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*Original Article*

# Merge In-Transit Methodologies in Enterprise Resource Planning for Logistics

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***Abstract*** *- This paper explores the Merge In-Transit (MIT) supply chain scenarios[5] within the scope of ERP Package[4]. SAP is a leading ERP product that provides an integrated solution for advanced logistics strategies. Some of the most common logistic strategies in an ERP Product include Inbound Logistics, Outbound Logistics and Reverse Logistics. Industries commonly use the Merge In-Transit strategy in outbound logistics to meet the end-customer requirements. The MIT strategy can also be applied to inbound logistics and reverse logistics for cost and time efficiencies. However, the MIT scenario is notably more complex than standard logistics processes. It involves logistics service providers (such as warehousing, distribution and transportation), third-party logistics providers (who handle shipping, packaging, and storage), and warehouse providers for managing the merge in-transit storage facilities. This paper presents one of the most effective and recommended MIT approaches within SAP, highlighting its potential benefits and complexities.*

***Keywords*** *- ERP, EDI IDOC, Inbound Logistics, Merge In-Transit, MIT, Outbound Logistics, Reverse Logistics, Supply chain Logistics, SAP, SCM, TMS.*

## 1. Introduction

Merge In-Transit is a logistics business process [7] where shipments from multiple sources are consolidated and then merged while en route to the final destination. SAP is a leading ERP product that effectively provides an integrated business solution to manage this complex supply chain logistics process [7].

## 2. Business Process & System Design

Before proposing a design solution, identify the stakeholders involved, such as the systems for integration, the business team responsible for logistics, and other relevant stakeholders.

### *2.1. Define Process*

Plan a detailed discussion with all relevant stakeholders (warehouse, carrier, third-party warehouse, IT teams) to finalize the process or business requirements. Key questions to address for finalizing the Merge In-transit business process include: - 1) Warehouses (Plants) - Which plants will be involved in the MIT Process? What products are eligible for MIT? How will stock availability be determined in real time? 2) Third-Party Warehouses (Merging Point): - Which third-party warehouses are involved? How will systems be integrated with these warehouses? How will data be exchanged? 3) Shipping Carriers (e.g., - FedEx, UPS, DHL) – Which carriers will be used for MIT Shipments? How will carrier selection be determined? Is this through Transport Management System (TMS) [6] (e.g., SAP TMS, Oracle Transport Management, Mercury Gate Transportation Management, etc.). If so, what are the carrier selection rules and conditions? How will such applications be integrated with carrier systems? What data will be exchanged with them? Is this for the final destination address or the merging point address? Based on the business stakeholders' inputs, prepare a flow diagram [6] of data/physical goods flow from i) Sourcing (Pick, Pack & Goods Issue) to ii) Shipping carrier handover to, iii) Goods receipt at Merging Point (from multiple sources), and iv) From Merging point (Pick, Re-Pack and Goods Issue) to, v) Carrier handover for final destination.

### *2.2. Define Systems*

Identify all the systems required to ensure smooth data flow at various stages of the goods movement. Document the list of systems involved, including those used by stakeholders such as warehouses (plants), carrier systems, and third-party integration software. Warehouses may use software packages [5], including SAP EWM, MAWM, or other warehouse management systems. Carriers may use web-based applications along with integration software. These integration tools could include SAP PI [12] or ALE IDOC [1], EDI Idoc [1] or file transfer, or simple XML file exchange. The following method outlines how to document the systems list based on process (Here, SAP ERP is used as an example).

**Table 1. Systems involved in key business processes**

| Process/Data | System |
|---|---|
| Material Master | SAP ECC |
| Vendor Master | SAP ECC |
| Customer Master | SAP ECC |
| Web Order | Online Website |
| Sales Order | SAP ECC |
| Delivery | SAP ECC |
| Warehouse Order | SAP EWM, WM or 3rd Party WMS |
| Communication | EDI – IDoc[1] |
| Middleware | WebMethods / SAP PI |

PS: If plants (warehouses) are managed by third-party logistics, the warehouse management system is not within the scope.

