

PLATFORM FOR PAYABLE BLOCKCHAIN ACCOUNTS FOR GOODS TRADE

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ABSTRACT: Transport companies take goods from their originators to their final destinations. In a business transaction, many documents like purchase orders, shipment notifications, invoices, and delivery receipts are exchanged. Sending and receiving goods, creating and managing invoices, and processing payments are all tasks shared by business partners. To everyone's detriment, disagreements during these processes will lengthen the time it takes and boost the associated expenditures. Manufacturers will send freight companies merchandise invoices, while shipping companies will send customers transportation invoices. Shippers typically handle claims and alternate payments before paying their suppliers and carriers. The goods shipped to you will be inspected by receiving. Suppliers and carriers double-check all payments made by the shipper through the accounts payable department. In this paper, we detail a blockchain-based accounts payable system for shippers that can file late delivery claims and remit payments to suppliers and carriers. By enhancing claims production and utilizing blockchain technology for dispute reconciliation, supply chain companies hope to eliminate process redundancies (accounts payable vs. accounts receivable). Disputes over financial transactions are diminished as a result.

Index Terms- Goods trade, accounts payable, invoice processing, dispute management, blockchain, smart contract.

I. INTRODUCTION

Foreign exchange necessitates communication between different countries. It's accessible by car, train, ferry, or plane. The majority of international trade is transported by liners (also known as cargo ships). Cargo ships have never been surpassed by any other transportation method in terms of efficiency and economy [1, 2]. Shipping containers of either 20 or 40 feet in length are used aboard these vessels. Freight forwarders, 3PLs, and 4PLs (logistics management organizations), ocean carriers, inland transport providers (trucks, rail, and barge), ocean transport providers (ocean carriers), port authorities, and cross-border customs agencies all participate in international shipments.

As the number of intermediaries increases, it becomes more difficult to conduct business across national boundaries. It's not easy to improve cargo visibility. Before preparing bills, resolving disputes, and finalizing payments, shippers and carriers should collect as much data as possible. Budgeting and dividing up bills can become complicated if each person gathers information according to their own preferences.

Our blockchain-based billing system is totally automated, and it includes:

(i) Contract management: The most popular routes for shippers are the shipping lanes that connect various international ports. Carriers (ocean, rail, or road), 3PL/4PLs, and freight forwarders may negotiate "contract prices" for a given shipping path. They last for a year but are updated weekly or quarterly. Logistics costs might be recalculated (e.g., per Bill of Lading or per Container). Contracts for shipping lanes are stored permanently and securely in blockchain's distributed ledger. When determining transportation costs, logistics providers and shipping businesses must come to terms through service contracts. This component keeps tabs on the expiration dates of all contract rates for shipping channels, notifies the appropriate parties, and then renews those rates.

(ii) Invoice generation: Using information from shipping lane contracts and Trade Lens cargo tracking systems, a blockchain smart contract generates electronic billing for carriers and freight forwarders.

(iii) Dispute management: Invoices generated by our system may be contested by shippers and carriers thanks to detailed audit trails.

(iv) Interaction with customer environments for accounting and payment settlement: Invoices that have been reconciled and approved can be sent directly to the customer's ERP system via API interfaces. Given the open nature of our system's design, it should be straightforward to incorporate it with emerging consumer efforts.

(v) Alert notifications: It is possible for our program to send out emails and text messages to specific individuals under specific conditions (e.g., the invoice issued, or dispute raised on the invoice).

2. SYSTEM DESIGN

EP and TradeLens work together to retrieve shipment details and tracking updates in real-time. EP provides a converter for receiving notifications in many formats in real time. Goods in transit can be traced in a blockchain ledger. Products are billed based on shipment events after they have been delivered to the shipper.

Invoice Number: Processing Orders (IP). Invoices and smart contracts share similar building blocks. To generate a CA for the shipment, the smart contract module compute CA makes use of the downloaded EDI papers (PO, DA, RA, and supplier invoice). The ledger keeps track of real-time shipment tracking events, and the accounting (CA) module of the smart contract generates bills for suppliers and carriers. Our system generates a CA/PA for every shipment, and the Handle Disagreement module allows you to file a dispute, add comments and supporting documents, and accept, reject, or modify the dispute. After a PA is finalized, a CA will be automatically approved if it has gone more than a predetermined number of days without being challenged.

