Design and Implementation of Human Resource Optimal Scheduling System Based on B/S Architecture

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Abstract

Manpower as a concept and a resource was formally proposed in the 1970s. At that time, developed countries attached great importance to human creativity and regarded it as the most important resource in social organizations. The system development of human resources management is particularly important. Through the development and construction of this system, human resources can be managed from the macro and micro levels, and their inherent potential can be explored to create wealth for the development of enterprises. Based on the field research, this paper sorts out the basic functional requirements of human resource management in colleges and universities, and carries out detailed system analysis, system design and system implementation according to the development method of object-oriented software engineering. MyEclipse6.0 is used as the development tool, and Java and MVC framework technical specifications, and finally developed a human resource management system based on B/S mode.

Keywords

Human Resource Management, Human Resource Management System, B/S Mode

1. Introduction

The most important thing in the 21st century is talents, people are the most important factor in productivity, and human resources are the most important resource in enterprises and institutions. The first industrial revolution that occurred in the 18th century turned capital into an important driving force for

economic development and social change. From the second industrial revolution that emerged at the end of the 18th century, science and technology showed huge force and productivity. The phrase "Science and technology is the primary productive force" has gradually come into people's field of vision, at that time the role of human resources began to show (Han, 2001). The real role of human resources is at the birth of the third scientific and technological revolution. With the advent of the era of knowledge economy, the world has entered the era of technology dominance. Knowledge and talents have become the symbol of a company's success. The real station of human resources at the forefront of history, began to play its role in the times. With the rapid development of network technology, the original C/S model can not better meet the needs of human resource management practices. In this context, this paper is based on the B/S model to further construct a human resource management information system, with a view to providing reference for improving the efficiency of human resource management. The marginal contribution of this paper is expected to be the development of a human resource management information system based on the B/S mode using MyEclipse6.0 as the development tool and Java and MVC framework technical specifications. Thus, a highly efficient and secure human resource management information system is constructed. So this paper focuses on the design and implementation of human resource information management system, and the main structure is as follows. Section 1 is the introduction, including the introduction of the background and significance of the study. Section 2 is the literature review. Section 3 is the overall description of Human Resource System. Section 4 is the introduction of the key technologies mainly used in the human resource management, such as J2EE, MVC and MVP, SSH as well as B/S and C/S. Section 5 is the System design. Section 6 is the System testing and result analysis. Section 7 summarizes the research.

2. Literature Review

The management of human resources originated in European and American countries. They have been involved in this field for research very early. After several years of research and theoretical time, their accumulated experience is very instructive, and they have even summed up certain management Model, for other countries, or some domestic enterprises and institutions to use it as a standard to carry out work (Zhao & Sun, 2011). Specific mature experience models include: 1) Advanced human resource development and management concepts. Although the research on human resources in Western European and American countries is relatively early, their understanding of it has also changed from initial neglect to important changes. Until recently, the management of human resources has gradually matured. In the development strategy of enterprises and institutions, talent strategy has become the first and foremost development strategy. 2) Fair and effective incentive mechanism. Foreign countries attach great importance to the management of university faculty and staff from

the perspective of human nature, and mobilize the enthusiasm of teachers more objectively from their performance and students' evaluation. 3) Staff changes training system. Human resources are a flexible resource with a strong ability to absorb new things, so appropriate personnel changes and training can improve the abilities of college teachers and fundamentally promote the self-growth of human resources. 4) A practical employment system. Abroad, the recruitment of teachers in colleges and universities is open, and the school's teacher information and other employment information are very transparent, which promotes the rational flow of talents. Various types of talents can flow freely in the school and give full play to their full potential advantage (Kong, 2011). Regarding the development and implementation of human resource management systems, there are designs and implementations based on C/S mode, some based on B/S mode, and development and implementation based on B/S and C/S mixed modes.

