

# The Application of Distributed Database on the Ship Parallel Collaborative Design Platform

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**Abstract**—This paper analyses the advantages of distributed database on the ship parallel collaborative design platform, advances the theory of ship parallel collaborative design database, describes the application of distributed database on the parallel collaborative design.

**Keywords**- parallel collaborative design; distributed database; ship design;

## I. INTRODUCTION

Since the 21st century, with the development of the computer technology, computer control technology has spread from network to the digital platform. Until now, digital shipbuilding has been into the practical stage. Collaborative design with the help of collaboration, aiming to design more satisfactory products, cut down the development cost, shorten the development cycle, improve the competitive power of the enterprises<sup>[1]</sup>. Traditional collaborative design is limited by the geographical restrictions, it's not convenient for the designers to communicate when they are in the different places. The widespread of network, improves the exchange and transmit of information, and it will also improve the user interface and the collaborative design products.

## II. ABOUT THE DISTRIBUTED DATABASE

### 2.1 The concept of the distributed database

Distributed database is combined with several workstations, these workstations also named node, they are bound in the communication network, each node has its free-running database system, they own their database, CPU, terminal and local distributed database by themselves. So logically, distributed database can be seen as a combined series of concentrated database systems, but physically, they are distributed<sup>[2]</sup>.

### 2.2 The features of the distributed database

(1) It is not the Emphasis on the concept of centralized control in a distributed database system, there is a globe DBA as the basis for the different hierarchical control structure, but each local DBA has his high degree of autonomy.

(2) The concept of data independence in a distributed database system is also important, however, adds a new concept--distributed transparency. So-called distributed transparency is when programming, it seems not to be distributed, therefore, the data transfer will not affect the program's correctness. However, the speed of execution of the program will be reduced.

(3) Unlike centralized database system, data redundancy is seen as the required characteristics. Firstly, if we want to copy data on the required node, it can improve the local practicability. Secondly, when some nodes break down, we can operate the copied data of the other nodes. Therefore, it can improve the effectiveness.

## III. SHIP PARALLEL COLLABORATIVE DESIGN DATABASE SUPERIORITY

The application of ship parallel collaborative design system processing data reflects in the following aspects superiority.

### 3.1 The organic combination of autonomy and collaboration

Distributed database is with autonomous characteristics, so it can meet the requirements of the ship parallel collaborative design system. It allows each node to implement local control, and lean less on some remote process center<sup>[3]</sup>. At the same time, distributed database system implements the flexible flow and the unified management of information among the nodes and of the information, so in a high level of the whole project, it can implement the collaborative management better.

### 3.2 Reliability

Reliability is also a major feature of the distributed database system, single node failure will not invalidate the entire system, ship parallel collaborative design system involves many studios, there's a high probability of failure of a sub-unit system. The use of distributed database technology allows system with flexible information, It can maintain the normal operation of the rest of the system. In addition, the distributed database can be in a plurality of different places, stale data is redundantly stored data to restore failure data.

### 3.3 Flexibility

With the continuous implementation of the project schedule among the ship parallel collaborative design system, there will be some units who finish their work and want to quit the project, and also some units who come into the project at the beginning, so the system should have the favorable ability of modularity and the ability to increase or decrease<sup>[4]</sup>. DDBS integrated some smaller database into a more complete database system, it has good modularity and also the flexible system structure, easy to increase or reduce the number of sites and processing power, and this increase affect less on the rest of the system.

#### IV. THE APPLICATION OF DISTRIBUTED DATABASE ON THE SHIP PARALLEL COLLABORATIVE DESIGN PLATFORM

This paper studies the design of the unit to a medium-sized( Institute of Ship Design Technology), with the study of the institute, we achieve our study. The institute consists of overall design studio, turbine design studio, electrical design studio, as it shows in Fig.1.



Fig1. the constitution the Institute of Ship Design Technology

Each studio is consist composed by a number of design groups, for example, the hull design studio consists the overall design group, structure group and outfitting group, and each group consists of several designers, as shown tin Fig.2.



