中國機械工程學刊第四十四卷第五期第 447~454 頁(民國一百一十二年)
Journal of the Chinese Society of Mechanical Engineers, Vol.44, No.5, pp447~454 (2023)

Research on Altitude Table Data Visualization and Data Flow Migration Technology Based on Multi-framework Integration

Qi-Fan Zhou*, Ying-Qing Guo**, Wan-Li Zhao*, Kun Wang*
Ke-Jie Xu*, Xin-Xin Tao*, Yun-Hui Dong* and Bo-Song Chai***

Keywords：simulated altitude test facility, Mybatis Automatic View Layer Construction, GateWay Current Limiting Mechanism, Load balancing mechanism

ABSTRACT

As an important method for the aero-engine performance testing, the data in the process of aero-engine -altitude simulation test is extremely valuable and essential. To display the data more intuitively and to explore its deeper meanings and potential value, the development of the real-time migration and visualization technology of the data flow generated from the simulated altitude test facility basing on multi-framework integration is proposed. Firstly, with the Mybatis-Plus automatic view layer, data stored in the bottom historical database can be visualized in the browser's table structure space. Then, data flow technology migration, referring to the JDBC (Java Database Connection) interface based on GateWay's current limiting mechanism and integrates multi-thread parallel transport flows using Mybatis' load balancing mechanism. Therefore, the essential information in historical database for subsequent algorithm analysis can be synchronized to local database. Finally, with Vue framework, data flow front-end monitoring interface verifies data visualization, integrity, and effectiveness in real-time.

Paper Received July, 2023. Revised August, 2023. Accepted September, 2023. Author for Correspondence: Qi-Fan Zhou..

* *Associate Professor, School of Power and Energy, Northwestern Polytechnical University, Xian, Shannxi, 710129, ROC.*

** *Graduate Student, School of Power and Energy, Northwestern Polytechnical University, Xian, Shan1ɑnxi, 710129, ROC.*

*** *Graduate Student, School of Computer Science and Techn ology, Zhejiang University, Hangzhou,Zhejiang 310031,ROC.*

INTRODUCTION

Altitude simulation capabilities and technical level are important indicators of a country's independent air-engine development [1]. During the process of altitude simulation testing, various sensors are used to measure the parameters of test equipment which is eventually stored as data information in the historical database (Oracle database) [2].In order to check the internal relations and values contained in the data analyzed, data mining and visual display of the data stored in the underlying database are essential tasks for testers, as is visual representation of the measured parameters of various sensors, so that testers can corresponds to technical operations.In order to avoid destroying the encapsulation and integrity of the historical database, it is necessary to migrate the subsequent data sources used for various algorithms from the historical database to the local database for data processing. Therefore, the research of data visualization and data flow migration technology is of great significance.

Currently, one of China's altitude platforms can test and verify variety of types of engines. However, when data from each test equipment of the altitude platform has to be used, the only option is to search the historical database, and query the corresponding data information. This leads to the fact that the level of visualization and intelligence is still lacking [3], and its deep utilization value has not been developed well. Specifically, the restriction of data value utilization is mainly reflected in the two following aspects: first, the research on data mining is not indepth enough, and it is not fully explored what hidden information is contained in the data mining itself or in various data association sets [4], and the system does not contain the deep connections and laws that it contains. Secondly, the system does not have the explicit expression of data that it contains. And only the limited original data measured by the system is simply displayed in the human-computer interaction interface. The data obtained by operators is restrained in value and form, and improvement in

data value and intuition of data display is urgently needed.

Data flow migration technology has already been developed steadily in academia and industry [7]. In a recent study, Manolis Delakisa, Guillaume Gravierb and Patrick Grosc investigated the characteristics of segments in data flows, and then put forward a segment model to solve the synchronization problem of heterogeneous databases [8]. TSpaces was proposed by Tobin J. Lehman, Alex Cozzia, Yuhong Xiong and other experts to solve the hooking problem of heterogeneous database systems. TSpaces is a type of database middle-wares, which solves the synchronous communication problem between heterogeneous database systems by studying and integrating the transaction and data access characteristics of heterogeneous database systems [9]; and Arun Kumar Yadav, Dr. Ajay Agarwal proposed a distributed data synchronization architecture based on transactional replication [10]; Emil Vassev has proposed a solution of database synchronization between enterprise multi-branch systems based on Microsoft message queue [11]. The IBM Company has developed a connection method that supports transparent access between heterogeneous databases, as well as a database synchronization middleware product called DB2 Data Joiner.[12].

