

Service-oriented Logistics Supply Chain Information Management System

ZHANG Bin-li

College of Economy and Management, Suihua University, Suihua 152061, China
zu9237@163.com

Abstract—In order for rapid, accurate and low-cost information exchange among supply chain enterprises during logistics business operation, this paper puts forward solution scheme to construct public logistics supply chain information exchange platform. Based on service-oriented framework, the platform adopts heterogeneous data exchange engine and data exchange agent to perform certain services functions such as end-to-end data exchange of heterogeneous information system in supply-chain enterprises, zero-development access, etc. The system test result shows function and performance of this platform can completely satisfy the requirements of logistics supply-chain enterprises information exchange and the system has the perfect openness and scalability.

Keywords—supply chain; logistics; use case; SOA; EDI

I. INTRODUCTION

A complete logistics process usually contains order processing, storage, transportation, distribution and customs declaration. The operation involves many supply-chain companies including factory, consignor, consignee, storing company, transportation agent, customs. It has become an essential problem to improve service quality as well as work efficiency of logistics enterprises and reduce logistics cost on how to perform rapid and accurate logistics information exchange and share between various supply-chain enterprises. There are two types of information exchange between logistics supply-chain enterprises. One of them is to adopt traditional methods to transmit information such as telephone, fax, email, etc. Information will be input to information system of various supply-chain enterprises by artificial means. The other one is to designate the developing information exchange system for the designated supply-chain enterprises. Although this mode could automatically exchange information, there are two obvious defects of this information exchange system. One of them is the small scope to be limited in designated supply-chain enterprises. The second one is when information system in current supply-chain enterprises updates or new supply-chain enterprises join, it needs secondary development. Enterprises are long in access period and high in cost. One of effective solutions for low-cost access and efficient information exchange in logistics supply-chain enterprises is to construct public logistics information exchange platform and take standardized access process as well as opening data exchange access to provide logistics supply chain enterprises with information exchange service.

Through designing and developing a SOA(service-oriented architecture)-based information platform project:

public logistics supply-chain information exchange platform, this paper analyzes framework, design and realization of this platform system. Towards platform system design, it applies excellent design practices such as SOA, layered structure, componentization to improve reusability, scalability and maintainability in platform system structure. On system realization, it also adopts enterprise-level ASP.Net development technology to guarantee efficiency and scalability in platform system.

II. RELATED WORKS

A. Supply Chain Management

The word of supply chain is from organizing relation graph. If purchase department starts to relate its supplier, it will get many suppliers from this purchase department. In converse, each supplier also has a group of its suppliers. For iteration, it will get a supply network or a series of supply chain. Supply chain has not formed a unified definition at present. Early views consider that supply chain is an internal process in manufacture industry and it refers that raw materials and spare parts in external purchase in enterprise produce, transform and sell to transit to retailers and users. Traditional supply chain definition is restricted at operation layer inside enterprises and it attaches importance to resources utilization of enterprises. Some scholars relate supply chain definition to purchase and supply management and use it to express supplier relationship but this concept is only limited between enterprises and suppliers. Meanwhile, independent operation of enterprises ignores other membership enterprises relationship in external supply chain and usually causes respective action of enterprises as well as target conflict among enterprises.

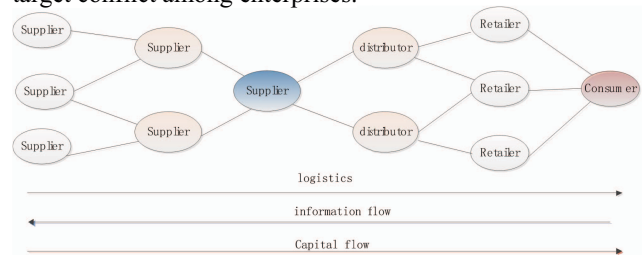


Figure 1. The structure of supply chain

B. Design and Planning of Supply Chain Information System

Supply chain information system is similar to pyramid structure and its basement is materials, resources, intermediate products and service trade information between suppliers and providers, which approximates to supply chain. Its upper layer is an application project to process general

information and information can avoid artificial intervention in higher-layered management after processing. The top layer in pyramid is decision support system to integrate data and provide managers with analysis results, explanation and decision. The information is driven by data and global supply chain especially needs standardized data. Supply chain contains products supply, production, assembling, transportation and wholesale. Data start from client order and each transaction occurs with above steps until product arrives at client. Various data are usually completed by electrical data interchange. Data exchange is far more important than initial transaction of order. They are operated by coordinating various organizing units. Predict and producing transaction ability play a foundation role and they are essential steps in strategic policy of enterprises. For the establishment of supply chain information system, its principle concept is to create a valuable network. Each individual enterprise in this network creates long-term and momentary super organization through information-shared network. The purpose to create these super organizations is to integrate between supplier and client in order to realize close cooperation between organizations to improve operating efficiency.

