IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 9, Issue 5, May 2020

Cloud Based Application for Contract Management and Freight Invoice Auditing of Air Freight- Blockchain Based Approach

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Abstract: Logistics is normally outsourced to Logistics Service Providers (LSPs) by Customers so that they can continue to focus on other important activities that they are specialized in, which improves efficiency and lowers logistics costs. Selection of LSP, optimal pricing and performance of the LSP has a significant impact on the profitability of the company and customer satisfaction. Currently, the process of issuing Request for Quote (RFQ) to LSPs, securing rates, negotiation and selection of LSP is done manually either over phone/mail and managed through spreadsheets. The current process is not transparent and not very efficient due to manual processes. Further, verification/audit of freight bills is done manually which is prone to errors and does not address the issue of excess/double billing. Assigning of General Ledger (GL) codes to freight bills during accounting of freight costs, (based on shipment parameters), i.e being done manually through excel sheets, With increase in demand for logistics due to free international trade, there is a requirement for a cloud based Business to Business (B2B) e-commerce tool which offers companies to secure quotes, negotiate rates, facilitate submission of freight invoices by LSP and enable companies to verify freight invoices against agreed rates.. This paper discusses "**AirfreightPro**", a collaborative cloud based tool which attempts to solves the problems faced in existing system by automating the freight contracting process right from issue of RFQ, securing rates, award of contract and also enable LSP to submit freight invoices online to the Customer. The tool makes use of "Blockchain" methodology of distributed ledger to facilitate timely payments and avoid excess payments.

Keywords: Logistics Service Providers (LSPs), Customer, Invoice-Audit, Orders, AirfreightPro, GLCode, Request for Quote (RFQ), Blockchain.

I. INTRODUCTION

Logistics is defined as managing the transportation of goods from origin to destination to meet Customer requirements. Several companies outsource logistics to LSPs to enable them focus on business in which they are specialized, while LSPs can continue to focus on logistics process since they are specialized in logistics related activities. Outsourcing of logistics will have positive impact on organization performance on account of best in class processes and efficiency of LSPs due to their core competence [1]. To improve the performance, organizations seek to focus only on limited activities which they are specialized and outsource logistics related activities to LSPs. By outsourcing logistics, organizations can reduce costs which is otherwise invested on building infrastructure for logistics related activities, which implies high financial risks, and have adverse impact on performance of organization [1].

LSPs can help organizations to reduce costs since they already have ready infrastructure for logistics and they are specialized in logistics. To reduce the costs of logistics outsourcing, organizations have to focus on making maximum utilization of capacity and allocate only required capital for logistics. Companies need not allocate capital in logistics thereby reducing financial risks [1]. Logistics outsourcing helps Customers to improve performance of services. At same time, customers outsource other activities which helps in reducing costs and improve quality of services which enhances overall performance [1].

LSPs plays a major role in transporting goods from origin to destination and it is responsible to manage complex supply chain activities and ensure goods reach destination on time and without any hassles. Therefore, LSPs should continue to innovate and carry out creative activities to stand among all the other LSPs. However, it is very important to be able to measure the various parameters contributing to positive impact of outsourcing on the organization performance, viz Cost reduction, on time delivery, addressing issues faced by Customers in minimal time and making use of latest technologies to drastically improve the performance of services. Currently some of the parameters are not being captured and rest are being updated through redundant and repetitive tasks manually.

IJARCCE

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II. LITERATURE SURVEY

Logistics is one of the activities that is being outsourced by Customers. Today in competitive world, market makes organizations to be active and focus on best practices to stay ahead of their competitors.

Jabir Arif, Fouad Jawab [1], proposed that outsourcing of logistics was initially aimed at reducing costs, later enabled Customers to increase flexibility and allowed customers to focus on limited set of activities which in turn enhanced the performance of services. Purpose of logistics outsourcing is to solve problems faced by customers to handle logistics activities and problems related to various outsourcing.

There is need for LSPs to improve performance by reducing costs, faster delivery of goods, minimal damage of goods during transportation, faster delivery of goods and making use of latest technologies to deliver high performance services and quickly respond to customer requests [1]. Logistics outsourcing has positive impact on organization performance because LSPs carry on logistics related activities and it reduces costs [1]. By making use of modern technologies, improving customer experience, on-time delivery and by reducing operational costs, logistics outsourcing has contributed to improved performance [1].