As an important test method in modern aero-engine test technology, simulated altitude test facility (referred to as simulated altitude test facility) has been paid attention to by many countries. With the rapid development of computer technology, the data acquisition, processing and monitoring system of the altitude platform is becoming more and more perfect. In order to improve the test level and efficiency, a set of engine altitude monitoring system is developed on the basis of the original hardware system.

As a result of the shortcomings mentioned above regarding data visualization and data flow migration for simulated altitude test facility, this paper proposes a real-time migration and visualization of the data flow generated by aero-engine simulated altitude test facility based on multi-framework integration. To visualize the altitude simulation data, Mybatis-Plus is used as the automatic view layer construction technology. By using this technology, experts can easily and intuitively view the parameter information conveyed by each sensor of the test equipment in the browser table structure space of the Vue framework. As far as data flow migration considered, there are two modes of access for JDBC interfaces: GateWay current limiting and Mybatis framework load balancing, which significantly cuts down the time for data synchronization and meets the real-time requirements eventually while ensuring data security and confidentiality. Finally, the corresponding conclusions are given through the process in which data flow synchronization is monitored through the front interface of Vue framework

MULTI-FRAMEWORK FRONT-END AND BACK-END INTERACTIVE TECHNIQUE

Selection of real-time synchronous database

When in the process of simulated altitude test facility, it is essential to collect hundreds of field names pa-rameters and tens of thousands of measurement points. In order to facilitate subsequent data analysis, engine performance evaluation, intelligent management and control, the data is of great importance to be collected and stored.

Collecting and storing data using another non-relational database may result in data loss or replacement. Therefore, Oracle database is applied in this paper as the source database of historical database and local data-base as Oracle database has advantages in storage, persistence and hot backup of historical data [16]. There are two parts in Oracle: the instance structure and the database system. The real realization of data storage is Ora-cle database system. Figure 1 illustrates the overall structure of Oracle and the subsequent data flow migration process.

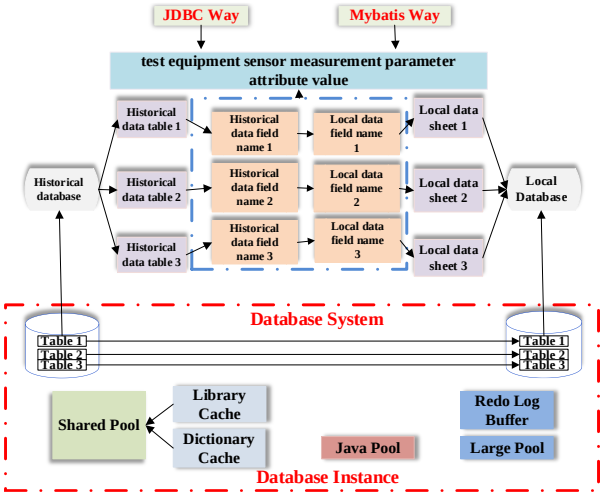


Fig. 1. Selection of real-time synchronization technology for Oracle database

Collection technology of measurement parameters of simulated altitude test facility

For the data flow migration and visualization function of simulated altitude test facility, this paper mainly describes two main technical points: first, the visualization function of data flow. The purpose of this part is to display the parameters measured by the various sensors of simulated altitude test facility. The key technical component of this application includes: the backend Mybatis-Plus framework pattern, Spring MVC(Model View Controller) design pattern, cross-domain data transmission pattern and front-end Vue framework pattern and Element UI technology.

Secondly, the real-time synchronous migration

function of data flow. A benefit of realizing the migration function is also that the historical database cannot be changed directly in general, as the direct operation of the historical database would cause the table structure space to change and destroy the data atomicity, and further undermine its encapsulation.

