# Design of Streaming Media Teaching Platform Based on Campus Network

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Abstract
Based on the current network situation and application requirements of Wuhan Polytechnic University, this paper designs a network streaming media platform which can be used by different kinds of audio and video resources with different requirements, in order to solve the school streaming media resources sharing platform practical problems. In addition, the initiative will enable teachers and students to better choose the appropriate streaming media resources according to their own needs, thus allowing greater autonomy in the scheduling of time and place, it realizes the normalization of audio and video file release and share in campus network.

Keywords
Network; Streaming media; Teaching platform; Teaching resources integration

Wuhan Polytechnic University has a basis for the construction of streaming media teaching platform. Satellite streaming video school live broadcast solves the broadband pressure facing students from outside the school to the streaming media website, saving a large number of video streams and downloading the bandwidth pressure brought about by the campus network. After the streaming media application platform is completed, the school's network service application will be further developed.

## The Overall Design of the Streaming Media System of the Campus Network

### Overall Design

The streaming media teaching platform of the campus network is mainly used for live broadcasting, on-demand broadcasting and broadcasting, allowing ordinary personal computer users to watch the

campus live broadcasting or on-demand video streaming by browsing. According to different audio and video resources and the ease of use by teachers, platforms can be divided into two categories: one is the teaching streaming media resources in the classroom of recording and broadcasting. Teachers can operate independently through this platform and make independent website, management system and interface. SMIL technology is used to realize the synchronous transmission of the teacher's teaching content screen and the recorded teacher video. Other teachers and students in the client can browse directly through the web page. The other is the integration of all streaming media teaching resources, including all kinds of live audio and video recording, satellite receiving system and media production center recorded streaming media audio and video. The streaming resources will be hosted on a video server and managed by a network hub staff. At the client end, users only need to enter the Web server through the browser to browse, and can also comment on the content of video resources or put forward the corresponding user needs.

## Recorded Streaming Media Teaching Resources in Classrooms

Self-recorded streaming video from each classroom or lab can be uploaded to the Internet for live broadcast at the end of the course, or stored on a streaming server first, after the post-production and then upload for students on-demand and learning. The biggest advantage of this model is that it gives the instructor maximum autonomy. In the classroom teaching teachers can get rid of cameras, camera workers, the most authentic reflection of the process of teaching. The video produced in this way can be used not only as a streaming media teaching resource for students to learn knowledge, but also as a starting point for students to communicate with teachers after class, and also as a basis for evaluating teachers. The most important thing is that teachers can look at their own teaching process through the recording of such teaching resources, and find out their own teaching shortcomings and advantages, so as to further improve the quality of teaching.

## School Other Teaching Resources Integration Platform

The platform can realize the integration of other streaming media resources. Whether it is satellite signal, video camera, existing streaming media resources or other signal sources can produce audio and video signals, can be converted into streaming media resources for students to learn and help teachers to improve themselves. These resources from a wide range of sources can greatly broaden the horizons of teachers and students. On the VOD platform, users can also comment on the streaming media files played by the entire streaming media platform through the client software, and interact with the streaming media resources in real time, so that the entire resource platform can better serve all teachers and students.

## Live Video and On-demand System

The subsystem of live video, rebroadcast and VOD must be able to connect seamlessly with satellite signal receiving system and various video source systems, and have flexible user authentication mechanism. All kinds of streaming media resources can be stored and accessed in the streaming media server for all clients to receive in real time through the browser. It requires stable operation of the system, clear live image and synchronous audio and video reception, provide high-definition video programs for campus network users. On the basis of supporting the current network protocol IPv4, it also fully supports the new generation Internet Protocol IPv6, which is convenient for the smooth migration to IPv6 network in the near future.

### Streaming Media Audio and Video Resources

1. Satellite Receiving System

Satellite network TV has three main functions: (1) it can receive satellite TV signals and live in the campus network in a controllable way; (2) it can receive satellite TV signals (16 channels) and record and edit satellite TV programs; (3) the campus network video live, collect studio video signal, live in the campus network (need to match with the media studio program).