LSPs act as backbone in e-commerce environment as they are solely responsible for handling logistics related activities. [2]. C.C. Luk, K.L, Choy, H.Y. Lam [2] proposed that there is a need to focus on all the aspects rather than only focusing on selection of LSPs which can lead to degradation of performance. LSPs take responsibilities of handling transportation of goods and make sure that goods reach customers on time with minimal or no damages. E-Commerce businesses outsource logistics activities to LSPs which helps them to achieve flexibility and reduce investment on warehouse management, transportation. [2]. Customer are required to choose LSPs which offers best services at minimal cost. Factors to be considered while choosing LSPs are cost, relationship, services and quality [2]. When goods are transported by LSPs there are high chances of products getting damaged which in turn reduces customer satisfaction. LSPs have to make sure that there is minimal or no damage during transportation of goods and ensure goods reach on time [2]. LSPs have to offer best price for the services offered, ensure minimal damage, make use of latest technologies such as goods tracking mobile application to stand among their competitors and gain advantage at handling e-commerce orders.

III. CURRENT PROCESS

The current process comprises of many manual tasks and is resulting in many inefficiencies and non-availability of data necessary for freight trends, spend analysis and to evaluate the performance of LSPs, such as:

- Rate Contracting process for freight starting from issue of request of quote, submission of rates, negotiation and selection of LSPs is being carried out manually through mails, phone calls and spreadsheets.
- Moreover, the process of rate negotiation is not transparent and bidding is not in real time
- There is no process to verify bills against agreed rates. Further, there is no provision to address the issue of excess billing or double billing
- Historical data on the rates agreed/billed by the LSPs for various origin-destination sets is not available for comparative analysis of spend over a period of time and study of trends
- Data on performance of the LSPs in terms of delivery quality (damages,mis-handling etc.,) and also the transit time is not captured for periodic evaluation against the set SLA (Service Level Agreement)
- Assigning appropriate GL Codes to freight bills based on shipment parameters is being done manually through excel spreadsheets.

IV. PROPOSED SYSTEM – CLOUD BASED E-COMMERCE TOOL FOR AIR FREIGHT ("AIRFREIGHT PRO")

The proposed system is a cloud based e-Commerce tool viz., "AirfreightPro" for air freight, to enable companies and LSPs to collaborate for all the activities.

The tool automates the entire rate contracting process for freight starting from issue of Request for Quote by the Customer, submission of rates by LSP, rate negotiations in real time and selection of LSP by the Customer through a set of transactions over the internet, backed with event based mail notifications

Figure 1, shows process flow diagram with 2 actors namely Customer and LSP. Customer shall issue Request for Quote (RFQ) for Air Freight, upon which LSPs shall receive mail notifications and LSPs can login into the application and

IJARCCE
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submit their offer price against the RFQ. After Customer receives offer price from various LSPs, the Customer can negotiate with LSPs in real time by repeatedly populating a target rate and the LSPs in turn revise the offer price until the deal is concluded by way of Customer confirming the Order on the selected LSP. The selected LSP would receive a mail confirmation of Order by the Customer. Once the Customer places the order, LSPs can no longer edit offer price. After Customer has placed order, LSP can enter shipment details for the particular transaction. The LSP shall update the shipment references such as Airway Bill#, Flight#, ETD (Estimated Time of Departure), ETA (Estimated Time of Arrival) and also ATD (Actual Time of Departure) and ATA (Actual Time of Arrival) and shall also upload a copy of the shipping documents into the system.

The LSPs shall also be able to submit the freight invoice containing the freight amount to be charged for the respective transaction/shipment into the tool, with a copy of the freight invoice as a file attachment. The tool shall facilitate verification / audit of freight invoices by populating the agreed rates for the selected shipment parameters. Auditing of freight involves and assigning appropriate General Ledger (GL) Codes to freight invoices based on the shipment parameters is also supported. Using Blockchain, we can increase the efficiency of freight invoice settlement process and avoid excess payments as follows:

- The LSP shall update the delivery details of the shipment in the system with the information about the receiver.
- Customer shall confirm receipt of the shipment in the system by verifying the delivery information entered by LSP.
- LSP shall be permitted to create freight invoice for the corresponding shipment only after the LSP updates the Delivery Details and the Customer enters the receipt confirmation, which facilitates avoidance of excess payments/double payments using Distributed Ledger based on Blockchain Technology.
- LSP will not be able to revise the freight invoice once the Customers approves for payment.

