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Analysis of Application Requirements of Streaming Media System Based on Campus Network

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***Abstract**: At present, the network construction of Chinese universities has been perfected day by day, and the application of various systems after the network has been built is also accelerating. The mature application of streaming media technology has been extended to many areas of our lives. How to build an efficient and stable platform in the healthy campus network is the focus of this paper. According to the actual demand and current situation of the school, this paper designs a streaming media teaching platform in the campus network, which can be used in the entire campus streaming media network teaching.*

***Keywords**: Campus network; Streaming media; System application requirements; Teaching interaction*

Background

The new technology represented by multimedia and Internet is developing rapidly, and at the same time, it promotes the process of teaching informatization. Video, audio and VOD (Video On Demand) based on network become an important way to improve the quality of teaching in colleges and universities. How to transform the traditional audio, video and film resources into the resources that are easy to live and demand on the network, and make the whole school teachers and students can share, has become an important application after the full coverage of the campus network. At the same time, teaching evaluation, excellent courses, distance teaching, foreign language autonomous learning, scientific research activities, lectures and so on all need to be recorded and retained through new technical means. Therefore, the focus of this paper is to discuss how to integrate the network platform of colleges and universities, so as to realize the integration and application of streaming media resources.

Wuhan Polytechnic University is a multi-disciplinary university with engineering as the backbone and coordinated development of Engineering, management, science, literature, economics, agriculture, art, law. The university has invested a lot of money and manpower in the construction of network and educational information, and has built up a relatively advanced campus network system, which lays a solid foundation for the next step of educational information (such as artificial intelligence) . The campus network covers all classrooms, laboratories, libraries, teaching departments, administrative departments, sports venues, family areas and student dormitories. The school also built a multimedia classroom, computer room, laboratory, phonetics room, independent learning center. However, in the daily teaching, the use of the above equipment by teachers still lags behind: first, although the campus network has been built, there is no corresponding teaching application arranged; second, the use and development ability of the existing equipment by school

Vol.2 No.1 2021
https://doi.org/10.37420/j.cer.2021.001

teachers is limited, the teaching content is rigid, the network teaching way is few, the campus net has not developed completely, can not attract the student. It is an urgent task to improve the frequency of using information facilities and the teaching service.

Research Analysis

Instead of being limited by classroom space, students can study wherever there is an Internet connection. Besides watching lively and interesting courses, students can also communicate and interact directly with teachers through the Internet. The application of teaching video makes students no longer subject to the constraints of space, and make overall arrangements according to their own needs and learning process anytime and anywhere, which has become the continuation of extracurricular learning. Streaming technology is a rapidly developing information release technology in recent years. Originally a product of paid video on demand over narrow band networks, streaming technology is taking over traditional media markets at an unimaginable speed because of widespread demand. Streaming media technology mainly uses digital technology to release audio and video streaming information. It not only solves the problem of large storage space and high cost of audio and video files, but also rapidly applies to the field of education with its high-quality picture, fast content index and convenient transmission mode.

There are two ways to record classroom teaching content in real time:

The first is the combination of traditional video editing and streaming media transmission technology. In this way, high-quality audio and video files are first produced by video recording, and then software is used to install and replace the teaching content, so that it can be edited into high-code streaming video format, such as AVI, MPG4, etc. Using the digital editing technology to carry on the nonlinear editing, the production into the streaming media format into the VOD. The advantage of this approach is that the picture quality is higher and the content is more complete. But the cost of resources is larger, time, manpower, material resources investment is more. In addition, this method is difficult to broadcast the teaching, which requires expensive equipment such as multi-channel camera positions, digital switchboard and delay captioning machine. Therefore, this VOD method is generally only used to apply for national and provincial high-quality courses and high-quality resource-sharing courses.

The second method is automatic recording and broadcasting system using tracking technology. That is, through the multi-channel camera fastball, screen video capture card and other fast production of one or more channel video stream, and the use of the platform set in the early strategy, automatically track and record the teacher's teaching video. Its advantage is that the capital investment is small, the recording effect can basically meet the learning needs of students, can be used for live broadcasting, and students can also timely communicate with the teacher, the real response to the on-site teaching situation.