The Wuhan Polytechnic University's satellite signal receiving subsystem plans to convert satellite signals into audio and video signals via satellite receivers and to output two channels of composite video. The satellite receiver transforms the satellite signal through the high frequency head to convert the high frequency signal of 3.4G ~ 4.2G or 10.70G ~ 12.75G into the intermediate frequency signal of 950M ~ 2500M, and send it to the video server, the video server for encoding processing.

The satellite receiver should be an anti-attack professional digital satellite TV receiver, which adopts the latest STI5518 chip, unique digital decoding technology and double PCMCIA DVB-CI interface, mainly including digital encryption signal (QPSK) input, ASI input and other input modes. Its features include: automatic detection of abnormal illegal signals, encounter illegal signals will interrupt the signal, signal interrupt prompt, can effectively prevent the invasion of illegal signals; with analog audio and video signal (CVBS) and BNC video output port; with RS-232 software upgrade interface; metal dome array has the advantages of high transmission rate and low bit error rate.

The satellite signal receiving subsystem is mainly used to receive the satellite TV signal, which can reduce the burden of school bandwidth. In the aspect of program configuration, the satellite signal receiving subsystem is installed for receiving foreign language and Chinese TV channel programs,

which can enlarge students' visual field and enhance their listening and speaking ability. Chinese TV channel program can be used for recording, editing, on demand, storage, but also in the campus network broadcast, to enrich the campus network service content, to meet the majority of teachers and students part-time life.

2. Automatic Recording and Broadcasting System

Automatic recording and broadcasting system is an upgrade of the resource classroom with camera teachers' self-recording, which uses infrared, image recognition or ultrasonic and other advanced electronic technologies to build an automatic tracking recording and broadcasting system. No matter what kind of technology it is, its fundamental is still to decorate a certain number of detection, tracking, positioning, intelligent strategy and other modules in the teaching room through its identification technology, which is jointly realized by arranging the operation of mouse and keyboard of teachers in different areas, as well as the voice excitation signal and the central control switch signal. The system has a strong advantage, which can realize the recording process without the participation of on-site staff, but the recorded audio and video can automatically generate streaming media and upload. At the same time, the encoding size of the generated streaming media video can also be modulated, generally ranging from 8K to 2000K. Teachers classroom video completely on in advance after many practical teaching develop strategies to implement after sampling, teachers are no longer have pressure, the whole teaching process can be carried out in accordance with the normal classroom teaching mode, also can better response normalized teaching level and problems in teaching, interaction between teachers and students can also be a complete record at the same time. In addition, the recording of the acquisition of sound through the microphone, intelligent central control and mixing desk can also achieve a very good effect. The final formation of the streaming media video streaming video server via a transport protocol directly, the streaming media video classroom finished recording broadcast live can be uploaded to the Internet at the same time, also can spread on after the completion of a recording media server storage on demand, once or post-production and then upload on demand for the student. The biggest advantage of this system is that it enables teachers to have maximum autonomy, and presents all scenes of classroom teaching in a three-dimensional and real way with the support of network streaming media resource transmission.

## Streaming System Resources of Media Production Center

The online teaching resources of Wuhan Polytechnic University include key construction courses, school-level excellent courses, provincial-level excellent courses, national-level excellent courses, and excellent resource-sharing courses. Each course contains course videos, and the media studio is the place where these courses are recorded. The school plans to invite experts, scholars, leaders

or students from inside and outside the school to interview on some hot issues and current affairs in the media studio from time to time. After the interview is recorded, it will be released on the streaming media server for students to broadcast on demand, or live broadcast through the campus network, and the campus network users can watch it in real time through the computer network. In addition to the release of streaming media for real-time video programs, the media production center is also responsible for the editing of all audio and video files of the school. For example, all teaching resources in the recording classroom can be edited and uploaded to the media production room. The media production center is also the place where all media files are converted into online streaming media files. Users' needs are known through the message on the client side of the web site, and all kinds of streaming media files are updated and supplemented in time, and sent to the streaming media server for all users to play on demand.

