

# The analysis on the construction OF CSCW system and Group Collaborative Mode

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**Abstract**—With the development and popularization of intranet/Extranet and Internet, it provides vast development space for manufacturing industry. The computer support cooperative work such as collaborative design and collaborative manufacturing based on web is presented under the background. Computer Support Cooperative Work (CSCW) is defined that in the environment supported by computer technology, a groupware cooperatively work to accomplish a common task. The paper is focus on the construction of CSCW system and group collaborative work mode in CSCW. The group collaborative model of CSCW should be intensified further to abstract the features of group collaboration and direct the research on collaborative work technology.

**Keywords**-CSCW; collaborative manufacturing; group communication; Group collaborative model

## I. INTRODUCTION

With the increasing market demand for product diversity and customization, the product renewing cycle gets sooner than ever before, at the same time, the supply period of product also gets shorter. In order to adapt to the change, enterprise not only need the highly cooperation among internal department, but should enforce the coordination and cooperation between enterprises to realize the sharing of information resources, human resources and facility resources between enterprises in and across the boundary. With the development and popularization of intranet/Extranet and Internet, it provides vast development space for manufacturing industry. The computer support cooperative work such as collaborative design and collaborative manufacturing based on web is presented under the background.

Computer Support Cooperative Work (CSCW) is defined that in the environment supported by computer technology, a groupware cooperatively work to accomplish a common task[1]. The aim of CSCW is to design various application system oriented to cooperative work, including the construction of cooperative work system, research on the work style of groupware, technology related with groupware work and the development of application system.

In order to meet the demand of distributed collaborative design/manufacturing/ business, the system structure of CSCW based on internet should have the some other functional mechanisms besides the characteristics of distribution, such as collaborative mechanism, communication mechanism, data control mechanism and

cooperation mechanism. Similar to communication, cooperation is an important content of group activity. In group activity, every activity must be accomplished by cooperation. Effective cooperation needs information sharing. While in many cases, people are isolated in the present information system, especially database system. For example, when two designers use the same CAD database, they can not modify the different components of the same object simultaneously, only through inter-check can they know the cooperators' work. Many tasks need good sharing environment, under which group activity information and every user's activity will be informed at the proper time.

There are many differences in CSCW application in different application background, while their common characteristic is to provide tools for supporting cooperative work. In order to simplify and direct the development of CSCW application system, it is necessary to generalize the common features of cooperative work of various CSCW application systems. In the following part, we will discuss the demand, environment and architecture of CSCW system.

## II. THE REQUIREMENT OF CSCW SYSTEM

The aim and feature of CSCW system is to make a group accomplish common task effectively based on information technology and some related technology. There are many-facets demands for developing a CSCW system because of the diversity of cooperative activity, the distribution and interactivity of group and the multimedia information. When we design and develop a CSCW application system, the problem of demand is confronted first. The life cycle of CSCW system development is similar to the ordinary information system development, including the following five phases as figure1 shows[2]. Combined with the feature of CSCW system, the demand of CSCW system is classified into the demand of application, the demand of system and the demand of technology.

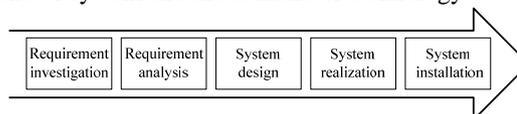


Figure 1. Life cycle of CSCW system development

### A. The requirement of application

The aim of CSCW system is to make users cooperate effectively for the application target. Different service is demanded for CSCW system because of different

application task, different partners and different working environment. The demand of application should have following features, such as cooperation ideology, information sharing, common group working mechanism, Universal and tailorable group working mechanism, real-world cooperative model, multiple selective control models, dynamic feature of application and service, collaborative mechanism, etc.

**B. The system requirement**

CSCW system is a kind of distribution system with wide application domain, which is based on computer network infrastructure and aimed at supporting group cooperation. So from the perspective of design and develop, a series of demand is presented for CSCW system.

