A MULTIAGENT CONCEPTUALIZATION FOR SUPPLY-CHAIN MANAGEMENT

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ABSTRACT

In Global world there is a huge network consisting by different companies for their suppliers, warehouses, distribution centers, retailers, with the help of these entities any organization acquired raw material, transformed, and delivered finished goods. The major challenges for Industrial organization are to reduce product development time, improve quality, and reduce cost of production. This is done only when the relationship among various organization/industrial houses is good. This is not only be done by the change of Industrial process/method but the latest electronic tools controlled by computer software is required to establish in this competitive world. Software agents consist of one or many responsibility of supply chain, and each agent can interact with others without human intervention in planning and execution of their responsibilities. This paper present solution for the construction, architecture, coordination and designing of agents. This paper integrates bilateral negotiation, Order monitoring system and Production Planning and Scheduling multiagent system.

KeyWords: Agent, Supply chain, Multiagent, Multiagent System Architecture for supply chain management

1. INTRODUCTION

To improve the efficiency of supply chain management it is mandatory to take intelligent, tactical, strategic and good operational decision at each end of chain. Under strategic decision the agent will take the decision about suppliers, warehouses, production units, transportation system etc. The tactical decision takes place to meet actual demand. The agent on operational level is responsible to execute whole plan. To do all things in smooth way the coordination among agents is must otherwise if the material do not arrive on time the production will stop, if finished good has been ready and warehouses are not empty then it will create a great confusion. The ability to manage all level of supply chain system [1], coordination, accurate and timely dissimilation of information is the enterprise goal.

2. Agent

In Software we can define the agent that it is an entity which consists of various attributes defines a particular domain. Exp: An agent deals with warehousing consist its local attribute as well as the details which will be coordinated with other entity (Agents). So agents emulate the mental process or simulate the rational behavior. A multi-agent system is a loosely coupled network of problem-solver entities that work together to find answers to problems that are beyond the individual capabilities or knowledge of each entity. The first issue is how the different activities of supply chain can be distributed in agents. A typical example of multiagent system is taken with the help of Coffee maker and toast maker. Let a person wants the toast as the coffee is ready, means the coordination between Coffee maker and toast maker is essential. Otherwise many situation may be raised like Coffee is ready but toast is not prepared and it comes after some time or the toast is ready and the Coffee is not prepared.

1. Agents are problem solvers.
2. Agents are pro-active.
3. Agents are goal-oriented.
4. Agents are context-ware.
5. Agents are autonomous

2.1 Requirement / Logistics agent

These agents coordinate all activities of plant and find the various demands of various sections. It holds the data of day to day production, find how much material has been consumed a day depending on the working hours a machine works. Categorized each component in different table and coordinates with other agent like Demand agent etc. The intelligent part of the agent is to find the efficiency of machine, minimizing cost increasing throughput etc. It can also consist feedback of the finished goods and suggest appropriate changes if required.
2.2 Demand Agent

This agent coordinates with other agent like requirement/logistics agent. The main objective of this agent is to fulfill the requirement of various section of the company/customer. The intelligent part of this agent is to acquire orders from various vendors, compare them on the basis of quality, price, availability etc. In case any demand increases or decreases automatically vendor will be communicated.

2.3 Transport agent

This agent is responsible for the availability of the transport, dispatching of finished goods at particular destination. It manages all the transportation routes.

2.4 Financial agent

This agent is responsible to avail the money for purchasing any material. It coordinates with other agents analyze the cost and ensure that the money has been paid to the party in definite time.

2.5 Scheduling agent

This agent is responsible for scheduling and rescheduling activities in the factory, exploring hypothetical “what-if” scenarios for potential new orders and generating schedules that are sent to the dispatching agent for execution. It assigns resources new orders and start times to activities that are feasible while at the same time optimizing certain criteria such as minimizing work in progress or tardiness. It can generate a schedule from scratch or repair an existing schedule that has violated some constraints. In anticipation of domain uncertainties like machine breakdowns or material unavailability, the agent may reduce the precision of a schedule by increasing the degrees of freedom in the schedule for the dispatcher to work with. For example, it may “temporally pad” a schedule by increasing an activity’s duration or “resource pad” an operation by either providing a choice of more than one resource or increasing the capacity required so that more is available.

