Collaborative Logistics Information Service Framework and Reference Model: Based on the Perspective of Service Ecosystem

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Abstract

This paper analyzed the system features and model constructs of collaborative logistics information services from the perspective of service ecosystem. With the example of public logistics services platform, this paper discussed the contents of its features, classified its technology realization and business model and put forward the corresponding system structure and key realization technologies, which provide reference model for collaborative logistics information development.

Keywords

Services Ecosystem, Logistics Information Services, Collaborative, System Structure, Business Model

1. Introduction

Informatization and logistics information services accelerated the technological innovation and model transformation of services science on the level of technologies, systems and business models, which results quickly development of technical application and business model in new field that have a significant effect on transformation and upgrading of modern industrial society and evolutionary technology path [1] [2] [3], which was demonstrated in IOT (Internet of Things), MI (Mobile Internet) and CC (Cloud Computing). Research and practices indicated that innovation and application of information technology will initiate the transformation of new technologies and industries of services science. The transformation in the emerging areas has a significant influence on the development and operation mode of informatization and information services, which is also a challenge to the traditional concept of informatization and

collaborative information services [4] [5]. Below I will introduce the development institution and direction of collaborative logistics information for you first.

1.1. Complexities of Collaborative Logistics Information Services System

Logistics information services system is a complex, dynamic, open and integrated information ecosystem, and it is also a cross-enterprise, cross-department and cross-region value net that has self-organizations, behaviors and development models, which surpasses the supply chain and value chain. We must study its dynamic growth law in order to avoid blindness in the construction and development of information service system [6] [7].

More attention needs to be attached to peoples, organizations and information, coordination and sustainable development of information environment. The innovation development of China's logistics services needs the information services' construct upgraded to a new level, and with corresponding to it, it's urgent to construct the sustainable development of collaborative logistics information services ecosystem [8].

1.2. Development Direction of Collaborative Logistics Information Service: Service Oriented

The model of developing third generation of "information-users oriented" is transforming to "services oriented" owing to the technical advancement, services managerial transformation and innovational development. The services oriented model reflects future development of collaborative logistics information services and its realization demanding features of integration, intellectualization, personalization and unification. Only this new model in which essence is the knowledge service mode which people pursue can meets the collaborative logistics information services' innovation development [9].

We researched and built the system of collaborative logistics information services which is a dynamic, open, integrated, smart and personalized system. Those are the target and mission of collaborative logistics information services, which provides reference model for collaborative logistics information development.

2. Systematic Analysis of Collaborative Logistics Information Service

Collaborative logistics information service system is an open, dynamic and complex large-scale system. Its establishment and development involves lots of important aspects, such as the establishment of technologies and standards, reorganization of services process, management integration of supply chains and transformation of business models [10]. In this new developing field of services research system, the most basic problem in how to build a collaborative logistics information services system that meets the needs of today's development, which needs a systematic strategic planning and implementation strategy. This paper systematic analyzed logistic information services combined the studies and prac-

tices of Airport logistics information services platform with the theories and methods of collaborative logistic information services system.

2.1. Features of Collaborative Logistics Information Services

Strengthen the studies and applications of collaborative logistics information services could help logistics enterprises reduce production costs, optimize the inventory, reduce tying of capital and shorten production cycle [11]. Therefore, it is necessary to analyze collaborative logistics information services. Below I will introduce some technical terms for you:

1) Integration. A convenient unified logistics information services platform is needed in order to collect, transmit and process massive amounts of information immediately. Therefore, the construction of an efficient intelligent logistics information services platform becomes the key link for services integration, which is a vital logistics services model in the innovation of services. At that stage, the logistics enterprises could easily interact with each other, integrate information of "objects" and break the boundary of single enterprise to optimize the allocation of logistics resources, which leads to an integration of services. The integration of services can be specified in four aspects, which is the intelligent entire trace of products, the integrated supply chain's logistics driven by the end-customers, customized the logistics solutions for the overall optimization of supply chain's efficiency and construction of supply chain with modern logistics services as the core.

