

Research on Optimization of Civil Aviation Meteorological Database System Based on Virtualized Cloud Platform

Ying Xia, Chenming Yu*

East China Regional Air Traffic Management Bureau. CAAC, Shanghai 200335, China

*Corresponding Author email: yeagi5353@gmail.com

Keywords: Meteorological data; Civil aviation; Management optimization

Abstract: The logical structure of civil aviation meteorological database application system needs to adopt three layers of internal mode, external mode to ensure the reliability of the system installation, concentrate on the study of atmospheric weather conditions and changing laws and weather forecasting. Maintenance of the meteorological information system has also developed from a single system to a multi-system, from mainframe to small cluster, redundant backup. With the increase of flights and the increase of system complexity, the maintenance requirements of information systems are also increasing. The most important system is the civil aviation meteorological database system. In this paper, the civil aviation meteorological database management subsystem was built to complete the rapid maintenance of the civil aviation meteorological database system, and the maintenance characteristics of the civil aviation meteorological database were comprehensively analyzed. Through the research and implementation of the civil aviation weather database management software, the various data in the database and the database itself have been effectively managed and optimized. The application aspect of the user has also been given certain considerations, making the database manager more efficient.

1. Introduction

Meteorology regards the atmosphere as the object of study and explains the atmospheric characteristics qualitatively and quantitatively. Concentrate on the study of atmospheric weather conditions and changing laws and weather forecasting. For civil aviation meteorological database application system, it must have high sharing, distributed invocation and security and reliability performance [1]. Its functions include real-time collection, processing, storage and distribution of various types of civil aviation meteorological data. In addition, it is necessary to establish a unified data model and user interface database so as to effectively organize and manage global real-time data [2]. In the maintenance department of civil aviation meteorological information system, the maintenance of meteorological information system has also developed from a single system to a multi-system. From host to cluster and redundant backup. Civil Aviation Meteorological Database System is the key project of civil aviation meteorology during the Eighth Five-Year Plan period. It has the largest investment in civil aviation meteorology, the widest distribution and the most complex business construction in the history of civil aviation meteorology [3]. The use of this new business system has basically changed the original operation mode of China's civil aviation meteorological business, so that most manual labor is completely realized by computers, which frees business technicians from complicated manual labor.

A complete meteorological business system must be a comprehensive, capable of handling these vast amounts of data, a wide variety of meteorological data with complex message formats. At the same time, it must meet the requirements of high effectiveness, high volume and high traffic usage. The purpose of developing the civil aviation meteorological database management subsystem is to provide maintenance personnel with a concise and reliable graphical operation interface [4]. The maintenance of most civil aviation meteorological database systems can be completed through simple training, thus improving the operational quality of the civil aviation weather database and ensuring

flight safety. The civil aviation weather database application system is designed and developed under the same basic requirements as other meteorological systems. Its goal is to be able to scientifically and efficiently complete the organization and storage of meteorological element data and the acquisition and maintenance of data [5]. At the same time, it can manage all kinds of relevant data and provide convenient and fast data services for users of the system. With the increase of flights and the increase of system complexity, the maintenance requirements of information systems are also increasing. The most important system is the civil aviation meteorological database system.

2. Materials and Methods

Since the civil aviation meteorological database application system is a substitute for the civil aviation meteorological database and fax broadcasting application system. Then it not only needs to fully realize the mature functions of the latter, but also completes the improvement and supplement of the original business system functions. According to the user's needs, call all kinds of records to the user at any time. When the local database is down, the data of the remote database will be used by the user. The expired data in the database will be deleted. But meteorologists are likely to need access to data that has been deleted from the database when doing relevant research. A remote query is actually a query to another database in the same format besides the default database of the system. For system maintenance personnel, the database application system mainly provides daily management and maintenance and data monitoring functions [6]. This can be a full backup of the local database or a database of other users who use the system. The civil aviation weather database application system will be the operational platform for future civil aviation meteorological services. Its role is to collect, process, store and distribute all types of civil aviation meteorological and meteorological products in real time. And seamlessly connect between the various subsystems of the entire business system.

