January 1, 2003

Logistics WebServices for Collaborative Order Management

Rainer Alt
Dimitrios Gizanis
Hubert Oesterle

Available at: https://works.bepress.com/hubert_oesterle/177/
Logistics Web Services  
for Collaborative Order Management

Rainer Alt, Dimitrios Gizanis, Hubert Österle  
University of St. Gallen, Switzerland

Abstract

Order management is a key operational business process. ERP systems organize this cross-functional process within a company and eliminate interfaces between functional areas such as materials management or finance. However, they are not designed to manage processes across different organizations and interfaces with external partners. There are still many inefficiencies in collaborative order management (COM) with customers, suppliers and service providers. Examples include repeated manual entries of order information or status information which are lacking or only partly available. Although solutions for COM exist, these are proprietary and costly in nature. Software vendors such as SAP, i2, Yantra or Optum are developing standard solutions with features such as seamless order routing between business partners and the availability of real-time information on multi-site inventory, transport capacities or delivery status. Logistics web services support COM solutions by providing additional value to manage processes with logistics providers such as tracking & tracing of shipments, event management, printing of barcode labels, or the preparation of customs documentation. This research describes the role of logistics web services in COM and outlines the prospects for their use in COM.

Keywords: inter-organizational-processes, business collaboration, order management, web services, logistics brokers
Introduction

Rapid and reliable order management ranks as a major operational business process. ERP systems have been developed to establish an integrated electronic order management process across an organization’s sales, materials management, production planning and accounting functions. However, mergers and acquisitions, autonomous divisions, and multiple sales channels have led to fragmented order capture and fulfillment systems (Keltz and Kraus, 2002, p.1). In order to increase customer satisfaction, companies need to provide a central order entry channel for their customers (one face to the customer), improve services such as centralized billing processes and provide real-time status information on distributed orders (Christopher, 1998, p.220). Today, orders require coordination and fulfillment across internal divisions as well as external parties such as contract manufacturers or logistics providers (Huang, 2002, p.1). In many companies the situation with inter-organizational processes and interfaces resembles the scenario which existed prior to the introduction of ERP in the 1970s. Isolated and incompatible information systems (IS) require time-consuming manual processes and entail the typical problems of redundant information. An external interface where electronic data interchange (EDI) has been used to improve electronic integration over the past 20 years is the relationship with logistics service providers. The shortcomings of EDI have included proprietary technology and standards plus high complexities in implementation and customization (Westarp et al., 1999). As a consequence, the link to logistics service providers has mainly been limited to high-volume transactions with large shippers (Angeles, 2000, p.45).

Today, various software manufacturers are developing integrated standard solutions for inter-organizational or collaborative order management. Vendors such as Yantra, Optum, and Vizional as well as established software suppliers such as SAP or i2 offer solutions under the heading of ‘Extended Order Management’ and ‘Distributed Order Management’ (Newton, 2001, p.9). They leverage their knowledge of internal order management to integrate suppliers and external parties such as banks, authorities, contract manufacturers and logistics companies. The aim is to reduce costs and order cycle times by means of electronically distributed order and status information, jointly performed inventory management, transport scheduling and availability queries. Benefits are expected to include a 10%-35% reduction in order and inventory costs (Pulsipher, 2002), (Schömer and Hebsiker, 2001). Several examples of existing logistics services show their relevance to order management:

- Large logistics providers offer ‘eLogistics’ services (e.g. FedEx Insight or UPS Online) which can be integrated into electronic shops or other eBusiness solutions using XML and/or web service standards with less effort than conventional EDI systems based on value added networks.
- Logistics brokers such as Inet-Logistics, BridgePoint, Viewlocity or Descartes provide supply chain transparency (visibility) and optimization functions which support the tracking and tracing of documents or shipments, create alerts or consolidate status information across various carriers (Teach, 2002), (Kilgore et al., 2002).
- Fourth-party logistics (4PL) providers offer entire logistics processes from warehousing and transportation to billing as well as supplying information technology solutions (Armstrong, 2002, p.28), (Homs, 2001). This also includes the ability to provide visi-
The question of how electronic Internet-based services offered by logistics service providers and logistics brokers can be integrated into COM scenarios and which services are required to support COM is a new research question for the order management or the logistics literature. To determine the core functionalities of logistics web services and their implications for COM solutions, eight providers of logistics web services were analyzed. This survey involved written questionnaires as well as interviews with five providers (Danzas, Descartes, Inet-Logistics, Viewlocity, and Yellowworld).

