

Research Article

Analysis and Study for Execution System of Agile Manufacture Setup Structure Basing on Agent

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Abstract: The Agent modeling method is used in the system, the function or unit can be transformed into Agent, so the setup structure for execution system of the agile manufacture system is built and the resources, requirements are all brought into the networks. The structure and function of the execution system basing on Agent are analyzed; the characteristics of Agent are also given. The system's operation relies on the interaction among the functional Agents.

Keywords: Agent modeling, agile manufacture, structure in layer

INTRODUCTION

Agile manufacture is the strategy of production and management in 21th century, whose target is to build the manufacturing group and action that can respond agilely and quickly to user's requirements. The system is a dynamic producing system and the main characteristic is uniting the producing resources in different areas or enterprises for the needing production through networks.

With the transformation of the market, the agile manufacture system presents a dynamic, distributed and complicated system, the execution system is the core of the whole system and it needs a new modeling method for improving the system's intelligence, flexibility, or other characteristics. The execution system is the centre of the whole agile manufacture system and makes the important role in the procedure of manufacture. Some setup structures based on Internet technique or other models were built for agile manufacture system, supplied some thought for the system study. In recent years, some researchers use Agent technique in their study and bring new thought to this area (Huini and Milil, 2002; Chuang-Xin *et al.*, 2005; Zhan and Quan, 2006). The system modeled by Agent technique can make full use of Agent's properties and all functional units can cooperate with one another for the common target.

THE BASIC STRUCTURE AND MAIN CHARACTERISTICS OF AGILE EXECUTION SYSTEM

As one of the new manufacture mode, agile manufacture could assemble the advantageous resources quickly, transform market chance into the

users' requirement and strengthen the competition capability in market extremely. The agile manufacture can also shorten the time between conception and cash and thus becoming the leading manufacture mode today.

The agile manufacture mode is built on the organization form of new type dynamic enterprises and has the property of distribution in physical scope. As Fig. 1 indicates, agile manufacture execution system transforms the entity enterprises into fictitious ones through information technique, the fictitious enterprises include manufacture capability and corresponding resources, which could build network for coordination and cooperation according to the market requirement. When the task is completed, the fictitious enterprises dismiss, but the entity enterprises network exists yet.

The basic structure of agile manufacture execution system is indicted in Fig. 1. The objective for building of fictitious enterprises is to use the member's resources fully. The resources include equipment, technology and workers; the procedure of fictitious enterprises' building is also the procedure of resources' reconfiguration. In recent years, researchers bring the Multi-Agent technique into agile manufacture system's cooperation problems, in order to strengthen the adaptability and flexibility and the system can cooperate and reconfigure smoothly for this technique.

The system's main properties are indicated as below:

- **Dynamic property:** The market requirement is dynamic; the members of agile manufacture execution system are also dynamic for requirement, these procedures include alignment of the structure, capability and resources, so as to adapt to transformation of production tasks.