C/S mode refers to a system architecture mode in which the database is placed in the backend server and the application software is installed in the client, where C stands for client and S stands for server (Ma, Zhao, & Fan, 2010). It has the advantages of fast access speed, stable operation and good security performance. With the rise of Internet technology, the B/S mode appeared, which is an extension of the C/S mode, where B is the browse and S is the server. The biggest benefit of the B/S mode is the relative simplicity of operation and maintenance, which can be realized by different people, different locations, and different accesses (Makboul, 2020). B/S and C/S mixed modes combine two common software application architectures, the high performance and flexibility of a C/S architecture with the convenience and ease of use of a B/S architecture (Mo & Su, 2001). Each has its own advantages and disadvantages. Long or short, the key depends on the needs of the user. However, the design and development of B/S mode are still popular at present, which are developed with J2EE framework and developed based on NET framework. In short, there are many ways to implement the human resource management system, and the key to the final choice depends on the needs of the user.

Compared with the research and practice of human resource management in European and American countries, as well as the development of human resource management system, there are many disadvantages in human resource management in our country, which urgently needs the efforts of researchers. This is because the change and development of China's higher education system and layout structure were formed late, and no major changes were made in the middle, but this is also understandable, because it is related to China's planned economic system at that time. With the advent of the 21st century, the current personnel management and human resource management system of our country's colleges and universities is slowly evolving, striving to develop in a better direction, and maximizing the advantages of a powerful country in human resources. But we still need to be aware of our existing human resources manage-

ment status: 1) the concept is not new, and the functional departments are not sound. Since the 1980s, although China's higher education has undergone earth-shaking changes, we should still be aware of our own shortcomings. With the scientific concept of development put forward, we should follow the concept of "people-oriented" in the management and research of human resources (Yu, 2010). 2) The structure is unreasonable and the management of human resources is loose, resulting in brain drain. The most important thing in colleges and universities is talents, so we should formulate a reasonable system to ensure that all types of talents can play their greatest role in the unit (Wang & Zhang, 2011). China's Human Resource Management System (HRMS) refers to an information system that combines human resource management with computer information technology. It has gone through several stages from generation to development: a) It has a single function and can only be viewed in the simplest way. b) In the early 1980s, with the development of computer technology, in addition to meeting the basic functions of the first generation, some functions of automatic report generation were added. c) Since the 1990s, the development of human resource management systems guided by management concepts has become active.

3. Overview of Human Resource Management System

3.1. Introduction to Human Resource Management

In universities and public institutions, the management of human resources is mainly to maintain the basic information of the departments designed in the system and various personnel reduce the workload of personnel in the personnel department, and help them make decisions about personnel transfer or personnel recruitment. Now the core proposition of human resource management is to deal with the relationship between people and organizations. This sensitive proposition naturally focuses on the focus of people and organizations—work and their duties. Jobs are composed of a family of jobs with basically the same job content. Jobs are a way of combining people and work. The focus is on people's work, not on people in work. The management of human resources is to sort out the functional positioning of each department, and edit the information of all kinds of personnel involved in the system, so as to link people and organizations. The centralized display of this information will greatly facilitate people's access to information. Every enterprise and institution has its own understanding of the concept of human resource management and its own management needs (Pan & Wang, 2011). According to its different development strategies, it plans to transfer human resources between various functional departments, and through the recruitment and training of employees in the unit Through a series of processes such as, assessment and evaluation, we can fully explore the enthusiasm of employees, give full play to their independent initiative, seek benefits for the enterprise, create value, and ensure the realization of the core value of the enterprise.

3.2. Introduction to Human Resource Management System

From the aforementioned analysis of the basic tasks, main content and management process of human resource management, we can determine the content that needs to be displayed in the human resource management system. Through functional and non-functional demand analysis, our team human resource management system. The contents of the basic modules are analyzed and presented. In general, the human resource management system should include the following functions:

First function is flexible editing and reconstruction of data. The human resource management system needs to confirm some specific indicators. Using this function in system management, the system administrator can edit some index items. If needed by the enterprise, indicators can be modified, added and deleted, so as to meet the flexible needs of users. Second one is data entry. In order to ensure the standardization of data entry and final display of information, and reduce the workload of personnel department managers, the system should establish standards to facilitate users to import with templates. This template can be summarized according to the daily work of the enterprise, which greatly facilitates novices operation (Zang & Ye, 2015). Third one is the flexible processing of data. When two departments are merged, or the information of personnel changes, the system should be able to flexibly handle the flexible flow of such information in the database, and there should be no ground deviation. Forth one is data analysis. Each module of the system should have the function of data analysis, which can display the basic information of different departments and different groups of people in rich charts, which is convenient for users to analyze and view. Fifth one is the automatic export functions (Zhang & Wang, 2011). When some key reports in the human resource management system need to be reported for approval, they should be easily printed out and sorted automatically. The last one is the personal setting function is simple. After the system is put into use, users at all levels, from super administrators, ordinary administrators, advanced users, and ordinary users, can easily modify and set their own basic information. From high priority to low priority, users with high priority can manage low-level users and maintain the role information of low-level users.

