

## Discussion on the application of collaborative design technology and application of enterprise in main engineering of oil field

Peng Jiang, Yundong Ma, Yuanhang Huang

Northeast Petroleum University, Daqing Heilongjiang 163318, China

### Abstract

Oil-gas field surface engineering is a system with dense fund and technique. A design task needs to be completed by designers who in different locations and different specialty. The important role of collaborative design technology in oil-gas field surface engineering is evident. This paper is based on the operation mode of Oil-gas field surface engineering, is combined with the collaborative design features, and proposes a simple versatility of Oil-gas field surface engineering CSCD System Structure Design and the management process, in order to use for the actual design work, and improve work efficiency.

### Keywords

collaborative design, Oil-gas field surface engineering, System Structure Design

### 1. Introduction

In information-based society, the working feature of people is groupmate, interaction, distribution and interoperability. The development of Computer supported cooperative work (CSCW) exactly adapt to the mentioned people's work feature in information-based society. Therefore, CSCW, considered as a technology will be widely used in the future, is a new nomenclature which was raised by American MIT's Irene Grief and DEC's Paul Cashman in a workshop on 1984. The aim of CSCW is to build a cooperative work platform supported by multimedia and communication technology ,which is a typical example used by collaborative design.

### 2. Basic knowledge

#### 2.1 The conception of collaborative design

Collaborate design is a design which has two or more design subjects to accomplish a design goal in different design tasks. Such as information exchange and mutual cooperation mechanism,

From the perspective of product design, the product collaborative development based on Internet is a integrated process of receiving user needs, organizing multiple collaborative product development team, using domain knowledge collaborative decision and output data.

Basic enabling technologies to support collaborative design include: product data sharing, data mutual operation across heterogeneous platforms,dynamic allocation of information resources and coordination and optimization technology of multi user decision.

#### 2.2 The feature of collaborative design

Collaborative design is a method to achieve a satisfactory outcome which require each member assumes the corresponding part of the design task and works interactively around a design project with the support of the computer.

##### (1)Distribution

The people who participate in Collaborative Design may belong to the different enterprises. Even in the same enterprise, different departments means different locations. So collaborative design must be supported by the computer network, which is the basic characteristic of collaborative design.

##### (2)Interaction

There always have interaction among people in collaborative design .It can happened at the same time. Such as collaborative modeling and tagging. Or at different time. Such as document design change process. Developers need to use a different way of interaction to satisfy different demands.

### (3) Dynamic

There always have changes in the whole process of collaborative design. Such as product development speed, the task arrangement for the staff, equipment status, etc... In order to make collaborative design can be carried out smoothly, the product developers need to obtain the dynamic information conveniently.

### (4) Cooperation and confliction

In some cases, the relationship between the design tasks is incompatible. In order to ensure the design process and the results are consistent, the sub task must be carried out in close collaboration. In addition, the process of cooperation is the process of group participation. Different people have different opinions. Therefore, the confliction in the process of cooperation is inevitable. So there must have conflict resolutions.

### (5) The diversity of activities

The activities of collaborative design are varied. In addition to the plans and details of the program designing, product modeling, parts processing, numerical control programming. There also have project management, task planning, confliction resolution and other activities, which are used to make the design go well. Collaborative design is the organic whole of these activities.

In addition to the above features, the collaborative design also has other characteristics, such as heterogeneity of computer software and hardware used by product developers, the complexity of product data and other characteristics and etc. The analysis of the collaborative design's characteristics can help to provide a reference for establishing a reasonable structure of the collaborative design environment.

## 2.3 Work style of collaborative design

According to the space position and response mode of the two sides, the working style of the collaborative design can be divided into four categories:

Face to face interaction. It means the cooperative members work at the same time, and in the same place, which usually can be carried out in the form of a meeting,

Asynchronous interaction. It means the cooperative members work in the same place at different time which can be realized by sharing database

Asynchronous distributed interaction: It refers to that the cooperative members work in different time and place in the support of internet, which can be realized through file management, E-mail, distributed database and so on;

Synchronous distributed interaction. It means the cooperative members work at the same time but in different sites which is difficult to achieve.