Therefore, data which needs to be utilized must be synchronized into the local database. According to the order of magnitude of measuring point parameters of simulated altitude test facility, the number of parameter field names of measuring points and the requirements of synchronization time, and two methods are adopted in the process of synchronization: JDBC(Java Datanase Connection) interface basing on GateWay current lim-iting mechanism, Mybatis framework integrating multi-thread parallel processing flow mode basing on load balancing mechanism. Each of these two modes targets a different situation and uses technology including Mybatis framework. JDBC interface pattern, load balancing weight selector pattern, GateWay current limiting pattern, Spring MVC design pattern, Spring Boot framework pattern, Vue framework pattern and Element UI(User Interface) technology. The combined flow chart is shown in Fig. 2

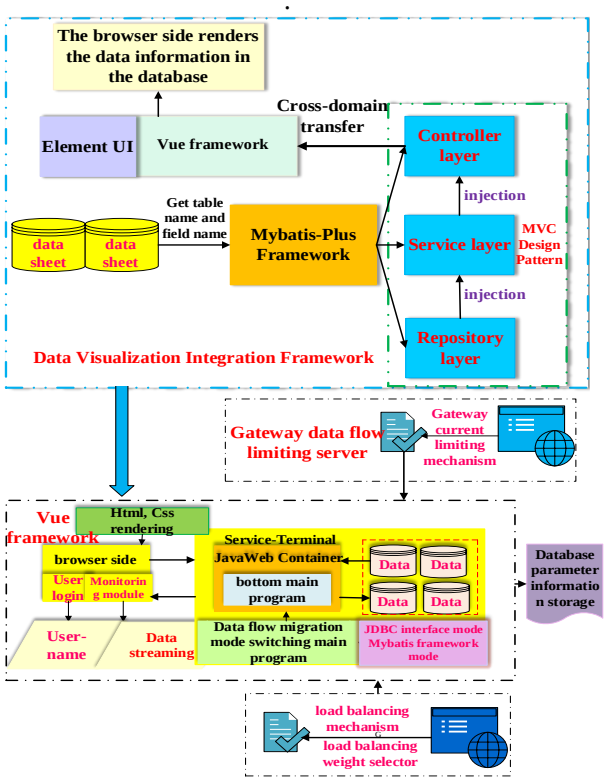


Fig. 2. Front and back-end interaction technology combination schematic

DATA FLOW VISUALIZATION AND MIGRATION TECHNOLOGY

Visualization technology of automatic view layer construction based on Mybatis-Plus Framework

Data flow visualization technology based on Mybatis-Plus framework allows the user to view data flow visually in the browser without querying related data from the database. A key componentof this process is the interaction between multipleframeworks and the transmission of data across domains. Firstly, several kinds of framework structures and their functions involved in the technology are introduced below.

(1)Mybatis-Plus Framework

Using Mybatis-Plus framework, you can interact with data and map it to the underlying database in Java. simulated altitude test facility entity object is created based on the data-base field names and data types., and then completes the automatic view layer builder after implementing the BaseMapper interface. It implements the three-tier progressive structure pattern of Spring MVC(Model View Controller) and automatically gener-ates field names, mapped with the field names of the corresponding data tables in the database accordingly, in the entity objects of the simulated altitudetest facility

(2)Spring MVC Design Pattern

Spring MVC design pattern, a three-tier structure mode, composed by Model, View and Controller [13-14]. In the case of circular dependency injection, the data can be displayed on the browserport if the mode injects the view layer into themodel, as well as injecting the encapsulated model layer into the front-end con-troller. Hence Mybatis-Plus's automatic view layer construction technology utilizes Spring MVC's three-tier progressive structure pattern [15], which is respectively corresponding to the Repository layer, Service layerandController layer.

Firstly, The Repository layerprovides access to the table structure corresponding to the simulatedaltitude test facility, and thenis sequentially transportated into the Service layerto realize the corre-sponding interface as well as implementation class. Secondly, the Service layeris sequentially transportated into the Controller layer. Finally, the data is presented in the browser by calling the rootdirectory path of the Controller layer.

(3)Cross-domain transmission technology of data flow

Due to the fact that the final measurement parameters of simulated altitude test facility must bepresented in the corresponding table structure of the Vue framework, However, the Controller layerin Spring MVC pre-sents the final data on the browser end under the given root path. If the dataneeds to be presented in the table structure set in the Vue framework, a masked port transmission program, which supports GET, POST, DE-LETE, and SELECT, can be used for cross-domain data transmission.

The implementation of this process is as follows:

(1) Firstly, store the test equipment parametersmeasured by sensors in the historical database byusing TCP protocol.

(2) Secondly, Java, as the third language to operate the database, configures the connection information, and gives the driver and database connection pool information.

(3) Thirdly, the entity objects of aero-engine altitude simulation test-bed are created, so the Base-Mapper interface is realized and the internal attribute values of the entity objects are automaticallygenerated which are mapped with the field namesof the data table one by one.

