) and Verifiable Credentials (VC), two identity related specifications recently published by the W3C.

DIDs are merely a way to globally and uniquely identify an entity, similar to a bar code identifying a certain product. DIDs can be implemented with many technologies but when talking specifically about this eBL solution on Ethereum the DID would use the Ethereum *Address* as identifier. In order to attach additional

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information for verification to a DID, a Verifiable Credential can be issued with the DID as its subject. A credential could state anything about the subject e.g. age, a driver's license or school certificate. Also, credentials are meant to be issuable by anyone or anything, often an issuer would also have a DID. Furthermore, as the name suggests, VC are designed in a way that they can be verified. As the issuer creates a cryptographic signature on the credential, anyone in possession of the signed credential can also verify its authenticity. Figure 3 shows the process of obtaining and presenting credentials.

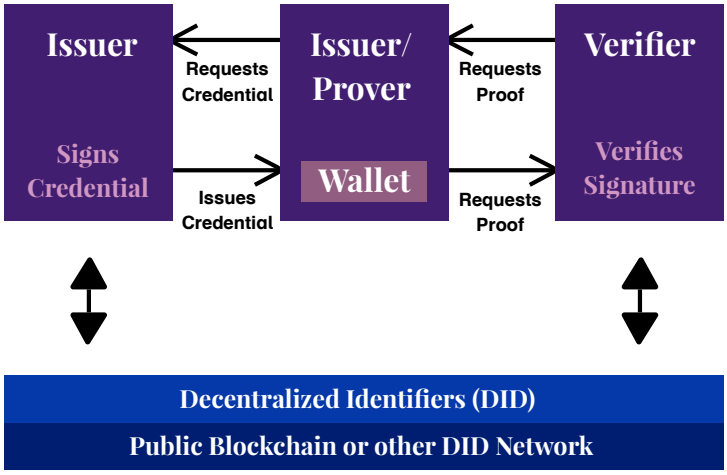

Figure 3 Information Flow Verifiable Credential[24]

Going back to the example where the Carrier would need to verify the identity of a Shipper, we can explore how verifiable credentials can help in this situation. In order to prove to the Carrier that the Ethereum *Address* receiving the eBL token is actually controlled by an authorized employee, the controller of the Address would need a credential. Such a credential could for example be issued by the Chamber of Commerce. That means, prior to the issuance of the BoL, the Shipper's employee obtains a cryptographically signed Verifiable Credential, stating that she is an employee of the Shipper and authorized to sign contracts. The Shipper sends that credential to the Carrier's clerk, who can verify the correctness of the cryptographic signature. The clerk also needs to make sure that the issuer of the credential is the Chamber of Commerce. This requires the Chamber of Commerce to publish its DID. If the credential passes the validation through the Carrier's clerk, and the Chamber of Commerce can be trusted, there is no doubt that the Ethereum *Address* must be controlled by an authorized employee of the Shipper and the clerk can proceed with the issuance of the eBL token to the verified *Address*.

[24]Alex Preukschat and Drummond Reed, "Self-Sovereign Identity", ISBN 9781617296598, https://livebook.manning.com/book/self-sovereign-identity/chapter-2/

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For the exchange of credentials to work there are a few requirements. As mentioned, the DID of the Chamber of Commerce, which issues the credentials needs to be well known and trusted. The verifier should only accept credentials from issuers they trust. Although credentials can be issued by anyone, credentials from certain issuers have more credibility than others. The trust relationship between verifier and issuer is shown in Figure 4. Also, verifier and issuer need to agree on a standardized data format for the credentials they use. If the issuer would use a different format, the verifier might not accept it and the credential would be rendered worthless for the holder. This requires some form of standardization or communication between Issuer, Holder and Verifier.

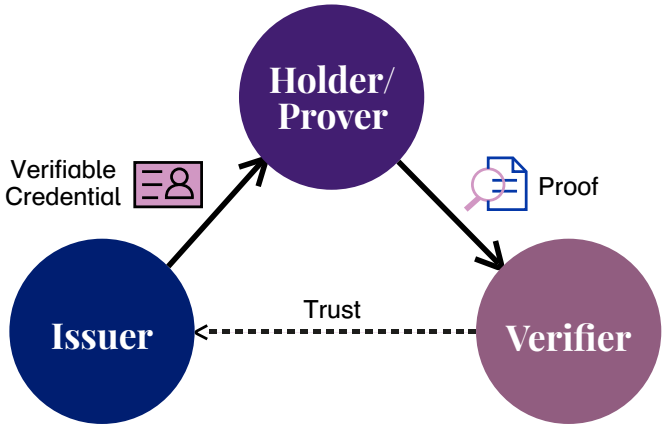

Figure 4 Relationship between Issuer, Holder and Verifier[25]