The AP module provides REST APIs (with permissions) and cron jobs to activate smart contract modules for user connectivity. In order to expedite data retrieval in the UI, Postgre SQL databases are cached. The blockchain ledger can be linked to the relevant EDI document (purchase order, delivery order, return authorization, supplier invoice, carrier invoice) using application programming interfaces (APIs). Through the reuse of previously stored documents, Cloudant DB speeds up API calls. A shipment's CAs and PAs can be queried using the Query API. Each blockchain company relies on APIs for user authentication. Notification settings are managed using APIs. When used, APIs can greatly enhance the user experience (e.g., transaction status monitoring and connecting with the client ERP systems). Watch The compute CA function of the smart contract is called upon to construct a CA. For each shipment, cron jobs generate a Payment Advice (PA). CA This is a communication link in the auto Approve chain code. Activate the auto-acceptance of CAs.

APIs enable users to submit new disputes, update existing ones, provide input, and approve or reject disputes (with access control settings). These APIs are used to interact with Dispute's smart contract module. This section can also invoke the smart contract module to terminate the current PA if there are no open disputes.

Information about transactions, EDI documents, and invoices (including CAs and PAs) are all recorded and made accessible to all parties involved in the network through a distributed ledger built on blockchain technology (e.g., shippers, suppliers, and carriers). The AP user interface in our blockchain platform communicates with the GP part via REST API. Manage Complaints allows users to lodge and track CA or PA complaints, while Manage CAs/PAs lists the CA and PA for a given shipment. Using the UI, we may interact with things in the real world using the External Data Sources tab. Generally speaking, a commodity shipment tracking system is an example of a "Shipments/Events Source," which is any organization that provides access to shipment tracking events in real time (e.g., TradeLens). Its dealings and events bolster the EP part. Data from EDI and CA/PA systems are utilized by our ERP software.

3. EVALUATION

In our study, we use a blockchain platform to model an international container transportation network. Membership service providers (MSPs) on the blockchain network represent container shipping participants. MSPs are blockchain peers. These nodes run Hyper ledger Fabric 1.4.1 in Docker containers within Soft Layer VMs. Each peer operates its own virtual machine (VM) with a 32-core CPU, 64GB of RAM, and a separate network interface. Red Hat Open Shift, a container platform, runs the Event Processor, Blockchain Invoicing Utility, and Blockchain Invoicing UI.

Our team benchmarks with Hyper ledger Caliper [15]. Caliper creates reports for blockchain implementations including performance data like tps and tx latency. We checked simulation latency and throughput. In our testing, 100 transactions per block and 500 ms block timeout were ideal. Hyper ledger Fabric's other parameters are left alone. Optimizing design parameters increases throughput [16]. Unless otherwise noted, our tests included four companies and 500 tps of Hyper ledger Caliper entries.

Complete model files for 10 shipping channels (see Section V-A). These highways cross 15 regions. Door-Port lanes consist of two voyages, one on land and one at sea (representing the lane service type Port-Door). Compute Fees creates two invoices every shipping. Section V-A states that each invoice incorporates fixed expenses, variable formula fees, business process fees, and computation type combinations. To conduct our studies, we randomly select one of 100,000 shipments. We've built real-time shipping events for these shipments together with compute Fee and retrospective Compute. We apply an arbitrary fee to newly-created bills using the add Manual Fee transaction mechanism. Let's imagine one of these bills' charges is disputed to practice manage Dispute. Chain code, distributed to every node in the network, defines how each transaction type operates. A million transactions were submitted ten times for each experiment. Below, we exhibit the average results of our experiments.

Figure shows how transaction-send rate affects throughput and latency for each of four transaction types. All four types of transactions have higher latency since more are sent per second, as seen below. Throughput increases with transaction sending rate, but levels off at 600 tps. The experiment portrays a hypothetical setup with several transactions. In 2017, 802 million TEUs, or 25 TEUs, were shipped worldwide[17]. The proposed system easily handles package throughput in the existing global trade context [17] and will expand effectively for future needs.