(4) Finally, the cross-domain data flow transmission program with shielded ports is written by using Vue framework, so that the data informationencapsulated can be visually presented in the simulated altitude test facility in the browser table structure of Vue framework.

The data information finally presented in the browser-side table structure of Vue framework is shown in Fig. 3.

MONTH	DAY	HOUR	MINUTE	SECOND	MSECOND	VP891_CON	VP892_CON
7	9	16	49	38	639	2.5733	1.9925
7	9	16	49	38	731	2.5733	1.9925
7	9	16	49	38	842	2.5814	1.9925
7	9	16	49	38	935	2.5814	1.9931
7	9	16	49	39	49	2.5814	1.9931
7	9	16	49	39	135	2.58	1.9895
7	9	16	49	39	249	2.58	1.9895
7	9	16	49	39	341	2.5755	1.9895
7	9	16	49	39	435	2.5755	1.9879
7	9	16	49	39	542	2.5755	1.9879
7	9	16	49	39	638	2.5787	1.9879
7	9	16	49	39	730	2.5787	1.992
7	9	16	49	39	841	2.5787	1.992
7	9	16	49	39	931	2.5804	1.9917
7	9	16	49	40	43	2.5804	1.9917
7	9	16	49	40	137	2.5709	1.9917
7	9	16	49	40	249	2.5709	1.9902
7	9	16	49	40	338	2.5709	1.9902

Fig. 3. Parameter measurement information display of aerial simulation test bench

JDBC Interface Mode based on GateWay Current Limiting Mechanism

A data flow migration mode based on GateWay current limiting mechanism is incorporated into this pa-per to achieve real-time data synchronization in consideration of the importance and confidentiality of the measured parameters in the test process of the simulated altitude test facility.

The execution flow of the program is shown in Fig. 4. Firstly, using the database connection function, give druid the data source, initialize the persistent pool configuration parameters, and parse the information in the configuration file to the timing program. Secondly, the test number and its corresponding information is synchronized across different data tables using Dynamic SQL(Structured Query Language) instructions, and finally the timer task program is completed into the mainprogram logic during the process of executing the timer program. When new data is submitted to the historical database, the main program can monitor the change in data volume in real time, and refresh and insert the data into the local database as well.

During the data flow migration, a remain problem is that each time the amount of data synchronized ap-pears to be different. A large amount ofdata will impede data synchronization, this problem dramatically in-creases the time of data synchronization. In this case, with GateWay current limiting mechanisms, the synchronization amount is well controlled within the range of the set amount at all times. This kind of setting can control the data synchronization amount of each time to be in the optimal order of magnitude.

First of all, a fixed range of data synchronization threshold will be set for each synchronization thread before the test data is synchronized, based on the test conditions, the JDBC interface mode is generally set to 20~30 lines of data synchronization per second, that is, each thread can synchronize 20~30 lines of data per second, such speed has greatly met the real-time requirements, when a certain moment of synchronization of the test When the amount of data synchronized at a certain moment is larger than the maximum valueof the set threshold, it may trigger a data synchronization blockage or even a server avalanche.

This mechanism can monitor the status of the thread whose synchronized data volume exceeds the set threshold in real time, and allocate its synchronized data to other threads to ensure that thesynchronized data volume of each thread is within the set threshold, which can alleviate the overload and transmission pressure in the synchronization process of a single thread on the one hand, and distribute the tasks to each thread on the other hand. On the one hand, this can alleviate the load overload and transmission pressure during single-thread synchronization, and on the other hand, the task can be as-signed to each thread, thusmaking the task more divided, which greatly exploits the advantages of this mechanism and multi-threading.

The peak fast processing mechanism is an additional optimization mechanism on top of the peak-shaving mechanism. When the trial synchronization data volume of a thread exceeds the threshold,in order to quickly reduce this overrun, the peak fast processing mechanism is needed immediately to process this overrun in real time to ensure risk avoidance.

The token bucket instruction optimization strategy is an abstract optimization strategy, which is a further optimization made under the condition of the peak-shaving + peak-fast processing optimization

strategy.

The bucket filled with gold coins is equivalent to the thread container when performing a trial data syn-chronization, where the gold coins represent the trial data for performing the synchronization, and when new coins are continuously put into the whole container, it is abstracted as addingnew trial data to the multi-threaded container. In fact, it is a threshold setting scheme, and the threshold determination process of the multi-threaded container symbolizing the token bucket is determined by referring to the volume of the token bucket, and this optimization makes the whole threshold selection more reasonable. Figure. 4 showsthe full process.