2) Personalization. The personalization of logistics services means the institutions of logistics information services can collect, arrange and update demand interests of business participants' initiative, and also push the logistics information services to participants based on their interests and characterize. Compared with the traditional information searching, the personalized services have two distinct features: one is pertinence which means provide customized services to users based on their personalized information needs; another is proactive. The platform can push the users' needed information to them initiative, which is different from traditional services model of "people search information". The aims of personalized logistics information services are to meets users' needs with their demands. It can be divided into three steps: firstly, analyze users' interests based on the collected information, and then to build users' interest database with the determined users' information needs; Secondary, by using the Internet technologies with the accordingly algorithms, extracting the users' accordant information in order to build the information database; Finally, pushing the information to the corresponding users.

3) Socialization. Socialization of logistics information services refers to the enterprises handed transport, handling and storage needed in the process of distribution, production and supply to the specialization enterprise, which leads to close ties between them. The socialization of logistics information services is the further result of social division of labor, which also means the socialization of logistics information services is the further marketing process for it is based on

specialization of logistics information services. That is because socialization and specialization are each other's premises and they are interdependence. Only by specialization, we can provide services to social in a socialization way, and socialization is the inevitable result of specialization development. As the important premier of socialization of logistics information services which specialization and value added logistics information services are its future direction, demands of logistics information services' socialization includes socialization of logistics infrastructure platforms. As the significant prerequisite of logistics industrialization and marketization, pushing logistics information services socialization is helpful for efficient specialized social division of labor and promotes marketization of logistics information services and development of specialized third-party logistics enterprises.

4) Intelligent. The intelligent logistics information services could provide services such as transactions and throughout monitoring. Compared with traditional way of marketing transaction, the intelligent logistics information services have two advantages: it can provide the complete information of markets and efficiently reduce the transaction costs. The logistics information services platform can collect the needs of logistics information services and the supply of logistics information services of small and medium-sized logistics enterprises, and therefore formed a transparent logistics information services market including these two industries. Each enterprise could get its needed marketing information according to their demands from this platform because its' open and transparency. To ensure the credibility of transactions between enterprises, this platform will certify the participant enterprises and evaluate its' logistics information services for regulating enterprises reputation mechanism, which will reduce their transaction costs largely. For lots of small and medium-sized enterprises, the logistics information services platform could provide an efficient and zero-cost way to obtain marketing resources, which helped them to solve the big problem of large cost in establishing new partnership prevented companies from acquiring new market resources.

The vital task is to ensure the object of logistics information services is the users of this platform, which are not only determined the platform's needs but also are essential for platform's construction and future sustainable development in the analysis of system needs. Through deep investigate and analysis, we put the services objects into four categories, which involved a wide range of related businesses, governments and individuals. There are logistics infrastructure providers, logistics supply or demand enterprises, services sectors in logistics industries and government-related functional department respectively, which was displayed in Figure 1.

2.2. Collaborative Logistics Information Services Based on Services Ecosystem

Domestic scholars have studied the concepts and elements of services ecosystem in recent years that is similar to biological ecosystem. Compared with biological
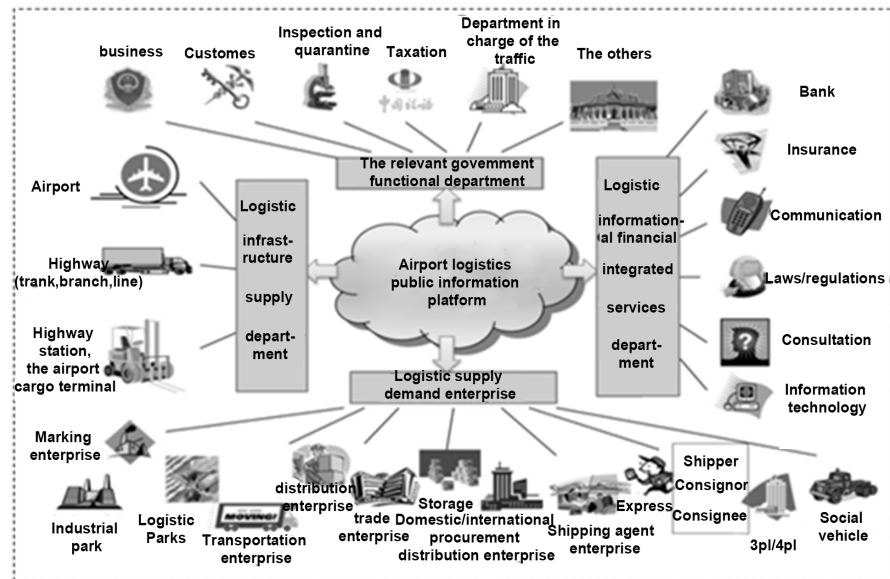
Figure 1. The service objects of the public information service platform of airport logistics.

