

Design of Personalized Online Education System of Forestry Science Based on Big Data Technology

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Abstract:

With the advent of the information age, the cycle of knowledge updating of forestry science is becoming shorter and shorter. How to make teaching and training of forestry science meet the needs of people in different places and learning time, the traditional face-to-face education of forestry science has been inadequate in this regard. In this case, modern distance education came into being. Its advantage is that students can interact with teachers and complete learning tasks when time and space are not unified. With the combination of computer aided instruction (CAI) and Internet technology, online education based on Web has become a new trend in the development of modern education. This paper takes the distance education system as an example. In the work practice, according to the performance improvement needs of distance education system. This paper uses web testing technology to obtain the mainstream network equipment, network transmission bandwidth, system response, network load and other information to comprehensively analyze and record the use of the system. In this paper, through the analysis of the network test report, according to the report to develop the best network optimization strategy. After the network is optimized, it is tested and optimized again to improve the network performance. So as to provide a comprehensive, convenient, intuitive and accurate test and optimization scheme for distance education network. The system can reduce the heavy performance guarantee work caused by the continuous complexity of online education network application, and provide convenience for online education application system.

Keywords: Computer aided instruction, forestry engineering, Internet technology, web testing technology, online education.

I. INTRODUCTION

China's distance education technology has basically entered a new stage based on network. In terms of basic education, a large number of primary and secondary education online schools

have sprung up spontaneously in recent years [1-2]. In the aspect of higher education, the Ministry of education has approved dozens of key universities to carry out the pilot work of network distance education, which accounts for a considerable proportion in China's universities. The unique advantages of network education in time and space determine that it can quickly achieve large-scale enrollment and realize the transformation to "mass education". In terms of adult education, the original distance education system in China is transferring to the network, forming a new pattern of multi-media coexistence. In addition, how to use distance education to promote the development of higher education in Western China is becoming a hot topic [3-5]. The development of modern distance education is of great practical significance for promoting the development of education in China, establishing lifelong education system and realizing the leap forward development of education.

Distance education is a kind of education form that students and teachers, students and educational institutions mainly use a variety of media means to communicate and teach systematically. Two way interactive video, one-way video broadcasting, video on demand and data sharing are commonly used in distance education. Modern distance education is supported by computer network (and satellite digital communication) technology, which has the advantages of free time and space, resource sharing, open system and easy cooperation. Network education, especially web-based distance education, has the characteristics of regional universality, technical complexity and cultural diversity, which makes it difficult for a large number of online learning resources to be shared and different education systems to communicate with each other. Distance education system involves a series of devices, such as server, transmission network, routing, terminal and so on. Its physical structure is very complex, involving many software and hardware applications, such as website, terminal and so on. Any failure or bottleneck in any part of the system may lead to poor operation or even collapse of the system. In the complex distance education system, system bottlenecks occur frequently, and it is often necessary to determine the fault and bottleneck of the system [6]. Therefore, it is necessary to develop the testing and optimization strategy of the distance education system.

II. GENERAL ONLINE EDUCATION SYSTEM NETWORK SITUATION AND SOLUTIONS

At present, the distance education providers mainly include: Education metropolitan area network of China basic education, distance education center of colleges and universities, special distance education network, etc. The users of distance education include school users, family users, correspondence Station users, etc. From the perspective of the use of the network, we can divide all kinds of distance education into one or two categories: the first category is the use of wide area network, which is distributed in the correspondence stations all over the country.

Students from 200 correspondence stations in the whole map are taught and tested in a unified way; The second type is the distance education that uses the private network to target the students in a certain area, such as the distance education of the students in each school based on the Chinese basic education man; The last one is the distance education provided by Internet for individual and family users [7-9].

Distance education is a form of education in which students and teachers, students and educational institutions communicate and teach systematically by means of various media. Two way interactive video, one-way video broadcasting, video on demand and data sharing are commonly used in distance education.

The network center of distance education in Colleges and universities generally uses bighammer 6808 as the core switch, Gigabit connection to the distance education server group, the router connecting to the WAN adopts nethammer, and g908nethammer 6908 can connect to the WAN through the special line. The correspondence education stations distributed throughout the country can be divided into large, medium and small ones. The network of large correspondence Station can use high-performance netha m380 router as the equipment to connect Wan, the core switch adopts bighammer6802 intelligent multi-layer switch, and the intelligent access switch is attached to connect users; Nethammer m242 router and m2024 Fast Ethernet switching unit network are directly used in medium-sized Correspondence Education station; For small correspondence stations, nethammer M128 router with Trinity function can be used directly.