[25]Alex Preukschat and Drummond Reed, "Self-Sovereign Identity", ISBN 9781617296598, https://livebook.manning.com/book/self-sovereign-identity/chapter-2/

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Section 4: Token Taxonomy Framework

The InterWork Alliance (IWA) has been set up to facilitate multi-party digital interchanges. Such interchanges require a trusted, agreed-to representation of value, and correlating contractual agreements. Unfortunately, technological disparity across platforms creates so called digital siloes in which data is "trapped", and so inhibits the level of interworking necessary for web-scale adoption. There needs to be a unified approach where all parties work together to build out an ecosystem that is global.

The IWA[26] is an independent, technology-neutral, cross-industry association determined to tear down these siloes by simplifying and standardizing how multi-party interchanges are accomplished amongst disparate technology platforms across use cases such as global sustainability, supply chains, healthcare and more. IWA is the non-profit custodian of the TTF and its membership includes industry heavyweights such as Accenture, IBM, Microsoft, Nasdaq, and R3.

4.1. The BoL and TTF

To analyze the BoL (and TradeTrust token) we follow the steps as described in the Token Taxonomy Workshop. Those are:

- Asset Ideation, see paragraph 4.5.1
- Defining the Token Base, see paragraph 4.5.2
- Discovering behaviors, see paragraph 4.5.3

4.1.1 Asset Ideation

Given that our focus is on the BoL, this is a trivial step, as the asset is a BoL.

[26] www.interwork.org

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4.1.2 Defining the Token Base

To be able to define the token base, we have to ask ourselves a number of questions as listed in Table 1.

Question	Answer	Remarks
Is the asset interchangeable?	No, each BoL is unique or as the Taxonomy refers to as non-fungible.	Each BoL is a unique combination of data and because of that no two are the same.
Can the asset be divided?	No, the asset itself cannot be divided.	Although the cargo on the BoL can be split between different receivers, the asset itself remains undividable. Therefore, once the cargo is split, the existing asset needs to be "burned" (i.e. destroyed) and new assets need to be "minted" (i.e. created).
Is the asset one of a kind?	Yes, it is one of a kind.	No two BoLs are the same.

Table 1 Defining the Token Base

4.1.3 Discovering Behaviors

To be able to discover the relevant behaviors, we have to ask ourselves the following questions. See Table 2.

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Question	Answer	Remarks
How do users typically interact with the token?	The interaction is centered around the creation, transfer of ownership and destruction of the asset.	A detailed description of the token interaction between users is described in paragraph 3.3 of this paper.
How do users typically interact with the token?	The ownership changes between the users based on predefined contractual rules.	For example, the token's ownership is transferred from the issuing bank to the beneficiary upon payment of the shipper.
How do the users identify it?	Currently the BoL's identification relies on having the physical original document.	As described in paragraph 1.2. For the TradeTrust token users rely on the uniqueness of the hash.
Is there an element of risk management involved?	Yes	For example, the prevention of unauthorized or incorrect transfer as well as the creation of fake documents. Furthermore, using the same BoL as collateral to obtain multiple loans can be ruled out[27]
Is it unique?	Each eBL is unique.	Each BoL is a unique combination of data and because of that no two are the same.
Does the asset need to be created on demand or is the asset ever taken out of supply because it transforms?	The asset is created on demand, upon the creation of the native eBL file. The asset is taken out of supply ("burned") upon transfer back to the carrier from which it originated.	The asset doesn't transform after the creation and remains the same until it is taken out of supply.

Table 2 Discovering Behaviours

[27]https://www.bolero.net/fraud-or-deception-using-bills-of-lading-can-be-eliminated-through-digitisation/

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4.1.4 Grouping Behaviors

Version 1.0 of the TTF only has Supply Control as Grouping Behavior. For the TradeTrust token we propose an extension of this Grouping Behavior with the **Burner** role and apply it to the Burnable behavior to provide authorization checks for invoking that behavior. Furthermore, we believe that given the more complex ownership structure of the BoL, there's a need to support the role of Beneficiary and provide authorization checks for invoking transfer to a **Beneficiary**. Finally, a case can be made to group behaviors on the basis of the various proofs that need to be provided (see paragraph 1.2). This cannot be decided on the basis of the analysis of a single token alone. As one of the authors' organizations is a member of the IWA, these changes to the TTF will be driven through the IWA's process.