The connection between the storage disk array and the host is shown in Figure 1. Two P650 servers are connected to two fiber switches, and the fiber switches are connected to two controllers connected to the DS 5020.

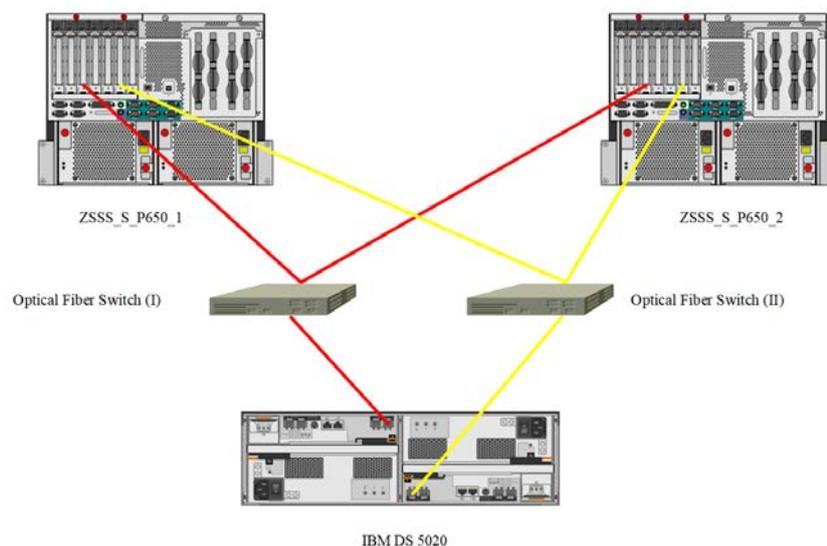


Figure 1 Connection between the disk array and the host

The logical structure of the application system of civil aviation meteorological database needs to adopt three-layer structure of internal mode, mode and external mode to ensure reliable installation of the system. The library structure of the civil aviation weather database needs to be divided into real-time library, historical library and inversion library from time. To ensure different applications of meteorological data by different aeronautical meteorological users [7]. The civil aviation weather database application system needs to have a security management function, the purpose of which is to prevent data leakage, alteration and other damage caused by illegal use of the database. To ensure that the system is working properly. Due to the large amount of data and the complexity of meteorological

data, database browsing has emerged in order to find the information that needs to be viewed as quickly as possible and to increase the rate of manual queries. For special information belonging to civil aviation, the civil aviation department shall provide relevant quality control rules. The database browsing function can browse the table structure and table records of the tables built by the system and other users, and make custom queries. The quality control of civil aviation specific information is carried out by the quality control rules provided by civil aviation. The application system of civil aviation meteorological database needs friendly graphical management interface so as to provide convenience for users to use database data and manage and maintain the operation of database. Hacmp configuration conditions are shown in Table 1.

Table 1 Hacmp configuration

Project	Master server	Backup server
HA software	HACMP 5.4	
Operation mode	Hot standby	
Volume group	mqvg	mqvg
Resource group	mqdata	
Application Server Name	mqser	
/etc/hosts	127.0.0.1	loopback localhost
	172.23.2.1	ZSSS_S_P650_1
	172.23.2.3	ZSSS_S_P650_2
	172.23.2.2	ZSSS_S_P650_1_vip
	172.23.2.4	ZSSS_S_P650_2_vip
	10.0.0.1	ZSSS_S_P650_1_priv
	10.0.0.2	ZSSS_S_P650_2_priv

The message data processing interface program reads a file from the communication subsystem and the database subsystem interface directory. After opening the file, a bulletin is separated by discriminating the identifier of the bulletin. The civil aviation message automatic processing program and the civil aviation message manual start processing program respectively use the automatic and manual input parameters to search the database sub-system and the communication sub-system civil aviation message interface directory [8]. From the storage directory of the log file, read the log file to view the implementation status of the data warehousing and database archiving and clearing functions [9]. By calling database query language to calculate the total amount of database data, the total amount calculated is provided to the monitoring system. Important meteorological information reporting and processing procedures carry out format detection and decoding according to the code format provided by civil aviation. The database connection function mainly sets different database connections for the management objects of the management subsystem. After setting and saving the connections in the program, the program will connect the database by default. Ground report processing procedures deal with ground report and ship report. Ground reports are converted into integer formats and placed in arrays, and some message format errors are processed according to processing rules.