- Openness

CSCW system should be a system with openness characteristics, able to support interconnection, interoperation and collaborative work between every entity partner. With open network architecture, it provides sharing mechanism oriented to single user application and service melted into the system to provide group cooperation support. This demand is mainly in view of network infrastructure and network communication.

- Group communication model

Considering the nature of distribution system, some kinds of group communication model is needed to support the information interchange among all the partners. Three typical group communication styles are client-server, multicast messaging and shared spaces. The three methods can be adopted in group as the figure 2 shows [3].

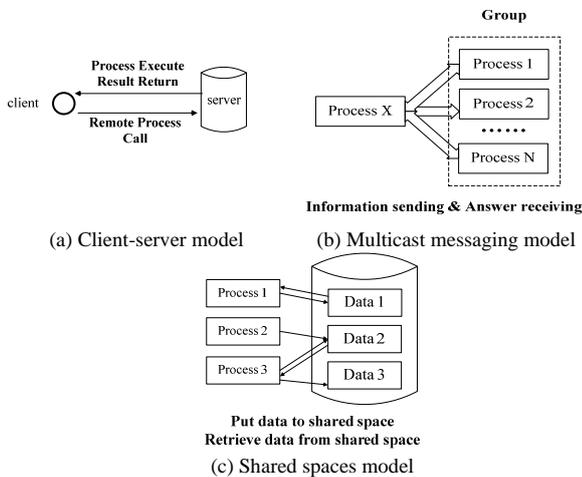


Figure 2. Group communication model

- Comprehensive supporting tool and function

CSCW is a field supported by multiple disciplines, cooperative members are from different structure and level, the cooperative model can be various, task has phasic characteristic. CSCW system should be able to provide comprehensive supporting tool and function to tolerate all kinds of application programs, to support cooperative model in every stage, to realize effective, seamless and consistent

support for multiple users, multiple tasks and multiple resources.

- Extensibility and re-configurability of system, reuse and inheritance of software

To develop a universal and comprehensive CSCW system is not necessary or possible. While based on comprehensive supporting tool and function, the Extensibility and re-configurability of system and the reuse and inheritance of software are necessary. Therefore adopting object-oriented method is a strategy of CSCW system development.

- safety demand

On the basis of network safety facility, CSCW system safety mechanism especially emphasizes member identity verification, access control and data encryption and decryption.

**C. The technology requirement**

In order to meet the application and system requirement of CSCW system, technology assurance is naturally necessary, including Information technology, fundamental tools, multimedia technology, distribution database, human computer interaction (HCI) and human interaction (HHI), safety technology[4].

**III. THE GROUP COLLABORATIVE MODEL OF CSCW**

The research on the group collaborative model of CSCW should be intensified further to abstract the features of group collaboration and direct the research on collaborative work technology. In the following part, group collaborative modes in CSCW field will be discussed and analyzed, such as conversation model, meeting model, process model, activity model.

**A. Conversation model**

Conversation model is the basic collaborative work mode in CSCW system, which regards the collaboration between two people is the basic element of every kind of collaborative activities. Therefore we can divide the complex collaborative activities into a series of inter-conversation between two persons to realize the group collaboration. The collaboration between two persons is accomplished through executing specific language, action.

A classical description about the execution of specific language and action in conversation model is speech-act theory presented by Searle, which involves five elementary illocutionary points to describe language and action, i.e., assertive, directive, commissive, declaration and expressive.

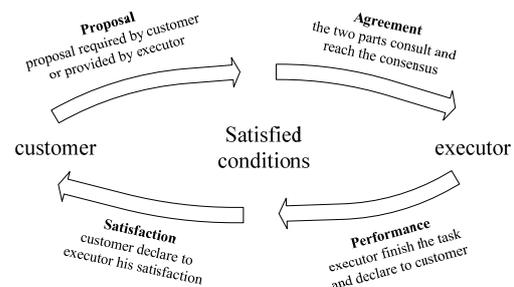


Figure 3. Activity workflow loop

The conversation model constructs workflow management system by using communication activities based on language and action, abstracting an activity workflow loop from the collaborative activities between two persons as the following Figure. 3 shows.