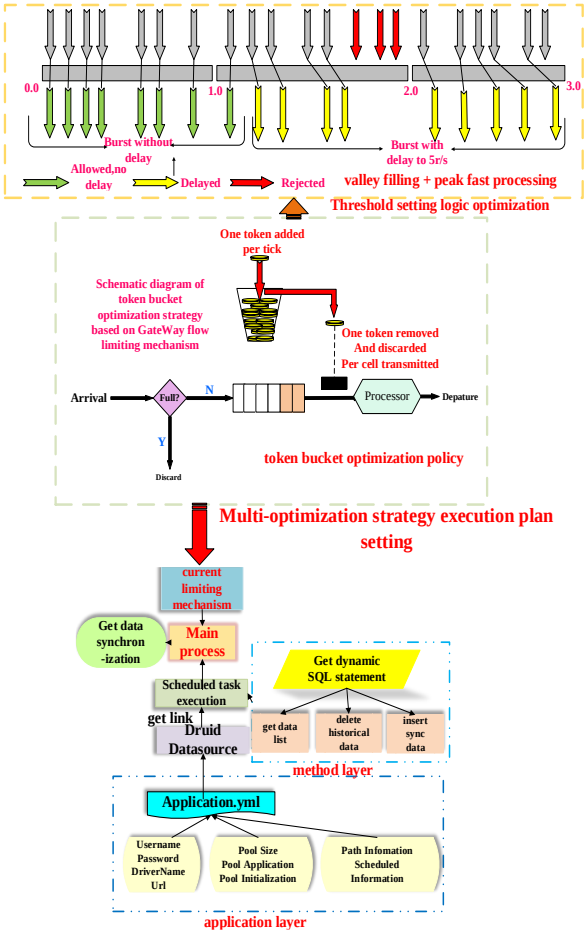


Fig. 4. Multi-mechanism optimization strategy execution thought process

Mybatis Framework Pattern Based on Load Balancing Mechanism

Mybatis framework mode is mainly implemented in the form of injection layer, including Repository layer, Service layer and Controller layer. Data monitoring logic is set externally to monitor the status of data synchronization. Its running process mainly includes the following procedures, as shown in Fig. 5.

The paper also introduces the concept of multi-threading. The multi-thread parallel transport flow, is dif-ferent from the traditional multi-thread mode, which adopts divide-and-conquer parallel processing, divides the data with 100 divided blocks, so each thread processes hundreds of lines ofdata, and multiple threads sim-ultaneously executethe indexing and inserting functions of data in parallel. This will greatly improve the effi-ciency of data synchronization and meet the real-time requirements [16].

The entity objects of aero-engine altitude platform is created, and the data acquisition and insertion func-tion interface of Repository layer is constructed as well, which is injected into Dao layer to complete the data source configuration. Finally,inject the connected Dao layer into the Service layer, add the multi-thread paral-lel transport flow logic, allocate the table structure to get the test-bed number information, and automatically searchthe synchronous table name.

Essentially, the repository layer implements theconfiguration information for the database. The reposito-ry layer is already connected and injected into the Dao layer. The Dao layer uses meta-annotations in Mapper files to parse SQL statements. The field name information of the data table of the simulated altitude test facili-ty is correspondingly associated with the entity attribute objects of the simulated altitude test facility. The whole connected structure is defined as Service layer.

Load balancing, introduced to solve the problem of the process of data synchronization in a certain thread, affects the logic of the main program. It occurs when too much data needs to be synchronized by a certain thread, causing a synchronization blockage, the logic of the load balancingweight selector is easily triggered leading to the load balancing weight value of this thread. At this time, the system will distribute its task amount to other threads to operate at the same time, which greatly reduces the likelihood of thread block-ages and database deadlocks as a result of overloading a single thread.

In this paper, the load balance selector of the DR mode introduced in the Mybatis framework is actually to establish an optimization strategy between the client and the server, abstract the master-slave database into a link cycle mode between the server and the client, and abstract the data flow chain into an information flow to achieve the information flow transmission scheme between the client and the server. In this process, hundreds of field names and tens of thousands of rows of sensor measurement data as a whole of the entire information flow constantly trigger the edge nodes of the load balancing algorithm, which areconstantly optimized and adjusted.