ecosystem, services ecosystem is a kind of social ecosystem which has mutual interaction with others, and its' aim is to coordinate services providers and environment in order to have a sustainable development [12]-[17]. We realized the features of China's logistics information services industry by systematical analyzing collaborative logistics services system, and then elaborated collaborative logistics services on the perspective of services ecosystem.

It was point out that the perspective of services ecosystem in the future direction of collaborative logistics information services. In the development of collaborative logistics information services on the perspectives of services ecosystem, it is emphasized that logistics enterprises should put the establishing a service ecosystem as the core aim under the guidance of collaborative logistics information while build the service strategy system, and it is the inevitable trend of complex Internet environment. The perspective of services ecosystem derived from service-oriented logic analyzed collaborative logistics information services from dynamic, systematic and loosely coupled network system. It integrated participants of social economy into collaborative logistics information services as the subjects, and it also viewing institutional and extensive interaction as the realization of common value and emphasizing logistics collaborative by the resource integration of social economy and service exchange [18] [19] [20] [21]. It becomes a hot topic to analyze collaborative logistics information services on the perspective of services ecosystem, and it is more coincident to the complex Internet environment changes and meets the needs of its development [17] [22]. Based on the big data and Internet technologies, the products and services could displayed in digitization, networking and intellectualization. The widely use of intelligent Internet products fundamentally reshaped the industrial competition and industrial boundaries and subverted traditional interactive way between logistics participants subjects. Therefore, it's worthwhile to analyze collaborative

logistics information services behaviors of social economy extensive participants included in services ecosystem based on big data and digital and resources of Internet and study how to promote resources reorganization and interaction between logistics services subjects through intelligent connect. The creation process of collaborative logistics information services based on the perspectives of services ecosystem was showed in Figure 2.

3. Systematic Designs of Collaborative Logistics Information Services

According to the methodology of system life cycle, this paper aims to discuss the overall framework, program and design of the overall function systems of collaborative logistics information services with the example of Airport logistics public information services platform.

3.1. Overall Frameworks

This paper has pointed out that an open, collaborative and sustainable development system framework is vital for the development of logistics information services. According to the system's need of its' construction aims, services demands, technology developments and integrated innovation, this paper put forward the overall framework of collaborative logistics information services, which was showed in Figure 3.

This framework fully reflected the system thought and methodology of logistics information services, and presented the distributed integration system, interactive operation mechanism, collaborative technologies mode and the varieties and personalized services mode of that complex system of Airport public information services platform.

3.2. Function Systems

The systems' function directly determines its services level and users' satisfaction. By systematic analysis, we studied the function system of Airport collaborative
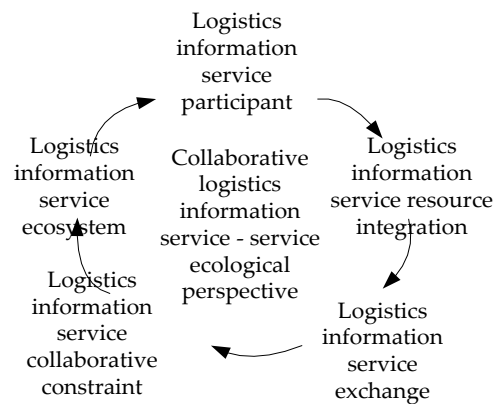