3. Result Analysis and Discussion

The database management subsystem adopts client or server mode. It can monitor and manage data processing and database in real time. Forecasting platform and service platform are presented to users in different forms by acquiring meteorological data in the database. The scale of database is closely related to hardware. The larger the scale, the higher the requirement of hardware. Perfect and optimize the functions under the condition of realizing the functions of the existing business system. Therefore, it needs to be developed with the support of commercial database system to ensure the reliability of transmission and the scalability of the system. At the same time, it is necessary to ensure

that all databases in the same center can get the same data. The migration and removal of the data file is divided into two parts. The migration of the archive file refers to the migration of the compressed archive file saved on the machine where the database management subsystem client is installed to the server. The migration of an archive means that the server's compressed archive is migrated out to the machine where the database management subsystem client is installed.

The disk array has a total of 16 600GB FC hard drives. In this implementation, the two hard disks corresponding to the 15th and 16th slots on the disk array are selected as the hot spare disks of the disk array, and the remaining 14 hard disks are used as the RAID 10 disk redundant array. The available disk space capacity after implementation is approximately 4TB. The specific allocation is shown in Table 2.

Table 2 IBM DS5020 storage system logical disk division details

Disk type	Disk number	Capacity	Logical disk name	Logic Disk Capacity	Partition mapping	Controller	Application type
RAID10	14	7*600GB=4.2TB	oradb1	500GB	ZSSS_S_P650_1 ZSSS_S_P650_2	A	Data base
			oradb2	500GB		B	Data base
			oradb3	500GB		A	Data base
			oradb4	500GB		B	Data base
			oradb5	500GB		A	Data base
			oradb6	571GB		B	Data base
			mq	600GB		B	Mq
			ocr	1G		A	Data base
			votedisk	1G	A	Data base	
Hot spare	2						
Total	16	Available capacity4T					

The operator platform completes daily business operations under the WINDOWS system through the client terminal of the civil aviation weather database application system. After the quality of the modified message is checked, it will be re-stocked. Note that the modified message will be checked again after the modified file is added. If it is qualified, it will be stored in the corresponding meteorological data table in the application library, otherwise it will be stored in the wrong report again. The data dictionary is stored in the directory dictionary directory, and the database is created by the application to read the data dictionary table in the database. Such as controlling the dictionary table, clear the dictionary table and the station number dictionary table [10]. Due to the huge amount of meteorological data, in order to speed up the screening rate of data in the database, manual data clearance can be completed at any time in order to organize and maintain the data in each database. It can transfer the expired data from the application library to the History Library and clear the expired data from the history library.

There are two ways to install the server: using graphical interface to install. And the installation method using command line mode. Both of these methods can complete the installation of the server. Users only need to choose one of them. We recommend that users use graphical installation method, which is more convenient and fast, but also provide command line installation method. Introduce the command line installation to the user. Due to the huge amount of meteorological data, in order to speed up the screening rate of data in the database, manual data clearance can be completed at any time in order to organize and maintain the data in each database. It can transfer the expired data from the application library to the History Library and clear the expired data from the history library.

There are two ways to install the server: using graphical interface to install. And the installation method using command line mode. Both of these methods can complete the installation of the server. Users only need to choose one of them. We recommend that users use graphical installation method, which is more convenient and fast, but also provide command line installation method. Introduce the

command line installation to the user.