## 2.4 Architecture of collaborative design

The structure of collaborative design can be divided as follows.

(1) centralized---A central control system structure with a real or virtual central control system, as well a information and knowledge exchange system;

(2) Distribution---A non-central control system structure. Each expert (or subject) that participating in the design is equally important. Besides, each design subject in which data and knowledge exist can contact directly. Without public central data and knowledge base, data and knowledge can also be concentrated in a particular working area, which is conducive to the data exchange between different design subjects;

(3) The federal system---A combination of two structure listed above. It has a distributed architecture formed by several design experts, and each experts of the design experts use the centralized design,

completing the design of data exchange and communication through the control of the main design experts.

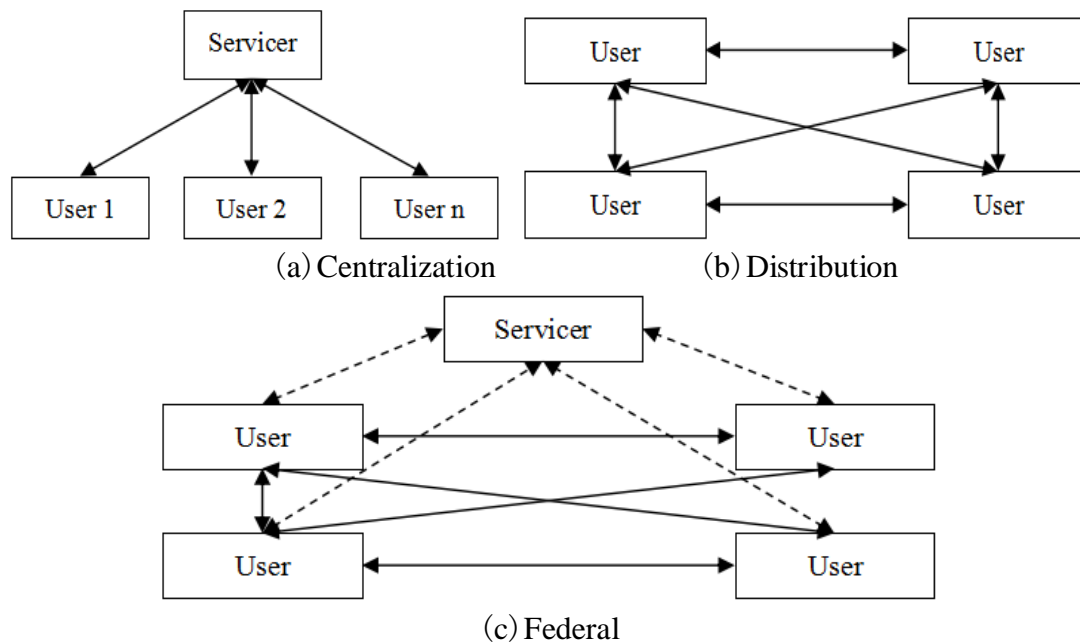


Figure 1 System structure diagram of Collaborative design

### 3. The application of CSD on the Oilfield Engineering

The design of the Oilfield Engineering needs to mechanical equipment, automatic control instrumentation, oily water treatment, water supply and drainage, fire protection, electric power, communication, engineering geological and surveying, civil engineering, road, thermal insulation, heating, and environmental protection and economic and other professional engineering work together. Like the design of oilfield subject engineering has the characteristics of collaborative work, under the computer and network condition, the territory which is involved in information sharing and group cooperative work can apply CSCW. Through collaborative design makes the whole work's efficiency to meet the overall needs of the design process.

#### 3.1 The determination of work methods and system structure

Through explaining the basic concepts of collaborative design, combined with the analysis of the Oilfield subjective Engineering design process. We can make sure that the Oilfield subjective Engineering design is asynchronous distributed interactive work style, federated architecture of collaborative design system. Certainly, if the whole design process is in the Scope of local area network, the person who participate in the work is not so many. It's reasonable to adopt the centralized architecture. And to ensure the integrity of the design system, we are supposed to support whether is synchronous or asynchronous to work style.