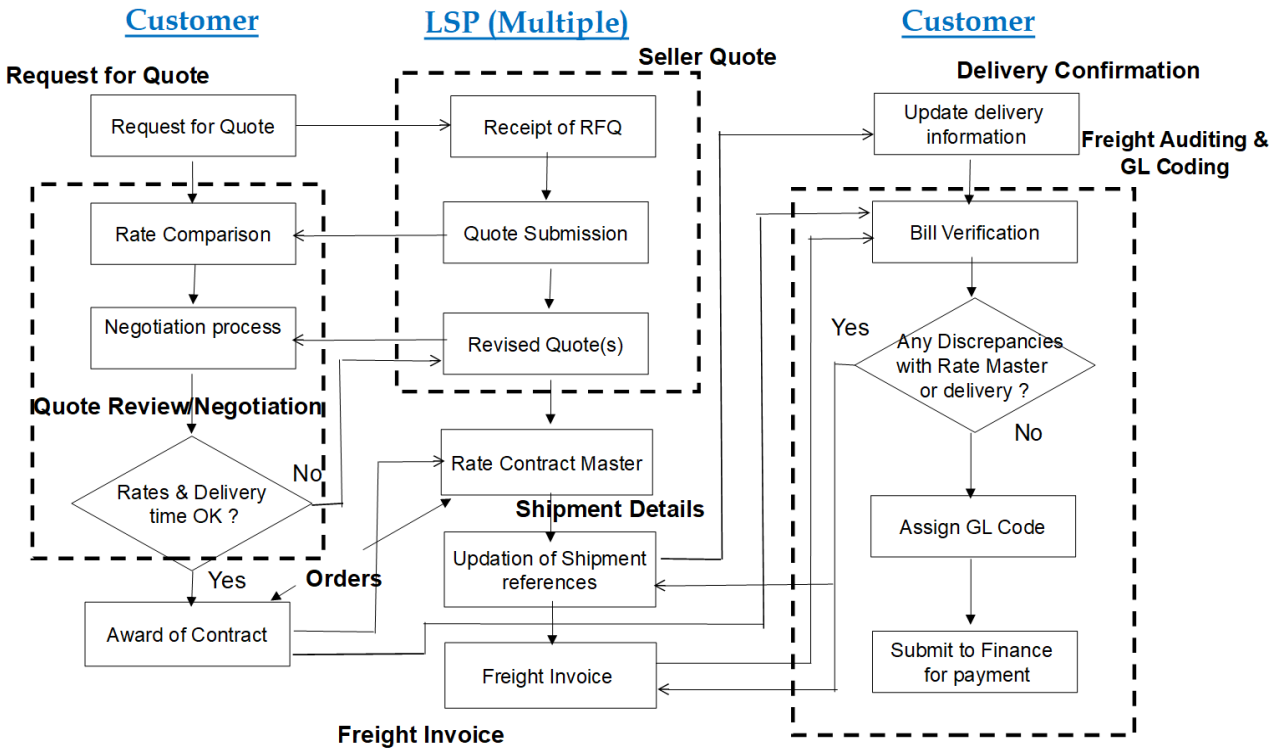

Figure 1. Process Flow Diagram

Some of the advantages of proposed system over existing system are as follows:

- Offers transparent process in selection of LSPs.
- Real time price negotiation by Customer with LSPs during bidding process.
- Tool also facilitates automatic verification of freight invoices with rate contract and confirmation of shipment receipt before approving for payment.
- Assigning GL codes to freight bills based on shipment parameters is also supported.
- Using Block Chain, it is possible to verify whether the customer has received shipment and avoid excess payments, using Distributed Ledger.

