Design of Online Sharing System for College Writing Teaching Resources in the Media Age

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Abstract. The traditional online resource sharing system does not describe the information data association semantics enough, which leads to a long resource search time. To solve this problem, this paper proposes an online sharing system of college writing teaching resources in the era of media. In terms of hardware design, C/S architecture and HDFS distributed architecture are adopted to design the overall structure of the system and optimize the data processing chip and data integrator; In the aspect of software design, it configures lightweight database, stores writing teaching resource data orderly, describes teaching resource by association, selects the optimal integration path, aggregates the shared associated data, calculates the optimal sharing path, and transmits teaching resource to the visiting users. The experimental results show that the degree of revealing the relevance of data nodes in the design system is higher than that of the two traditional systems, which improves the integration efficiency of writing teaching resources and shortens the search time of the same type of resources.

Keywords: Teaching resources · Online sharing · Hardware design · Software design

1 Introduction

At present, writing teaching resources have become the focus of school construction, which has a great impact on educational informatization. Teachers and students have increased their dependence on online teaching resources. However, due to the rapid increase in the number of teaching resources, the efficiency of searching teaching resources is poor. Aiming at this problem, an online sharing system of writing teaching resources is designed.

In foreign countries, the research on the sharing of teaching resources is earlier. Through the system mode, service mode and economic mode, using the relationship characteristics from description to analysis, the cooperation between different school districts is realized, and the quantitative and qualitative methods are adopted to sort out and share information resources. Domestic research on teaching resource sharing has also made great progress, building a technical platform for excellent teaching resources, using literature analysis and case analysis to summarize teaching resources, providing dynamic and easy to expand resources through private cloud mode, and information

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resources can be virtualized, which is the teaching information resources to be transmitted, Provide computers and other equipment as required. Combined with the above theory, the traditional resource sharing system is improved, the resource processing chip and integrator are optimized, the associated semantics of database resource information are integrated, the associated teaching resources are associated together, and the search time of teaching resources is shortened.

2 Design Method of Online Sharing System for College Writing Teaching Resources in the Media Age

2.1 Hardware Design of Online Sharing System for Writing Teaching Resources

Design the Overall System Architecture

Using C/S architecture and HDFS distributed, the overall architecture of resource sharing system is designed. The HDFS API interface is called to store and read the teaching resources of writing. The basic information of users is stored in the database, and the resource data is uploaded, downloaded and shared through the web service interface. The mode of four-tier architecture is as follows: interface presentation layer, which is mainly used for system interface design, including control layout, content display, interaction design, etc.; business logic layer, which is mainly used to realize business logic of each function point, plays a bridge role between interface presentation layer and data access layer, encapsulates business logic code in the system into logical functions In the teaching resource sharing system, for the sake of data security, the data access layer does not participate in the direct interaction with the database server, but through the WCF service mode, the database operation is independent, forming a separate In the database proxy server, the system only needs to call this service in the data access layer; in the infrastructure layer, in order to further increase the encapsulation of program code, the data fields in the program are encapsulated into different classes of the model layer, so as to facilitate the frequent use of data fields by other architecture layers [1, 2].

NF is adopted in infrastructure layer_ 5270m4 server, install multiple virtual hosts on it, deploy and install Hadoop system cluster, and install elasticsearch distributed search engine to locate resource data. On the underlying infrastructure, virtualization technology is used to build a private cloud, and VMware vCenter service is deployed and installed. The host resources with esxi are clustered and integrated to form a hardware resource pool, including computing resources, storage resources, network resources, and so on Client client is used to manage the hardware resource pool on the server side. The hardware resources in the resource pool are virtualized into several independent virtual machines to provide resource sharing services [3]. So far, the design of the overall system architecture is completed.