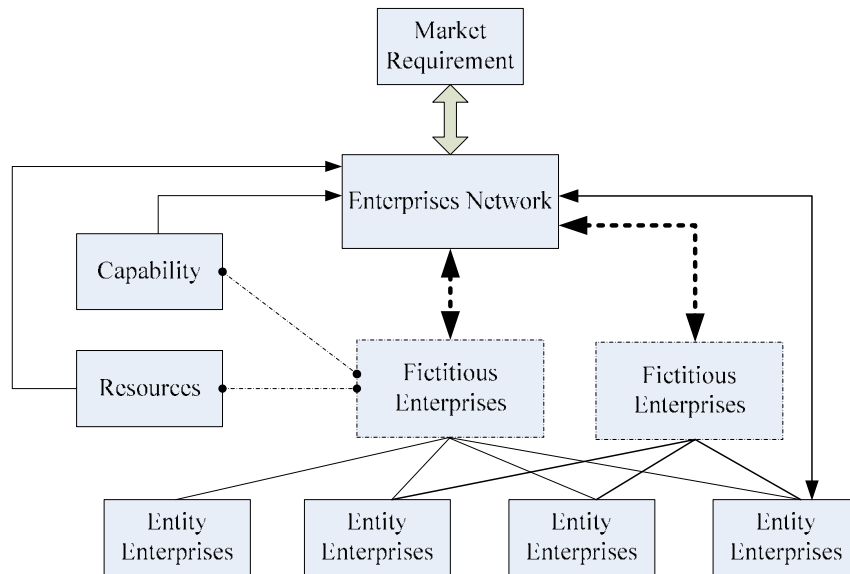


Fig. 1: Basic structure of agile manufacture execution system

- **Property of fast reaction:** The agile manufacture execution system must shadow market transformation in real time and react to the circumstance quickly, in order to grasp market opportunity and create profit.
- **Property of reconfiguration:** During the agile manufacture, enterprises can build network according to market requirements, the network can aggregate the corresponding resources and build fictitious enterprise for the production task. When the new task generates, the resources and structure in fictitious enterprise will also transform dynamically, which is called “reconfiguration”.

SETUP STRUCTURE OF AGENT BASED AGILE MANUFACTURE EXECUTION SYSTEM

With the development of technology, the agile manufacture system has become a complicated system. The new modeling technique is needed for the complicated problem solving. The modeling technique based on Agent is the most widely used one in recent years.

The Basic Properties of Agent: The properties of Agent include automation, communication, cooperation and mobility (Stefanoiu *et al.*, 2000; Rana *et al.*, 2002).

- **Automation:** The automation property is Agent’s basic property. Agent can make decision automatically without user’s invasion.

- **Reaction:** Agent can sense its circumstance (such as user, program, other Agents) and react in real time for the transformation of the circumstance.
- **Cooperation:** Agent is an opening system that can cooperate mutually and enlarge its knowledge through interaction and cooperation. Agent can resolve the confliction among them through coordination.
- **Communication:** Agents can transform information each other, communication can improve Agents’ capability of cooperation and coordination. It’s the basement of the cooperation and coordination.
- **Mobility:** Agent can move from one node to a new node in any status and maintain its original status. This property can adapt to the complicated system for solving problem.

The modeling method based on Agent uses the Agent properties fully and the complicated system using Agent technique can possess good properties such as adaptation, flexibility and sensibility, etc.

Agile manufacture execution system basing on agent: The system based on Agent has several Agents, such as manufacturing Agent, requirement Agent, coordination Agent, data Agent, searching Agent, market researching Agent, all Agents cooperate one another through networks coming to the whole systems’ target. The Agent’s function is introduced dentally and the operation procedure of system is also given. The mechanization of the system is indicated in the following Fig. 2.