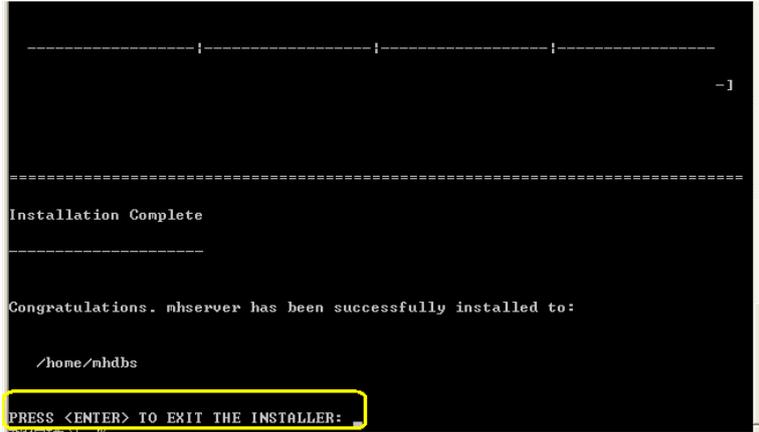


Figure 2 Open telnet

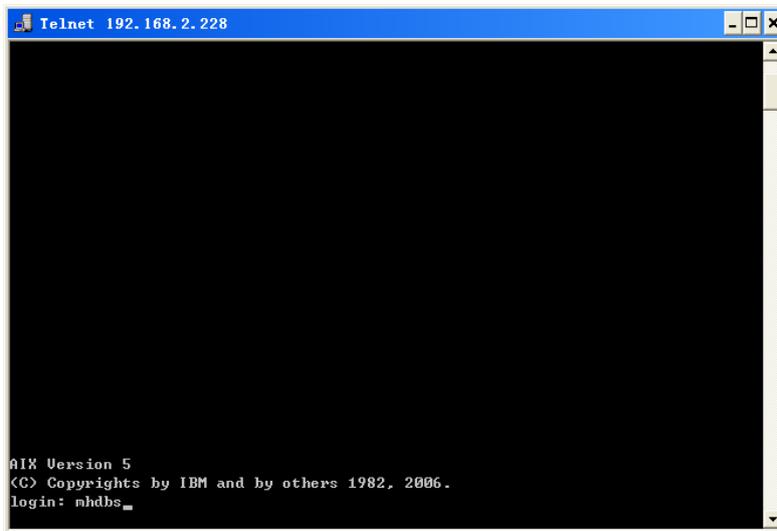


Figure 3 Re-login mhdbs

Make sure that the oracle database is installed on your AIX system before installation, and you have added an AIX user with the username oracle. Install the two files Install.bin and Install.sh, please confirm that you already have these 2 installation files, the icon is shown in Figure 4.

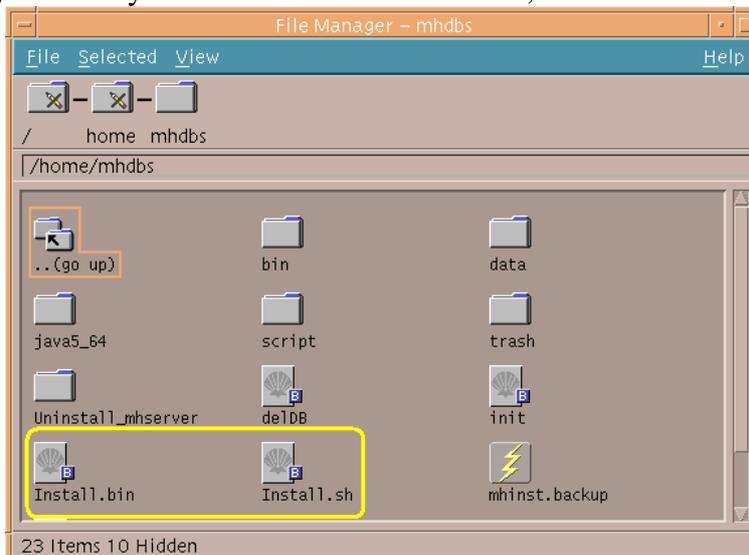


Figure 4 Installation file

The configuration file modification function is mainly to quickly modify the inbound