**Collaborative Order Management (COM)**

**Description of the COM Process**

Order management is a process that follows information and contracting activities and starts with the availability of a formal order document. Typical order management tasks include administrative functionalities such as quotation processing and monitoring, order handling and billing as well as scheduling tasks such as shipment planning and logistics. Both internal organizations (e.g. sales organizations, production plants) and external business partners such as suppliers, manufacturers or logistics providers are involved in order management. A growing form of goods delivery is third-party order processing. In this case the company which receives an order from the customer acts as intermediary but bears legal responsibility for the delivery to the customer. A customer order automatically triggers one or more purchase orders to the suppliers who deliver direct to the customer, possibly via assembly factories or merge centers. Examples are to be found in particular in the high tech industry with HP, Dell and Cisco (Tompkins, 2001). Although ERP systems such as SAP R/3 support third-party order management, these still harbor inefficiencies such as batch data transmission, insufficient real-time information on supplier inventory levels, no order visibility outside of the organization and inconsistent workflow to coordinate order fulfillment with suppliers and logistics providers (Newton, 2001, p.6).

Figure 1 shows a generic COM process. Once information has been obtained by the customer on products, terms and conditions, the actual order processing begins with pricing, credit limit or availability checks. The main features of COM are:

- **Sourcing and order split.** Defined rules determine the supplier depending on purchasing contacts or dynamically based on product availability. The ‘order split’ (or order decomposition) feature assigns order positions from the customer order to individual suppliers (Newton, 2001, p.4).

- **Order and delivery visibility.** COM coordinates transportation execution across organizations and enables the connectivity of order capture systems with multiple fulfillment systems. An important function is to provide order and delivery visibility across all partners and systems.

- **Invoicing.** COM supports various invoicing scenarios, e.g. individual or collective billing, or by means of credit memos. In the latter case, customers are billed for the
complete products and services while settlement with the respective suppliers is based on the products and services they have actually delivered.

Integrated processes such as COM require integrated information architectures. Integration software and services (Business Collaboration Infrastructure, BCI) from vendors such as webMethods, BEA or SAP (Exchange Infrastructure) offer partner directories, process logic, data formats, etc. for the integration of heterogeneous backend systems. Existing studies report various business benefits to be derived from COM technologies (Newton, 2001), (Pulsipher, 2002):

- Reduced order management process cost through improved system-to-system communication and lower warehouse and safety stocks,
- Shorter order cycle times through internal and external business units,
- Improved customer service due to central ordering channel,
- Dynamic partner determination (sourcing), e.g. based on suppliers’ real-time inventory data,
- Increased revenues via additional third-party products and services, and
- Improved valuation of logistics services and supplier performance.

![Figure 1: Example of a Collaborative Order Management Process](image)

Extended Order Management with SAP CRM

Since 2001, SAP AG has been developing a COM solution termed Extended Order Management which uses their mySAP platform. Figure 2 shows SAP’s inter-organizational COM scenario with the organizations, applications/modules and systems involved. It starts with a customer order which is received by company A’s CRM system via various channels (telephone, fax, EDI, eShop, etc.). The items of a customer order contain data on the product, article number, order quantity, unit of measurement, etc. The financial accounting system (SAP FIN) checks the credit limit. For each product the CRM system determines the procurement location, e.g. procurement via internal warehouse and/or production sites or external suppliers, and generates partial orders for individual positions which are then automatically forwarded to companies B and C (‘item dispatching’). The individual orders are broken down into partial orders by means of an order split mecha-
nism based on defined rules (e.g. a strict product-supplier assignment) in the CRM system.

Once the (partial) orders are created in the respective systems of companies B and C, pricing is performed and the customer receives an order confirmation specifying quantity, price and delivery data. The goods can be delivered by two basic methods: (1) Each supplier (B and C) independently delivers the respective order items direct to the customer. (2) Consolidated, grouped deliveries require the individual partial orders to be delivered to a consolidation point (merge center) where they are packed and then delivered to the customer. The selling company’s CRM system receives a message (Advanced Shipment Notification, ASN) which the customer can view as part of real-time order tracking. There are three payment options:

- In the case of internal charging (intercompany billing) each of the suppliers (B and C) sends one invoice per order position to company A. The latter performs a transfer and sends a full invoice to the customer.
- With the credit system, B and C do not issue invoices. Instead A transfers the invoice amounts immediately on the basis of the ASN information and thus issues a full invoice (self-billing). The customer again pays A.
- Collective billing means that a full invoice is issued on the basis of the ASN information. However, company A does not pay the suppliers immediately but periodically on the basis of a collective invoice.