IJARCCE

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V. APPLICATION OF BLOCKCHAIN

Blockchain can be defined as distributed ledger technology that enables parties to record transactions without compromising on security and transactions once recorded are permanent. Since Blockchain is decentralized, databases are shared among parties in the network which removes the need for trusted third parties to verify, record and coordinate transactions. The ledger can be updated only when all the participants in the network agree and all the changes to distributed ledger are auditable. In logistics industry, there are some disputes which can be solved using Blockchain. Blockchain also helps to improve efficiency of freight invoice settlement process. Digitized documents and real time shipment data are embedded in the system to reduce inaccurate data and to verify shipment delivery. LSP shall update the shipment references such as Airway Bill and shall also upload the copy of same into the system. Customer shall update the delivery confirmation of shipments in the system only after which freight invoice for the corresponding shipment can be created by the LSP, which helps avoid excess payments and facilitates timely payments using Distributed Ledger based on Blockchain Technology. Similarly, LSP shall not be permitted to revised any freight invoice once the same is approved for payment by the Customer.

VI. LOGISTICS SERVICE PROVIDERS (LSPS)

LSPs have evolved from offering basic services to several different types of services of varying complexities due to changing demands of Customers.[1]. Logistics services have grown by leaps and bounds from serving domestic market to serving international markets and number of goods and services are increasing rapidly [1]. Thousands of services have been introduced recently and several LSPs and Customers have entered market which has made market increasingly competitive. As companies grow, it becomes increasingly difficult for them to maintain same performance and also they also find lot of difficulties to handle transportation of goods [1]. To improve performance and focus on tasks in which they are specialized, companies tend to outsource logistics to LSPs who are specialized in logistics related activities.

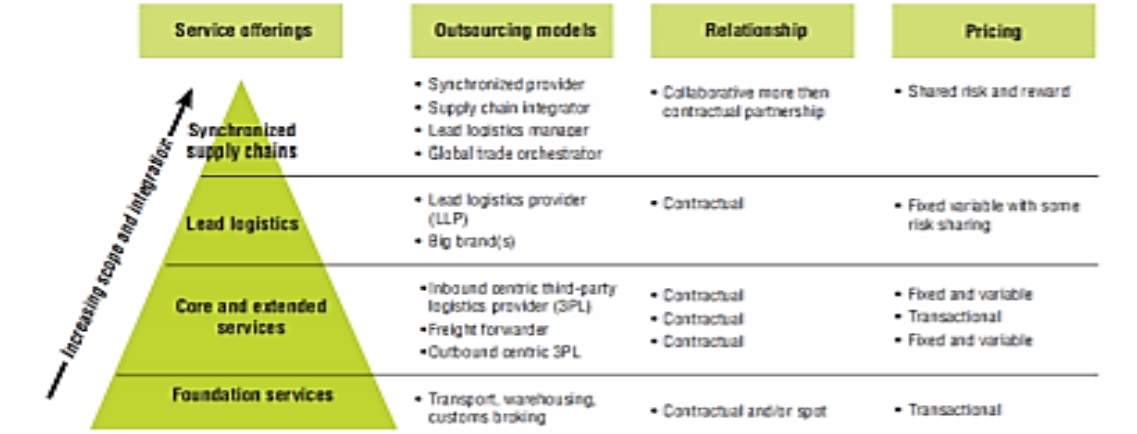

Figure 2. Evolution of the LSPs

Figure 2 shows how LSPs have evolved from different perspectives- services offered, outsourcing models, relationship and pricing. LSPs play crucial role in life of Customer. They take up logistics related activities so that customers need not worry about transportation, warehousing and delivery of goods which in turn reduces burden on customer and it helps in growth of organization. LSPs are solely responsible for transporting goods from origin to consumer via distributors [1]. LSPs carry out several logistics related activities and Customer has to decide which activities has to outsourced to LSPs and which have to be carried out internally. By outsourcing logistics, customers get lot of flexibility to focus on other activities and adapt to market changes. LSPs can help customer to meet increased demand, reduce costs and ensure faster delivery of goods. LSPs have helped customers to improve performance by reducing costs which otherwise would have been invested in logistics thereby leading to financial risks. Also LSPs ensure that customers are satisfied with services offered and adopt strategies for quick delivery of goods. LSPs use modern technologies to deliver high performance services and improve Customer satisfaction [1]. Even though logistics outsourcing has helped Customer in several ways, there are some problems which companies are currently facing such as no transparency in choosing the right LSP and rate contracting process right from Request for Quote(RFQ), submission of rates, negotiation is carried out manually through mails and spreadsheets which does not offer best and transparent way and verification/audit of bills with rate contract is being carried out manually which is time consuming and prone to errors and current system does not address the problem of excess billing. There are some criteria which is taken into consideration in selection of LSPs such as cost, relationship, services and quality [2]. Adopting different strategies and fulfilling all demands of customer is challenging task for LSPs [2].