Based on the above functional brief, the HRM system should also have some non-functional features. The non-functional characteristics of the human resource management system are as follows: First, the open interface. Provide a powerful data import interface, which should realize easy import and export functions and seamless integration with other systems, provide upload and download functions, and facilitate users' use. Second, it is simple and easy to use. The human resource management system is used a lot. Almost every employee in the enterprise will log in and use it. Everyone has different knowledge and understanding abilities. The design of the system should be more simple and easy to use, starting from the most original ideas of users, convenient easy to use. Third, flexible query. The system should provide the function of displaying from

different sides, displaying information from different dimensions, and visually highlighting the display to users in different display forms. Fourth, easy maintenance. Any human resource management system, if its maintainability is poor, then its lifespan is extremely short. At the beginning of the design of the system, the viewpoint of dynamic progress and development should be adhered to, and certain excuses should be left in the design of each module, to facilitate subsequent changes in requirements, so as to facilitate subsequent administrators to take over and maintain.

4. Brief Introduction of Key Technologies of Human Resource Management System

4.1. J2EE Architecture and Its Model

J2EE is a framework concept, which can easily solve the problem of enterprise-level WEB application development. The core technology of J2EE includes more than a dozen types such as EJB, Java Servlet, and JSP. J2EE applies a four-layer distributed model and provides different demand responses according to different customer requests, which theoretically realizes the basic characteristics of high cohesion and low coupling software development. The following is a typical four-tier architecture of J2EE: 1) Application client programs, Applets client layer components and other client layer components running on the client computer. 2) WEB layer components running on the server, which can be JSP pages, or some technical frameworks such as FREEMARK. But according to the layered rules of J2EE, HTML and APPLETS are not components of the WEB layer. 3) Business logic layer components running on the server side. When developing different types of enterprise-level applications, you should be able to flexibly use different components and services according to your needs. 4) The enterprise information system layer software running on the JBOSS server.

4.2. MVC and MVP Model

The MVC (Model-View-Controller) architecture was first proposed by the SMALLTALK language research group and applied to user interaction applications. MVC stands for Model-View-Controller, which separates the input, processing, and output processes of an application in the form of Model, View, and Controller. Such an application is divided into three layers—model layer, view layer, and control layer. View (View): Responsible for formatting the data returned by the model and providing it to the user. There can be multiple attempts to use the same model, but it depends on how the data should be represented (Ma, Zhao, & Fan, 2010). Model (Model): Defines the relevant rules of the world or process to be represented by an application, and can be considered as a specification responsible for application data and its behavior. Control (Controller): Responsible for determining how the application responds to what is happening in the application space (usually the user's actions), for which it is necessary to coordinate the model and view to produce an appropriate response.

The separation of model, view and controller allows a model to have multiple display views. If the user changes the model's data through a view's controller, all other views that depend on that data should reflect those changes. Therefore, whenever any data change occurs, the controller will notify all views of the change, resulting in an update of the display. This is actually a model change-propagation mechanism.

4.3. SSH Framework

SSH is the abbreviation of Secure Shell, formulated by the Network Working Group of IETF; SSH is a security protocol based on the application layer and the transport layer. SSH is currently the most reliable protocol designed to provide security for remote login sessions and other network services. Using the SSH protocol can effectively prevent information leakage in the remote management process. Traditional network service programs, such as: ftp, pop and telnet are inherently insecure, because they transmit passwords and data in clear text on the network, and people with ulterior motives can easily intercept these passwords and data. Moreover, the security verification methods of these service programs also have their weaknesses, that is, they are easily attacked by the "man-in-the-middle" method. The so-called "man in the middle" attack method is that the "man in the middle" pretends to be a real server to receive the data you send to the server, and then pretends to be you and sends the data to the real server. After the data transmission between the server and you is changed hands by the "middleman", serious problems will arise. SSH is also commonly known as three-tier architecture: the first layer is the entity class layer, the second layer is the business logic layer, and the third layer is the presentation layer (display layer).

