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Study on Campaigns Logistics Military Container Transportation Management Information System Based on Multi-agent

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Abstract: It is an important way to improve the capability of by means of utilizing the military container transportation in campaigns logistics information and management system which is the foundation of building up the Logistics of "serving the troops" and "supporting the war". It has drawn the attention of leaders and commanders in headquarters and at army's root, so we should carry out detailed premise and fasten the construction. Based on the systematic analysis of current situation of the management and information system of military container transport in campaigns logistics and adopting the Multi-agent System technology of Artificial Intelligence, the article discusses the combination of Military Container Transportation System and Multi-agents technology, construct a structure model of a Multi-agent system, analyzes the types of agents and layers, describes the inner relations among agents, illustrates the way of developing the Information and Management System with examples and points out the advantages of this structure model.

Key words: Campaigns logistics, military container transportation, multi-agent, information and management system

INTRODUCTION

Military Container Transportation contains storing, transporting, loading, unloading, supplying and managing military materials (Zhu, 2010). Military Container Transportation is widely used in the whole process that involves military materials from purchasing to consuming. The military container transportation technique gained examination in the recent high-tech local wars. With the development of the information technology, some latest technologies, such as computer network technology, global positioning system, bar code technology, EDI technology, etc, have been gradually adopted in the process of military container transportation. However, because military container transportation' information is so huge and complicated, informatization is always limited in some local field and cannot form integration. This kind of distributed information can only play roles in some certain unit in military container transportation process, thus, it cannot give full scope to the resultant force effect produced in the interaction on each other. This article, based on the study on present development of military container transportation system, puts forward with a concept of building a systematic campaigns logistics military container transportation information system with the combination of multi-agent technology.

PRESENT DEVELOPMENT SITUATION OF CAMPAIGNS LOGISTICS MILITARY CONTAINER TRANSPORTATION INFORMATION SYSTEM

As same as the development of INTERNET, the intranet of our army experiences rapid progress. Within campaigns logistics, each military service can get interconnected through military intranet which provides a platform for survival and development for modern military container transportation management information system. Among the important logistics departments, its own informationized management, such as automatic management of transportation departments, has been realized, but among the information systems of every military departments lack of a universal standard criterion, the data exchange among these departments are still transferred by means of traditional tables, documents and cannot realize the data exchange between different information systems (Yan and Zhou, 2013). The fusion and processing of data cannot meet the feature of fast and real-time of warfare and training.

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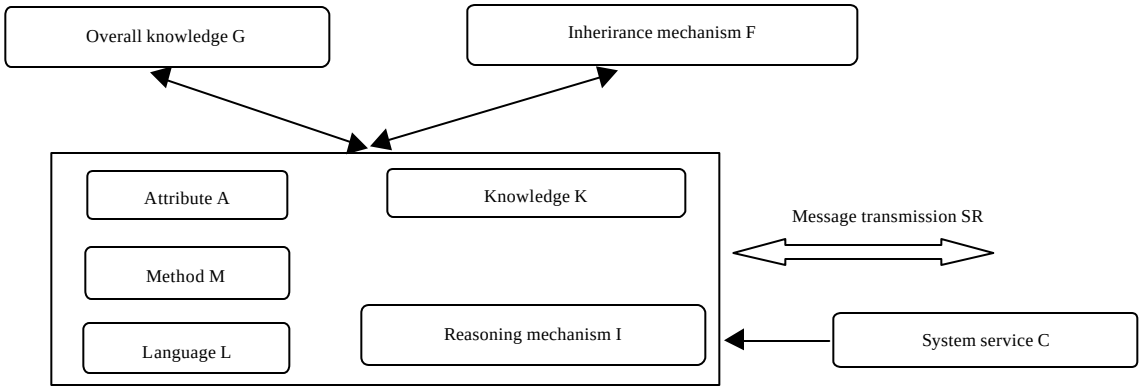

Fig. 1: Internal structure of Agent

MUFTI-AGENT TECHNOLOGY

The study on agent originated first in Agent technology originally come from Distributed Artificial Intelligence (DAI), later it combines with various techniques in other fields and broadened its own studies from DAI. It is generally acknowledged that Agent should have knowledge, goal and capability. Knowledge is a kind of description about the environment where Agent locates and problems needed to be solved which can be obtained from customers, other Agents and study by the Agent himself. Goal is the problems and tasks needed to be solved. Capability is the means and methods to solve these problems (Lu *et al*., 2011). Agent can be defined as the following multi-group form, Agent = (M, K.A.I.L, S,R,G,F,C). Figure 1 shows the detailed description on Agent.