Design Neuron Chip

Neuron chip is an important hardware device in the online sharing system of writing teaching resources. It controls user access and realizes the upload, transmission, search and download services of teaching resources. Neuron chip includes mci43120 and mc143150 series. Mc143150 series supports external memory and is suitable for complex application in control system. Mci43120 has ROM, does not support external memory, only stores writing teaching resources. There are three 8-bit CPUs in the chip, namely MAC CPU, network CPU and application CPU. The specific structure is shown in Fig. 1

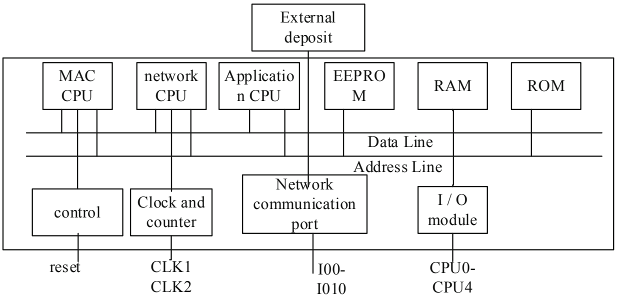


Fig. 1. Neuron chip structure

I/o0 -- I/O10 represents 11 programmable input and output pins, and service pin is used to identify users. According to different access devices, neuron chip has 34 working modes to choose, so as to flexibly configure the upload and download modes of teaching resources. CLK1 and CLK2 are 16 bit timing counters. CLK1 inputs teaching resources and outputs them from I/o0 channel through a multi-channel selection switch in I/O4 ~ I/O7. CLK2 can only input from fixed channel I/O4 and output from I/o0 channel. CP0 ~ CP4 represents five information data management, and its management configuration is divided into three different interfaces: differential mode, single mode and special mode, so that the resource online sharing system can adapt to the reading and transmission of different file formats.

Mac CPU is neuron chip medium access control processor. It communicates with network CPU through shared RAM network buffer, controls physical layer and data link layer of shared system, and completes conflict through hardware driving data transmission link [4]. The network CPU is the network processor of the chip, which controls the network layer, session layer and presentation layer of the sharing system, and completes the functions of route addressing and network management. The network CPU and MAC CPU share the network buffer in RAM, and the firmware performs the operation of user code and user code call. Through sharing the application buffer and network CPU in the memory, the network CPU searches and transmits information data, and completes the application service of teaching resources. So far, the design of neuron chip is completed.

Design Teaching Resource Data Integrator

According to the online sharing service function of teaching resources, the data integrator of the system is optimized. The overall construction of the integrator is divided into five modules: core, associated interface, power supply, network function and peripheral circuit. Svb12f762 chip is selected as the integrator, and its configuration should meet the circuit requirements of the integrator. The level conversion is carried out through the svb12f762 chip, so that the integrator can maintain high level all the time when the bus is idle and reduce the reflected signal. An isolation link is added to the data integrator interface to transmit the correlation integration signal of digital resources from the signal line, and isolate the interference signal, so as to ensure the stability of the communication signal in the process of Digital Resource Association integration [5]. The overall framework of the data integrator is shown in Fig. 2

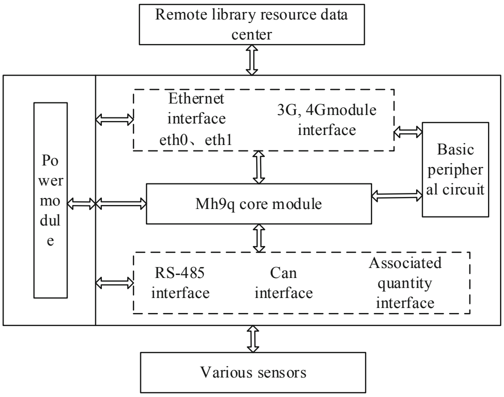


Fig. 2. Framework of data integrator

As shown in the figure above, the core module uses the mh9q core data board produced by Freescale company to build 4 GB EMMC flash and 2 GB memory to collect the information data of writing teaching resources, and collect them to cortex-a9 four core processor, and drive the resource data through Ethernet and can bus interfaces, so as to support the operation of data association and integration. In the optimization of the power module, the data integrator uses 24 VDC power input to make the collector face the industrial general interface. The power module is connected with the neuron chip to convert the transistor transistor logic level signal. The level is directly connected with the input and output interfaces of the core module, and the can transceiver of writing teaching resources is added to stabilize the output of 5 V power supply, so as to realize the overall optimization of the data integrator [6]. So far, the hardware design of the system is completed.