4.4. B/S and C/S Framework

System architecture design starts with several steps such as system requirements, system decomposition, technology selection, and formulation of technical specifications and development instructions. The architecture design is usually carried out after the system analysis is completed. The development of this system will be based on the B/S mode architecture for specific development and implementation, and an MVC framework model has been realized. The advantage of setting up the architecture in this way is that users can easily access and browse the system, and at the same time, each business module can have a lower degree of coupling, both in the overall architecture and in the partial complex business processing, while maintaining High cohesion. According to the research comparison of C/S and B/S, it is found that these two modes have their own advantages and disadvantages, but combined with the development requirements of this system, users need to be able to access it conveniently. Each user only needs to install a browser on his computer and connect to the Internet to access the human resource management system of his subordinates on the server, change

and add his own basic information, and view some personnel change information at the same time. However, the development of C/S mode requires users to install the client program uniformly, which will reduce the efficiency of human resource management. Therefore, the B/S mode is chosen here for system development.

5. System Design

5.1. System Design Goals

The trial operation user of this system is the personnel department of a certain university, so the design goal of the system is to make the system better serve the colleges and universities. Through the use of the human resource management system, managers can quickly and efficiently complete the higher education. The daily personnel management of colleges and universities reduces the cost of human resource management, enabling managers to concentrate more energy on achieving efficient and great strategic goals.

Specific to the design of the system, the design of the system will adhere to the idea of software engineering, optimize the functional modules of the system, and design each module from the architectural level, so that the coupling degree between the various modules of the system is low, and each module increased cohesion. The database design should ensure good field scalability to facilitate subsequent increase in demand. In this way, a good design has been carried out at both the data level and the module level, so that the design of the entire system can guide the subsequent development work and reduce the trouble caused by design changes. Specifically, the goals to be achieved in system design and implementation are as follows: First, the design of personalized interface: users with different roles need to provide different welcome interfaces and different system functions (Wang, 2011). The layout of the system interface should be reasonable and intuitive, and the operation of the system should be simple and easy to grasp. Minimize the training time and training cost for users of all levels to use the system. Second, the security and stability of the system: the operation of the platform should be stable and safe to ensure the normal use of users. Third, the configuration of the client: the development of the platform is based on the B/S design, as long as the client interface is installed with a browser, the system can be used. Different versions of browsers can guarantee users' normal access and use. Fourth, technical standards: In order to integrate with some existing systems, the design and development of the platform, including the setting of database fields, must comply with national standards. It is necessary to improve the interface with other systems and platforms to facilitate the integration with other systems and platforms. Fifth, it has good scalability: in order to better meet the needs of future users, it is necessary to ensure that the system platform has good scalability. Sixth, it has better portability and scalability: among the modules of the system platform, it is necessary to ensure that each module has a high degree of loose coupling.

5.2. System Architecture Design

1) System physical architecture design

According to the B/S development mode adopted by the platform, the corresponding physical structure of the platform basic framework can be determined, which can be used as a reference for system detailed design, system testing and system deployment. The physical architecture diagram describes in detail various communication entities related to the system architecture, including Web server (apache server), database server, firewall, Internet and different user terminals. Among them, the apache server is mainly used to receive request information from user clients and produce dynamic web pages, and handle various businesses in the teaching process, including judging user permissions, judging data access permissions, and providing logical rules such as user needs; the database server is responsible for To store and manage various database tables, the database server and web server are separated in physical structure, and a special person is in charge, which can ensure data security, reduce data transmission volume, and provide data access speed, etc. The user client terminal uses a browser to use the system platform.

2) Functional architecture design

Through the comparison of C/S and B/S frameworks in the third chapter, combine the development requirements and business requirements of the human resources management system. Users of the system include super administrators, ordinary administrators, advanced users, and ordinary users. After entering the system through identity verification, they can access the modules with access rights granted by the system. The system is supported by the built database platform, strictly abides by the MVC development model, and reduces the change cost as much as possible.