According to the application of distance education in Colleges and universities, the scheme has the following characteristics:

1. Large capacity switching processing of core switch

As a distance education service provider, colleges and universities use bighammer6808 as the core switch. Bighammer6808 is an intelligent multi-layer switch based on 10g platform, with distributed crossbar backplane structure and 256g switching capacity, which meets the requirements of large capacity data exchange.

2. Core router

In any complex application environment, the core router can maintain efficient forwarding performance. It is the entrance for all students to access the distance education server. It needs to have very high performance, and carry out the corresponding security, QoS and other

strategies that occupy more resources and affect the performance of network equipment. Nethammer g908 has 4G backplane, and the packet forwarding ability is up to 2.4mpps, And this packet forwarding rate will not be reduced by increasing ACL policy and QoS policy [10].

3. Perfect QoS guarantee

The most important technology to ensure QoS in Wan backbone should be congestion avoidance, which requires network devices to limit according to service types to ensure the quality of service of high priority data. Nethammer series routers support flow classification, queuing, scheduling and shaping mechanisms such as wred, WRR, PQ and WFQ, so as to ensure the video, sound and video quality of distance education The quality of shared document data transmitted over the network.

4. Support of DVPN in the whole network

The distance education network should be a safe network. It is a very common method to use VPN to transmit data in Wan. However, traditional VPN requires remote devices to have a fixed IP address, while many correspondence stations use ADSL / ISDN and other access methods. The IP address is dynamically assigned, so it is difficult to use traditional methods to establish VPN, DVPN can not only establish VPN tunnel between two routers with fixed IP address, but also establish VPN tunnel in the network with fixed IP address at one end and unfixed IP address at the other end. The networking scheme of users will be more flexible, and the correspondence Station can be connected with the equipment of the center through various access modes, thus reducing the network construction cost. DVPN combines the advantages of GRE and IPsec VPN technology, which can ensure that the VPN network is more perfect in terms of confidentiality and easy management. It is a customized VPN solution for distance education.

5. Multicast support in the whole network

The data types of distance education are mostly video and voice, and the transmission over Wan is challenged. If the teaching application can be carried out through multicast, the bandwidth will be greatly saved and the transmission quality will be improved. The nethammer series routers of harbor company support multicast routing protocols such as DVMRP, PIM, IGMP and group management protocols, It plays a key role in improving the transmission quality.

6. Router solution

In small correspondence stations, nethammer M128 is generally provided with "three provinces in one". It has eight Ethernet ports, which are directly connected to the user's PC machine, and there is no need to purchase another switch; Nethammer M128 has built-in DHCP server and NAT function, which saves DHCP and NAT server; Nethammer M128 supports ADSL access mode, eliminating the need for ADSL modem: this integrated design minimizes the number of devices, reduces the number of failure points, simplifies operation and maintenance, and provides users with the best cost-effective solution.

For basic education, many cities have established their own education man, whose purpose is to use the network to improve the quality of teaching and enhance the communication between schools. Distance education is the core to achieve this goal. The advantage of educational resources can be concentrated in the core node to provide distance education resources for the following schools. Because the education man covers all primary and secondary schools in the man, the purpose of distance education is to provide services for all schools, and the construction of man generally adopts the networking mode of switch, and the bearing medium is generally optical fiber. In such a network, we can carry out the education mode with higher requirements for bandwidth and service quality, such as interactive multimedia teaching. Generally, the basic network with high switching capacity, high QoS guarantee, high port density and high bandwidth is provided to lay a solid foundation for distance education. The education man generally has several core nodes. The core switch is biga suner 6808 intelligent multi-layer switch, which is connected into a ring with 10G Ethernet port, and connected to the distance education server group in Gigabit. In order to make good use of distance education resources in schools, according to the use characteristics of school e-classroom, generally provide school access solutions, using 6802 and Li hammer3550 intelligent switching unit network. The network solution for distance education application of education man has the following characteristics:

1. Based on 10g platform and distributed crossbar architecture, it provides non blocking processing for distance education.

2. IEEE 802.is/iw, as an IEEE International standard protocol, can provide ms level link protection without technical risk. It is a low-cost link protection technology suitable for distance education network platform.

3. Comprehensive security of content, device and user, perfect ACL access control policy customization, prevent illegal content access; Broadcast packet suppression and broadcast source location function, ensure the security of network equipment: IP + MAC + port binding,

support port anti check technology, quickly locate illegal users, ensure the safety of network users.

