**Use Case: Trade Finance and Logistics on Blockchain**

International trade raises the kinds of situations that starkly illustrate the inefficiencies and distrust in real-world processes that blockchains were designed to mitigate. We select a small slice of an import/export scenario with simplified versions of transactions that are carried out in the real world as our canonical use case in this chapter. The reader will not only get hands-on experience with developing a practically useful application on Hyperledger Fabric, an application that can be a model for most enterprise applications, but will also gain an appreciation for the unique features that blockchains provide and the rationale for design choices made by the Fabric developers.

**Overview**

The scenario we describe involves a simple transaction: the sale of goods from one party to another. This transaction is complicated by the fact that the buyer and the seller lie in different countries and there is no common trusted intermediary to ensure that the *exporter* gets the money it was promised and the *importer* gets the goods it was promised. Such trade arrangements in today’s world rely on:

* Intermediaries that facilitate the payments and the physical transfer of goods, and
* Processes that have evolved over time to enable exporters and importers to hedge their bets and reduce the risks involved.

**Real-world process**—The intermediaries that facilitate payment are the respective *banks* of the exporter and the importer. The trade arrangement is fulfilled by the trust relationships between a bank and its client, and between the two banks. Such banks typically have international connections and reputations to maintain. Therefore, a commitment (or promise) by the importer’s bank to make a payment to the exporter’s bank is sufficient to trigger the process. The goods are dispatched by the exporter through a reputed international *carrier* after obtaining regulatory clearances from the exporting country’s government. Proof of delivery to the carrier is sufficient to clear payment from the importer’s bank to the exporter’s bank, and such clearance is not contingent on the goods reaching their intended destination. (*it is assumed that the goods are insured against loss or damage in transit.*) The promise made by the importer’s bank to pay the exporter’s bank specifies a list of documents that are required as proof of dispatch, and the precise method of payment to be made immediately or over a period. Various regulatory requirements must be fulfilled by the exporter before getting documentary clearances that allow it to hand off the goods to the carrier.

**Simplified and modified process**—Our use case will follow a simplified version of the above process, with certain variations to demonstrate the value of the blockchain in facilitating this trade. A payment promise is made by the importer’s bank to the exporter’s bank, though in two installments. The exporter obtains a clearance certificate from the regulatory authority, hands off the goods to the carrier, and obtains a receipt. Production of the receipt triggers the first payment installment from the importer’s bank to the exporter’s bank. When the shipment reaches the destination port, the second and final payment installment is made, and the process concludes.

**Terms used in trade finance and logistics**—The following terms are used to refer to certain instruments and artifacts that are in play in our trade scenario. The application we will build in this chapter uses very simplified forms of these instruments.

* *Letter of Credit*: This refers to a bank’s promise to pay an exporter upon presentation of documentary proof of goods having been shipped. Called L/C for short, this document is issued by the importer’s bank at the request of its client, the importer. The L/C states the list of documents that constitute proof of shipment, the amount to be paid, and the beneficiary (exporter) of that amount (exporter in this use case. We introduce small variations in our use case to make this instrument comprehensible to the reader: (i) the L/C is issued to the exporter’s bank rather than directly to the exporter, and (ii) the L/C states that payment will be made in two identical installments, the first upon production of two documents (see below), and the second upon the goods reaching the destination. A sample L/C is illustrated below.

**Toy Bank, Ltd.**

Issue Date: March 1, 2018

L/C Number: 23868

Toy Bank, Ltd. hereby issues this irrevocable documentary Letter of Credit to Lumber Inc. for US$500000 payable immediately upon sight by a draft drawn against Toy Bank, Ltd., in accordance with Letter of Credit number 23868.

The draft is to be accompanied by the following documents:

1. Order Bill of Lading
2. Packing List
3. Invoice

*Authorized Signatory*

*Wood Bank Ltd.*

* *Export License*: This refers to the approval given by the regulatory authority in the exporter’s country for the shipment of the specified goods. In this book, we will refer to it as E/L for short. A sample E/L is illustrated below.

**ABC Government**

**Department of Forestry: Inspection Services**

License to Export Wood

**LICENSE NUMBER: 76348**

License Holder: Lumber Inc.