Research Purpose and Content

This paper mainly studies how to enrich the resources of streaming media into the classroom teaching and students' after-class learning by means of live broadcast and VOD under the environment where the

campus network platform has been completely established. Expand various audio-video teaching application systems based on the integration of campus network platform and streaming media technology, and give practical technical solutions. The program is mainly divided into three parts: First, automatic recording and broadcasting system for teaching resources. Taking advantage of its features of low cost, fast construction speed, real response to teaching reality and powerful interactive function, the platform of streaming media video live broadcast and on-demand is established. Second, based on the existing audio-video and future audio-video teaching resources, they are converted and integrated and put into the streaming media server for students to learn. Third, the audio and video signals received by the satellite are directly decoded digitally, and then converted into streaming media resources. One part directly enters the teaching resource platform, the other part enters the teaching resource platform after modification under the guidance of the teacher. In order to coordinate with the specific design of the scheme, this paper will study streaming media live broadcast technology, on-demand technology, streaming media information processing technology and transmission technology, so as to provide a reference for the construction of network streaming media system resource platform of Wuhan Polytechnic University.

Overview of Streaming Media Technology

Streaming media technology (Sasabe, Wakamiya & Murata, 2005), which is not a new media, only uses the server to compress the existing audio, video and video content into independent data packets and then transmits them to the network. The other end of the user can receive the download while decompressing to watch. Using the buffer to make the actual download time is far less than the user watching time, to a certain extent, can avoid the interruption of playback. With the spread of broadband Internet, streaming media technology allows us to have voice and video chats. This technology has many advantages when applied to teaching, even better than the effect of on-site teaching. With the development of technology, streaming media technology has solved various limitations of traditional media, and it is stronger than the traditional way in terms of transmission mode and communication interaction. Streaming media is no longer a single streaming transmission technology, but a technology based on many basic technologies, such as "network communication technology suitable for streaming transmission and multimedia data acquisition, compression, storage, transmission technology" (Ma, 2011).

Streaming Media Transmission Method

Streaming media transmission technologies fall into two categories: Progressive Streaming and Realtime Streaming. Progressive streaming transport is represented by sequential downloads, where customers receive downloads and store downloaded files while viewing online content. But users can only view the parts that have already been downloaded, not the parts that have not yet been downloaded. Standard HTTP servers can send sequentially streamed files and do not require other special protocols, so sequential streaming is often referred to as HTTP streaming. Realtime streaming, on the other hand, differs from HTTP streaming in that it allows media to be viewed in real time, making it particularly suitable for live broadcasting. In addition, it can also provide video recording function, which is interactive and can satisfy the user's operation of backward or fast forward in the process of playing. Realtime streaming must match the corresponding network bandwidth, but media quality can be poor when the network is clogged. Realtime streaming transmission needs special

Vol.2 No.1 2021
https://doi.org/10.37420/j.cer.2021.001

streaming media server and streaming transmission protocol, "in a sense, it is actually a kind of VOD technology" (Liu & Hu, 2011).

Technical Principle of Streaming Media

The concrete realization of streaming media transmission is largely realized by caching. Data is packaged into packets of different sizes and sent asynchronously across the network. Because the route chosen for each packet is different, all packets arrive at the client at completely different times. Therefore, "it is very important to use the cache to determine the order of packets, and use the empty cache to cache the subsequent content that has not been played yet, so as to ensure the continuous and stable output of the streaming media data stream".

Transmission Mode of Streaming Media

1. Unicast

Unicast is a point-to-point one-way connection, which allows the source host to send packets to the target host through this connection. Before sending a packet, the router will find the sending path according to the address of the target host. The address in the packet is unique. In unicast state, "it is impossible for multiple users to obtain the same packet".

2. Broadcast

The concept of broadcast is the opposite of the concept of unicast, which allows a host to send packets to multiple hosts. Any host on the network segment will receive the packet sent from the broadcast host, but this will cause a waste of network resources and low efficiency, "will occupy the network bandwidth to a large extent" (Xing, Wang & Zhao, 2003).