4. Perfect QoS the core layer of the scheme can strengthen the centralized control of network security through NAT, MPLS VPN and other means. At the same time, the whole network equipment supports a variety of QoS based on port, MAC, VLAN, IP, application type and so on; It supports flow classification, queuing, scheduling and shaping mechanisms such as wred, WRR, Po and WFQ, endows distance education solutions with high intelligence and efficiently supports various teaching applications.

5. The whole network multicast support in order to effectively reduce the occupation of network bandwidth and minimize the possibility of blocking, the whole network multicast is a good solution. The above scheme provides PIM, dfmrp and other multicast router protocols on the core layer of bighammer6808, and PIM, IGMP and other multicast protocols on the campus core exchange, IGMP snooping protocol is provided on the P hammer3550 intelligent access switch, which truly realizes the multicast support of the whole network and well supports the large-scale distance education participated by tens of thousands of students.

6. Perfect hierarchical and decentralized network management, convenient and efficient Easytouch network management platform, in the completion of rapid network configuration, fault analysis, accurate fault location, while maintaining the ease of use of the network management system; To achieve decentralized network management, simplify the management system of large education metropolitan area network, and make the carrying network management of distance education application easier and easier.

For home users and individual users who use distance education through Internet, there are various access ways. Their network status is mainly related to the operators they use, including ISDN, dial-up, ADSL and other ways. They can access to the Internet and access the external servers of various distance education institutions for teaching services.

III. ERHMA MODEL

ERHMA is an agent-based two-layer filtering model, which is divided into two parts: Web education resource pool filtering layer and Web education resource subclass filtering layer. In the first part, the subcategories of Web educational resources are obtained by filtering with the algorithm HA_SA based on semantic similarity. In the second part, the candidate Web education resources are obtained by filtering the filter algorithm HA_Q based on Q learning, and its logical block diagram is shown in Figure 1.

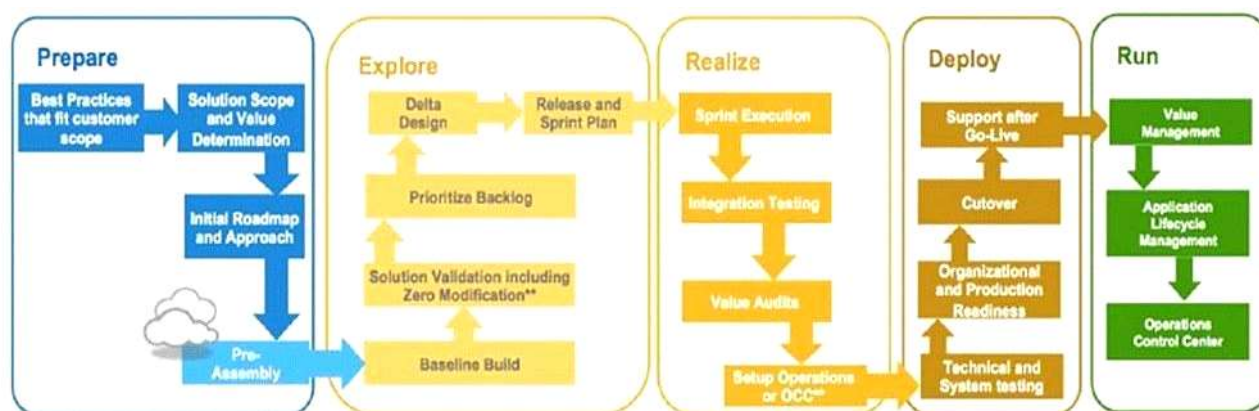


Fig 1: Hierarchical Model for Pre-selection of Web Educational Resources

In Figure 1, the Web education resource pool is a variety of educational resources that can be searched from heterogeneous networks, and belongs to the lowest level resources of the model. Every educational resource in the Web educational resource pool $E=\{e_1, e_2, \dots, e_i, \dots, e_n\}$ has corresponding attributes after preprocessing, namely resource name, resource number id and resource type. Web educational resources subclass is composed of several educational resources subclasses filtered by semantic similarity comparison. Candidate education resource layer is a user-oriented Web education resource, which is obtained by filtering subcategories of education resources by learning according to user feedback information. ERHMA model is dynamic and intelligent because of the Agent technology.