**FOR THE PURPOSE OF EXPORTING WOOD BY SEA OR AIR**

Commencing On: March 1, 2018

Ending on: March 1, 2019

*Authorized Signatory,*

*Department of Forestry*

* *Bill of Lading*: This is a document issued by the carrier to the exporter once it takes possession of the shipment. Called B/L for short, it simultaneously serves as a receipt, as a contract obliging the carrier to transport the goods to a specified destination in return for a fee, and as a title of ownership of the goods. This document is also listed in the L/C, serves as proof of shipment that will automatically trigger a payment clearance. A sample B/L is illustrated below.

**Worldwide Shippers**

BILL OF LADING FOR OCEAN TRANSPORT

Shipper

Booking ID

Consignee

Notify Party

Place of Receipt

Place of Delivery

**PARTICULARS FURNISHED BY SHIPPER**

Description of Goods

Weight

Measurement

Freight Charges

*Authorized Signatory,*

*Worldwide Shippers*

*Lumber Inc.*

*Toy Company*

*7625901*

*Toy Bank, Ltd.*

*Port ABC*

*Port LMN*

*Wood*

*600 tons*

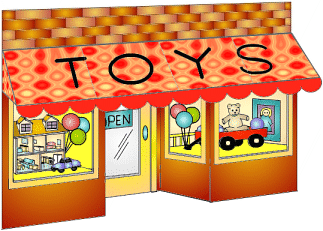
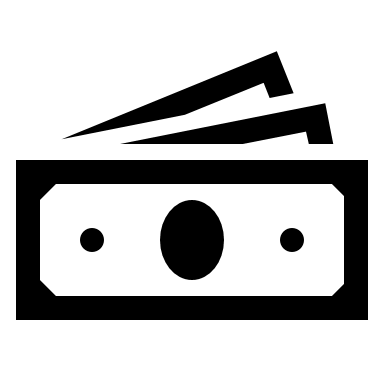
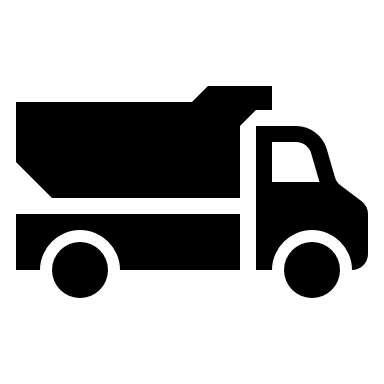
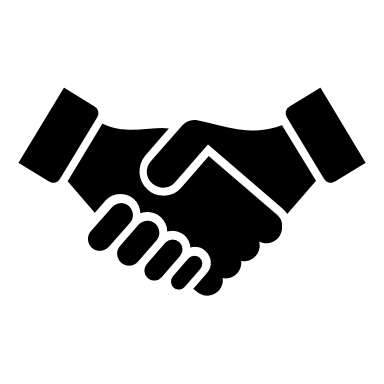
*1000m × 800 m*

*US$40000*

**Shared Process Workflow**

Every instance of such a trade takes a long period of time to complete, involves interactions among different sets of entities at different times, and has many different moving parts that are difficult to keep track of. We simplify the process somewhat into the workflow that is described below. Implemented on a blockchain, the sequences of transactions described in these steps (and illustrated in Figure xx) can be carried out in an irrevocable and non-repudiable manner. In this sequence of events, we assume a straight linear narrative where parties are agreeable with each other and nothing untoward happens; guards are built in the process only to catch errors.

1. Importer requests Exporter for goods in exchange of money
2. Exporter accepts the trade deal
3. Importer requests its Bank for an L/C in favor of the Exporter
4. The Importer’s Bank supplies an L/C in favor of the Exporter, and payable to the latter’s Bank
5. The Exporter’s Bank accepts the L/C on behalf of the Exporter
6. The Exporter applies for an E/L from the Regulatory Authority
7. The Regulatory Authority supplies an E/L to the Exporter
8. The Exporter prepares a shipment and hands it off to the Carrier
9. (a) The Carrier accepts the goods after validating the E/L, and (b) supplies a B/L to the Exporter
10. The Exporter’s Bank claims half the payment from the Importer’s Bank
11. The Importer’s Bank transfers half the amount to the Exporter’s Bank
12. The Carrier ships the goods to the destination
13. The Importer’s Bank pays the remaining amount to the Exporter’s Bank