The entire information flow is transmitted on a small scale to solve the problems of slow data

transmis-sion speed, large load and transmission collapse caused by huge data volume at the same time, the load balanc-ing optimization algorithm of DR mode has carried out a global optimization strategy for the migration of data streams ina single mode. The amount of data transmission per unit time meets the real-time requirements and has good stability.

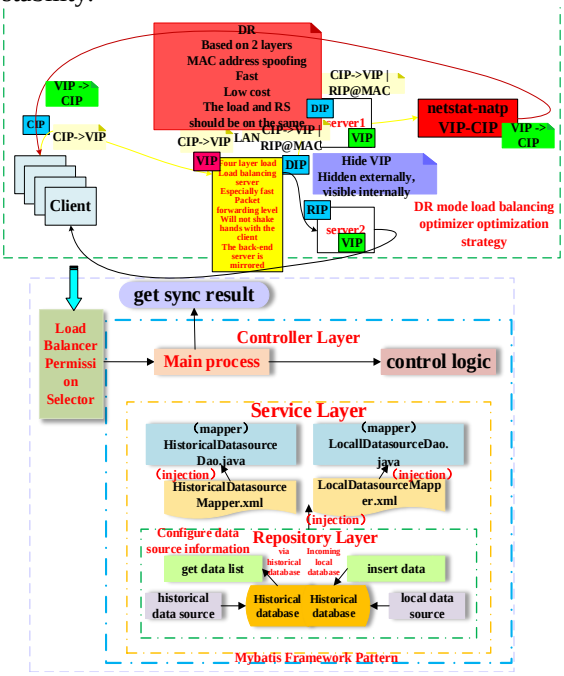


Fig.5. Mybatis Framework Pattern Based on Load Balancing Mechanism

REAL-TIME VERIFICATION OF DATA FLOW MIGRATION

JDBC Interface Monitoring Interface Based on GateWay Current Limiting Mechanism

JDBC interface to prevent the loss of synchronous data or network delay, resynchronizing all the required data is preferable when there is only a small amount of data added each time. When the amount of data is very large, it is necessary to choose Gateway mechanism to call incrementalsynchronization method, and each synchronization limits its synchronous data amount within the allowable range of mechanism regulation to preventthe possibility of deadlock caused by synchronization blockage.

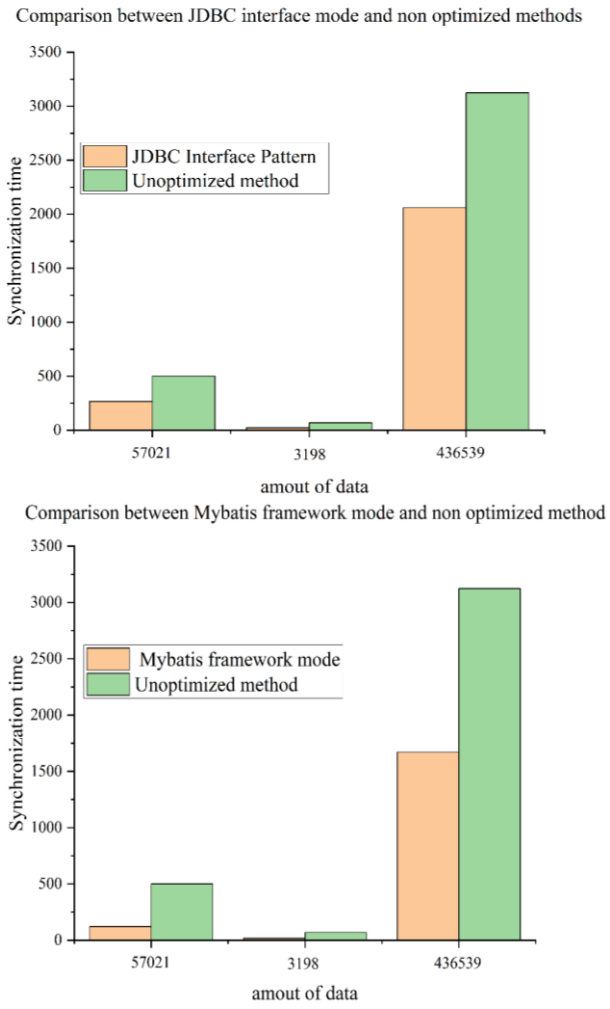
The data synchronization amount of this method is 200 + rows of data per second, which meets the real-time requirements. The relationship between synchronization duration and synchronization data amount is shown in fig. 6 which is combined with the final result of the Mybatis framework schema, including the amount of data synchronization with time relationships and front-end monitoring interface., the figure shows the comparison between the fusion mode of peak clipping and valley filling + peak fast processing and tokenbucket optimization strategy under GateWay current limiting and the mode without optimization. The results show the advantages of this optimization mechanism.