Figure 2: SAP’s Extended Order Management Scenario with Collective Billing
Requirements for Logistics Management

The outbound fulfillment which is performed by logistics providers has to be monitored within a COM scenario. Customer orders which are split into various partial orders lead to multiple transport operations that can be handled autonomously by different suppliers and logistics providers. However, a customer requirement for complete deliveries calls for centralized fulfillment coordination. This function incorporates all physical and information processes which are triggered by a customer order, e.g., storage, order picking, transport and returns handling as well as information logistics processes (Bayles, 2001, p.182). In summary, COM has three main links to logistics management:

- **Sourcing.** Suitable logistics providers need to be determined on the basis of price, quality and/or other criteria.
- **Scheduling.** This refers to planning the transport or returns handling among the multiple parties involved.
- **Monitoring.** To attain quality in a distributed environment, control and event management mechanisms need to be established.

Logistics Web Services

Web Services Overview

The current discussion on web services distinguishes between two perspectives (Hagel and Brown, 2001), (Gisolfi, 2001), (Kirtland, 2002), (Keen and McDonald, 2000): (1) web services from a technical perspective, which includes the standardization of transport protocols, service descriptions, message syntax, and directory structures; (2) web services from a business perspective, which emphasizes the out-tasking of process elements to a web service provider. The following focuses on the business view and considers web services as external services which are integrated into the COM process. They perform clearly delimited and highly standardized tasks which are charged on a time and/or transaction basis, and can be integrated into company information systems such as e.g. ERP, CRM, electronic product catalogs, APS or portal systems. There are four basic types of web services (Österle et al., 2001, p. 43):

- **Business process web services** perform tasks in specific processes such as procurement, production, distribution, marketing, sales and customer service. In the case of purchasing office materials, this might include the search for the best priced supplier of office stationery, the organization of auctions, payment processing via the internet or online parcel tracking while the goods are in transit.
- **Content and transaction web services** provide IT application functions and support the collection of information and interaction by means of virtual rooms or instant messaging. They provide content, evaluate, syndicate and store it, and supply application functions for transactions, such as news or research reports, stock exchange prices,
product catalogs or community functions, etc. They are not process-specific and can be used in different business processes.

- **Integration web services** provide uniform access to network-based applications. They support the exchange of information and coordination between different organizations. This involves secure transportation and protocling of messages (messaging, routing), converting messages into different formats (EDI, XML, fax, mail or paper), helping to find and identify market players (directory and subscriber registration services), etc.

- **IT operation web services** offer modular basic services as a basis for other web services. They support the transportation of information at the data level with tasks ranging from pure network operation and internet service providing to the backup of entire information systems.

The logistics web services described below are assigned to the first two categories because integration and IT operation web services are not specific to COM.

**Inet-Logistics**

Inet-Logistics (http://www.inet-logistics.com) (Austria) was founded in 2000 as a subsidiary of the forwarding company Gebrüder Weiss (http://www.weisslogistics.com). In 2002 a sales volume of around € 4.5 million was achieved with 35 employees. By connecting shipping companies with different third-party logistics (3PL) providers such as DHL, FedEx or UPS, Inet-Logistics performs a typical broker function. The company currently offers the transport documents for a customer order, label printing with bar codes for parcel delivery, the electronic forwarding of transport orders to 3PL providers based on EDI, visibility of 3PL provider status information and customs documentation. The physical flow of goods is handled by the shipper’s existing carriers who also pay the broker fee to Inet-Logistics. By linking up with Inet-Logistics, 3PL providers benefit from a standardized data interface for the transport order and a higher parcel volume through the acquisition of new customers. The payment for fulfilling the customer order between customer or wholesaler and supplier remains unaffected by Inet-Logistics. ETA SA, a member of the Swatch Group, uses the Inet-Logistics solution as a web service for creating transport documents and the electronic notification of 3PL providers as well as for tracking delivery status information (Alt et al., 2002). Due to the connection between the Inet-Logistics server and ETA’s online shop, customers can obtain the status of their delivery until the proof of delivery. Connections to the tracking systems of FedEx, Swiss Post, etc are available through the Inet’s web service.

**Viewlocity**

Viewlocity, headquartered in Atlanta (USA) (http://www.viewlocity.com), provides a Supply Chain Event Management (SCEM) solution which is used amongst others by DHL, Dell, Volvo, Exel and Carrefour. The company has a total of 15 offices worldwide and employs over 350 staff.
Viewlocity’s solution makes inventory, delivery and order information visible across many disparate parties. Data from different systems are integrated taking authorization levels into account. The solution also includes a performance measurement service that enables shippers to monitor logistics providers along the supply chain (e.g. on-time delivery). One of Viewlocity’s partners, Business Gateway AG, offers visibility tools (order, inventory and shipment monitor) via ASP (Application Service Providing) as a web service. The software modules are then billed primarily on the basis of transaction volume rather than licenses.