3. Multicast

Multicast is a network technology that allows one or more senders to send a single packet to multiple receivers. The core idea of IP multicast is: sending data packets to a group of hosts through an IP address; The sender only sends the message to an address, and the receiver only needs to join the group to receive the message. All receivers receive the same data stream; The members of the group are dynamic and can join or quit the group at any time according to their own will. Each host can join multiple groups at the same time; Each multicast address can have multiple data streams on different ports, and many practical applications can share a group address. IP multicast technology can effectively avoid the broadcast storm caused by repeated transmission, and can break through the limitations of routers to send packets to other network segments. Multicast group, group management protocol and multicast routing are the key parts of IP multicast. "It is an important way to broadcast news in the case of superior bandwidth usage in campus network" (Eriksson, 1994).

Streaming Media File Format

1. ASF Format

The suffixes for Microsoft ASF files are .asf and .wmv, and the corresponding player is Microsoft's "Media Player". Users can combine graphics, sound, and animation data into one file in ASF format, and can convert video and audio from other formats to ASF format. And they can also use sound cards and video capture cards to save peripheral data such as microphones, video recorders in ASF format. At the same time, ASF-formatted files can be added to the command script, users can use this to achieve interactive operations. In the implementation of streaming multimedia content publishing, "ASF files are often divided into network packets to be transmitted over the Internet" (Du, 2010), so ASF files have the advantage of small size and are very suitable for transmission in the network. Windows Media Player of Microsoft can play files in this format directly.

2. Real Media Format

Real Media can be used for entertainment, training and online education:

(1) Illustrated Audio. The Web Tour feature allows users to voice or video narratives of Web pages. Users can watch or listen to presentations using the Real Player software or browser.

(2) Streaming Video. After the video signal is obtained by camera or projector, live broadcast based on Internet is carried out through Web site;

(3) Remote Seminar. Instructors give advance notice on the Internet, and the audience visits a URL before the lecture begins. When the lecture starts, the audience can see the speaker's image and PPT picture and hear his voice. When the speaker flips PPT, the PPT picture on the client side will also flip automatically, and the whole lecture can also be recorded for future broadcast.

(4) Pay by View. When a user wants to watch content live or on demand from a content provider, if the user does not have a license, Real Player takes the user to the content provider's website and "pays to apply for a license" (Peng, 2014). Common formats are RM, RMVB, RA, RV, and so on.

3. Quiek Time Format

Quiek Time is a video format introduced by Apple Inc.. It has the programming interface of C and Pascal, which can be used to control the Time base signal when using more advanced software. Applications can use Quick Time to generate, display, edit, copy, and compress movies and movie data, just as they edit text files and still images. It can create streaming technology using Apple Script simple digital media technology and supports SMIL to provide the basis and standards for interactive media creation. The file type can store content, modified file type and other information, and the suffix is *.mov. "We can see that Sony's small digital recording devices often use this format to save streaming media files" (Tao,2002).

Vol.2 No.1 2021
https://doi.org/10.37420/j.cer.2021.001

4. Other Formats

MPEG, FLV, AVI, DVI are some common streaming media formats, but users will have different choices according to the different needs of the network operation. These formats now often appear in a variety of streaming media resources.

Transmission Protocol of Streaming Media

Streaming media transmission protocol is a necessary basic component to ensure the smooth transmission of streaming media in the network. Now, several transmission protocols of streaming media have been widely recognized as follows:

1. Realtime Transport Protocol/Realtime Transport Control Protocol

It is a protocol for the transmission of multimedia data streams over a network. RTP provides one-to-one transmission of real-time audio and video data or, if the underlying network supports it, sends data to multiple endpoints, namely one-to-many transmission. Realtime Transport Protocol consists of two parts, RTP and RTCP. RTP contains some important fields that enable the receiver to judge the received packet and restore it to the original state. "RTCP realizes the user's operation of playing, pausing, fast-forward, recording and positioning of streaming media content through RTSP".

2. Resource Reser Vation Protocol (RSVP)

It is a signaling protocol established and controlled by the transmission channel that reserved the required resources in the network. "This protocol urges the receiver of streaming data to actively request the router on the path of data flow" (Schulzrinne, Casner, Frederick & Jacobson, 1996) and reserves a certain resource, namely bandwidth, for the data flow, so as to ensure the quality of service. However, RSVP does not improve the ability of multimedia data transmission, it must cooperate with other realtime transmission protocols to complete multimedia communication services.