configuration file of the civil aviation weather database system to conform to the system operation specifications. The system can directly read the temperature and humidity values of each sensor through the network to achieve the purpose of remote monitoring of the equipment room. The quality control program performs extreme value detection, standard isobaric inspection and internal consistency detection on the input feature values, and then obtains a factor value plus factor credibility value report, and then transfers the report element data into the data storage process. program. The graphic image and grid data processing program is for satellite, local graphics, fax maps, radar, grid points, binary common formats and other data. The program stores the data before decoding and the data after decoding, and writes detailed processing information to the log file, then moves the processed files into the garbage directory for backup. Read out the storage period from the configuration library, transfer the data beyond the storage period from the application library to the history library, and delete all kinds of expired data in the history library. If any step fails, an error message is returned and the data archive is completed. Otherwise, the successful prompt will be returned and the result of manual archiving will be displayed. Describe the documents and information filed at that time. This includes the category, time and size of the archive.

4. Conclusions

The application system of civil aviation meteorological database provides a unified business platform for the operation of meteorological centers in seven regions of China, which is the link of business links. Civil aviation meteorological database application system is established by commercial database management system, so that its logical structure can realize three layers of internal mode, mode and external mode. The internal model for data storage can store a large number of global real-time meteorological data and Aeronautical Meteorological messages, provide a medium for historical, real-time and inversion libraries, and provide support for data collection and future statistical research. External model solves the problem of data use that meteorological users are most concerned about, and ensures the simplicity and humanization of data query, message release and other functions. The three layers are progressive, ensuring the normal operation of the system, while ensuring the stability, security and portability of the system. When a problem occurs in a certain layer, it is only necessary to maintain this level and reduce the work. the amount. For database administrators, in order to provide better services on all aspects of the database, it is crucial to effectively manage and organize the database. The application aspect of the user is also given certain considerations, which can meet the special requirements of the user part, and make the database management personnel work more efficiently.

References

- [1] Frech M, Zinner T. Concept of Wake Vortex Behavior Classes [J]. *Journal of Aircraft*, 2004, 41(3):564-570.
- [2] Fernández-González Sergio, Sánchez José Luis, Gascón Estíbaliz, et al. Weather Features Associated with Aircraft Icing Conditions: A Case Study[J]. *The Scientific World Journal*, 2014, 2014:1-18.
- [3] Stone L D, Keller C M, Kratzke T M, et al. Search for the Wreckage of Air France Flight AF 447[J]. *Statistical Science*, 2014, 29(1):69-80.
- [4] Rasmussen R, Cole J, Moore R K, et al. Common Snowfall Conditions Associated with Aircraft Takeoff Accidents [J]. *Journal of Aircraft*, 2000, 37(1):110-116.
- [5] Silva S S, Jensen L, Jr R J H. Safety Benefit of Automatic Dependent Surveillance-Broadcast Traffic and Weather Uplink Services [J]. *Journal of Aerospace Information Systems*, 2015, 12(8):1-8.
- [6] Ng H K, Sridhar B. Computational Approaches to Simulation and Optimization of Global Aircraft Trajectories [J]. *Journal of Aerospace Computing Information & Communication*, 2016, 13(2):1-8.

- [7] Xie J, Wan Y, Zhou Y, et al. Distance Measure to Cluster Spatiotemporal Scenarios for Strategic Air Traffic Management [J]. *Journal of Aerospace Information Systems*, 2015, 12(8):1-19.
- [8] Christopher A B A, Balamurugan S A A. Prediction of warning level in aircraft accidents using data mining techniques[J]. *The Aeronautical Journal*, 2014, 118(1206):935-952.
- [9] None. Rain Erosion Tests on Aircraft Surfaces at Supersonic Speeds[J]. *Aircraft Engineering and Aerospace Technology*, 1955, 27(6):190-190.
- [10] Feng S, Hu Q, Qian W. Quality control of daily meteorological data in China, 1951–2000: a new dataset[J]. *International Journal of Climatology*, 2004, 24(7):853-870.