### *2.3. Key points to be Considered*

- It is essential to design high-level integration points and triggers across all systems to develop a seamless and efficient system.
- Understanding the current business process is crucial for designing a scalable and innovative future-state process.
- Standard controls, protocols and security models must be implemented using a risk-based prioritization approach.
- Create a process flow and conduct a playback session with business stakeholders to identify and remove any gaps in the design.
- Involvement and agreement from all stakeholders are crucial, as the MIT process involves more participants than the regular process.

### *2.4. System Architecture*

Identify the End-to-End data flow and goods movement for the MIT Scenario. This starts from customer order placement to customer delivery. Ensure all integration points are designed as per the identified business process. Ensure the mode of data flows, such as interfaces from/to ERP applications using EDI-IDOC [1] or ALE-IDOC [1], RFC, SAP PI [3] for XML exchange, etc. Central ERP Application (e.g., SAP ECC) holds the master [2] and transactional data such as material master, customer master [2], vendor/partner master [2], serial number data, and sales order delivery respectively. Transport Management System (e.g., SAP TMS) holds the carrier/partner information.

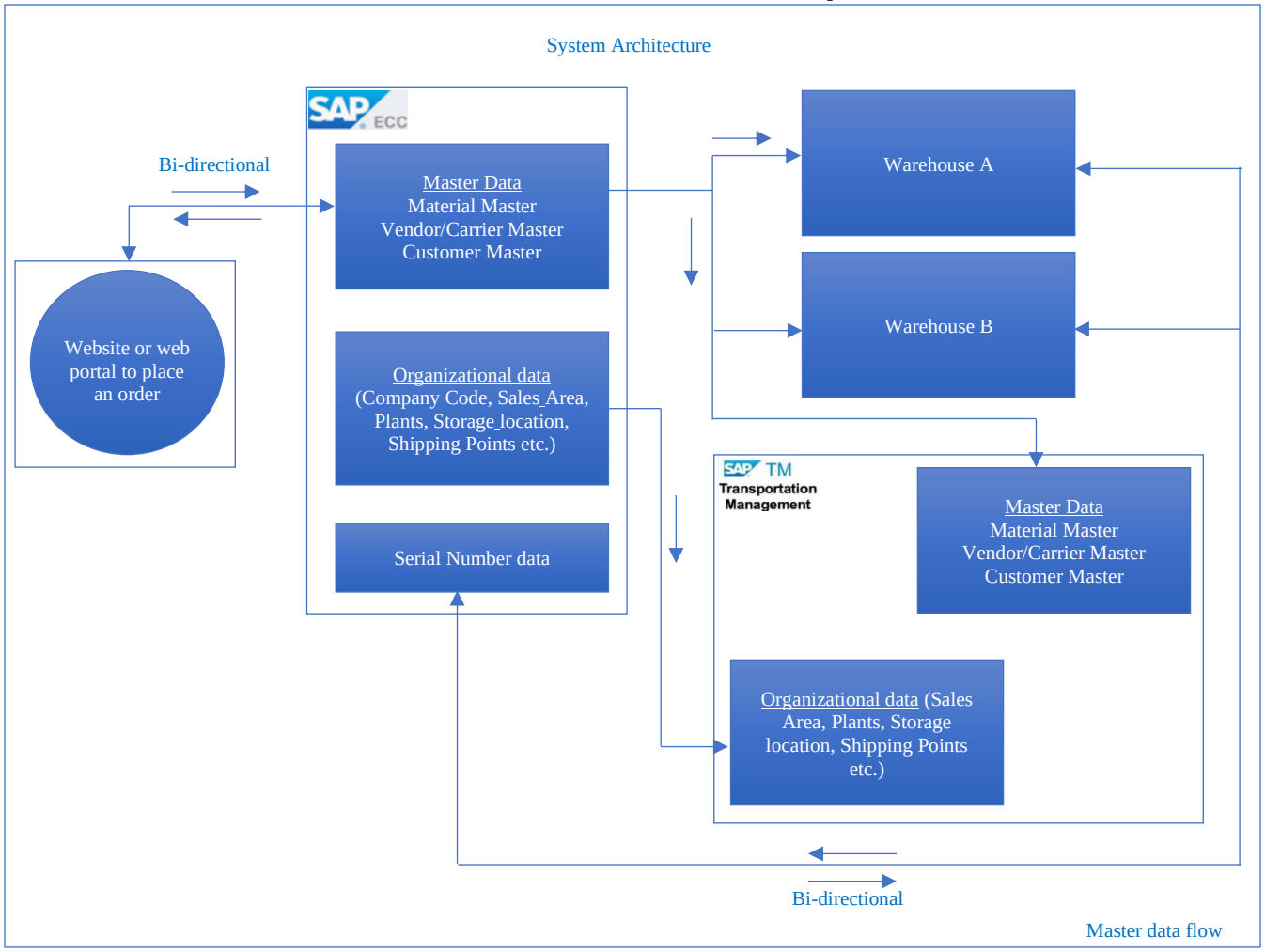


**Fig. 1 System architecture**

TMS will have the required business rules/condition records to determine the best carrier for shipment based on dynamic carrier rates. These two systems must be integrated using standard ERP interfaces. Leverage existing standard interfaces (such as DELVRY03 IDoc Type for delivery transfer from SAP ECC to SAP TMS) to meet the business requirements. Similar integration is required with warehouses and merging points, which can be achieved through EDI-IDoc or ALE-IDoc communication about the shipment. Central ERP Application is the single source of truth for the business transactions and also acts as a source for all customer master data [2] and material master data [2].

This ERP Application is responsible for feeding [14] this data to upstream systems (such as online web services/web portals) and downstream systems (such as SAP TMS, WMS for plants, and carrier systems for shipment-related transactional data).

Below is the system architecture representing the master data flow between systems [14]. Master data [2] includes material master, vendor/carrier master (source is SAP ECC), customer master (website input), organizational data and serial data feed data to all systems. Below is the System Architecture representing the transactional data flow between systems.