## Streaming Media Design

### Video Live Server System

Streaming media live broadcast is mainly realized through video live broadcast server. This system needs access layer switch with multicast function, and the access layer design of Wuhan Polytechnic University has been able to fully support this condition. The live broadcast server must be a multi-channel video broadcast device (streaming media encoder), and the input disconnect for use with the satellite receiving system must be more than 16 channels, and the output terminal shall be linked to the video server or storage via a gigabit network port. Through the live server to realize the AV signal network live; The latest hardware coding compression and streaming media technology are used to complete the functions of multi-channel audio and video acquisition, coding, live broadcast and video storage; Single device can realize 16 channel AV signal acquisition, coding and live broadcast; The video stream is adjustable from 8kbps to 2000Kbps; The audio output stream is adjustable from 8kbps to 160Kbps; Support standard PAL and NTSC; The resolution supports 352*288 and 704*576 real-time coding; The main function of the server is to provide all kinds of audio and video live and on demand in the campus network. In order to support the capacity of 7×24 uninterruptible coding, the server of streaming video resource generation is required to support the satellite receiving system, which requires the design of 16 video capture cards and a high performance server as the hardware base, but for stability, we'll stick with the standard rack-type structure. Most of the single function servers are functional servers, but because of their small size and relative stability, the disadvantages of poor heat dissipation can also be overcome. The server can insert subtitle support, support remote management, set audio and video processing tasks, and can set operation strategy, according to the preset strategy to ensure the normal operation of the system. At the same time, it also supports security function authentication and provides convenient and safe system to system interface. The client can choose the network TV channel freely and re-

cord audio and video according to the user's actual needs. If multicast mode is adopted, the number of users receiving live broadcast can reach unlimited number. The system directly supports B/S and C/S mode, and also supports remote management mode. It can support the functions of 16A/V signal collection, compression, coding, storage, live broadcast and on-demand of files after recording, and has audio and video output stream, convenient future according to different streaming media resource requirements for output stream modulation (audio 8Kpbs-160Kpbs, video 8Kpbs-2000Kpbs) . If the number of live users can be considered to take low bandwidth bitstream, or part of the streaming media audio and video files need to be edited with a Non-linear editing system can be used to save high bitstream. The system supports the mixed use of different bit streams, can set different bit stream output to run on different channels in one system, and can record streaming media directly onto IPSAN memory, users can easily and flexibly use the various options buttons and operation menus of audio, video and data communication in this interface.

## Video Acquisition System

The video acquisition system is mainly used as a server for recording audio, video and implementing live broadcast in the media production center. As it only needs to handle the transcoding and publishing of video signals along the way, the hardware requirements of this server are not very high, but in order to make use of the school's other resources, such as the stadium, the laboratory, the lecture hall live video, then the server needs to be more portable, can be moved at any time, this can improve its utilization rate can also reduce a large number of hardware investment. The collection system is also mainly used for live broadcast, its function is a single-channel video live server, through which the AV signal can be broadcast live on the network, using the latest hardware coding compression and streaming media technology, the system supports 352*288 and 704*576 real-time coding, and its function is to provide live and on-demand broadcast of all kinds of audio and video in campus network, help stream media video resource generation. The system can insert subtitles, support remote management, can handle audio, video tasks, to support the market, such as highconway video and other more popular video compression card. The basic interface requirements are: 1×compound SD, 1×DV1394 SD/HDV, 1×compound SD, 1×DV1394 SD/HDV, 1×compound SD, 1×DV1394 SD/HDV. The basic interface must have, the acquisition equipment must use the modular design, in order to be convenient to meet the future demand, at any time to upgrade.

The live broadcast of video capture system will use Standard Streaming Media Transfer Protocol, supporting unicast, multicast and other network protocols; streaming media resources with various file formats can be broadcast on the network, and broadcast task time can be set, according to the need to set a task list for different times, different files broadcast, broadcast user reception can not be interrupted. Support the whole campus network live broadcast, free from the restrictions of gateway, routing, firewall to provide live streaming services, audio and video transmission between