Pre-selection stratification of Web education resources includes three stages: pretreatment of Web education resources, classification screening according to semantic similarity comparison, and screening according to user feedback information. The preprocessing stage and similarity comparison stage are resource-oriented classification and screening processes, while the learning and screening stage based on user feedback information is a user-oriented resource screening process, which makes the model better centered on user needs. At this stage, users need to feedback their satisfaction degree, which adopts the commonly used scoring mechanism: five grades (11, 12, 13, 14, 15), and the satisfaction degree gradually increases. The algorithms in this paper are divided into filtering algorithm HA_SA based on semantic similarity and filtering algorithm HA_Q based on Q learning.

Firstly, a filtering algorithm HA_SA based on semantic similarity is adopted, which mainly considers the following two aspects:

(1) How to calculate the weight of the feature item in the resource according to the feature item extracted from the resource.

(2) How to calculate the semantic similarity between two Web educational resources to filter the resources.

The algorithm uses vector space model to filter the web education resources, quantifies the resources into a group of feature items, respectively counts the word frequency of the feature items in the resource name (title) and text, and calculates the weight of this feature item. Finally, the similarity between the two web education resources is calculated according to the cosine formula. The implementation process of the algorithm is shown in Figure 2.

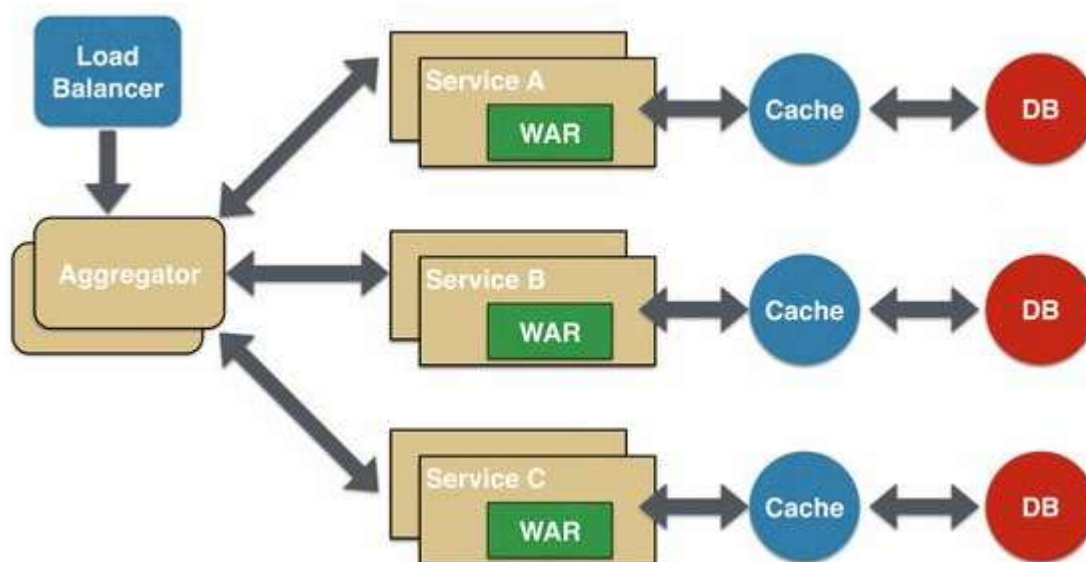


Fig 2: HA_SA algorithm's execution flow execution flow

Assuming ϵ represents a given lower limit of similarity, if the similarity of a resource is lower than this value, the resource is filtered out in this resource class.

Algorithm 1 filtering algorithm HA_SA based on semantic similarity

Enter Web education resource set $E=\{e_1,e_2,\dots,e_i,e_n\}$, ϵ

Output the subset of Web education resources $E'=\{e'_1,e'_2,\dots,e'_i,e'_n\}$ after semantic

similarity comparison

Step1 for (all $e_i \in E_i$) { initialize e_i ; }

Step2 for (all E_i)

Step2.1, obtaining a feature vector $e_i \in E_i$;

Step2.2 Calculate e_i weight according to formula (1) (according to title and content);

Step2.3 for (all $e_j \in E_j$)

Calculate the similarity between e_i and e_j according to formula (2);

If $\text{sim}(e_i, E_j) > \varepsilon$ then put e_i into E_j ; }

If ($E_i = \phi$) delete e_i ; }

Step3 returns E_j

In this paper, a filtering algorithm HA_Q based on single Agent Q learning is proposed, which mainly considers the following three aspects: (1) How to adjust the Q value of Web education resource user Agent according to learning; (2) How to get the return value; (3) How to determine the next action according to the current state. Due to the complexity and mass of users of Web educational resources, the problem becomes more and more complicated.