4.1.5 Property Sets

Version 1.0 of the TTF defines the following property sets: SKU and Files. As TradeTrust data about the type of goods is not stored on-chain there's no need for the use of the Property Sets. The Files property sets is used, as the token is wrapped around the original native data format file of the eBL.

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Section 5: International Token Standard

The International Token Standardization Association (ITSA) e.V. is a not for profit association under German law that aims to promote the development and implementation of comprehensive market standards for the identification, classification and analysis of DLT- and blockchain-based cryptographic tokens. As an independent industry membership body, ITSA unites over 100 international associated founding members from various interest groups, including industry associations, banks, stock exchanges, startups, universities, research institutes, law firms, tax advisors and other industry stakeholders. In order to increase transparency and safety on global token markets, ITSA currently develops and implements the International Token Identification Number (ITIN) as a market standard for the identification of cryptographic tokens, the International Token Classification (ITC) as a standard framework for the classification of cryptographic tokens according to their inherent characteristics, and the International Token Database (TOKENBASE) as standard for the qualitative and quantitative analysis of these tokens. Besides these projects, ITSA facilitates the internal exchange of thought through working groups as well as the setup of country and city charters. Externally, ITSA represents the interests of its members and acts as a sparring partner for standardization bodies, regulators, and government agencies.

5.1 International Token Identification Number (ITIN):

The International Token Identification Number (ITIN) is an open market standard for the unambiguous and secure identification of DLT- and blockchain-based cryptographic tokens. An ITIN is provided upon request as well as proactively by the International Token Standardization Association (ITSA) e.V. It assigns each token a unique nine-digit identification number, which comprises a randomly generated eight-digit Token ID (two four-digit blocks separated by a hyphen) and a one-digit Checksum that ensures the correct communication of the identifier (also separated by a hyphen from the two four-digit blocks). As an arbitrary alphanumeric identifier, the capital letters do not follow any encoding system and have no inherent meaning. The letters “I”, “L” and “O” as well as the numbers “0” and “1” are excluded in order to avoid confusion. All English three- and four-letter words such as for example “ONE” or “COIN” are excluded too in order to ensure a maximum of fairness at generation and assignment. The special alphanumeric structure of the identifier allows for the identification of over 850 billion cryptographic tokens and thus caters to the future needs of a global tokenized economy.

5.2 International Token Classification & Definitions for eBL

The International Token Classification (ITC) is a holistic standard framework for the classification of DLT- and blockchain-based cryptographic tokens according to their inherent characteristics. The first version of the ITC has already been applied to more than 800 cryptographic tokens and shall provide clarity and transparency for all market stakeholders involved. It follows a synoptical design based on the current research landscape as well as existing best-practices and builds on a flexible and extendable 360-degree approach, which employs different dimensions to describe a token’s properties. The dimensions are clustered in four-dimensional groups that cover Economic (E), Technological (T), Legal (L) and regulatory (R) aspects of a cryptographic token. Within these groups, the initial version of the framework features

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Economic Purpose (EEP), Industry (EIN), Technological Setup (TTS), and Legal Claim (LLC) as the first four dimensions that each feature a multitude of token categories and sub-categories. Future versions of the ITC will present more dimensions in order to capture other characteristics of tokens, but also more detail in each dimension through the addition of new categories and sub-categories or a further differentiation of existing ones (e.g. a breakdown of sub-categories into distinct groups).

ITC Classification for eBL

ITC	Dimension	Category	Sub-category	Identifier
	Economic Purpose	Utility Token	Ownership Token	EEP22O
	Industry	Transportation and Warehousing	-	EIN08
	Technological Setup	Non-Native Protocol Token	ERC721 Token	TTS42B
	Legal Claim	Absolute Rights Token	-	LLC33

Label	Identifier	Definition
Economic Purpose	EEP	This dimension describes the reason for a cryptographic token's creation by the issuer from an economic perspective. In its current version, the ITC differentiates between the categories payment (EEP21), utility (EEP22), and investment (EEP23), which all offer various sub-categories with more detail. Many cryptographic tokens (especially Utility Tokens (EEP22)) feature many different functions and thus serve different economic purposes. Therefore, the classification of a cryptographic token according to this dimension focuses on the primary economic purpose of a token. If such primary purpose is not clearly stated by the issuer, the team of researchers classifying the token decides on the most important feature of a token and determines its primary economic purpose on that basis.