Figure 2. Creation of collaborative logistics information services from the perspective of services ecosystem.
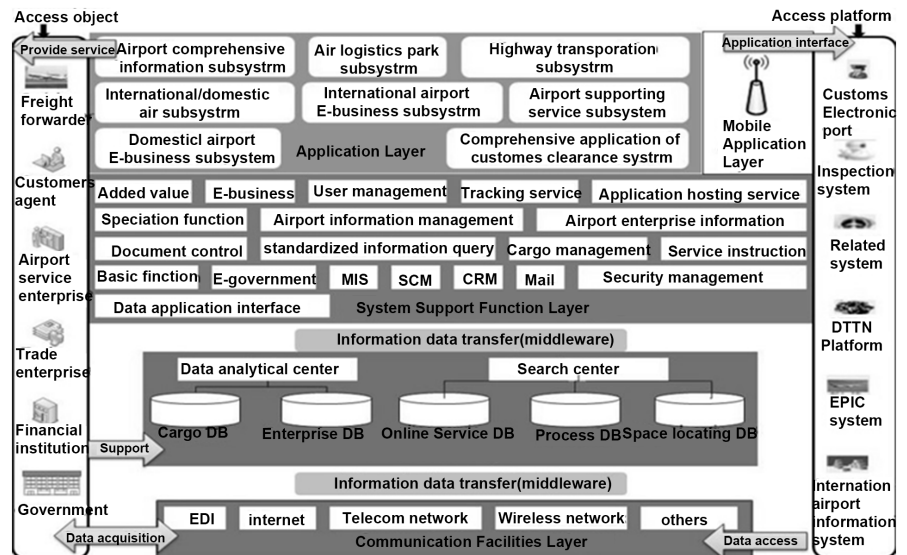
Figure 3. System framework of airport logistics public information service platform.

logistics information services platform. **Figure 4** depicts the structural and collaborative services, configuration, composition, and distribution and acquisition model.

The significance of determining system's functions of collaborative logistics information services is to explicit the top-level design of system's functions, and then to design the collaborative logistics information services' function structure based on it.

4. Key Implementation Technologies of Collaborative Logistics Information Services

4.1. Technologies Configuration of System

Such a complex information system needs application of large amounts of technologies innovation especially application of the core technologies in the area of IT. In line with the needs of construction and development of this system, this paper pictured the implementation of technologies configuration mode, which was showed in **Figure 5**.

4.2. Internet of Things

Internet of things means real objects Internet which was consisted by EPC tags, readers, Savant server, ONS server, PML server, and many databases, and it use EPC and RFID technologies to achieve the automatic recognition and real-time sharing of information of global objects [23] [24]. The application system of Internet of Things is the extension, deepening and integration of Internet computing model. The principle of operation was showed in **Figure 6**.