A. Increased transaction rate vs. performance

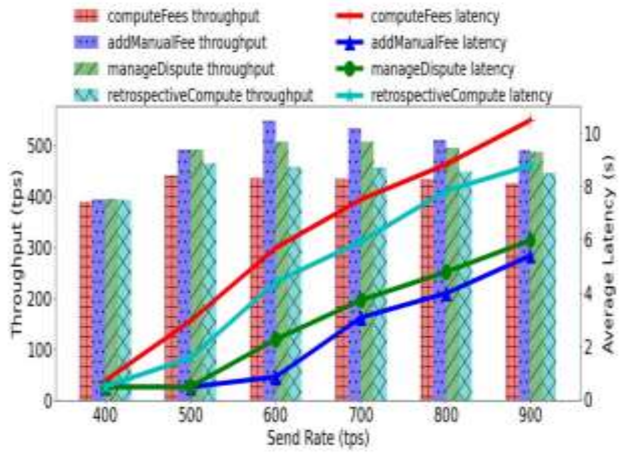

Figure: Send rate affects performance

B. Increase in number of peers vs. performance

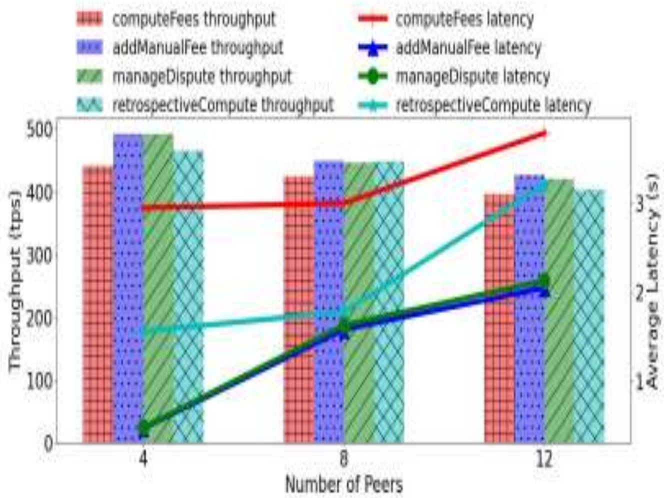

Figure. Performance effect of more peers

We then looked into the possibility of incorporating new blockchain peers. Supply chain members benefit from this development. Both throughput and latency are impacted by the nature of the transaction. Having more peers in a network slows down transactions and increases latency. Endorsements are gathered and validated by more peers in the Hyper ledger Fabric network. Increases in both delay and throughput are seen. Our system is the same. Optimization can be enhanced by reworking the endorsement policy [18].

Table I
PERFORMANCE FOR 1 DC VS 5 DCS DEPLOYMENTS

Transaction Type	Throughput(tps)		Average Latency(s)	
	1 DC	5 DCs	1 DC	5 DCs
computeFees	441.1	235.3	2.95	12.82
addManualFee	492.2	266	0.47	10.13
manageDispute	492.3	244.8	0.48	11.23
retrospectiveCompute	465.4	237.4	1.56	12 .00

C. Peers of diverse geographies vs. performance

Table I shows how throughput and latency are impacted when global trading participants are replicated across multiple DCs. Four data centers were considered as potential hosts for the block chain's peers, while a fifth was considered as a potential host for the orderer node. These results show that with increasing peer dispersion around the globe, latency and transaction throughput increase. Ping latency was 1 millisecond when all blockchain nodes were situated in the same DC. Distribution among five DCs, however, increased the ping latency to [40-130] ms. Therefore, performance diminishes when operating over a slow network. Such conditions are perfect for the operation of low-latency networks. Our proposed system can accommodate demand that is more than ten times that of the global transportation sector even without optimization [17].

4. CONCLUSION

This paper proposes a block chain-based accounts payable system to expedite accounting by merging accounts payable and accounts receivable, speeding up invoicing, and reducing time spent mediating commodities transaction disputes (domestic and global). Our accounts payable system uses distributed ledger technology to enable transparent, auditable billing (block chain). The total of these four categories is a PO's claim guideline. Accounts Payable leverages Trade Lens real-time events to collect and consolidate invoices from suppliers and carriers before issuing payment advices. Before receiving payment, shippers must pay the CA-PA difference. We integrated cloud micro services and Hyper ledger Fabric blockchain to build this solution (but any other permissioned block chain platform can also be utilized here). We used a real-world marketplace to test our smart contract modules' reliability (transactions). Results demonstrate a single system may meet many user needs. Trade Lens users test the current procedure.

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