#### 3.2 The demand of the CSCD System

The CSD System in the Oilfield subjective Engineering is based on computer network facilities, support the distributed system which is aimed to group cooperative. So it should have the openness of the system, can support collaboration entity interconnection of all parties concerned, operation, cooperative work; Resource sharing and real-time interactive, generally require some type of group communication model to support exchange of information between the collaborative parties; It also should have scalability and reconstruction, software reuse and inheritance; Security mechanism is also indispensable at the same time, on the basis of network security facilities, specially emphasis the authentication of people who join in the design, access control and the requirement of data encryption and decryption.

### 3.3 The system structure design of CSCD in the Oilfield Subjective Engineering

In the Oilfield Subjective Engineering design system, CSCD is a design platform, every field designers through the Internet or Intranet access collaborative design system, the user can log in on the platform by sharing whiteboard or multimedia communication medium for communication with other related designer. At the same time, it also can call the query and modify the design data or graphic design in the system database, also can access the standard database or knowledge base to find related to the design of the relevant standards and specific example. Then according to this idea can design a good collaborative environment engineering design platform, the system of concrete structure as shown in the figure below:

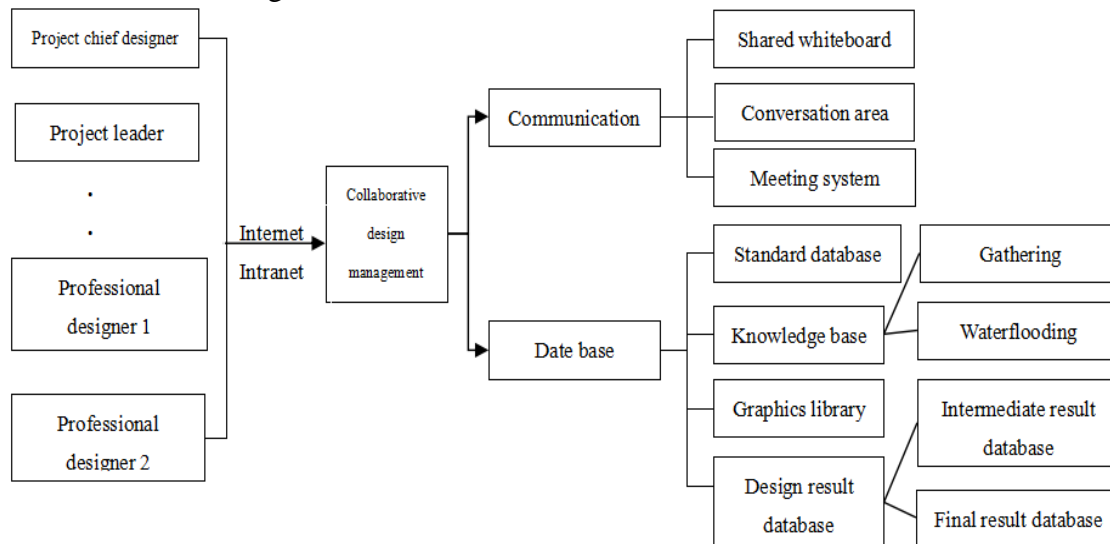


Figure 2 Structure diagram of System specific composition

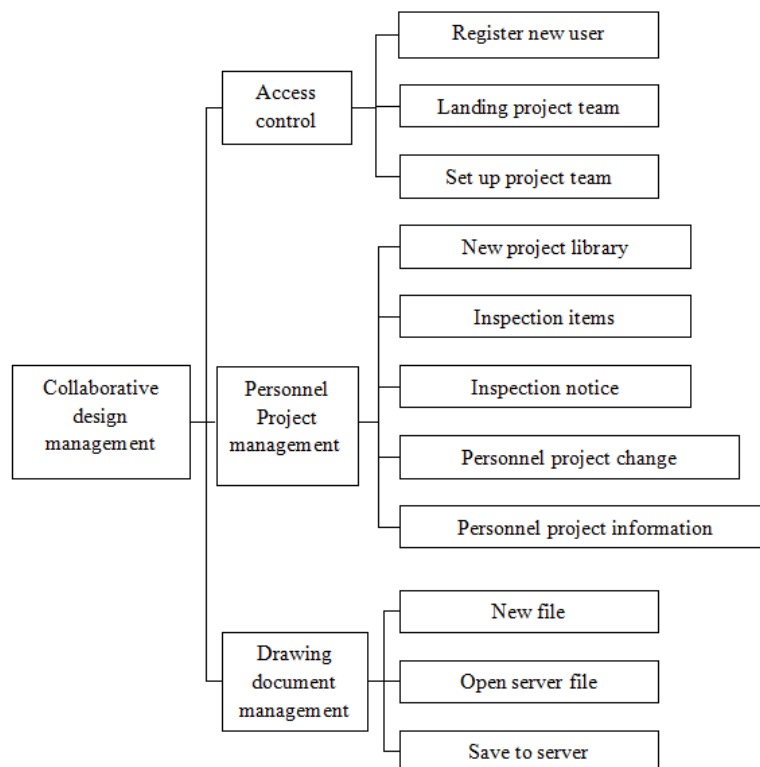


Figure 3 Management module

The CSCD system in The Oilfield Subjective Engineering adopts the resource sharing type design approach. Its design sharing resource stores essential data, graphics, etc. in the design process, it

includes database, graphics library, engineering knowledge, case database and so on. The whole system needs the support of shared resources. Database stores the whole graphics and documents of the current work, including the intermediate results database and the final results database. Unfinished drawings and documents should be saved to the server's intermediate results database regularly, for preventing the project leader's inspection. Find errors then correct it on time. After reviewing, all the correct drawings and documents should be saved to the server's final results database, it's convenient for other designers to refer. The common