3 MIDDLE AGENTS

3.1 Facilitators

Agents to which other agents surrender their autonomy in exchange for the facilitator's services. Facilitators can coordinate agents' activities and can satisfy requests on behalf of their subordinated agents.

Fig 2: Architecture of Multiagent
3.2 Mediators

Agents that exploit encoded knowledge to create services for a higher level of applications.

3.3 Brokers

Agents that receive requests and perform actions using services from other agents in conjunction with their own resources.

3.4 Helpline/Yellow pages

Agents that assist service requesters to find service provider agents based on advertised capabilities.

3.5 Agent Interaction

Interaction is one of the important features of an agent [2]. In other words, agent recurrently interaction to share information and to perform task to achieve their goal. Researchers investigating agent’s communication languages mention three key elements to achieve multiagent interaction. [3][4][5]. A common agent communication language and protocol

- A common format for the content of communication
- A shared ontology

4. AGENT COMMUNICATION LANGUAGE

There are two main approaches to design a agent communication language [6], The first approach is procedural and the second one is declarative. In procedural communication is based on executable content but in declarative communication is based on definition assumptions and declarative statement. One of the more popular declarative agent languages (KQML)[8]

5. MULTIAGENT SYSTEM ARCHITECTURE FOR SUPPLY CHAIN MANAGEMENT

Our framework provides a GUI application that enables the design of multiagent system with protégé-2000[7], as well as single agents or multiagent communities using common drag and drop operation.

Fig-1-Architecture of Multiagent Supply Chain Management System
6. FORMULATION OF BEHAVIOR TYPES

Behavior depends on the generic templates and workflow i.e. receiving and sending the message. Execute the stored application and gives necessary deriving decision using inference engine.

There are four types of workflow terminals.

6.1 Add-on terminals
For the addition of predefined function.

6.2 Execute terminals
Execute the particular reasoning terminal.

6.3 Agent Types
After the formulation of behavior type we get a new agent type in order to be used later in multiagent system development i.e.

Agent Type = Agent + Behavior

6.4 Receiving terminals
For the filtration of receiving information.

6.5 Sending terminals
For the composition and then send further.

New agent can be created by existing one which will be a template for creating agent instances during the design of a multiagent system architecture.

6.6 Data base for agent
This unit acts as a storage facility to ensure inters functionality between all system components. In this system the database stores ontologies, behavior, types of agent and the historical data to be mined. This unit can be designed by RMI.

6.7 Agent training system (ATS)
This system gathers information from the data mining procedure and then takes the decision and sends this decision into the newly created agent.

6.8 Data Mining System
This system holds the implementation of data mining algorithm executed by data mining procedures which gives a new decision model which are again enabled into agent via ATS. And also responsible for embedding specific knowledge into agents. This data mining module receives the information from the XML document and executes the suitable data mining functions designed by the application developer. These models represented in Predictive Modeling Markup Language [8] which is a data mining standard defined by DMG (Data Mining Group) [9] provides the agent platform with versatility and compatibility to other. Major data mining software are Oracle SAS SPSS and MineIT etc

7. CONCLUSIONS

Information technology based solution frameworks offer a way to more effectively integrate decision-making by enabling better knowledge sharing and facilitating more transparent economic transactions. The multi-agent system paradigm promises to be a valuable software engineering abstraction for the development of computer systems. In addition, the wide adoption of the Internet as an open environment and the increasing popularity of machine-independent programming languages, such as Java, make the widespread adoption of multi-agent technology a feasible goal.

REFERENCES


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