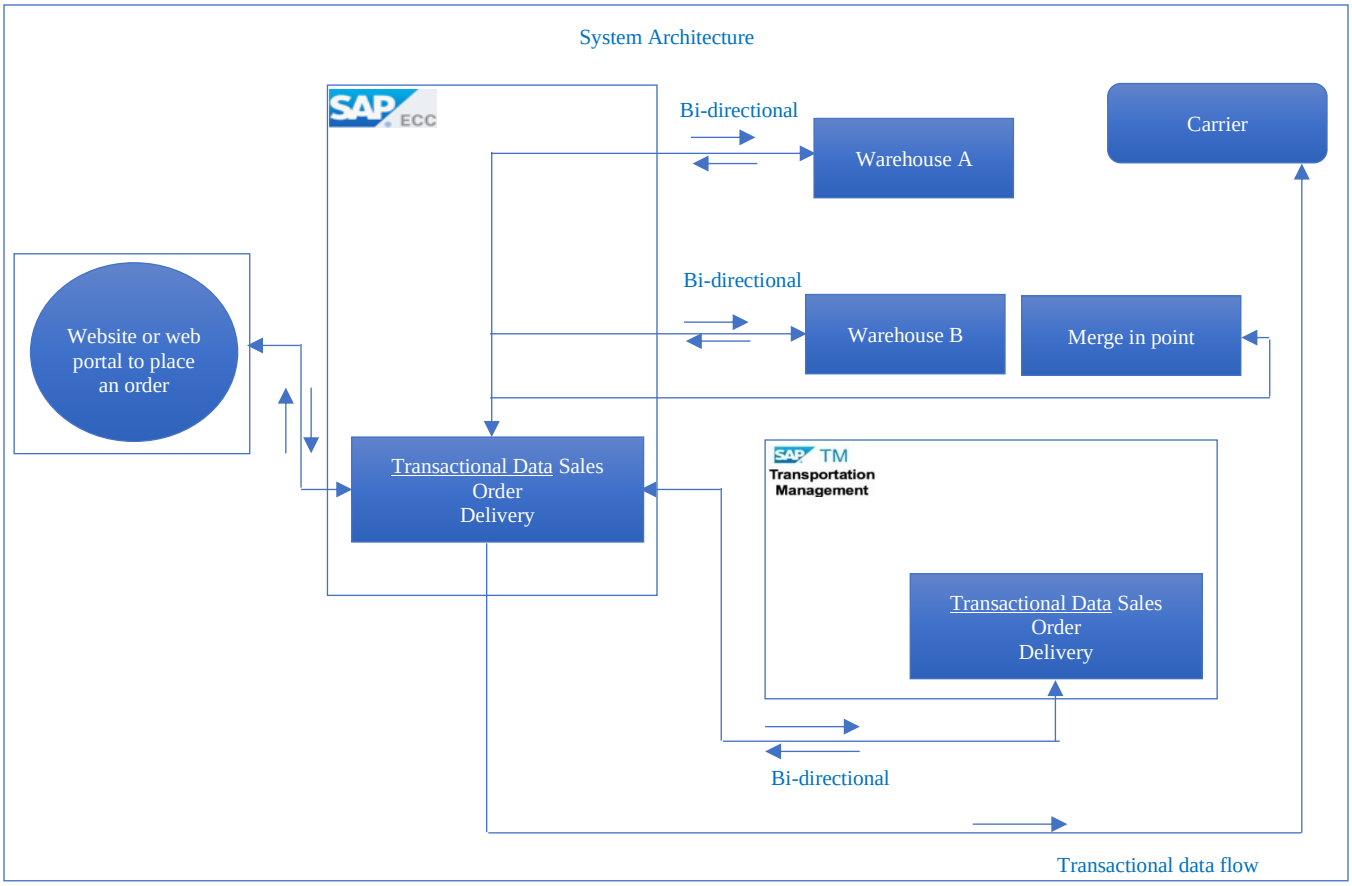


**Fig. 2 System architecture representing the transactional data flow between systems**

## 3. Business Scenario - Process flow [16]

The process starts with the customer placing an order online.

1. The customer creates an online order for two or more products and selects a 'Complete Delivery' option. 'Complete Delivery' is for a single shipment of all the products in a sales order.
2. A sales order will be created in SAP ECC through the WebOrder Interface from WebServices [5].
3. SAP ECC creates a single delivery for this MIT scenario.
4. Outbound communication from delivery through EDI IDoc 940 to multiple warehouses and the merging point.
5. The warehouse ships the goods to the merging point.
6. Inbound communication from warehouses confirms the goods dispatch.
7. The merging point combines the goods for final shipment to the customer.
8. Inbound communication from the merging point after shipment dispatch confirms the delivery.
9. The carrier ships the goods to the destination and confirms back if required.
10. The customer receives the goods in a single shipment.

**Table 2. Sales document types and shipping points by location**

| Doc. Type | Sales Org. | Location1 | Location2 | Location 3 | Shipping Point |
|---|---|---|---|---|---|
| **OR** | 1000 | Plant 1 | Plant 2 | | SHP1 |
| **OR** | 2000 | Plant 1 | | Plant 3 | SHP2 |
| **OR** | 3000 | | Plant 2 | Plant 3 | SHP3 |