III. SERVICE-ORIENTED LOGISTICS SUPPLY CHAIN INFORMATION MANAGEMENT SYSTEM DESIGN

A. Basic Model Structure

The model is the supply-chain model construction methods which are applied to different industrious standards. This can integrate enterprise business process reengineering, performance evaluation, benchmarking management and the best business analysis into a model inside framework which merges description, measurement and evaluation supply chain. This provides involving entities of supply chain with a standardized language communication which is easy for both parts to find problems and their improving directions in supply chain with joint efforts. such model nearly covers all business between enterprise and its client, from product order form to price payment, involving supplier in enterprise supplier, client in enterprise client, equipment, materials, products, softwares, etc, which enterprise operation needs in supply chain.

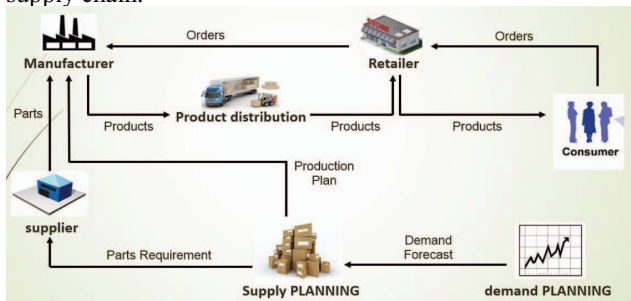


Figure 2. Conceptual model of supply chain

Besides usual logistics process in supply chain, that is, from supplier, dealer, logistic provider to consumer, this

model also includes an information platform. This platform cannot only have simple functions such as data information query, transmission in usual platform, it can also have other functions such as display, trade, payment and evaluation.

The system technology framework of EDI platform adopts SOA framework, encapsulates services through various component units in system and defines access between services and contract to construct the whole system. Through applying SOA framework, it realizes loose coupling between each component in platform system and improves reusability and scalability.

B. Data Receiving and Sending and Transformation Subsystem

The system case graph of data receiving and sending as well as transforming subsystem is shown as figure 3. This subsystem mainly realizes external data communication access between heterogeneous data exchange engine and EDI platform. The detailed functions of each case are:

(1) Data Upload. It externally offers data uploading service access to receive uploading data of platform client enterprises. System transforms basic code and data format according to the preset data mapping configuration information, and then stores the transformed data to platform database.

(2) Data Pushing. According to the preset data pushing mode, it obtains the designated data from platform database, transforms basic code and data format according to the preset data mapping configuration information, calls EDI Agent in platform client enterprises or logistics information system to offer data pushing service access. It sends the transformed data to platform client enterprise.

(3) All data upload and pushing operation all record journals for platform users and platform managers to query.

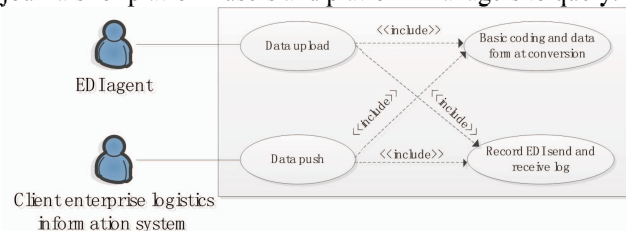


Figure 3. Use case of data transceiver and conversion

C. Portal Site Subsystem

The use case platform portal site subsystem is shown as figure 4. In platform client enterprises, this subsystem mainly realizes relevant staff's artificial data input, downloading and managing related platform information in their enterprises. The detailed functions of each case are:

(1) User's register and login out. It offers user's registering service, related identity verification and system operation authority control.

(2) Login passwords setting. It offers user's voluntarily setting their passwords function.

(3) Data Query/Download. It offers functions such as uploading and inputting data, downloading data, uploading/downloading historical records and statistical information, platform cost information query in this enterprise and artificially downloading other supply chain enterprise to send data.

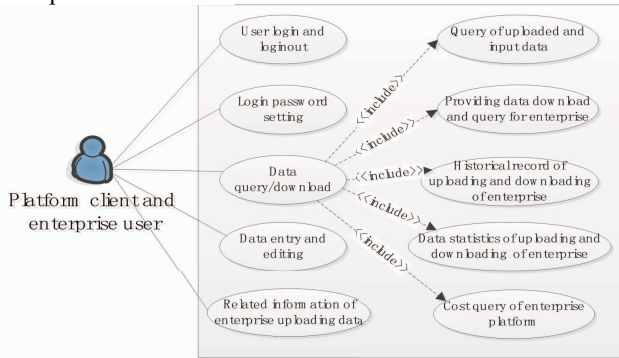


Figure 4. Use case of portal subsystem

D. Management Sub-system

The use case graph in platform management sub-system is shown as figure 5. This sub-system provides platform with comprehensive management service. Detailed functions of each case are shown:

(1) Basic code setting of platform standard. This refers to basic code to set platform data storage standard.