drawings and graphics in the Oilfield Ground Engineering are stored in the graphics library, for providing resources to designers. The Engineering Knowledge Base preserves every major's design specifications and standards in the Oilfield Ground Engineering, and provides calculative functions to certain design size. Instance library storage, which applies all the project team of collaborative design system to complete all the drawings and documents. When a project is completed, the project all drawings and documents should be saved to the final graphics library.

From the chart, we can see collaborative design management is the soul of the system, it manages, schedules, coordinates and organizes to design process of the system, It has the access control, project management and drawing document management functions. Management module diagram as shown below:

In the module of collaborative design management, access control is used to control the user to enter each subsystem and gives permission after entering the system. For example, after entering the multi-user workspace, whether has the relevant data query and modify the permissions, whether has organization of multimedia conference, etc. Including registering a new user, logging in the project team and creating a project team module; The part of project management personnel is used to task division, such as building up a project, task decomposition, task decomposition and progress monitoring, including new project, check items, check notice, changes of personnel, and personnel management information; The part of drawing file management is used to save drawings and documents, it's convenient to query, modify and ensure the correctness of the documents, mainly including version management, query, view, mark and design drawing review, version management is the core of the drawing document management, it includes construction and maintenance of version information, Version of the operating, the security maintenance, the consistency of the maintenance, monitoring and solving version conflicts, it's consist of mewing files, opening the server files and saving to the server, etc.

## References

- [1]LI Jian, ZHANG Hongliang, WANG Jibin, XIONG Guangleng.Research on the method of collaborative design based on Network [J]. Journal of Tsinghua university (Science and Technology), 2000, 40(9):93-96.
- [2]Zhang Cheng Wang Yunli Xiao Tianyuan.Research on distributed real time collaborative design environment [J]. Computer Engineering and Applications, N01.2002.
- [3]Wei xiaoming.Research summary of collaborative design technology [J]. Forestry Machinery & Woodworking Equipment,2002, 12 (30) :4-6.