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VII. SOFTWARE DESIGN

Software is developed by using ASP.NET 4.5 framework and SQL-Server as database. Front end is developed using Bootstrap 4.0 and backend code is written using C#. There are two actors namely LSP and Customer and each one carries out different set of transactions.

A. *Customer Transactions*:

- *Request for Quote(RFQ)*: Customers can enter the details of the package to be sent like number of packages, dimensions, Gross weight, Origin Airport, Destination Airport and then submits the Request for Quote (RFQ). Once RFQ is issued, LSPs would receive mail notification about the same.
- *Quote Negotiation*: Customer can shortlist appropriate LSP and then negotiate price in real time with LSP.
- *Orders*: Once Customer places the order, Customer receives the details of order. LSP can no longer edit the offer price.
- *Delivery Confirmation*: Customer will confirm if shipment has been received as claimed by the LSP.
- *Invoice Audit and GL Coding*: Once LSP generates invoice for the shipment, Customer can verify if LSP has prepared invoice according to the rate contract. Customer can either accept/reject the invoice. If Customer accepts the invoice, LSP can no longer edit invoice details for the shipment and if Customer rejects the invoice, LSP is given option to make changes to the invoice.

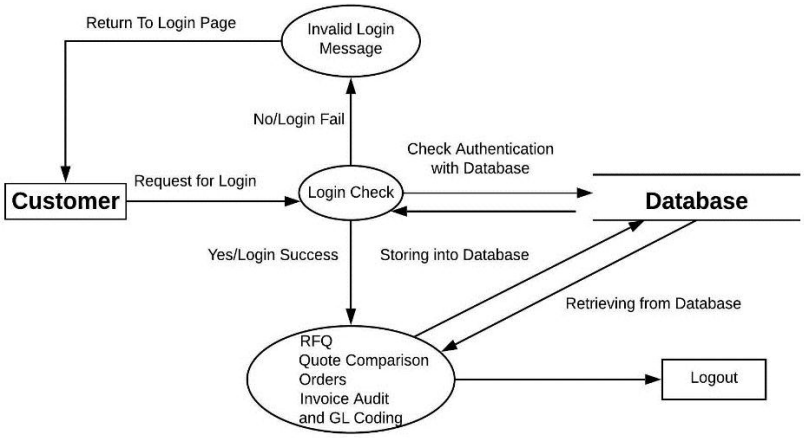

Figure 3. Process Flow Diagram for Customer

B. *LSP Transactions*:

- *LSP Quote*: After Customer submits RFQ, LSP can submit offer price for the corresponding RFQ upon which Customer shall receive mail notification about the same.
- *View Orders*: LSP can view orders placed by Customer on them.
- *Shipment Details*: LSP can enter shipment details for only those RFQs for which order has been placed on them by the Customer.
- *Invoice Generation*: LSP can generate invoice only for those shipments, which have been delivered by LSP and receipt of the same is confirmed by Customers.