A large electronics company which operates Viewlocity’s Shipment Monitor itself receives, for example, real-time information on pick-up and transfer times to the 3PL providers at all the nodes in its transport chain. The exact assignment of transport routes to the 3PL providers means that more effective quality controls on delivery performance are possible. In the case of unforeseeable events such as late or early deliveries, the system initiates exception handling procedures and automatic alert messages to all relevant partners.

**Danzas/Descartes**

The Danzas Group (Switzerland) is part of the Deutsche Post World Net and generated sales of € 9.2 billion with 45,000 employees in 2001. The services offered range from complex, global logistics tasks to comprehensive 4PL services. At the beginning of 2001 Danzas appointed Descartes System Group headquartered in Waterloo (Canada) as its IT partner. Founded in 1981, Descartes employs around 550 people worldwide and generated an annual sales volume of some USD 80 million in 2001. The Descartes solution operates a logistics network (Global Logistics Services Network, GLSN) which connects partners along the supply chain and provides services such as route planning and optimization, order, inventory and shipment visibility.

Danzas uses the Descartes logistics network as a logistics web service. This has enabled Danzas to build a group-wide infrastructure for consistent visibility of logistics activities in all forms of transport within a short time frame. The GLSN platform integrates over 6,000 companies to which Danzas can offer electronic services without additional effort. Descartes looks after maintenance and operation of the network.

The services offered by Danzas via this infrastructure (delivery visibility, event management, etc.) have been implemented as part of a pilot project. One of Danzas’ customers organizes the transportation of computer parts (memories, hard disks, etc.) from Penang (Malaysia) to Europe themselves and used various logistics providers for this purpose. However, it was not always possible to ensure on-time deliveries at the European distribution warehouse. Large safety stocks were needed at the distribution warehouse in order to process and distribute orders from the distribution warehouse in time. To improve visibility, Danzas now manages the information logistics in this pilot project. The customer uses tracking & tracing and reporting services as well as alert management from Danzas. The pilot project was implemented in 4 months.
Transplace.com

Located in Plano, Texas, Transplace Inc. (http://www.transplace.com) was formed in July 2000 with the merger of the six US logistics companies Covenant Logistics, J.B. Hunt Logistics, M.S. Logistics, Swift Logistics, U.S. Xpress Logistics and Werner Logistics. Transplace employs over 500 people and has contacts with more than 3,000 carriers. Customers include large shippers such as Nestlé, Michelin, and Wal-Mart. Transplace operates a DNE (Dense Network Efficiency) network which connects shippers and 3PL providers. This platform is used to access available transport capacities in real time and for optimizing transport schedules. A key element here is a neutral transport award/optimization based on customer preferences with the goal of keeping vehicles moving (‘collaborative continuous moves’). Over 1.2 million truckloads and grouped deliveries as well as 5.7 million less-than-truckload deliveries are managed annually via DNE.

Suitability of Logistics Web Services for COM

The logistics web services analyzed show different functional emphasis and possibilities which are relevant for COM:

- Solutions from Viewlocity, Danzas and Descartes increase the visibility of orders (order visibility), inventory levels (inventory visibility), deliveries and transport operations (delivery visibility) across divisions and companies. They consolidate order information from different partners and make information on orders, inventories and deliveries broadly available. As a result, up-to-date status information is visible for all the partners involved, in particular for customers.

- Real-time status information is a prerequisite for the implementation of event management services and enables the identification of transportation bottlenecks in real time. As soon as inefficiencies are recognized it is possible to intervene in handling processes at the right time. If, for example, a supplier is unable to fulfill an order in time, alerts are sent out to appropriate parties and the order is re-brokered to a backup supplier (Huang, 2002, p.10). Early warning mechanisms of this kind are to be found in the solutions offered by Inet-Logistics, Viewlocity, Danzas und Descartes.

- The Inet-Logistics solution can generate transport orders and transfer these to logistics providers electronically in the required format (transport document management). Shippers and/or suppliers enter the transport orders via a browser (logistics browser) or via their ERP system. The benefit of using the service is that a company only needs one interface to the Inet-Logistics service which organizes the required interfaces to the logistics providers.

- In addition, Inet-Logistics creates the technological platform for the electronic integration of a company’s supplier network (supply chain integration): the logistic browser takes care of the electronic integration and order handling with external suppliers who do not use IT systems. Suppliers can confirm incoming orders and as a re-
result they can also generate the creation and sending of transport orders. For COM solutions this means that the logistics web service can also ensure that suppliers without IT are incorporated into order handling operations electronically.