2.2 Software Design of Online Sharing System for Writing Teaching Resources

Design Teaching Resource Database

According to the functional requirements of the hardware of the resource system, a lightweight database is configured to store the information data of teaching resources in an orderly manner, and record the operation status of the system's associated integrated digital resources. DAQ is embedded in the hardware of data integrator_ status_ TB table and data_ store_ TB table, where DAQ_ status_ TB is used to store the running state,

Table 1. DAQ_ status_ TB configuration

Field name	Field meaning	Field type
start_time	Serial number of data association integration interface	Blob
sensor_num	System operation status	Interger
ID	Ms level, time stamp	Interger
daq_serial	Auto increment primary key	Interger
status	Serial number of various sensors	Text

Table 2. Data_ store_ TB configuration

Field name	Field meaning	Field type
Raw_data	Serial number of Digital Resource Association integration	Text
sensor_number	Raw data	Interger
store_date	Association type	Blob
daq_type	Consolidated data	Text
Process_data	Auto increment primary key	Interger

data_ store_ TB is used to store all kinds of writing resources. The details are shown in Table 1 (Table 2).

Using MySQL database and concurrent operation, we can directly access the data files of writing teaching resources. To simplify the access process, users send access requests through text/htm1; charset = UTF-8//in the PHP processing module of the database, then process the PHP script, parse the data of the book digital resources, read and write the data configuration file through login BTN > submit-text2//, receive the return information of PHP script, and finally generate var export (LIST1, 10) - catch//displays data to the entire web page to monitor the data in the database. So far, the design of library digital resource database is completed.

Describe the Relevance Semantics of Teaching Resources

Using ontology semantics, the teaching resources stored in the database are processed by data, and the terms, descriptors and titles related to the teaching resources are described by association semantics to obtain descriptive metadata. Firstly, according to the naming standard of cool URIs formulated by the semantic web, the writing teaching resources are named by URIs. With the help of various description methods provided by FRBR, a vocabulary set of associated data is created to describe the semantic ontology of teaching resources [7]. The specific types are shown in Table 3.

Table 3. Classification criteria of digital resources association semantics

Semantic name	Subnet type involved	segmentation criteria
Hirarchy	P-P; K-K; M-M	Genus
Citation relation	P-P; M-M	entity
Correlation	P-P; K-K; M-M	Integral part
Equivalence relation	P-P; K-K; M-M	synonymous
Attribute relation	P-P; P-K; K-K; M-M	Synonymous
Discuss the relationship	K-K; K-M; M-M	synonym
See relation	P-K; K-K; K-M; M-M	Antonymy

According to the contents of the above table, the progressive transformation mechanism of teaching resources association semantics is constructed, and the corresponding sub network types are selected. Then it describes the associated semantics of teaching resources. With the help of entity extraction mechanism and d2rq transformation tool, the writing teaching resources are transformed into RDF metadata. On this basis, new semantic descriptive metadata is created. Finally, combined with the characteristics of online resource sharing, the publishing mode of associated data is selected to expand the teaching resources of writing, and a network environment with stronger Resource Association and scheduling is constructed. Combined with service and associated data, the integration system can link internal and external resource data. So far, the description of digital resource association semantics is completed.

Integration Path of Computing Teaching Resources

According to the user access and retrieval information, optimize the associated data network, select the optimal resource integration path, take the path as the link path of the associated data, add and modify the writing teaching resource data. First of all, the association semantics is standardized, and the frequency of different semantic query words is counted. Then the core query words are determined, and the four attributes of the core query words are determined. Then, the similarity between different writing teaching resources and the word is calculated.If the similarity distance formula is used, the similarity calculation formula Q is as follows:

$$Q = \left(\sum_{i=1}^{4} \left(\mathrm{a_k} - \mathrm{a_j} \right)^{\mathrm{k}} \right)^{\frac{1}{\mathrm{k}}} \tag{1}$$