This algorithm uses the Q learning method in the enhanced learning model to filter the Web education resources, and takes the users of the Web education resources as Agents. According to the Q value (state-action) of the initialized agents, it selects the appropriate actions to continue learning until it reaches the learning level expected by the target agent. The execution flow of the algorithm is shown in Figure 3.

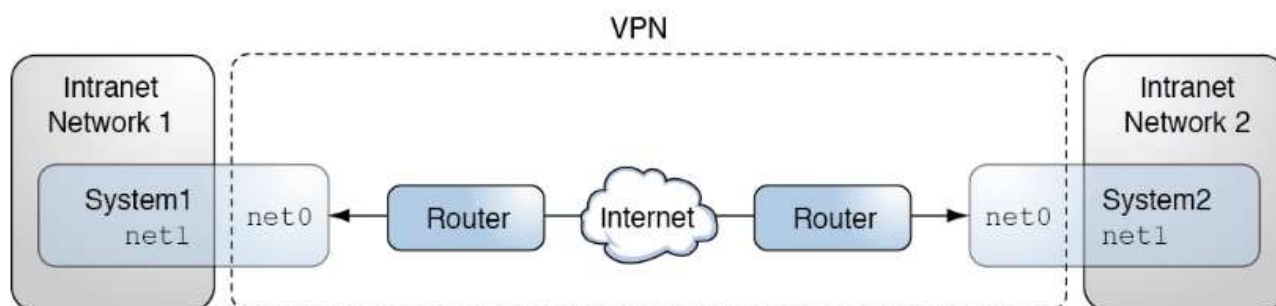


Fig 3: HA_Q algorithm's execution flow execution flow

HA_Q algorithm firstly initializes the Q value (action-state) and learning degree γ of Web education resource user Agent; Secondly, for a certain action executed by the user Agent, the reward value is obtained through learning; Then, the q value is updated by the Q value updating formula (i.e., formula (3)); Finally, it is judged whether the satisfaction degree is greater than the expected learning degree of the user Agent, and the candidate Web education resources are obtained.

IV. Experimental data

Assume that γ represents the learning degree expected of user Agent; N_i indicates the satisfaction degree. If the satisfaction degree is lower than the learning degree, the state is transferred according to Boltzman function, and the resources selected by the user Agent in this behavior are filtered out.

Algorithm 2 Filter algorithm HA_Q based on Q learning

Step1 for (all S){ initialize s,a, γ ; }

Step2 for (all St)

Step2.1 Select the state St;

Step2.2 for (all U){ Execute action at to generate new state St+1
, get a reward $rt+1$; }

Step2.3 Adjust the value of v according to formula (3);

Step2.4 $St \leftarrow St+1$;

Step2.5 if($N_i < \gamma$) is selected for state transition according to Boltzmann distribution;

Else if($St+1$ meets the goal) {End of learning; }

End of Step3

The data set used in the experiment is a set of resources $E\{e_1, e_2, \dots, e_{50}\}$ randomly acquired by CNKI. Firstly, these resources are preprocessed to form feature itemsets, and the weight of each word is calculated according to formula (1), and the experiment in this paper is compared with the results of CNKI search. Table 1 shows the data after pretreatment. Agent and model are selected as two feature items in feature item set, and the title, text and total indicate the frequency of feature items appearing in resource e_i respectively.

TABLE I. Pre-processed data

RESOUR CE SEQUENCE NUMBER	AGENT			MODEL		
	Tit le	Te xt	Total	Tit le	Te xt	Total
e1	1	19 0	191	0	3	3
e2	1	23	24	0	2	2
e3	1	23	24	0	2	2
ei	0	0
e50	1	43	44	0	2	2

Ten users were randomly selected from HowNet to evaluate these 50 resources, with five grades (11, 12, 13, 14, 15). The satisfaction degree of the acquired data is calculated, and the efficiency of resource search is enhanced by Q learning algorithm.

V. CONCLUSION

In this paper, Agent agent-based hierarchical model ERHMA for pre-selection of Web educational resources is proposed. The target resources are screened twice: (1) classified and screened by the filtering algorithm based on semantic similarity; (2) The filtering algorithm based on Q-learning is used to screen twice to reduce the scale of candidate services. This experiment filters the resources with low similarity and low user satisfaction, which is close to the needs of users. However, this model has not considered the factor of credibility, so we will study how to establish a hierarchical credibility model for pre-selection of Web educational resources in the future.

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