The identity of two collaborators is defined as customer and performer. The activity work loop is composed of four phases that are proposal phase (proposal required by customer or provided by executor), agreement phase (in the phase, the two parts consult and reach the consensus), performance phase (executor finish the task and declare to customer), satisfaction phase (customer declare to executor his satisfaction). All kinds of collaborative work are all composed of some basic activity work loops. Action workflow is a collaborative work system based on this model, which is used to construct business process workflow, Candidate review process Workflow, etc. E-mail system as a basic tool for realizing the collaborative work system of conversation model has been adopted widely.

*B. Meeting model*

Meeting model is a basic method of collaborative work oriented to multi-person group. The participants gather together, discussing the same task, changing information, consulting with one another and making decision. Figure. 3 provides some concepts of meeting model. Every party in collaboration shares work space or information space to conduct collaborative activities. The CSCW environment based on this model includes computer meeting system, electronic bulletin, sharing application system.

The most typical example is the computer meeting system, which may be text meeting system, multi-user hypertext system, face-to-face meeting room system, real-time synchronous meeting system and multimedia desktop meeting system, just as table 1 shows.

TABLE I. THE TYPES OF COMPUTER MEETING SYSTEM

Information type	interactive style	
	asynchrony	synchrony
Text	Text meeting system	meeting room system
	Multi-user hypertext system	real-time meeting system
multimedia		Multimedia desktop meeting system

*C. Process model*

Process model is based on the concept that any complex task or operation can be decomposed into a series of serial or parallel sub-tasks with the interrelated and interdependent features to form a workflow.

Because process model strictly stipulates the task, operation and action of every party, this kind of collaboration is predetermined and highly-structured collaboration, short of flexibility. CSCW system designed by this process model is suitable for the units with relatively fixed work flow, such as the CSCW environment in computer integrated manufacturing system, OA system in enterprises and EDI, etc.

*D. Activity model*

Just as the aforementioned, process model is predetermined and highly-structured collaboration, short of flexibility. Many actual collaborative tasks generally can not determine the detailed execution process; every participant has certain independence, the whole collaborative process may not be structured. Activity model can describe the group collaboration with universality. It is similar to process model, while it does not describe a collaborative task as a collaborative process composed of many operation steps, but breaks it down to many activity sub-task with definite object based on activity theory, then define the relationship among tasks and accomplish collaborative tasks through executing activity.

Activity theory regards the activity that human take part in is the elementary unit of human life and the development of things, which has the following characteristics:

- 1) An activity has an object, activity can be different according to the object, and the object changing to another state is the motive that causes activity.
- 2) An activity has an active subject, which grasp the motive of the activity. Activity can be individual or collective, while there is no need for every participant to know the motive of activity.
- 3) An activity is a collective phenomenon, which exists in a specific environment and can change the environment.
- 4) The motivation of activity development is the contradiction.
- 5) An activity is realized through the conscious and purposeful action of participants

So, we can divide a task into many activities composed of active subject and object with certain aims. The members of task group execute the activities step by step according to some rules and finish the task collaboratively.

IV. SUMMARIES

Based on the requirements of CSCW system, the architecture, environment, platform and tools that the CSCW system needs is determined. By establishing collaborative working environment, CSCW system can change the style of information communication; eliminate the barriers in time and space; improve the working quality and efficiency. Therefore the integral benefit of enterprises is improved[5].

The above models are to abstract group collaboration from different aspects: conversation model defines the collaborative relationship between two persons; meeting model describes the interactive collaboration method among many persons; process model and activity model depict the collaborative process of every participant. Every model has

its advantage and suitable environment. While in real world, different levels and styles of collaboration is needed to finish a task, single collaborative model can not meet the demand for describing collaborative style and process. Therefore, to some specific tasks, we make many model mixed to describe from different levels.

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