**IMPORTER**



**EXPORTER**



**CARRIER**



**REGULATORY AUTHORITY**



**IMPORTER’S BANK**



**EXPORTER’S BANK**

1

2

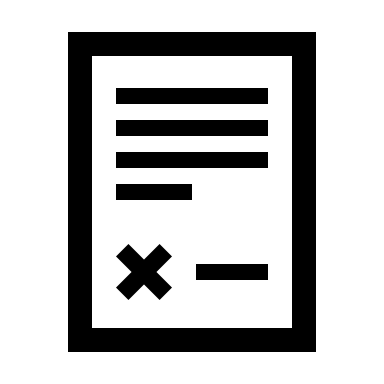
3

4

5

6

7



9 (b)

8

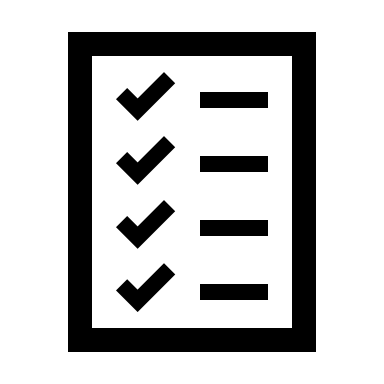
10

11

12

13

9 (a)



**Shared Assets and Data**

The participants in the above workflow must have some information in common that gives them a view into the trade arrangement and its progress at any given instance.

* Below are the assets owned by the participants, and shared with each other to drive the process from one stage to another. This includes documentary and monetary assets.

|  |  |
| --- | --- |
| **Asset Type** | **Asset Attributes** |
| Letter of Credit | ID, Issue Date, Expiration Date, Issuer, Beneficiary, Amount, List of Documents |
| Bill of Lading | ID, Shipper (Exporter), Consignee (Importer), Party to Notify (Importer’s Bank), Places of Receipt and Delivery, Description of Goods, Freight Amount |
| Export License | ID, Issue Date, Expiration Date, Beneficiary, License Holder, Description of Goods |
| Payment | Amount in standard currency units |

* Below are the data elements that circumscribe the options available to participants in each stage.

|  |  |
| --- | --- |
| **Data Type** | **Data Attributes** |
| Trade Agreement | Requested by Importer, Accepted by Exporter |
| Letter of Credit | Requested by Importer, Issued by Importer’s Bank, Accepted by Exporter’s Bank |
| Export License | Requested by Exporter, Issued by Regulatory Authority |
| Shipment | Prepared by Exporter, Accepted by carrier, Current position/location |

**Participants’ Roles and Capabilities**

There are 6 categories of participants in our scenario: {Exporter, Importer, Exporter’s Bank, Importer’s Bank, Carrier, Regulatory Authority}. The terms in this set refer to roles which an entity can assume in a trade deal; e.g., a company exporting goods in one instance may be an importer in another. Capabilities and restrictions of each role are listed below.

* Only an Importer may apply for an L/C
* Only an Importer’s Bank may supply an L/C
* Only an Exporter’s Bank may accept an L/C
* Only an Exporter may request an E/L
* Only a Regulatory Authority may supply an E/L
* Only an Exporter may prepare a shipment
* Only a Carrier may supply a B/L
* Only a Carrier may update a shipment location
* Only an Importer’s Bank may send money, and only an Exporter’s Bank may receive money

**Discussion: Benefits of Blockchain Application Over Current Real-World Process**

The risks inherent in transferring goods or making payments in the absence of safeguards (like a trusted mediator) inspired the involvement of banks and creation of instruments like the Letter of Credit and the Bill of Lading. A consequence of these processes was not just additional cost (banks charge commissions to issue Letters of Credit) additional overhead. Applying and waiting for export licenses to be awarded further increases the turnaround time. In an ideal trade scenario, time would be consumed in the processes of preparing and shipping the goods once a deal has been inked, and nothing else. In recent times, the adoption of SWIFT messaging over manual communication has made the document application and collection processes more efficient, but it has not fundamentally changed the game. Blockchain, on the other hand, with its (almost) instantaneous transaction commitments and assurance guarantees, opens possibilities that did not exist earlier. As an example, the one variation we introduced in the simplified use case was payment by installments, which cannot be implemented in the legacy framework because there is no guaranteed way of knowing and sharing information about a shipment’s progress; such a variation would be deemed too risky, which is why payments are linked purely to documentary evidence. By getting all participants in a trade agreement on a single blockchain implementing a common smart contract, we can provide a single shared source of truth that will minimize risk and simultaneously increase accountability. In subsequent chapters, we will demonstrate in detail how our use case is implemented on the Hyperledger Fabric platform. The reader will be able to appreciate both the simplicity and elegance of the implementation, which can then be used as a guide for other applications to revamp their archaic processes using this exciting new technology.