In the formula, i are the four attributes of the core query words and a is the associated data of the writing teaching resources. k, j are the visualized spatial dimension of the data and the quantified value of similarity distance, where $j = 2$ or 3 are taken. When $k = 1$, it represents the real distance between the core query word and the spatial dimension. When $k \neq 1$, it is the bounded distance, representing the total absolute wheelbase on the spatial dimension [8]. By transforming formula (1), it is found that the optimal path to transform the infimum distance S is as follows:

$$S = \frac{1}{c^{Q}} \tag{2}$$

By calculating the sharing path of information resources, the integrated writing teaching resources are transmitted to the visiting users. In the formula, c refers to the frequency of the associated data of teaching resources and the core query words. When $0 < c < 1$, the optimal path value S is between (0, 1). The smaller the value, the closer to 0; when $c < 1$, the smaller the value, the closer to 1 [9]. According to the occurrence frequency of different resource associated data, the value k, j of two link parameters is determined to make the value reach the limit value S, and the final path of the conversion data's definite bound distance is obtained. The path is used to transform the associated data of teaching resources, and the optimal mode of resource integration is obtained. Finally, the query words that are not closely related to the associated semantics are eliminated, the service function of the associated data is improved, and the link path between the associated data and the resource ontology is mapped to form the integrated data of writing teaching resources, so as to complete the calculation of the integration path of teaching resources.

Choose the Best Sharing Path of Teaching Resources

Judge the sharing path of information resources, and transfer the integrated writing teaching resources to the visiting users. Firstly, the integrated writing teaching resources are virtualized. Through virtualization technology, multiple computers are logically virtualized into one computer, so that the shared services can run independently on the logical computer, and each logical computer can perform different operations, so that the storage resources and the host can be integrated to realize the digitization of writing teaching resources [10].Suppose that the service of the i shared path Q_{i} can satisfy the user's sharing request, the buffer idle value of the path receiving information resource is A_{i}, the transmission rate is λ_{i}, and the average transmission delay is μ_{i}, then the probability of k data blocks to be sent in the shared path at any time is Q_{ik}, and the relationship can be obtained as follows:

$$Q_{ik} = \begin{cases} \left(\frac{\lambda_i}{\mu_i}\right)^n A_i & n = 0, 1, \ldots, A_i \\ 0 & n \geq A_i \end{cases} \tag{3}$$

When the scope of this judgment $\frac{\lambda_{\mathrm{i}}}{\mu_{\mathrm{i}}}$ is less than 1, $\frac{\lambda_{\mathrm{i}}}{\mu_{\mathrm{i}}} < 1$, the sharing path of writing teaching resources is as follows:

$$Q_{\mathrm{i}} = \left(1 - \frac{\lambda_{\mathrm{i}}}{\mu_{\mathrm{i}}}\right) \Big/ \left[1 - \left(\frac{\lambda_{\mathrm{i}}}{\mu_{\mathrm{i}}}\right)^{A_{\mathrm{i}}+1}\right] \tag{4}$$

When $\frac{\lambda_i}{\mu_i} > 1$, if the average residence time of output data block is W_i, the average number of data blocks entering the shared path is T_i, and the average number of data blocks transmitted is L_i, then the shared path is:

$$Q_i = \frac{L_i}{T_i \lambda_i \times (1 - W_i)} \tag{5}$$

After determining the sharing path of information data transmission, the information resources are scheduled, and the shared resources are provided to users through the path. In the process of scheduling, it is necessary to deploy various applications of sharing services, improve the sharing program of digital sports information resources, so that users can access the writing teaching resources of colleges and universities through the cloud, so as to complete the selection of the optimal sharing path of teaching resources and realize the system software design. Combined with hardware design and software design, the online sharing system design of college writing teaching resources in the era of media integration has been completed.

3 Experiment and Analysis

The design system is recorded as experimental group A, and two groups of traditional online sharing system of teaching resources are respectively experimental group B and experimental group C. The integration effect and retrieval efficiency of the three groups of systems on teaching resources are compared.