Fig2. the design groups in the Institute of Ship Design Technology

As far as some project, there can be one chief architect, and under him, there can be vice chief architect, and there are also a number of professional design group, named leader and some crow. We can set different roles depending on the nature of the design documents for each member.

##### 4.1 Data segmentation and redundant problems

To be considered in the design of a distributed database system, database is divided into the parts which assigned to different places, so that each part of the tuple get what they want, and it can greatly reduce the communication time between communication and system response<sup>[5]</sup>. This related to the availability of the system, efficiency and query processing. At the same time, redundant design should be carried out in the allocation of these data, the use of high frequency data should exist in its use of the respective partial redundancy. This relates to the query processing, concurrency control and also relates to the reliability of the system. Take the ship parallel collaborative design system as example, extracting the part of the data to illustrate, as specified in Table 1.

Name	Unit Type	The number of units	Whether to begin	Whether to end
overalldesign studio	studio	15	1	0
Structural group	group	7	0	0
Outfitting designers	designer	3	0	1
Structural	design	5	0	1

designers	er			
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Table1. Basic information of the design description table

Note: 1stand for yes,0 stand for no

The first step: Horizontal division, relationship is divided into several logical condition defined subset, the horizon split information of the above table is as following:

Unit-1 = basic information of the unit {unit type=studio}

Unit-2 = basic information of the unit {unit type =group}

Unit-3 = basic information of the unit {unit type = Outfitting designers }

Step 2: vertical split. The respective horizontal sub-set is divided into a number of the subset defined by the projection, then the horizontal split data unit-3 is vertical split:

Unit-3.1 = Unit-3{Name, The number of units }

Unit-3.2 = Unit-3{Name, Whether to begin }

Unit-3.3= Unit-3{Name, Whether to end}

Based on the actual needs of the results of the vertical split, we can also split horizontally, as unit-3.1, horizon split as following:

Unit-3.1-1 = Unit-3.1{ Name= Outfitting designers }

Unit-3.1-1 = Unit-3.1{ Name = Structural designers }

According to the actual situation, when the data is horizontally and vertically split, it forms a logical fragmentation, it is the distribution of the data unit, according to the demand and use of the various units of data ,the data fragments can be stored in one or several places. Frequently used fragments should have redundant, distribute the fragments into these nodes to improve the efficiency of the data processing. As Unit-3.1-1 is not only to be distributed in the local database of outfitting designers should also be distributed to the overall design studio database

##### 4.2 The structure design of the parallel collaborative database

Parallel collaborative design system to achieve the functions of combining Institute, studio, designer, networked business process, standardization, and shorten the business approval cycle, in the structural design, it can meet the above the functions<sup>[6]</sup>. Data distribution is reasonable, necessary data should distribute to the junction, local users who don't have the permission couldn't process the data. At the same time, The structural design should be able to achieve the best combination of data processing efficiency, data security, system reliability. The system architecture design is shown in Figure 3.

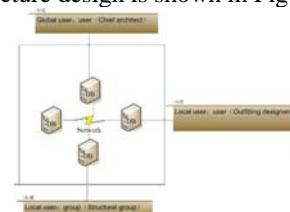


Figure 3. Distributed database structure

## V. CONCLUSIONS

Parallel collaborative design research is the concerned field of ship and computer, modern ship design is not just a process of design calculations, graphics processing, and gradually developed into a web-based technology to support parallel collaborative design process, and also the remote collaborative, multi-disciplinary design process. The process to achieve the purpose of shortening the design cycle to improve design efficiency, This paper analyzes the advantages of the distributed database on the ship parallel collaborative design, proposes the concept of the ship parallel collaborative design distributed database, describes the application of distributed database on the parallel collaborative design project. However, the ship design process itself is complicated, Considering these functions mentioned in this article from the practical point of view is to be further improved.

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