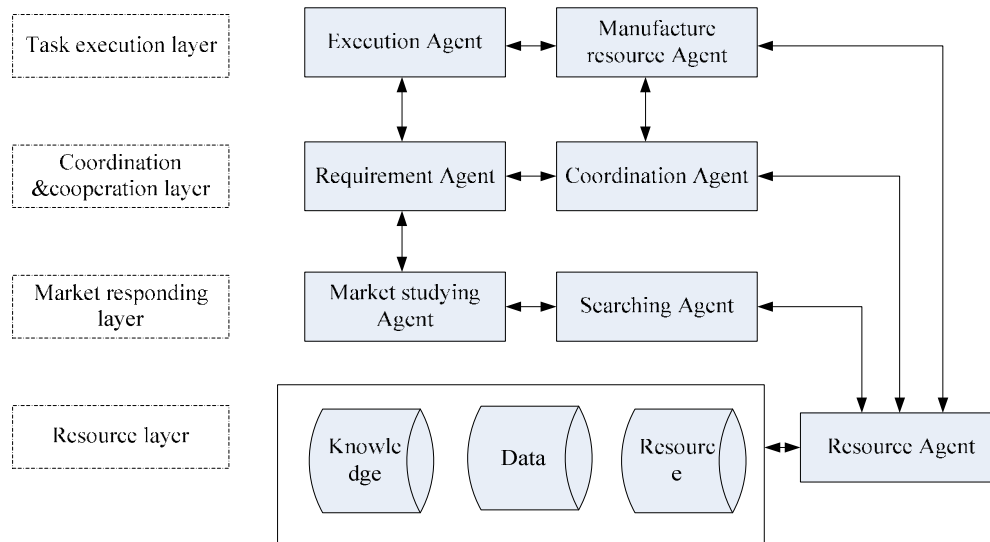


Fig. 2: Agile manufacture execution system structure basing on agent

The frame of agile manufacture execution system based on Agent roughly has four layers: the first layer is resources lying in global area widely, whose data and information are registered by resources Agent in enterprises network, this can do basic work for the whole system; the second layer is responding layer for market requirement, the market studying Agent and searching Agent is in this layer, which can answer to the market requirement and search for the fitful resources to supply the manufacture requirement; the third layer is coordination and cooperation layer, mainly includes coordination Agent and requirement Agent, which can coordinate the cooperation, competition and actions among corresponding Agents oriented to market requirement; the fourth layer is task execution layer, the execution Agent and manufacture resource Agent are in this layer, which would complete the task according to system's command. The manufacture Agent represents fictitious enterprise, which is the polymerization of manufacture resources related to market requirement.

The enterprise network and fictitious enterprises in agile manufacture execution system all transform into corresponding Agent after using Agent modeling method, all Agents would pay attention to market requirement at any moment and coordinate mutual action in real time for the most profits.

ANALYSES FOR THE RUNNING PROCEDURE

The market studying Agent responds to market requirement, transforms information to searching Agent; the searching Agent search for the enterprises

that have the corresponding manufacture capability and transforms the result to requirement agent; the requirement agent generates the practical requirement and transforms it to coordination Agent and execution agent; coordination Agent coordinates the resources in local or global area, makes further investigation for the task information and then transforms the correct information to execution Agent and resources Agent for completing the task. The corresponding information and knowledge are stored after the task accomplishment, the fictitious enterprises dismiss, but the enterprises network exists yet for the new tasks.

DISCUSSION

The satisfactory production or service is the core of agile manufacture, the fundamental requirement and execution mode have changed greatly comparing with the traditional manufacture mode (Gao, 2003; Meng and Qiu, 2006). With the usage of Agent technique, the system's efficiency can be highly promoted, but there are still some problems should be resolved. The adjustment and building of the production management and fictitious running mechanism are the first tasks and these are the important objectives in the agile manufacture area.

CONCLUSION

Agent is always defined as some computing system that can complete tasks in advance autonomously (Zhen-Kun *et al.*, 2008). The fictitious enterprises can be supplied to run effectively by using Agent technique in agile manufacture and the member enterprises can cooperate with each other well.

The execution system of agile manufacture system uses Agent technique for modeling, can retain the Agent's properties such as flexibility, integrity and intelligence, which is a valuable choice for improving the whole system's properties.

REFERENCES

- Chuang-Xin, G., S. Ye-Cai, C. Yi-Jia and H. Zhen-Xiang, 2005. Studies on power enterprise open architecture of information integration based on multi-agent system technology [J]. Proceedings of the CSEE, 25(4): 64-70.
- Gao, E., 2003. Research on multi-agent based shop floor control architecture and technique [D]. Ph.D. Thesis, Submitted to Hefei University of Technology.
- Huini, H. and G.T. Milil, 2002. Power system stability agents using robust-wide area control [J]. IEEE T. Power Syst., 17(4): 1123-1131.
- Meng, W.C. and J.J. Qiu, 2006. An artificial immune algorithm to distribution network reconfiguration [C]. Proceedings of the CSEE, 26(17): 25-29.
- Rana, O.F., M. Winikoff, L. Padgham and J. Harland, 2002. Applying conflict management strategies in bdi agents for resource management in computational grids [C]. Proceedings of 25th Australasian Computer Science Conference (ACSC2002), 4: 205-214.
- Stefanoiu, D., M. Ulieru and D. Norrie, 2000. Fuzzy modeling of multi-agent systems behavior: Vagueness minimization [C]. Proceedings of World Multi Conference on Systemic, Cybernetics and Informatics (SCI'2000), Orlando, Florida, USA, July 23-26, 111: 118-123.
- Zhan, H. and Y. Quan, 2006. Application of Multi-agent Technology in Power System [J]. J. Chongqing Univ. Natural Sci. Edn., 29(11): 53-57.
- Zhen-Kun, L., C. Xing-Ying, Z. Bo, Y. Kun and L. Hao-Ming, 2008. Dynamic reconfiguration of the distribution network based on multi-agent systems [J]. Proceedings of the CSEE, 28(34): 72-79.