3.1 Experimental Preparation

This paper selects a university electronic library, extracts writing teaching resources as experimental elements, uses Stanford topic recognition model toolbox to annotate data resources semantically, and takes semantic annotated digital resources as experimental

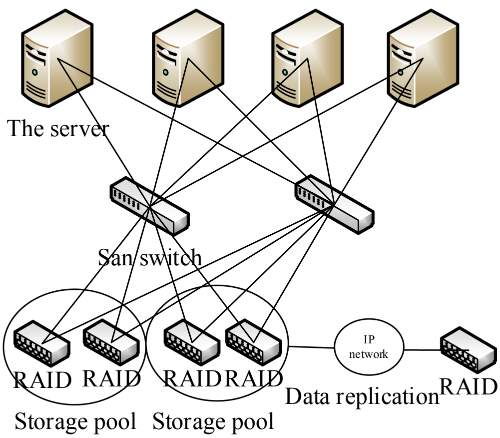


Fig. 3. Storage device of resource virtualization

objects. Three groups of experiments share their resources respectively. The storage device of group a resource virtualization is shown in Fig. 3

The windows host is configured with 2 GB memory, 2.50 ghz, 100 M/Gigabit Campus network card, 320 G SATA hard disk, and the operating system is windows7; the host server is configured with 2.13 GHZ, 4 G memory, Gigabit Campus network card, 1t SATA hard disk, Xeon four cores, the kernel version number is linnux 2.4.20–8, and the operating system is Linux RedHat 9.0. The related semantics of writing teaching resources are described in Table 4.

Table 4. Experimental data elements and their relationship

Entity	Element code	Associated element code
Practice on your own	P1	P2, P3, M2
Online course	P2	P1, K2, M1
Keyword analysis	P3	M2
Model text	K1	K3, P1, K2
Extracurricular reading	K2	M3, P1, M2
Summary of key points	K3	M2, K1, P2, M3
teacher commenting	M1	P2, M2,
Writing template	M2	P1, K2
Expert lecture	M3	K1, P2

The visualization of the relevance semantics of the writing teaching resources selected in the experiment is shown in Fig. 4

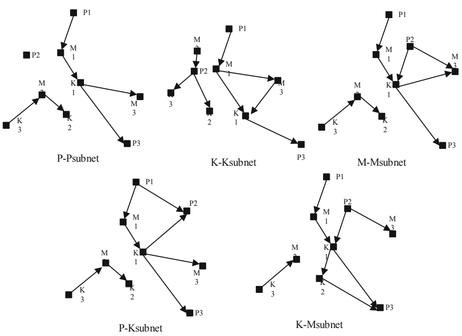


Fig. 4. Visualization results of resource association semantics

The semantic relations of nine node elements are obtained, which are correlation relationship, argumentation relationship and reference relationship. Selecting P-P, K-K and

M-M subnets to construct deep aggregation hypernetwork, the association relationship of different nodes can be obtained, as shown in Fig. 5.

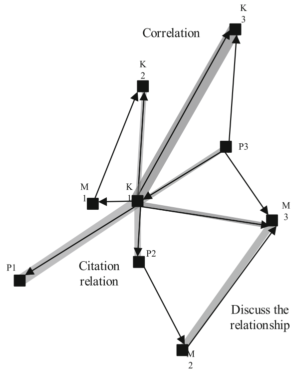


Fig. 5. Aggregated hypernetwork visualization results

The thickness of lines in the graph represents the strength of the relationship between different node elements. Three groups of experiments were conducted to obtain the visualization nodes in the deep aggregation hypernetwork, and the resource set of the integrated nodes was constructed by UCINET software.

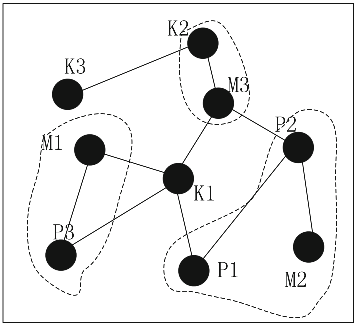
3.2 Experimental Results

Results of the First Group of Experiments
The results of the three groups of experiments for 9 node elements are shown in Fig. 6

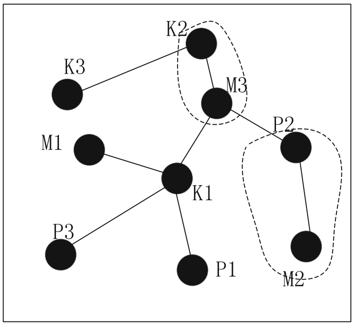
As can be seen from Fig. 6, the node set of the resource set integrated by group B and group C is relatively loose. Group B constructs the association semantics of P2, M2 and K2, m3, while group C only constructs the association semantics of K2 and M3, and nodes P3 and M2 do not have a clear relationship with other nodes. However, there are more association relationships between nodes in group A than in group B and group C, and three associations of p1p2m2, k2m3 and m1p3 are constructed Semantics.