The Multi-Agent System (MAS) can be defined as a large-scale complex system loosely coupled by lots of multi-problem solvers distributed in network, these solvers interact with each other to solve the complicated problems that cannot be solved only by the capability and knowledge possessed by any one; the problem solver is normally called as agent, who owns an autonomous character (Mhonyai *et al*., 2011).

According to relationship between the character of autonomy and Agent, multi-agent system can be classified into three main categories. The first is the system composed of control agents and under-control agents; the second is the system composed of agents, namely that there is no grade among agents, the conflicts among which is dealt with negotiation; the third is the system composed of flexible agents.

MUFTI-EGENT CAMPAIGNS LOGISTICS MILITARY CONTAINER TRANSPORTATION MANAGEMENT INFORMATION SYSTEM MODEL

Military container transportation system combined with multi-agent technology: Military container transportation system is a resolvable dynamic system. As a part of the logistics system, no matter how large and scale the military container transportation is, it can be resolved into several connectedness subsystems in theory. In the course of practical operation, the relatively independent subsystems do exist, there are entity sectors corresponding to the links of container transportation, such as purchasing, transporting, storing, manufacturing and supplying. These entity sectors have to accomplish their own mission and to reach the most optimal objective. They are able to think independently and complete mission and can recognize the current state of other agents and can change its own behaving mechanism by accepting the request or demand from other agents. All agents mentioned above satisfy the definition of agent. Military container transportation System is a multi-objective complicated function system, it requires that the quantity of materials not only meet the needs of war, but also hope as short as possible a processing period, the best quality of materials, the most economic cost of materials. In this multi-target contradictory movement, namely the multivariate function relationship, great management difficulties are evitable in order to gain the best effect. The contradictions between local optima and global optima are the usual ones that exist in the large systems. But the coordination mechanisms of multi-agent system can suit to solve such problems. These

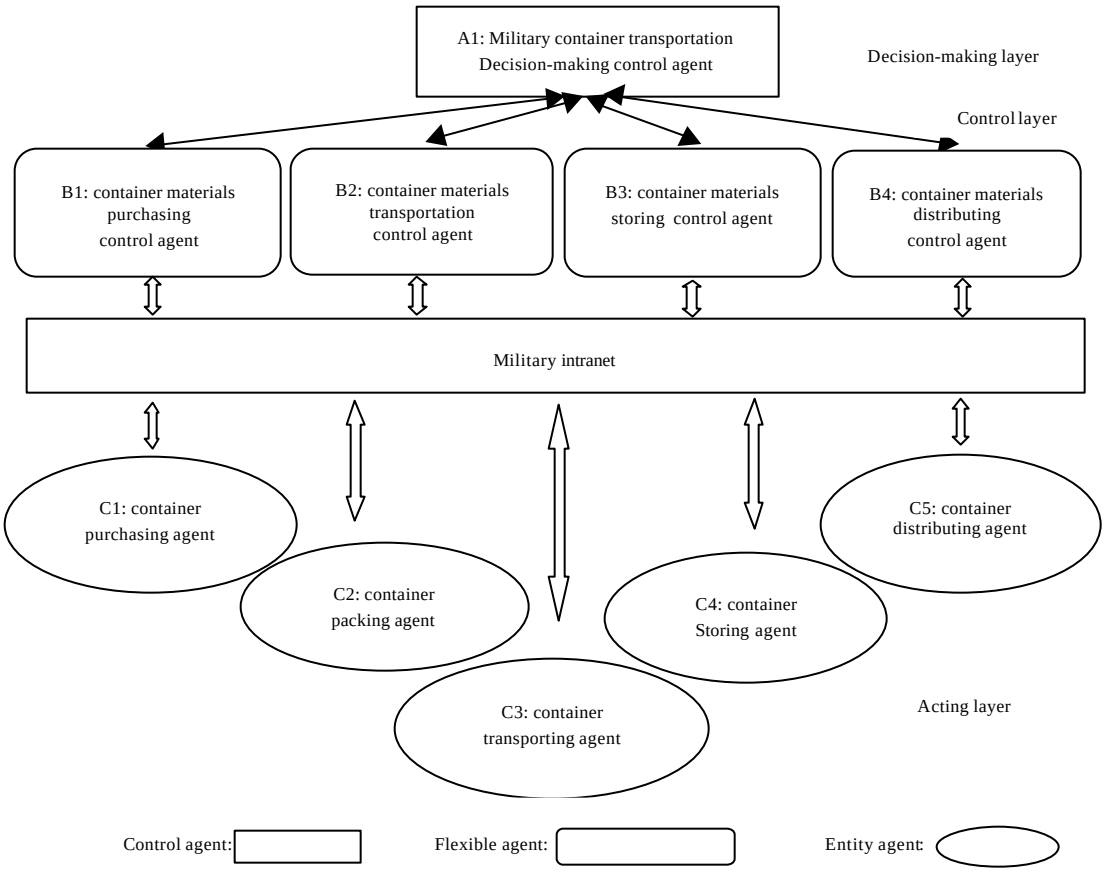

Fig. 2: Structural model of multi-agent campaigns logistics military container transportation management