Monitoring interface of Mybatis framework forload balancing mechanism

Load balancing is proposed to solve the problem in the case of multitasking, large amount of data reading occur in scenes with a lot of data and complex situations. The load balancing mechanism is used to optimize it accordingly, and the execution speed of each thread parallel processing flow is optimized, so that each part can be superimposed, and the execution the whole system is significantly sped up. In this process, the data quanti-ty, data synchronization time and date and other related information contents of data flow synchronization are mainly monitored.

What's more, there is a double-selection function of switching data synchronization mode, and an addi-tional interface is reserved making the preparation for the joining of a new way where it can be dynamically selected. Throughout the platform, selecting the test number and then the synchronization of the data can completed corresponding to the test number. And the test can be expanded as well. Besides, the data table cor-responding to the test number can be also added. The data flow migration process can also be carried outsynchronously or step by step. The data synchronization amount of this mode is 300 + rows of data per second, which meets the real-time requirements.

The relationship between synchronization duration and synchronization data amount and front-end moni-toring interface.is shown in Fig. 6, The figure also shows the comparison between the DR optimization strategy under the load balancing mechanism and the method without the optimization mechanism. The results show that the load balancing optimization mechanism can achieve the rapidity and integrity of real-time data synchronization to a large extent, indicating that this method has obvious advantages.



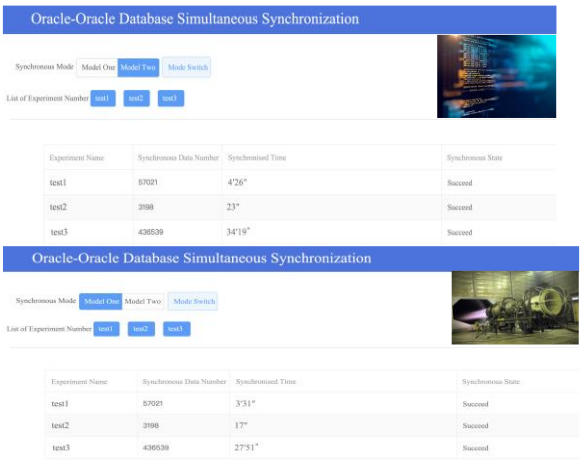


Fig. 6. Dual-mode switching combination verification comparison results graph

CONCLUSIONS

This paper presents and explains the technology using a multi-framework integration to visualizeand migrate simulated altitude test facility data flow. y verifying the functions of these two parts, the following conclusions are obtained:

(1)The research significance of this paper is that using data visualization technology and data flow migration technology to carry various optimization mechanisms can visualize the data generated during the operation of the simulated altitude test facility and quickly migrate the data flow, providing optimization for the functions at the data transmission level. in accordance with. In the future, this technology can be truly used in simulated altitude test facility experiments to provide more efficient and optimized solutions for data migration.

(2)The data migration solution that uses JDBC interface to fuse multithreaded parallel processing streams and introduces peak clipping and valley filling + peak fast processing under GateWay flow limiting mechanism, and the data migration solution that uses Mybatis framework to fuse full incremental mode switching and introduces DR optimization strategy mode under load balancing mechanism. These two data real-time synchronization methods can give full play to the advantages of the two modes so as to independently switch the optimization strategy required, and these two methods are not comparative relations, but optimization strategies and algorithms of two different mechanisms based on different application scenarios, providing a direction for better realization of data migration goals in the future.

(3)Two real-time synchronization methods of sensor measurement parameters of simulated altitude test facility with optimization mechanism are proposed in this paper, which provide better solutions to problems such as difficulty in realizing real-time data synchronization of original simulated altitude test facility, incomplete data synchronization and large data transmission limitation in the process of data synchronization, greatly meet the real-time synchronization, integrity, visualization mode, real-time monitoring visualization, stability and single time load optimization of data.

ACKNOWLEDGMENT

This is a part research accomplishment of the project “National Science and Technology Major Project(J2019-V-0003-0094)”, RMB 650,000 for the military-civilian integration project.