We can see from the **Figure 6**, in addition to the hardware of EPC tags and readers was added in the system of the Internet of Things, a specialized application server and new marketing PML was also needed for information
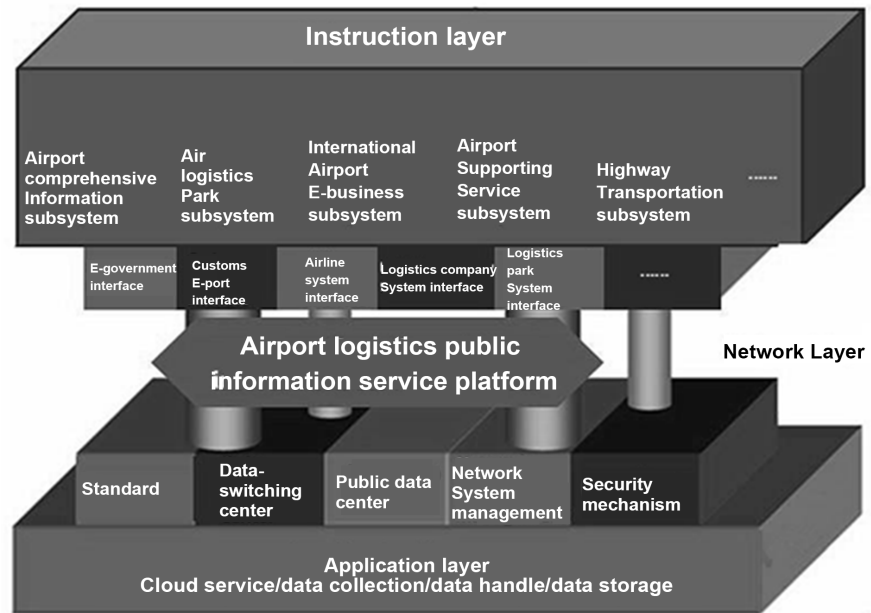
Figure 4. A system function design of the public information service platform for airport logistics.
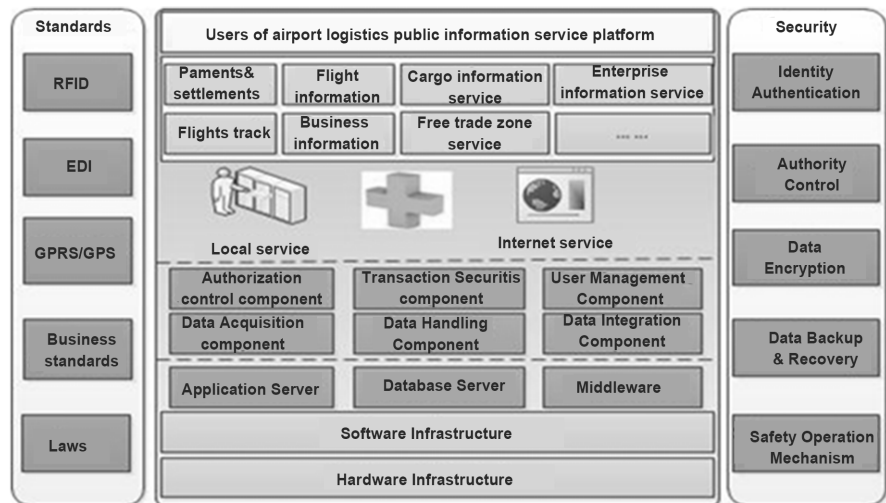

Figure 5. Technical realization configuration system of airport logistics public information service platform.

expressions. Such elements contains Savant server, namely software of network data exchange, which was used for collecting, storing, dealing and exchanging EPC information; objects naming server which function is equivalent to DNS; entities expression languages that was used to describe objects in standard.

4.3. Mobile Internet Technologies

Mobile Internet is the services based on mobile network, which including three elements: mobile terminals, mobile network and application services. On the other hand, mobile network combines traditional network with mobile communication
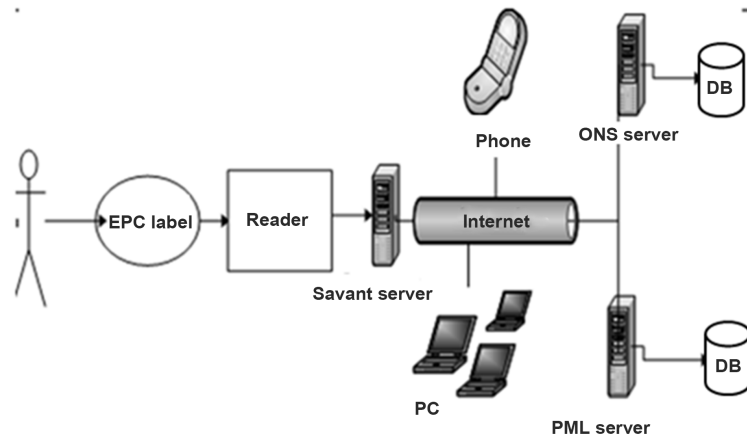
Figure 6. Internet computing model of IOT (application architecture).

network, and the terminals users' get access to traditional network through mobile communication network; in another aspect of it, mobile network possess a large amount of new application services and business, and it can provide a variety of personalized services [25] to users according to the terminals characters such as mobility, localizability and convenience.