mechanisms can be expressed by the control agents of middle layer of the model proposed in the following explanation (Xiao *et al*., 2013).

Military container transportation system is a part of the military operations or wars. The cooperation between each entity factor is also the key to win the war. The military container transportation system is also the same, the cooperation between the entity sectors is indispensible as well. The coordination mechanism of the multi-agent technique provides a feasible scheme, that is to say, every agent should send and receive information in accordance with uniform standards and protocol, accept the instruction from higher and same grade of agent, then blend the shared information of same grade of agent and finally get a quick solution within its own regulation (Pacino and Jensen, 2012).

Through the discussion on the current development of campaigns logistics management information system and the combination with agent technique, we can conclude that the idea of agent system meets the demand of developing military container transportation system. Therefore, on the military intranet, we can propose the following structural model based on multi-agent campaigns logistics military container transportation information system, shown as Fig. 2.

Description about the agent in the Model

Categories and layers

Control agent: It locates at the top of the figure and is the core of the whole Campaigns Logistics Military container transportation Management Information System, whose objective is to make the military container transportation system obtain the best military value, to reach a quick and accurate military materials support. It receives and process information from other agents and quickly generates the logistics decision, then sends control information to the lower agent.

Flexible agents: They are the coordinative mechanism of the multi-agent system in the middle layer of the figure which is also equal to the management departments of each specialized sectors of military container

transportation. Their objective is to accomplish the optima of each local process of military container transportation. They receive control information from top layer and shared, specific information from bottom layer and get the solution of its own mission in accordance with its own regulation, then send control information to control the activities of lower agents.

Entity agents (under-control agents): They are the acting layer which are at the bottom of the figure. They are equal to the entity sectors in the military container transportation process, responsible for the implementation of military container transportation process, whose objective is to accomplish the collection and minimally processed information. They receive control information from each agent in the middle layer and feed back the needed minimally processed information to flexible agents.

Information system

Description about the relationship of agents: The agents in the system are classified into layers which is mainly the reason of characters of campaigns logistics military container transportation system. The relationship between top layer and middle layer is kind of corresponding which represents the centralized controllability of military container transportation system. This kind of relationship can ensure the system to resolutely carry out mission. However, the relationship between the middle and bottom layer is kind of many-to-many loosely coupling relationship. Of course, it cannot represent that the implementing will be out of control, it just shows the best advantage of multi-agent system, namely, to solve problem single agent cannot achieve through coordination of multi agents. The relationship of the agents in the same layer is kind of mutual study, namely, to build a cognitive model acknowledged by other agents in the same layer in the inner agents to recognize the current state of other agents.

Realization of multi-agent military container transportation management information system: Figure 1 introduces the internal structure of Agent and it is an abstract model. The following figure is a more specific structural framework of Campaigns Logistics Military container transportation Management Information System. As to the realization of agent Ci at the bottom can be built on the basis of correspondingly specific management information system. Figure 3 shows the structural model of the agent, taking storing agent as an example.

The current management information system in this layer is consummate, if it were quit and redesigned, it would be a time-cost and effort-cost task, because the most functions accomplished by the agents in this layer have been realized by the existing management information system. From this point of view, just to build a standard interface communicated and coordinated with other agents of the whole system can realize all the functions agents hope to do. The command receiving interface is responsible for receiving commands from middle layer, shared information interface is responsible for processing minimally information and sharing them with upper agents and provides with the needed information to upper agents for making decision and coordinating (Caschili and Medda, 2012).