the requirements of complete synchronization, can not appear any signal lag phenomenon. The delay time of receiving audio and video should be less than 1s. The client should be able to use text to communicate in real time while watching streaming video. The streaming media format files encoded after video capture and recording are the most commonly used streaming media formats nowadays, such as Microsoft's ASF or WMV format. The streaming media files can be edited by the third-party editing software on ordinary computers, video recording policy can be set at any time, with the function of providing video for clients. After recording the audio and video files, the streaming media files can be automatically uploaded to the VOD library (or can be set to not upload) to provide VOD services for users. The client can visit the streaming video website at any time in the place supported by the network environment, and receive live or on-demand streaming media resources. Video-on-demand streaming media files can be used by third-party VOD systems. The video collection system can support the hierarchical management of different user rights, remote access management, and set various time-sequential policies in playback.

The basic hardware configuration of the video capture system is: CPU Intel corei 5 or above, memory 2GB or above, display card ATI 1G, system hard disk 2T SATAII; mixed encoding of audio, video and audio is required. Audio: MP3, WMA, etc. ; video coding support MPEG4, WMV, DIVX, XVID, H.264, flv, etc.. In the case of low-stream VCD effect can be achieved, in the case of high-stream DVD or small high-definition effect. Audio requires sampling frequency at 32k to achieve clear and smooth quality. Live broadcast requires a very low occupancy rate of system resources, can match a variety of image sizes, "support subtitles, subtitles scroll, time and other real-time insertion" (Ni, Zhang & Guan, 2003).

## Streaming Media Service System (Embedded WEB Server and Web System)

### System Function Requirements

The streaming media server itself is not directly oriented to users. As an underlying system on the network, the streaming media service system calls various other network data exchanges to interact with network clients or browsers, and the user can not see this streaming media system. As a transmitter of complex data, streaming media server provides various interfaces for upper-level clients or browsers, on the basis of which many upper-level applications are derived, on the other hand, streaming media server is an audio and video application platform based on IP network, which includes streaming media audio and video live broadcast, on-demand broadcast and broadcast (Yang, Liu & Meng, 2009).

The hardware requirements for streaming media servers are: rack-mounted servers, six-core

to strong E7450 series processors *4(>=2.40GHz) , ECC memory 16G, >=667MHz, hard disk (>=15000rpm) , capacity >=1.2TB, Raid card (support RAID0/1/5/6/10) , >= 7+PCI-E slots, 3*100/1000 network card, DVD, 1+1 hot swap redundant power supply and hot swap redundant fan, guide rail support optional hardware remote management card.

### Web Server

The Web server runs the Web VOD system, which is based on Php+MYSQL Architecture and runs on the LINUX/BSD operating system. In order to improve the stability and expansibility of streaming media system, streaming media server and Web server are usually used in streaming media system. In contrast to the streaming media server used for managing and publishing streaming media files, the Web server serves as the streaming media server for directory services, and the Web server provides an interface for users, the user accesses the content on the web server interface via the http protocol, thereby configuring the .asx files locate streaming content posted on streaming media servers. The location of a streaming stream is often done by placing a hyperlink in the user interface on a web server to a location file (.asx) that a user can click to point to.asx files are located on a media stream on a media server, and pop up media player (such as realplay) to play automatically. “The advantage of streaming media can be brought into full play by using this transmission, which is also the main way of streaming media distribution and management.” (Guan, 2013).

### Storage Devices

The Wuhan Polytechnic University is built with adequate and secure storage, and both FCSAN and IPSAN are connected to the campus network in a very reliable way, fully meeting all the space and security requirements of a streaming media system.

## Handling of Streaming Media Sources

### Instructional Design of Live Streaming Media

The Wuhan Polytechnic University plans to create two types of webcasts, one of which will be live streaming of instructional videos, requiring a client to be installed on a computer in a multimedia classroom, then call the installed USB network camera, microphone head, start the client after entering its working interface.

The client has three recording modes. The first is panorama mode. This mode collects and compresses the signals of the multi-camera into a single video stream, which is displayed on a video interface and can be played in IE and other playing software, it can support the network and does not

occupy much bandwidth, at the same time, it can produce network courseware quickly.