Results of the Second Group of Experiments
On the basis of the first group of experiments, we searched the related writing teaching resources, and the search time comparison results are shown in Table 5.

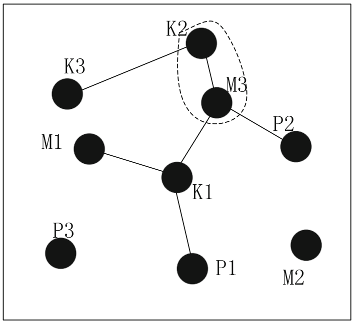
According to the data in Table 5, the average search time of group A is 4.1 s, and that of group B and group C is 11.5 s and 14.6 s respectively. Compared with group B and group C, the search time of group A is reduced by 7.4 s and 10.5 s respectively. To sum up, the degree of revealing the relevance of data nodes in this design system is higher than that of the two traditional systems, which improves the integration effect of writing teaching resources and shortens the search time of the same type of teaching resources.



(a) Results of group a construction



(b) Results of group B Construction



(c) Results of group C construction

Fig. 6. Comparison results of resource integration

Table 5. Resource search time comparison results (s)

Association Code	Group a search time	Group B search time	Group C search time
P1	4.3	11.2	13.8
P2	4.2	10.3	14.2
P3	3.9	11.5	14.9
K1	4.4	12.3	15.1
K2	3.8	10.2	13.8
K3	3.7	11.2	14.0
M1	4.2	12.9	14.2
M2	3.5	11.8	15.8
M3	4.9	11.7	15.3

4 Conclusion

The design system through the associated data and virtualization, deep aggregation of writing teaching resources, shorten the resource search time, improve the efficiency of resource sharing. However, there are still some deficiencies in this study. In the future, private cloud will be used to determine the optimal scale of resource sharing, so as to make resource sharing more stable and effective.

References

1. Mingfang, Z., Rui, T., Yu, X., et al.: The construction of excellent resources-sharing course platform of analytical chemistry and its application in online teaching. Guangdong Chem. Ind., **47**(15), 179–180+195 (2020)
2. Ying, F., Meng, L.: Design and research of online education course resource sharing based on cloud platform. Mod. Electron. Tech. **43**(1), 175–178 (2020)
3. Zeng, F.: Design and implementation of new engineering collaborative teaching platform. J. Guangdong Ind. Tech. Coll. **19**(3), 12–15+20 (2020)
4. Yongsheng, H., Sai, J., Jie, C.: Design of teaching platform based on meteorological big data and resource sharing. Comput. Technol. Dev. **30**(3), 132–136 (2020)
5. Hui, S., Ren, Y., Jun, C.: Research on the construction of online teaching and resource sharing management platform in Digital campus. China Med. Educ. Technol. **33**(1), 60–64 (2019)
6. Yuting, J.: Construction of distance learning resource sharing platform based on cloud computing. China Comput. Commun. **31**(21), 230–231 (2019)
7. Zhang, G.: A study on the sharing path of high-quality virtual simulation teaching resources in the view of regional integration. J. Jining Norm. Univ. **41**(6), 97–99: 103 (2019)
8. Fu, W., Liu, S., Srivastava, G.: Optimization of big data scheduling in social networks. Entropy **21**(9), 902 (2019)
9. Liu, S., Li, Z., Zhang, Y., et al.: Introduction of key problems in long-distance learning and training. Mob. Netw. Appl. **24**(1), 1–4 (2019)
10. Liu, S., Lu, M., Li, H., et al.: Prediction of gene expression patterns with generalized linear regression model. Front. Genet. **10**(12), 120 (2019)