REFERENCES

Arun K. Y. and Ajay A., “A Distributed Architecture for Transactions Synchronization in Distribut-ed Database Systems,” International Journal on Computer Science and Engineerin & 2010, 26: 46-52.

Chen Y.D., Zhao M. and Guo Z. “A fast response and scheduling method for power supply

resources based on cloud computing task allocation," Automation Technology and Applications,2022,41(10):60-63+68.
Emil V., "Enterprise Multi-Branch Database Synchronization with MSMQ," CoRR, 2019, 0912: 12-18
Guo X., Liu T., and Wen G., "Correction method for additional resistance of aeroengine test bench," Journal of Aerodynamics, 2003, 18 (6): 839-844
Jia X. Y., Zheng Q., and Jiang Y. T., "Leakageand Rotordynamic Performance of T Type Laby-rinth Seal," Aerospace Science and Technology，2019,88：22-31.
Ling P., Tan X.Y. and Xiao P.W., "Oracle inequality for sparse trace regression models with expo-nential β-mixing errors," Acta Mathematica Sinica, English Series:1-23[2022-10-11].
Manolis D., Guillaume G. and Patriek G., "Audiovisual Integration with Segment Models for Tennis video parsing," Computer Vision and Image Understanding, 2008, 1 1 1 (2): 32-38.
Miao K.Q., and Zhu M.Y., "A general characteristic correction method for special regulating valve of altitude platform," Gas Turbine Test and Research, 2019, 32 (4): 22-26, 42.
Rose J. B. R., Jinu G. R., and Brindha C. J. " A Numerical Optimization of High Altitude Testing Facility for Wind Tunnel Experiments , " Chinese Journal of Aeronautics，2015，28(3).
TobinJ. L., AlexCozzia. and Yu H.X., "Hitting the distributed computing Sweet Spot with TSpaees," Computer Networks, 2020, 35 (4): 24-30.
WANG G.B., LI F., FAN L.W. and LIU H.C., "An Efficient SCF-PEKS Without Random Oracle Under Simple Assumption," Chinese Journal of Electronics,2021,30(01):77-84.
Yang S.P., Tan B.S., and Deng X.F., "Numeri-cal and Experimental Investigation of the Sealing Effect of a Specific Labyrinth Seal Structure," Mathematical Problems in Engineering，2019(4)：1-14.
Yang Z.M., Ai Y.T. and Su J.Y., "Research on the sealing characteristics of a new type of labyrinth seal structure connecting the dynamic and static frames of the high-altitude platform,". Propulsion Tech-nology, 2022,43 (08): 98-105.
Zhang L.K. and Yan Z.X., "Log analysis of Oracle database based on LogMiner," Computer and Network, 2013, Z1: 145- 147.
Zhao W.L., Guo Y.Q. and Sun H., "Research on an Adaptive Threshold Setting Method for Aero-Engine Fault Detection Based on KDE-EWMA," Journal of Aerospace Engineering. 2022, Vol.35(No.6)
Zhu M.Y., Wang X., and DAN Z.H., "Pressure PI Gain Scheduling Control Research for Altitude Ground Test Facilities Air Intake Control System," Journal of Propulsion Technology，2019，40（4）：902-910.

基於集成框架的高空類比試驗資料視覺化及遷移技術研究

周啟凡 郭迎清 趙萬里 王昆 徐柯傑
陶欣昕 董韞慧
西北工業大學動力與能源學院

柴博松
浙江大學计算机學院

摘要

作为航空发动机性能测试的重要方法，航空发动机高空模拟试验过程中的数据是极其宝贵和不可或缺的。为了更直观地展示数据，挖掘数据的深层含义和潜在价值，提出了基于多框架集成的模拟高空试验设备产生的数据流的实时迁移和可视化技术开发。首先，利用 Mybatis-Plus 自动视图层，将存储在底层历史数据库中的数据在浏览器的表结构空间中可视化。然后，进行数据流技术移植，参考基于 GateWay 限流机制的 JDBC（Java 数据库连接）接口，并利用 Mybatis 的负载均衡机制整合多线程并行传输流。因此，用于后续算法分析的历史数据库中的重要信息可以同步到本地数据库。最后，通过 Vue 框架，数据流前端监控界面可实时验证数据的可视化、完整性和有效性。研究结果表明，采用优化算法的测试数据每秒同步量分别达到了 300 多行和 400 多行的上限，完全满足实时性目标。