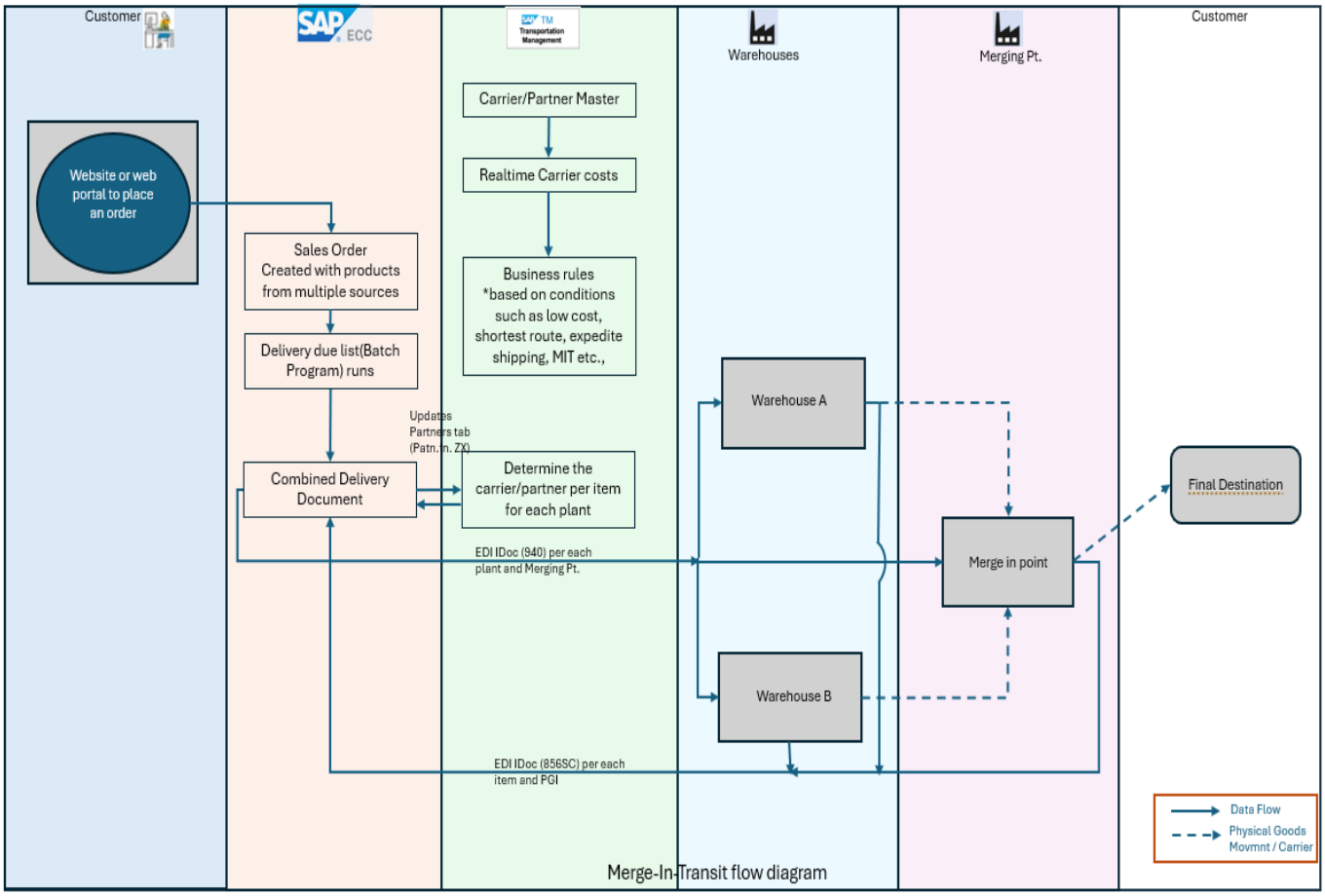


**Fig. 3 Business process flow**

## 4. Configuration Steps

These steps apply to sales orders with the 'Complete Dlv.' [16] option checked. The sales order should be created as a single delivery for the MIT Process. To create a single delivery and avoid split deliveries, sales order item-level fields must have the same value even if the item-level plants are different. The sales order item shipping tab fields control the delivery split [6]. Key criteria include: 1. Ship-to Party, 2. Shipping Point, and 3. The route is the main criterion for creating multiple deliveries [6]. You can use FORM routines. DATEN_KOPIEREN_001 and DATEN_KOPIEREN_002 are used to control data from sales orders using SAP ABAP [3].

### *4.1. Assign Shipping Points* [16]

Use this step to maintain manual shipping points. One of the criteria for delivery split is 'Shipping Point' (e.g., SHP1, SHP2 etc.).

**Table 3. Transaction code and IMG path for shipping point assignment**

| Transaction Code | SPRO |
|---|---|
| IMG Menu | SAP Customizing Implementation Guide -> Logistics Execution -> Shipping -> Basic Shipping Functions -> Shipping Point and Goods Receiving Point Determination -> Assign Shipping Points |

### *4.2. Custom Table to Maintain Shipping Points*

A custom table holds the combination Plant 1 from Sales Order Item 1 and Plant 2 from Sales Order Item 2, along with Shipping Point (e.g., SHP1). Similarly, other combinations and shipping points are maintained. Below is an example of a custom table in ERP (e.g., SAP ECC).