Agent Bi of middle layer and agent A1 of top layer are control agents. It is required to conduct the tasks of information fusion, finding solution and planning, therefore, its internal system is more complicated. The following design can be considered to build the agents

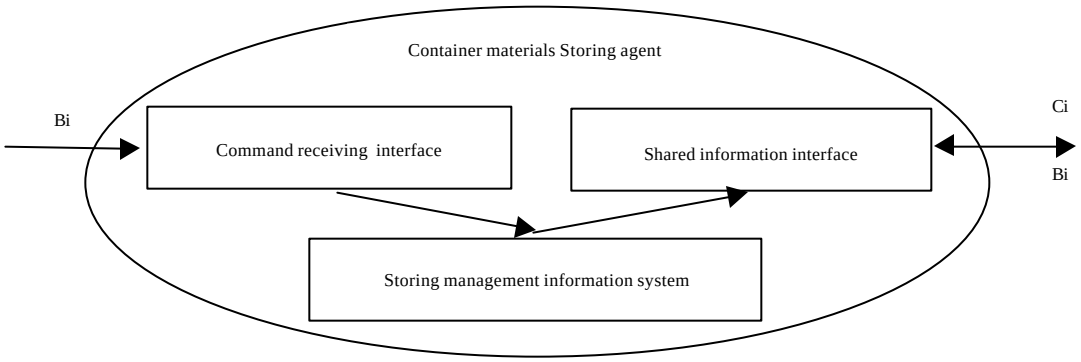

Fig. 3: Container materials structure of storing agent

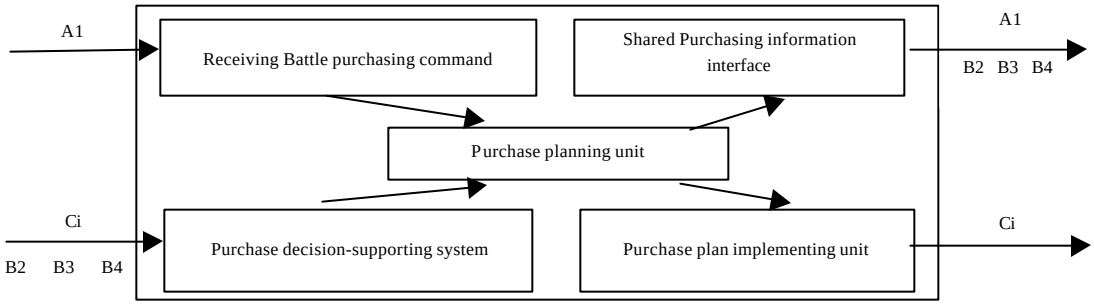

Fig. 4: Container materials Structure of purchasing control agent

structure, taking purchasing control agent, shown as Fig. 4. In the figure, the purchasing decision-supporting system and the planning unit is the key point, the agent depends on it to realize its most of objectives. As to the other agents in middle layer, their structure is almost the same as Fig. 4, the agent of top layer is as well except the information exchange and flow, because its information-shared object may include systems outside this agent system, such as the campaigns command automatic system.

Through the above analysis, we can conclude that the transmission and coordination of information among agents is the basis of the whole system. Right now, the platform of military intranet can basically meet the need of system. Therefore, a uniform standard is needed to realize the coordination among agents in this platform which can transmit and receive agents' information. Knowledge query and manipulation language is a communicative language and protocol that agents can share and coordinate with each other which can solve the problem of communication standards among agents and can also realize the data structure exchange and trans-platform remote call (Saeidi *et al*., 2013).

Advantages of model: To make use of multi-agent technique to design the structure model of the campaigns logistics military container transportation management information system has the following advantages:

- **Model can fully uses the characters of agents:** To make use the concept of agent to pack and describe a certain objective, such as transporting or storing, can make a complicated military container transportation system be richly layered and with clear structure
- Model can not only describe the system's function, but suit physical structure of the military container transportation system. Every agent has correspondent logistics departments or logistics management process
- **Realization of the Model makes full use of the present system:** We can clearly conclude from the specific realization structure of the agents in the up Model that integrating the present system is one of the advantage in developing the multi-agent logistics system
- **Model has a strong dynamic adaptability:** The development of military container transportation systematic organization structure is in the process of changing. With the development, new departments of new functions may come to occur. When these departments or functions occur, it is not necessary to change the topological structure of the whole system. We can add the relative agent to the relative layer in the system in accordance with the uniform standard of the whole multi-agent system which ensures the whole system a nice scalability

CONCLUSION

Information warfare is a various dimensional warfare model and high informatization is necessary to win the war. This article put forward with the general structural model based on the multi-agent campaigns logistics military container transportation management information system which makes the complicated system brief and simple and provides a concept of building our military container transportation system. In the real building of system structure, besides it needs the support of present information techniques, the analysis about the communicative and coordinative relationship of between varied agent will be a complex process. Because of the secrecy of military system, it is necessary to take the communication security of agents in this open system model. In the control agent, the development of decision-supporting system is the key point of the realization of the functions of the whole system which needs to be further studied.

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