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Dimensions (continued)		
Label	**Identifier**	**Definition**
Industry	EIN	This dimension describes the industry that a cryptographic token is intended to be used in by the issuer. The categories of this dimension are based on the North American Industry Classification System (NAICS) in order to allow for enhanced comparability and reference. Within these general industry categories, sub-categories provide for token market specific differentiation. By default, Payment Tokens (EEP21) are assigned to the sub-category Payment Services (EIN10A) within the industry category Finance and Insurance (EIN10). However, if a Payment Token (EEP21) is intended as a means of payment within a specific industry, the respective industry category should be adjusted. Moreover, Investment Tokens (EEP23) are usually not assigned to Finance and Insurance (EIN10) but to the industry category that the token issuer is active in.
Technological Setup	TTS	This dimension describes the technological properties of a cryptographic token and provides information on its level of implementation. In the current version of the ITC this dimension differentiates two cases: a cryptographic token that is native to a distributed ledger and thus forms an integral part of it, and a cryptographic token that is not native to the distributed ledger, but implemented through a Crypto-Economic Protocol on top of it. Currently the first category (Ledger-Native Token (TTS41)) does not feature any sub-categories, but it will soon distinguish between the type of ledger that the token is implemented on (e.g. blockchain, directed acyclic graph (DAG), etc.). The second category (Non-native Protocol Token (TTS42)) already features the Ethereum ERC20 and ERC721 token standards as sub-categories and will soon encompass other protocol standards too.

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Dimensions (continued)		
Label	**Identifier**	**Definition**
Legal Claim	LLC	This dimension describes what right a cryptographic token does provide its owner with. Currently, it features three distinct categories: tokens that do not provide its owner with any right except to the token itself (No-Claim Token (LLC31)), tokens that provide its owner with relative rights towards a third party (Relative Rights Token (LLC32)), and tokens that do represent absolute rights (Absolute Rights Token (LLC33)). As most Utility Tokens (EEP22) and Payment Tokens (EEP21) are issued in a decentralized way and without legal claim to a central counterparty, they generally form part of the first category (LLC31). Currently there are only a few Investment Tokens (EEP23) on the market, but by definition most of them provide some sort of relative right(s) towards a natural or legal counterparty and thus classify as Relative Rights Tokens (LLC32). Since most jurisdictions currently still do not allow for the management and transfer of absolute rights (e.g. ownership rights) through distributed ledgers, the last category of Absolute Rights Tokens (LLC33) is currently rather future-oriented.

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Categories		
Label	**Identifier**	**Definition**
Utility Token	EEP22	A Utility Token is intended to provide a certain sort of utility or right to the token holder within a clearly specified environment (e.g. decentralized network, third-party ecosystem, business relationship or jurisdiction).
Transportation and Warehousing	EIN08	The category Warehousing and Transportation covers business sectors ranging from logistics, pipeline and freight transportation, passenger transportation and (inter-)urban transit systems, harbor and airport operations, packing and crating, as well as relevant support activities.
Non-Native Protocol Token	TTS42	A Non-Native Protocol Token is a cryptographic token that is implemented through a Crypto-Economic Protocol on top of a distributed ledger. As such, a Non-Native Protocol Token is not an integral part of the distributed ledger on which it is implemented.
Absolute Rights Token	LLC33	An Absolute Rights Token provides its owner with absolute rights (right in rem) to the token and its underlying asset or value (e.g. intellectual property rights or ownership of material objects). With the transfer of the token to a new owner, the absolute rights are also transferred to this owner.

Sub-categories		
Label	**Identifier**	**Definition**
Ownership Token	EEP22O	A Utility Token is intended to provide a certain sort of utility or right to the token holder within a clearly specified environment (e.g. decentralized network, third-party ecosystem, business relationship or jurisdiction).
Ownership Token ERC721 Token	TTS42B	The category Warehousing and Transportation covers business sectors ranging from logistics, pipeline and freight transportation, passenger transportation and (inter-)urban transit systems, harbor and airport operations, packing and crating, as well as relevant support activities.

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Section 6: eBL Token Legal Review

6.1 Token

TradeTrust separates the ownership of an item that a document of title represents from the content of the document. It does so by separating the responsibility of tracking legal ownership from the content of the document. The proof of ownership is the focal point of the TradeTrust project. The eBL token is created for the purpose of managing and transferring ownership of a document in TradeTrust.