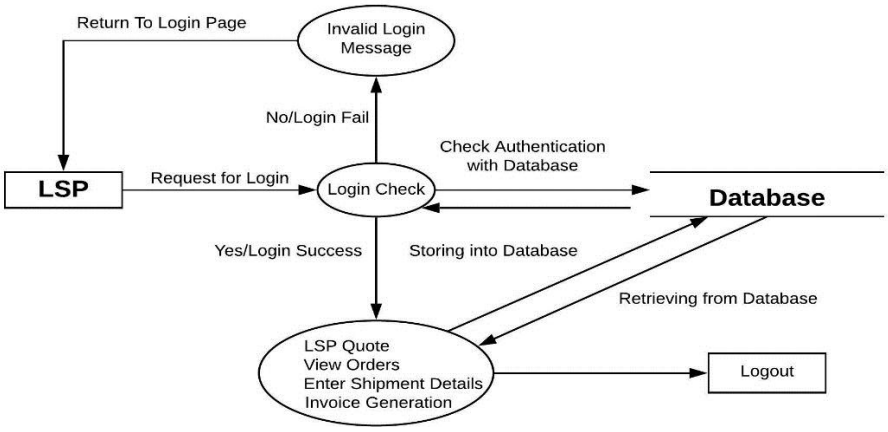

Figure 4. Process Flow Diagram for LSP

VII. CASE STUDY

A. *Background*

A Company "ABC"(Customer) imports medical equipment such as ventilators, Ultrasound scanners, MRI Scanners etc., from various suppliers in United States of America to Bangalore, India and sells the same in the Indian market. There are several hospitals in India, which purchase medical equipment from ABC Company. In order to import the Medical Equipment, ABC Company requires a LSP who can pick-up the Equipment from the supplier in USA, transport the same by air to India and deliver the equipment to Hospitals as required by the Customer. Since equipment are very heavy, Customer should choose appropriate LSP who offers competitive price and have best track record in terms of safely handling packages, is reliable and delivers packages faster. Existing system is not at all effective in choosing the right LSP and it does not offer transparency and is not efficient. Currently, all the process right from Request for Quote till finalising the contract is being done manually using Excel sheets and mail. There is no provision for Customer to confirm whether LSP has delivered equipment to hospital and there are chances LSP might raise invoice more than once for the same shipment, so Customer ends up paying twice for same shipment.

B. *Advantages of "Airfreight Pro" Tool*

This tool offers solutions to the problems faced in existing system by automating the process right from Request for Quote till finalising the contract. When ABC company wants to import equipment required for any hospital, it can issue Request for Quote and once Customer submits the RFQ, all the LSPs registered in the portal will receive mail notifications. LSPs can login and submit the offer price for the RFQ. Customer can choose appropriate LSP and negotiate price in real time and once Customer is satisfied with price offered by LSP, it can place order after which the LSP can no longer change the offer price. LSP can enter the shipment details only for those shipments for which orders have been placed by Customer. Only when LSP delivers the shipment and Customer confirms the delivery of equipment, LSP can generate freight invoice for the particular shipment. After LSP generates invoice, ABC Company can audit the invoice and check if invoice is as per agreed contract and if the total amount of invoices exceeds the agreed air freight rate as per the order and approve/reject the invoice accordingly. This tool solves the problem of excessive/double billing and allows Customer to verify if shipment has reached. Once Customer approves the invoice, LSP can no longer edit the details in the invoice. If ABC company rejects the invoice, LSP has to revise the invoice and re-submit to the Customer. While approving the freight invoice, ABC company also assigns a General Ledger (GL) code for internal accounting purposes to identify the relevant department/product category/Customer for which the freight cost was incurred.

IX. CONCLUSION

This tool helps to solve problems faced currently in logistics and it automates the process right from RFQ till finalizing the contract. It enables Customer to negotiate offer price with LSPs in real time and it helps Customer to verify whether shipment has been delivered by LSPs which ensures transparency, that does not exist currently. LSPs can generate invoice only after Customer confirms the delivery and invoice is audited by Customer to check if invoice generated by LSP is as per rate contract and if the shipment has been received by using distribution ledger model of Blockchain approach, which solves double/excess billing problem faced by Customers currently. So this tool solves many problems which is being faced in logistics.

X. SCOPE FOR FUTURE ENHANCEMENTS

There is scope for many enhancements in field of data analytics and IoT. Some of the enhancements are:

- SMS module can be added to receive alerts for various transactions.
- Interface with airline websites for real time shipment tracking.
- This tool can be enhanced to support trucking and ocean freight.
- Data analytics can be used to analyze air freight costs per kg for different weight slabs for each airport pair. It can also be used to display last traded price.
- IoT can be used to track change in temperature and humidity in case of temperature controlled cargo. History of temperature and humidity can be transmitted from the cargo container to the tool.

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