3) System function module design

This part will design the process in more detail from the business process and give a detailed description. The designed human resource management system should try to improve the independence between the functional modules of each system. 1) Module independence the independence of modules means that each module in the system only designs sub-functions that meet the requirements, has no direct connection with other modules, and only exchanges data through simple interfaces or intermediate modules in the system. The independence of modules in the system can be measured by two indicators of system coupling and cohesion. In order to ensure that the system modules have good independence, various unnecessary data calls should be reduced as much as possible, and modules that are closely related and have similar functions should be integrated into one module, which is also convenient for future system debugging and calling. 2) Module coupling the coupling of the module refers to the degree of close relationship between the various modules in the system. When designing system modules, the coupling between system modules should be reduced as much as possible and closely related modules should be integrated into the same module

to ensure that the modules have as high independence as possible. When designing the interface between modules, the design should be as simple as possible, and a system as loose as possible between modules should be established to facilitate future system debugging and operation and maintenance. 3) Module cohesion the degree to which the various elements in the module are combined with each other in the system becomes the cohesion of the module and the cohesion is measured from the perspective of function. The stronger the cohesion, the more functions are required to be integrated in the module, and the more complex the module is. In order to achieve high cohesion and low coupling of modules, improve the independence of modules. The system can be designed hierarchically, such as designing subsystems of the system, designing sub-modules within modules, and so on.

4) Organization management

The organization management module includes three sub-modules: organization management, position management, and organization chart display. The most authorized user of this module is the super administrator, because the organization structure of a unit cannot be easily changed under normal circumstances. Once it needs to be changed, the super administrator needs to modify the information, and other users can only view and browse related information. The organization management sub-module is mainly to perform operations such as adding, modifying, deleting, and querying the organization setting information of a unit. The post management sub-module is mainly designed from three posts: technical posts, management posts, and teaching posts. Special posts can be added under appropriate circumstances to meet development needs. The system will also manage vacant positions according to different departments, improve the management efficiency of personnel, and at the same time can be used as a basis for personnel recruitment. The organizational chart displays the sub-module, and the administrator is responsible for uploading and maintaining the latest organizational charts of departments and units. In actual situations, there may be mergers and splits of certain departments. In order to ensure timely update of information, it is necessary to set up this module for organizational management.

5) Attendance management

The attendance management module includes two sub-modules: daily attendance management and overtime management. The daily attendance module is responsible for managing the daily attendance information of employees. The overtime management module centrally displays the overtime information status of departments or employees from different dimensions. The attendance management module is an important management module for information exchange and transmission between ordinary users and advanced users. After logging in to the system, first judge the user. If it is an ordinary user, fill in the attendance sheet. The attendance sheet is divided into three types: overtime application form, leave application form, and business trip application form. If you need to

handle the above three applications, you need to fill in the corresponding documents and report to the senior user for approval. After the senior user logs in to the system, he is responsible for the approval of the application documents submitted by ordinary users. If the approval is passed, it will automatically enter the background data processing and enter the salary accounting process.

6) Salary Management

The salary management module includes two sub-modules: salary and bonus management and distribution management. The formulation of salary management objectives should proceed from the development strategy of the entire enterprise unit, combined with the human resource management strategy, and comprehensively consider the salary level, salary structure and adjustment. The formulation of an appropriate salary policy plays an important role in attracting and retaining talents, and ultimately can enhance the competitiveness of the entire unit. The salary and bonus management sub-module is interrelated with the attendance management module. The data processed by the attendance management module is used as the input data of the salary and bonus management module, and the salary and bonus are calculated through personnel events such as leave, overtime, and business trips. Because salary data is relatively sensitive data, in terms of data maintenance, through authority control, salary managers at all levels can only see the salary level information of their own units. The payment management sub-module in the salary management module mainly means that after the salary calculation is completed, the salary is paid on time according to the planning management system of the unit, and statistical analysis reports are issued, such as employee salary schedule, salary summary table and payroll, these Information can provide support for decision-making of high-level users.