The eBL token represents an absolute legal right with regards to the Bill of Lading within the ecosystem of TradeTrust. The link between token and document is created through the hash of the documents content. The eBL token is created on demand, upon the creation of the native eBL file. Each token is unique, non-fungible and has as such no value. All contractual arrangements with respect to the shipped goods such as the price, payment and delivery terms are agreed in a separate smart contract. The eBL token is also not used for value transfers as all payments and security arrangements will be handled by banks. The eBL tokens can also not be converted into fiat money or other tokens. The token is burned upon transfer back to the carrier from which it originated and solely acts as a proof of ownership.

6.2 Legal Framework

In general, tokens can be sorted into three categories based on their economic function. A token may act as a means of payment, function as an investment or confer digital access rights to an application or service.

- Transaction tokens: tokens as a means for general transactions or value transfers (e.g. virtual currencies). Users can affect global peer-to-peer transactions without the involvement of a third party (such as a bank).
- Investment tokens: tokens used as an alternative or addition to existing financial instruments. Some investment tokens qualify as financial instruments as defined in the FSA (e.g. shares, bonds or units in an investment fund offered in the form of tokens). Other investment tokens share similarities with existing financial instruments or regulated activities (e.g. they are used to fund business activities).
- Utility tokens: tokens as an entitlement for using or gaining access to a specific application or service offered by or through a provider's platform (blockchain-based or otherwise).

Currently, besides the provisions under the Dutch Money Laundering and Terrorist Financing Prevention Act, there are no specific laws or regulations with respect to tokens or crypto assets. It should therefore be assessed if the token triggers a license requirement or prohibition under the existing regulatory framework. In order to make this assessment all characteristics of the token need to be taken into account. The financial services in the Netherlands are governed by the Dutch Financial Supervision Act (FSA). Generally, the FSA requires persons carrying on certain financial services to be under supervision of the Dutch Authority for Financial Markets (AFM) or the Dutch Central Bank (DCB), unless an exclusion or exemption applies.

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6.3 Token assessment

We have assessed the regulatory provisions that are most likely to relate to the eBL tokens. Please find the analysis below. We note that this analysis does not give a complete overview of the regulatory framework in the Netherlands. The analysis only sets out the provisions and definitions that we deem relevant given the current characteristics of the eBL token.

6.3.1 Security

The question whether tokens qualify as securities is of importance as it is prohibited to offer transferable securities to the public in the European Economic Area (EEA) without publishing a prospectus that has been approved by a competent authority, unless an exemption applies.

In order to qualify as a security within the meaning of the FSA, the token should qualify as (a) a negotiable share or other negotiable instrument or right considered equivalent and not being an apartment right; (b) negotiable bond or other negotiable debt instrument; (c) any other negotiable instrument issued by a legal person, corporation or institution by which securities referred to under (a) or (b) may be acquired through exercising the rights attached to this instrument or through conversion, or settled in fiat money. Taking into account the available guidance regarding the qualification of a token as a security, it is important, among other things, whether (i) a return is distributed to the token holders, (ii) the token holders participate in the capital of a company and (iii) the negotiability of the token.

A token must be negotiable in order to qualify as a security within the meaning of the FSA. The Dutch legislator has clarified the scope of the term negotiability. To determine whether or not an instrument is negotiable, it is not decisive whether there is a specific market for these instruments, but rather whether the specific instrument is negotiable based on its characteristics. A clear indication that the instrument is negotiable is the extent of standardization. The more standardized an instrument is, the more likely it is to be negotiable.

Each eBL token is unique and not standardized. The token can be transferred but will not be traded on a capital market or money market. The eBL tokens do not provide for a participation in the capital of a company and do not entitle to payments in return related to such capital. The token does not represent any value and an increase of the value of the token is therefore not possible. However, an increase of the value of the shipped goods is possible. These price arrangements are agreed upon in a non-transferable smart contract and not in the eBL token. The token can also not be converted into cash, tokens or other securities. Given these characteristics the token does in our view not qualify as a security.

6.3.2 Financial instruments

It is prohibited to provide certain investment services and activities with respect to financial instruments without being licensed by the AFM, unless an exemption applies. These investment services include broker services, investment advice and platform services.