- Danzas, Descartes and Transplace offer services for transport optimization. The core element of the Transplace service is the neutral transport order assignment/optimization functionality.
- The reporting services (supply chain reporting) provided by Viewlocity, Danzas and Descartes evaluate operations in supply chains. This means that frequent complaints and thus the performance of carriers or subcontractors can be identified in real time.
- All providers offer clearing services which integrate and harmonize status information (e.g. transport status such as ‘pick-up’, ‘delivered’, ‘in transit’) from supply chain partners (also from those without their own IT). This is generally done via web interfaces. Status information can be specifically processed for shippers, customers and the intermediary, as well as being used for COM solutions.

### Logistics Web Services

<table>
<thead>
<tr>
<th>Logistics Web Services</th>
<th>Inet-Logistics</th>
<th>Viewlocity</th>
<th>Danzas</th>
<th>Descartes</th>
<th>Transplace</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order Visibility</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Delivery Visibility/Tracking</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Inventory Visibility</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Event Management</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Supply Chain Integration</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Transport Optimization</td>
<td>○</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Transport Document Management</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Supply Chain Reporting</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Clearing Services</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

**Legend:** ● Service available ○ Service not available

Table 1: Support Tasks of the Logistics Web Services Investigated

Logistics web services improve visibility across different partners, provide monitoring mechanisms in the form of early warning systems, integrate suppliers without IT into the handling processes and optimize transport operations. Table 1 summarizes the tasks supported by the logistics web services investigated based on the business process, content and transaction level described above.

In summary, COM may be supported by several web services as they perform different and in some cases complementary tasks. Figure 3 shows tasks performed by logistics web services to support COM. This may yield business opportunity for providers of business collaboration infrastructures that integrate various logistics web services. A shipper can thus support a collaborative availability check, for example, by means of a suitable logis-
tics web service (inventory visibility) which is supplied with up-to-date inventory information by its suppliers.

![Collaborative Order Management Process with Logistics Web Services](image)

**Figure 3: Collaborative Order Management Process with Logistics Web Services**

### Conclusion

The implementation of control processes by supply chain event management tools are the key to handling logistics in COM. This research has shown that logistics web services process real-time information and support specific tasks related to inter-organizational processes. These services create visibility along the supply chain, provide proactive monitoring, integrate suppliers with or without IT into the handling processes, and optimize transport operations, etc. They improve collaboration with all suppliers and logistics providers and help reduce operational costs. However, the research reveals that logistics web services support various functions of the COM process and that a portfolio of web services is required to cover important COM functions such as order visibility, transport optimization, or supply chain reporting.

Companies have three main options for integrating logistics web services related to COM: they may use standard software, develop their own individual solution or use a 4PL provider. Whichever is the case, logistics web services can help to supplement standard and/or custom solutions. Although tools for the inter-organizational coordination of logistics activities (‘fulfillment coordination’) are supplied with SAP’s extended order management standard solution, logistics web services provided by Inet-Logistics, Descartes, Danzas or other web services not considered here such as Celarix are examples of how standard solutions can be extended. These web services reduce complexity by connecting to their logistics networks and provide better integration with the systems of logistics providers.
If COM is to reap the full benefits of logistics web services, the software vendors will have to provide interfaces for logistics web services in their applications and solutions. Many of the logistics web services considered place different emphasis on the delivered functionality. Companies have to decide which tasks (one or more) can be out-tasked and delivered cost-effectively by logistics service providers. Although logistics web services can improve the integration of several partners on a systems level, integration on the process level can still be a problem as long as process standards are not established or widely used.

Finally, this research presents a number of issues for further research. First, companies will only integrate web services in their COM processes if they have a positive impact on business goals. Case studies of integrated web services support the identification of metrics and benchmarks. Second, the technological dimension of web services has not been analyzed since the five web services did not use these standards. However, web service technology will have a significant impact on the integration of web services in the forthcoming years. Third, this integration will lead to new business opportunities for providers of business collaboration infrastructures. Business models and the services offered are relevant in this area.

Acknowledgements
This research was part of the Competence Center for Business Networking 2 (CC BN2), a multilateral research project within the research program Business Engineering HSG at the Institute of Information Management, University of St. Gallen, Switzerland. The authors acknowledge the support of the partner organizations Deutsche Telekom AG, ETA SA Fabriques d’Ebauches, F. Hoffmann-La Roche Ltd., Hewlett-Packard (Switzerland) AG, SAP AG and Triaton GmbH.
References


Newton, C. J. (2001). Managing Order Fulfillment Across the Supply Chain. AMR Research