From the perspective of macroscopic view, the structure of mobile network consisted of mobile subnet; access network and core network. The mobile terminals and subnets is the subject of mobile network; the access network is mainly responsible for providing access services for heterogeneous mobile terminals and mobile subnets as well as shielding complex mediums features of mobile terminals and subnets which have influence on the core network [26]; the core network is mainly responsible for maintaining backbone network topology and routing information of traditional network, and also provides an unified standard for route switching. The system structure of mobile network was showed in Figure 7.

4.4. Cloud Computing Technology

Cloud computing based on the increase, usage and delivery mode of related service of Internet. It usually refers to a kind of dynamic and virtual resource which can be easily extended. It's a pay-per-use service which providing usable and convenient network access as needed and could enter a configurable computing resources shared pool. Those resources included network, server, storage, application software and services which can be provided quickly, requiring minimal administration and interoperating a little with service provider.

Cloud computing make computing distributing on a mass of distributed computers instead of local computer and remote server. The operation of enterprise date center (EDC) is much more similar to the Internet which enterprises can swift resources to the applications of need and access computer and storage system. Cloud computing has some generally accepted features including very large scale, virtualization, high reliability, universality and high scalability.
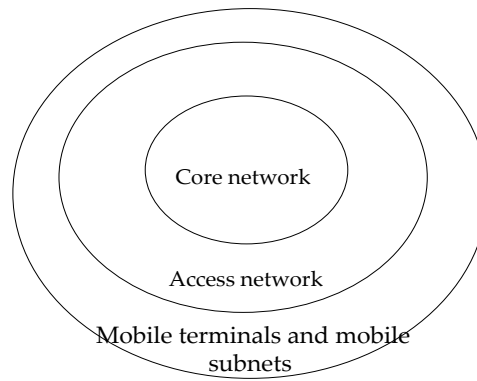
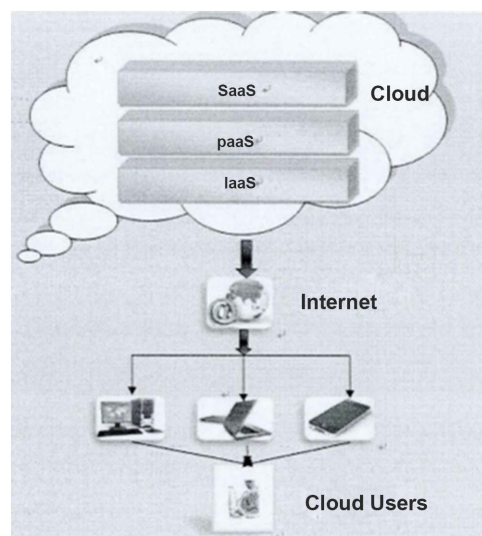**Figure 7.** System structure of mobile network.

Figure 8. Cloud computing services model.

With the wide spread of Internet, more and more large scale complex Internet applications have appeared and gradually developed towards the trend of collaborating. The rapid development of cloud computing can meet the need of flexible and efficient collaboration, and provide high availability and scalability for applications. Cloud computing services model was showed in Figure 8.

5. Conclusion

The thought, the theory and the methods of the system of collaborative logistics information services will play an important role on the development of the logistics informatization in our country. Both information technology and reformation of business model are challenging the development of logistics information services. Collaborative logistics must adapt for the informatization, e-commerce technology and the needs of the development of the services. It also needs to adapt for industrial transformation and promotion. We researched and built the system of collaborative logistics information services which is a dynamic, open, integrated, smart and personalized system. Those are the target and mission of

collaborative logistics information services. This research also has several limitations. First, this paper just put forward the framework of collaborative logistics information service system and there are lacks of formal description of each part; Second, we proposed this framework for future reference but it also need to be tested whether it's adoptable, or it's a safety system; Third, this paper put forward this model only with one example of public logistics services platform. Future research could adopt more examples to testify it.

Acknowledgements

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