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Financial instruments include, among others, securities and derivative contracts. The FSA describes the following derivative contracts; (i) options, futures, swaps, forward rate agreements and any other derivative contracts relating to commodities that must be settled in cash or may be settled in cash at the option of one of the parties, otherwise than by reason of a default or other termination event, (ii) options, futures, swaps and any other derivative contracts relating to commodities that can only be physically settled provided they are traded on a regulated market or a multilateral trading facility, and (iii) options, futures, swaps or forward rate agreements other than those referred to under (ii) and any other derivative contracts relating to commodities which can be physically settled and are not intended for commercial purposes, and which have the characteristics of other derivative financial instruments.

The eBL tokens are not a representation of value and do not provide token holders with contractual rights to acquire or dispose of certain investments or goods. The eBL tokens cannot be settled in cash or converted into fiat money or other tokens. The eBL tokens are also not traded on a regulated market or a multilateral trading facility. The key functionality of the eBL token is to proof ownership. All contractual arrangements with respect to the shipped goods such as the price of the shipped goods, payment and delivery terms are agreed in a separate smart contract. Given these characteristics the eBL token itself does in our view not qualify as a derivative contract or other financial instrument. It is possible that these contractual arrangements that are agreed upon in a separate smart contract do qualify as a derivative contract and financial instrument.

6.3.3 Investment object

No party may offer investment objects to consumers in the Netherlands without a license granted for that purpose by the AFM. Investment objects relate to property, entitlement to property, and or entitlement to a return in cash or part of the proceeds from the sale of property. The term 'investment object' has four requirements, in which it must, in short, be a (right to a) property that is acquired other than for no consideration, where a return in money is promised and where the management is primarily carried out by someone other than the acquirer. The eBL tokens do not represent any value and there is no management by TradeTrust of the tokens. In addition, there is no investment return related to the tokens. Consequently, the eBL tokens cannot be considered as an investment object under the FSA.

6.3.4 Electronic money

Issuing electronic money (e-money) in the Netherlands is a regulated activity. Electronic money has been defined in the FSA as electronically, including magnetically, stored monetary value as represented by a claim on the issuer which is issued on receipt of funds for the purpose of making payment transactions (...), and which is accepted by a natural or legal person other than the electronic money issuer.

As the eBL tokens are not issued by a central body, but are decentralized, they are not classified as e-money. In addition, no one can claim monetary value with the eBL tokens. The eBL tokens do not represent a claim on the issuer and they are not issued in exchange for money. The eBL token does not contain any provisions regarding the price of the underlying goods or payment terms. These arrangements are provided for in a separate smart contract. Based on the above analysis, the eBL tokens are in our view not covered under the category electronic money.

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6.3.5 Crypto asset

In the Netherlands, the Money Laundering and Terrorist Financing Prevention Act (Act) defines a virtual currency as "a digital representation of value that is not issued or guaranteed by a central bank or a public authority, is not necessarily attached to a legally established currency and does not possess a legal status of currency or money, but is accepted by natural or legal persons as a means of exchange and which can be transferred, stored and traded electronically". On the basis of the aforementioned Act, crypto service providers, i.e. firms offering services for the exchange between virtual and regular currencies, and providers of custodian wallets for virtual currencies must request registration with DCB. It is our understanding that the TradeTrust will not provide exchange services with respect to the eBL tokens and does not offer wallets itself (only via a third party) and therefore no registration with DCB is required.

6.3.6 Payment services

In the Netherlands a license is required for payment services, unless an exemption applies. In the current TradeTrust ecosystem all payment services will be performed by a third party (bank). TradeTrust or other parties will not perform payment services.

6.4 Conclusion

The key functionality of the eBL token is to proof ownership. We conclude that the eBL tokens, as they are currently structured, do not fall within a type of financial instrument that is regulated in the Netherlands under the FSA or within the definition of e-money. Also, no payment services are performed by TradeTrust and no registration with DNB as crypto service provides is required. Consequently, given the current characteristics of the eBL token they fall outside the scope of financial supervision. The eBL token can be classified as a utility token based on its economic function. [We will discuss our analysis with the AFM and update this White paper, if needed.]

The characteristics and function of the eBL token should be carefully monitored. If for instance the eBL token will represent value it can be considered an investment and probably also a financial instrument. As a result, the issuer might be required to publish a prospectus and/or TradeTrust might require a license to provide investment services. Also, if the eBL token can be used for value transfers, or converted into fiat money, it will trigger a license requirement or prohibition. A re-assessment is also necessary of payment services will be performed. The analysis above is limited to Dutch law and we have not considered any future legislation, including but not limited to the Regulation of Markets in Crypto-assets (MiCA).

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