### *4.3. Custom Development to Populate Shipping Point*

Use USEREXIT_SAVE_DOCUMENT_PREPARE in user exit MV45AFZZ to modify the field "xvbap-vstel" to overwrite the shipping point. Implement existing ABAP Coding [3] to determine the shipping point from the above table and populate it in the shipping point field 'xvbap-vstel' if the Sales Order 'Complete Dlv.' field is checked.

### *4.4. Delivery Document Interface to TMS* [17]

TMS can determine and provide the proper carrier information to ship goods from 1. Plant 1 (Warehouse A) to Merging Point, 2. Plant 2 (Warehouse B) to Merging Point, and 3. Merging point to customer delivery. Sometimes, businesses can maintain merging points in the same final plant.

In this case, no separate merging point is needed. Leverage standard interface to communicate with TMS, maintain business-defined rules, and develop condition records to determine the proper carrier/partner. Pass the carrier back to SAP ECC to update the delivery document header partners tab with custom partner types (e.g., Z1, Z2). These partners are required to do this when sending the EDI-IDoc 940 message to plants. Plants will hand over the goods to the carrier upon dispatch.

### *4.5. Delivery Document – Outbound Interfaces* [17]

Create three EDI - IDoc 940 output types to send a shipment order from the delivery document to Plant1, Plant2, and Merging Point:

1. EDI 940 to Plant1 provides information about Delivery Item 1 and the serial number information, along with the carrier details from the delivery partner tab to dispatch item 1 goods.
2. EDI 940 to Plant2 provides information about Delivery Item 2 and the serial number information, along with the carrier details from the delivery partner tab to dispatch item 2 goods.
3. EDI 940 to Merging Point pass the information about the delivery items 1 and 2 to the customer address to dispatch all items.

### *4.6. Delivery Document - Inbound Interfaces* [17]

1. EDI – Idoc 856SC receives from Plant1 after goods handover to the carrier. This 856SC IDoc will complete the picking of Delivery Item 1.
2. EDI – Idoc 856SC receives from Plant2 after goods handover to the carrier. This 856SC IDoc will complete the picking of Delivery Item 2.
3. EDI – Idoc 856SC receives from Merging Point after goods handover to the carrier. This 856SC IDoc will complete the delivery PGI.

This will complete the delivery of all items in the sales order to the customer.

## 5. Business Use case

Business organizations from different domains, such as the consumer electronics sector, retail business sector, medical sector and Automotive sector, can utilize this MIT Process for their supply chain needs.

- Consumer electronics business organizations sell products from other company brands along with their strategic products. When a customer places an order for their product along with products from other company brands, they can use the MIT process to ship all items to the customer in a single shipment.
- Retail business giants sell thousands of brands from different suppliers. They can use the MIT process to ship goods from different suppliers to the customer in a single shipment.
- Pharmacy giants in the American drug wholesale industry can distribute drugs from suppliers to medical business operations. The MIT Scenario helps reduce logistics costs when they sell products from multiple suppliers (multiple sources) to retailers.
- Similarly, the automotive industry can procure goods from suppliers across the globe (i.e., the USA, China, and Japan). They can utilize the MIT process in their sub-contracting POs to consolidate delivery to OEM into a single shipment.

## 6. MIT Advantages

- Merge Points are less expensive and do not require a warehouse-like setup.
- Reduced inventory, as merge points consolidate shipment and do not need a warehouse to hold inventory.
- Lower costs less due to reduced transportation and inventory needs.
- Improved customer satisfaction with a single or consolidated shipment to customers.

## 7. Training

Training needs to be provided to all users who will work on the MIT process [18]. Since this process is not a regular method for shipping goods directly to customers, the warehouse team needs to be trained to understand the communication of EDI IDoc 940 with the serial data and destination addresses. UAT Testing by the business team can help convey the process to the warehouse team.

## 8. Conclusion

Understanding the end-to-end business process before designing a solution to implement the SAP supply chain MIT process is critical. It must be carefully discussed with business teams to include all the required master data and business transactions. SAP-TMS can be helpful in determining the best carrier based on route, cost and time.

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