(2) The setting of standard logistics information data format in platform. This is basic code to set platform data storage standard.

(3) Client management. This contains client's basic information management, start/stop control of client account, the involved logistics information type setting of data exchange between client and platform, related enterprise and data requirement relationship setting of client's supply chain, data push setting in client's enterprise information system, EDI communication parameters setting of data push for client and data mapping setting in client enterprise information system EDI.

(4) Client's receiving and sending data statistics. This provides the designated clients with statistical query of client's receiving and sending data information.

(5) Receiving and sending state monitoring of Platform data. It checks receiving and sending journal of platform data in real-time and hints abnormal data communication in time.

(6) System security management. It offers management of platform user account and user's operation authority setting.

(7) System Maintenance. It offers back-up of platform data and cleaning function of historical data.

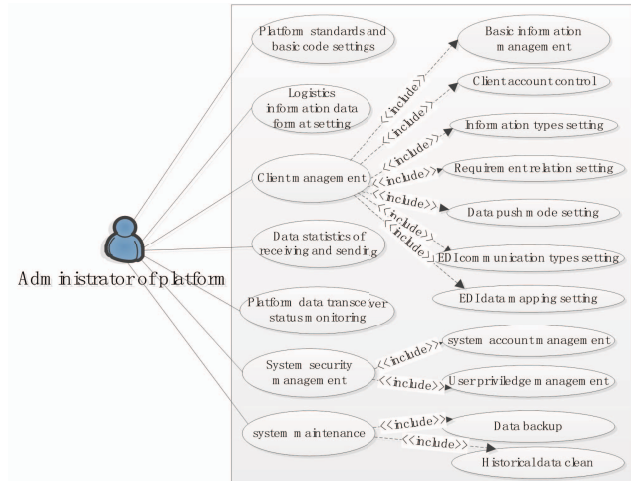


Figure 5. Use case of management sub-system

IV. SYSTEM REALIZATION AND TEST

This paper adopts MS SQLServer2015 as background database and WEB server adopts MS IIS8.0 and ASP.NET as Web development tool without special requirement for client. Figure 6 is the home page in system and client information can be registered after successful verification. After system successfully registers, it will show client's operation authority at its left framework in figure 7. It mainly include client's information correction, order input correction, commodity query, delivery information query, etc. Navigating interface and navigating system during user's order input will guide users to search and filter goods.

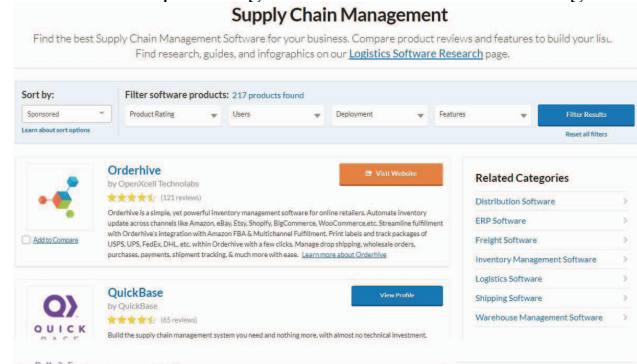


Figure 6. Home page of user login

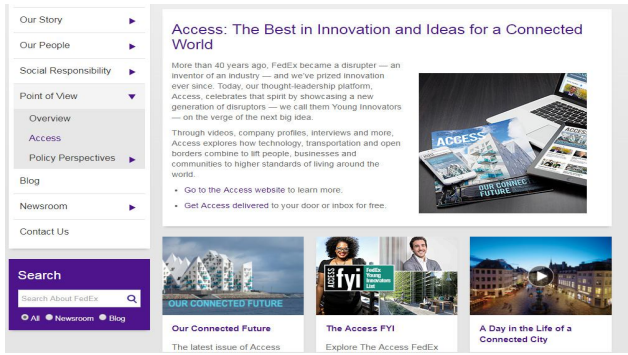


Figure 7. Commodity choice interface

For we test input and output operation of commodity. After commodity reaches store house, examination clerks check commodity quality at first, and then, warehouse keepers check whether quantity and classification of commodity match the order. Warehouse keeper will then distribute commodity warehouse stock location and finally operate commodity to input and put on shelves. Sometimes, Since inputting, outputting and account book in commodity need regular accounting, print congregate report and cannot randomly correct account book outside accounting time, account time must be set at first in figure 8. During accounting time, we can correct outputting and inputting accounting book within accounting time. However, we can counteract only through output and input. Because distributing center can simply assemble commodity, dismantle the whole box and mix bagging, we specially increase suite management function. Figure 9 is purchasing warehousing operation of distributing center and storage allocation adopts artificial and computer-assisted combination. Complete inventory control also contains many basic information settings, account maintenance and statistics.