The second is the movie mode. In this mode, multiple camera signals and computer signals are automatically switched according to a pre-designed strategy, according to the teacher's manual operation of the computer or the student's interaction with the teacher, and then form a single picture of audio and video streaming media for live broadcast. This mode can effectively integrate the real-time teaching, the interaction between students and teachers and the display of multimedia courseware, reduce the bandwidth of the network, and facilitate the dissemination and application.

The third is the resource model. In this mode, the multi-camera signal and the computer signal are collected and compressed into multi-picture streaming media respectively. The recorded video can exist in the form of a single file, which is characterized by the ability to obtain a single video material, it is convenient for post-editing and application. This mode is also a recording and broadcasting classroom with intelligent scene switching function built on the basis of a single audio-video resource production classroom.

In the output of streaming media format, wmv, asf are common streaming media output format, the feature is not to install plug-ins and live on demand software, easy to use, the whole recording system operation is very simple, easy to use. Teachers in class can easily choose automatic recording and manual recording, the operation method is also very simple, after class press the "End"button can easily control the end of recording task, complete the recording of the classroom teaching video. Teachers no longer have the pressure of recording audio and video. The whole teaching can be carried out normally according to the usual classroom teaching mode, which can better reflect the various teaching levels and problems in the normal teaching, the interaction between teachers and students can also be completely and completely recorded by this system, which shows all the scene contents of classroom teaching in three-dimensional reality with the support of network streaming media resource transmission. The system can automatically identify all the key links in the teaching process (teachers' blackboard writing, using teaching courseware, interacting with students, etc.) , automatically switch the scene, and realize the whole scene full automatic recording. The camera locates the teacher according to the teacher's position, and tracks the teacher's teaching process: when the teacher writes on the blackboard, the camera records the teacher's writing process and content; when the teacher operates the computer, the camera will switch to the operation of the computer and record the picture of the computer courseware in real time. When the teacher asks a question to the student, the camera will automatically point at the student and record the question and answer process, the camera slides back to the teacher and continues to record the lesson.

Audio is an important part of teaching streaming video recording. In the classroom, even if the teacher does not know the exact location of the microphone, audio acquisition can be realized

through remote audio recognition technology, the directional microphone naturally records the voices of both teachers and students. The smart mixer automatically balances the proportion of input audio sources and reduces noise, making the sound part smoother and making the sound file more realistic. The last streaming video is sent directly to the streaming video server through the transmission protocol. After recording, the streaming video can be preset with the recording template according to the recording requirements and parameters, and the film beginning and end are automatically generated, direct transmission to the streaming site for live broadcast, but also to the media production center through non-editing software for post-editing, in accordance with the requirements of teachers to produce a variety of streaming video for students to learn, for the already uploaded teaching audio and video will automatically form a VOD resource library of streaming media resources.

## SMIL

SMIL (Synchronized Multimedia Integration Language) is a markup Language very similar to HTML that describes presentations of real-time behavior, presentation layouts on output display devices, and hyperlinks between collaborative media. It can demonstrate streaming video, audio, images, text and other types, allowing a group of different, independent multimedia objects to be demonstrated in a multimedia synchronization presentation. “Multiple stream-based multimedia objects can be synchronized using SMIL” (Lu, 2013). SMIL tags come in pairs, starting with <smil> and ending with </smil>, similar to html syntax, and consist of body and head in a program with .smil file extension or .smi file. Additional information is placed in the <head> tag. If you need comments, use < !-- … --> annotation, the server will skip the code execution within the program, it is easy in SMIL to associate media files with tag attributes and can set the format of media files. In SMIL, the format and path of media files can be set through markup language, and “multiple files can be combined into file groups at the same time, and then the playback order of media files can be set through tags” (Zeng, Mao & Shen, 2014).

The increasing perfection of the existing products and the international standard language provide a larger space for the development of the multimedia assisted teaching platform based on streaming media which is suitable for the Internet environment. Synchronous multimedia on-demand system realized by SMIL technology can effectively integrate teaching resources in the school, provide favorable online support for students to continue learning after class, facilitate students to choose various teaching resources independently, and combine face-to-face classroom teaching with offline independent learning organicly. Expand students’ vision, improve learning efficiency, and consolidate learning knowledge.

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