3. Real Time Streaming Protocol (RTSP)

RTSP is an application-level protocol developed by Real Networks and Netseape for multimedia flow control. The main use of this protocol is responsible for the transmission of multimedia data over the network, using RTP/RTCP to provide data transmission services. It can set up and control one or more audio and video streaming media for simultaneous time streaming (Schulzrinne, Rao & Lanphier, 1998).

Analysis of Application Requirements of Streaming Media System based on Campus Network

Existing Network Environment of Wuhan Polytechnic University

1. Overall Campus Network Structure of Wuhan Polytechnic University

The campus network of Wuhan Polytechnic University has been stable and mature, covering all teaching areas, laboratories, libraries, teaching departments, administrative departments, stadiums, family areas and student dormitories. The campus network generally adopts a star network topology structure, with two main nodes, which are located on the fifth floor of science and education building of Changqing campus and the third floor of Jinyin Lake campus library, covering all office areas, teaching and experiment areas, student dormitory areas and family areas in the range. All buildings in the school have adopted the standard intelligent structured wiring scheme, and the core switch of the campus network has implemented the dual-machine hot standby, making full preparations for the ten-megabyte backbone network and the new generation of Internet. The university has established the interconnection with China Education and Research Network, China Telecom and other export links, so as to realize the quick and stable access to the network information resources at home and abroad. At the same time, in order to make reasonable use of the outlet resources of the campus network, the controller limits the traffic of the relevant network access applications of the campus network users, so as to ensure the normal access of the entire campus network users to the network resources inside and outside the campus. The layout of campus network construction is reasonable and rigorous, and takes sustainable development as the goal to ensure its own expansibility.

2. Campus Network Construction Plan of Wuhan Polytechnic University

The campus network of Wuhan Polytechnic University is a standard extensible network. The campus network adopts the standard access layer, convergence layer and core layer three-layer exchange design model, covering all teaching areas, office areas and dormitory areas. Wireless hot spot coverage is built in stadiums without fixed information points. All kinds of basic applications in the campus network have been carried out. OA system, mail server, library management system, educational administration system, examination system, self-service learning center and campus card system can assist all kinds of work normally and efficiently.

Planning of streaming media system of campus network

1. Webcast

In the media studio, focus interviews, streaming media audio-video production, scholars' lectures and other activities can be conducted. After the activity recording is completed, it will be released to the streaming media server through nonlinear editing for students to broadcast on demand, or the recorded realtime classroom teaching can be directly broadcast on the network as a resource by using the campus network after recording on the switching platform. The audio and video of teaching, scientific research, news and foreign language learning received by the satellite receiving system can be instantly converted into streaming media digital signals for live broadcasting in the campus network.

2. Video on Demand

Self-built or purchased video and audio resources, teaching resources, quality courses, quality resource sharing courses, scientific research experiment and practice images can be uploaded and published to facilitate

Vol.2 No.1 2021
https://doi.org/10.37420/j.cer.2021.001

students and teachers to watch and learn on demand. Satellite signals and automatic recording of classroom course resources can also be edited and then uploaded to the server to make their content more rigorous and detailed. Using network and multimedia technology to develop distance education can not be limited by time and space, and it is convenient to share all kinds of teaching information and teaching resources. Not only can it meet the needs of students' independent learning in multimedia classrooms, dormitories and libraries, but teachers can participate in learning lectures and conferences in various office areas.

3. Streaming Media File Recording, Saving, Publishing and Management

Automatic recording and broadcasting system is integrated with separate recording, live broadcasting, on-demand broadcasting, release and management. In this way, the teacher can directly broadcast the video after recording, edit and modify it after class, or store it in the special automatic recording classroom server, and apply for editing in the media production center. Satellite receiving system, teaching resources, audio-visual resources to streaming media resources, and streaming media resources independently produced by the media center are stored in another streaming media server, which can realize live broadcasting and on-demand functions separately.

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