Location	Description	Date	Where	Qty	Price	Condition	Est. Value	Model	Serial #	Notes
12	Family room	10/21/2003	SI Electronics	1	\$2,600.00	excellent	\$2,750.00	abcdcf1	by3000	Only had for a year so post, no mark
13	Family Room	3/18/2004	CDE Furniture	1	\$2,400.00	good	\$1,900.00			
14	Family Room	6/19/2007	U2 computers	2	\$1,250.00	good	\$375.00	bcdcfq2	ks1002	
15	Family Room	3/16/2002	Gift	1	\$635.00	average	\$325.00			gift from parents, mark on one small mark
16	Family Room	11/02/2003	EPIC Furniture	1	\$1,175.00	good	\$395.00			
17	Living Room		Personal sd	1	\$600.00	average	\$525.00			Some wear
18	Living Room	7/11/2005	THE Wilson Shop	1	\$4,350.00	excellent	\$4,400.00			Still looks new
19	Living Room	7/11/2003	Paintings R Us	1	\$1,295.00	excellent	\$1,150.00			Great shape
20	Kitchen	3/15/2008	Microwaves R Us	1	\$200.00	good	\$245.00	n/a	n/a	Used sec
21	Kitchen		Refrigerator	1		good				
22	Kitchen	3/11/2010	Heat It Up	1	\$175.00	excellent	\$175.00	n/a	n/a	bought to replace old one
23	Master Bdrm	3/11/2004	CDE Furniture	1	\$2,000.00	good	\$975.00			
24	Master Bdrm	3/19/2006	CDE Furniture	1	\$649.00	good	\$350.00			A few scratches on the rim
25	Bdrm 1		CDE Furniture	1	\$900.00	average	\$500.00			Some wear and tear
26	Bdrm 1	4/17/2006	EPIC Furniture	1	\$450.00	good	\$450.00			Looks great
27	Bdrm 2		Various	Various	\$400.00	good	\$365.00			
28	Bedroom		Wash/Dryer	1	\$200.00	average	\$20.00			
29	Utility	3/19/2009	WD Center	1	\$1,395.00	excellent	\$1,935.00			Not a scratch
30	Various		Various	Various	\$3,000.00	Various	\$2,500.00			
31	Garage		Garage Sale	1	\$250.00	average	\$175.00			
32	Garage	1/19/2000	Appliances center	1	\$2,000.00	good	\$1,700.00			Normal use
33	Garage		Various	Various	\$1,050.00	good/excel	\$1,000.00			

Figure 8. Generation interface of accounting period

Name	SKU	Stock	Price	Categories	Tags	Date
Revlon ColorStay Beautiful Color Permanent Liquid Hair Color Medium Blonde (D-11) 50g Quick Dry View Duplicate		In stock	\$350.00	Hair Color	hair color	Published 2017/01/07
Revlon ColorStay Beautiful Color Permanent Liquid Hair Color MEDIUM ASH BROWN		In stock	\$350.00	Hair Color	hair color	Published 2017/01/07
Revlon ColorStay Beautiful Color Permanent Liquid Hair Color LIGHT GOLDEN BROWN		In stock	\$350.00	Hair Color	hair color	Published 2017/01/07
Revlon ColorStay Beautiful Color Permanent Liquid Hair Color LIGHT BROWN		In stock	\$350.00	Hair Color	hair color	Published 2017/01/07
Revlon ColorStay Beautiful Color Permanent Liquid Hair Color Light Auburn		In stock	\$350.00	Hair Color	hair color	Published 2017/01/07
Revlon ColorStay Beautiful Color Permanent Liquid Hair Color Light Ash Brown		In stock	\$350.00	Hair Color	hair color	Published 2017/01/07
Revlon ColorStay Beautiful Color Permanent Liquid Hair Color DEEP RICH BROWN		In stock	\$350.00	Hair Color	hair color	Published 2017/01/07
Revlon ColorStay Beautiful Color Permanent Liquid Hair Color DEEP BROWN		In stock	\$350.00	Hair Color	hair color	Published 2017/01/07

Figure 9. Generation interface of goods warehousing

V. CONCLUSIONS

This paper analyzes the defects of traditional supply chain logistics operation, fully considers modern global supply chain management environment and studies new features as well as operating mode in logistics management and control. Furthermore, starting from sales management in modern enterprises, it establishes a novel enterprise sales management information system under supply chain management mode. Based on service-oriented framework, this platform uses heterogeneous data exchange engine and data exchange agent to realize end-to-end data exchange of heterogeneous information system in supply chain enterprises and zero-development access.

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