7) System security design

First, the system adopts a permission access mechanism. According to different user identities, different system operation permissions are granted. According to the actual situation of Huaneng Xinjiang Energy Development Co., Ltd., the system users are divided into three layers: super administrators, ordinary administrators, advanced users, and ordinary users. The super administrator can maintain the global database, set user permissions, manage accounts and other functions, but cannot modify the content in the database table, let alone view the encrypted information in the database. Ordinary administrators can maintain department-level databases and perform corresponding operations. Advanced users mainly refer to departmental decision-makers and relevant personnel in the HR department, who can perform related business operations. Ordinary users are ordinary employees except the company's decision-makers and staff of the personnel department, who can only inquire about some information and submit personal information and related applications. Users must perform identity authentication when accessing the database, and need to enter the correct user name and password to log in to the system. After the user passes the identi-

ty authentication, the system will perform access control according to the user authority information stored in the ORACLE database system. Second, encrypt the database. The confidential information stored in the database is encrypted and stored, and the information in the database is changed into an unreadable form through encryption technology. Even if the data leaks, the plaintext of the private information cannot be seen without a corresponding decryption program, thereby improving the security of the system sex. Third, implement IP control on access links. Since the human resource management system is only used by internal employees in the local area network, it is possible to set specific IP segment access to the server, deny external illegal IP access, and "ping in" operations, etc. Close the unused ports in the server, leaving only the ports used in the system. You can also screen out other unused port visits in TCP/IP screening. Fourth, the database security log. Strengthen the records of database logs, focus on recording important data access records, and place database access logs in a specific location to facilitate future queries, while preventing malicious attackers from invading the database server to tamper with or delete security logs. Fifth, data backup and recovery. During the use of the database, it may be damaged for some reason. Therefore, in order to ensure the integrity of the data in the database and facilitate the recovery of the system in the future, we need to regularly back up the database in different places. The powerful backup and recovery functions provided by ORACLE itself can enable us to perform backup and recovery work better without knowing the related operations of many background databases.

6. System Testing and Result Analysis

Software testing is an indispensable means to ensure system security in the process of system development and implementation. The following will briefly introduce some commonly used software testing methods. From the perspective of whether the test is aimed at the internal structure of the system and the specific implementation algorithm, it can be divided into white box testing and black box testing. First, black-box testing is also called functional testing or data-driven testing. It is a test to check whether each function can be used normally when the functions that the product should have are known. When testing, the program is regarded as a black box that cannot be opened. Without considering the internal structure and internal characteristics of the program, the tester performs the test on the program interface. It only checks whether the program function is normal according to the requirements specification. Use, whether the program can properly receive input data to produce correct output information and maintain the integrity of external information (such as: database or file). Black-box testing focuses on the external structure of the program, without considering the internal logical structure, and only tests the software interface and software functions. It is mainly used for software acceptance testing. The black-box method is an exhaustive input test. Only when all possible inputs

are used as test cases can all errors in the program be found in this way. There are actually infinitely many test cases, and one not only needs to test all legal inputs, but also tests possible inputs that are not legal. Second, white-box testing is also called structural testing or logic-driven testing. It is to test whether the internal actions of the product are carried out normally in accordance with the provisions of the specification under the known internal working process of the product to verify that each path in the program works correctly as intended, regardless of its internal function. The main methods of white-box testing include logic driving and basic path testing, etc. The white-box method is exhaustive path testing, which is mainly used for software acceptance.

Through the functional test of the human resources management system based on B/S mode, we obtained the following results: the functions of each module are easy to operate, the response time of the database in the system is normal, the maintenance operation of basic information is normal, and no errors occur; in the system When entering the basic information of personnel, due to the large amount of information for each personnel, the operation is time-consuming. It is recommended to add the function of batch data import later. Statistical analysis management is a bright spot in the realization of the system, and each display function runs well without errors. The personal settings and the function points in the system management module have all met the requirements of the initial functional requirements analysis, and the data export function is easy to use without obvious errors. Through the analysis of the above test results, the human resource management system based on the B/S mode is convenient and fast to operate, the interface is beautiful and generous, and the process of data processing is clear and reliable. It conforms to the concept of human resource management in the 21st century and greatly promotes the development and the efficiency of human resources management makes up for the lack of management work.

7. Summary

In daily management work, through the edification of practice, managers will also develop new management concepts, and instill the latest management concepts into the functional modules of the system in a timely manner, so that they can maximize the role of computers and help managers making effective choices so that the human resource management system based on the B/S model can lead the management work of the enterprise forward is the direction that this research still needs to work on. In future work, I will be more practical and continue to conduct in-depth research and development to make the system more perfect and achieve more humanized management.

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Conflicts of Interest

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