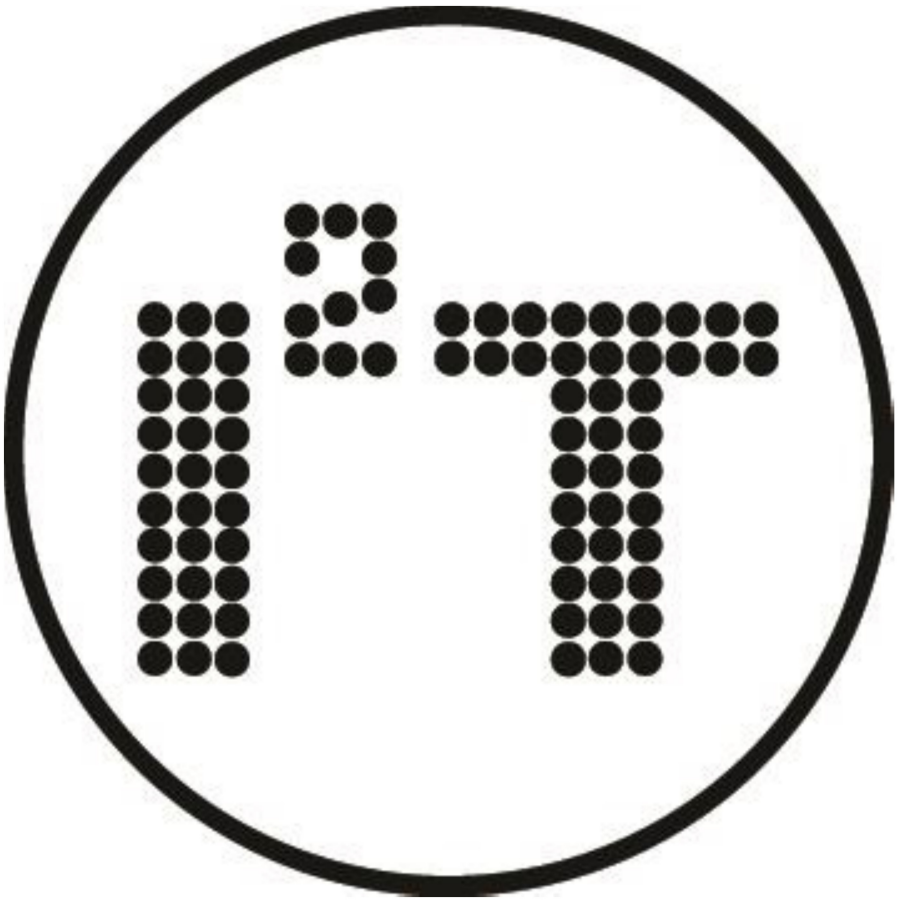
International Scientific – Practical Conference
« INFORMATION INNOVATIVE TECHNOLOGIES»



Prague – 2017
April 24-28

UDC 681.3 + 681.5
I 64

I 64 Information Innovative Technologies: Materials of the International scientific – practical conference. /Ed. Uvaysov S. U., Ivanov I.A. – M.: Association of graduates and employees of AFEA named after prof. Zhukovsky, 2017, 700 p.

ISSN 2542-1824

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It is interesting for a wide range of researchers, teachers, graduate students and professionals in the field of innovation and information technologies.

ISSN 2542-1824

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In the social sphere, the UNESCO Chair is involved in preparation and carrying out events aimed at integration of persons with health disabilities into the educational environment of the university. For example, a great deal of work is being done in training the student team for participating in regional championship on professional skills for people with disabilities «Abilympics» [5]. In 2017 students, learning according to educational programs, implemented by the teachers of the UNESCO Chair, will demonstrate their skills in three spheres: the development of web applications, system administration and databases. Not only the teachers, who play the role of experts at the championship, but also senior students train those, who have health disabilities, for participating in the events. This helps them to get teamwork skills and to become integrated into student and professional environment.

CONCLUSION

Focusing on UNESCO's tasks in the field of sustainable development to ensure access to education for all, the UNESCO Chair staff involves students into creating new information products, thereby enhancing the role of ICT in modern society of equal capabilities.

ACKNOWLEDGMENT

The students of the department involved in this field took part in Hackathon «Cyber Garden» (Taganrog), in the contest «ITSM Junior League» (Moscow)[4], in the international competition of graduation projects «Young Leaders-2016» (Kazan) [2], in the competition «KemSU Innovative Ideas» (Kemerovo, 2016), in the Regional Youth Hackathon «IT-breakthrough» (Kemerovo) and in «UMNIK» contest.

REFERENCES

1. The state program «Accessible environment» for 2011-2020. [Web resource] // Access: http://government.ru/programs/215/about – (reference date: 01.03.2017).

2. Fokin D.S., Karabtcev S.N. The software package «DIOD» as a medium for providing information for persons with visual impairments // Young leaders - 2016: Collection of materials of the I International Contest of research works. Volume III (Natural and Technical Sciences). – Kazan: "Róketa Union", 2016. – 161-167 p.

3. Karabtsev S.N., Khorosheva T.A., Makarchuk R.S. Information support of accessible educational environment for persons with disabilities in the university // International research journal. – Vol. 2(56), part 3. – 2017. – 105 – 108 p. DOI: 10.23670/IRJ.2017.56.065.

4. The results of the contest «Junior League ITSM-2016». [Web resource] // Access: http://www.itsmforum.ru/news/all_news/2016_10_17 - (reference date: 01.03.2017).

5. The Regional championship of professional skill for people with disabilities «Abilympics». [Web resource] // Access: http://odt-kuzbass.ru/abilimpiks.html – (reference date: 01.03.2017).

A LIVE STREAMING SERVICE ARCHITECTURE

Korolev D.A.
NRU HSE
+7 (903) 610-32-90 dkorolev@hse.ru

Abstracts – This paper describes an approach to the architecture of the broadcasting complex for a multi-camera online video live streaming based on a combination of approaches, protocols, and equipment from related fields: IPTV, CCTV, computer networks. The proposed approach is based on the already established commercial service and represents the results of experimental development.

Keywords – live streaming; internet broadcasting; RTSP; RTMP; VPN; multiple camera.

INTRODUCTION

There are established approaches to live broadcasting: in television, video surveillance, web video streaming. These approaches are due to traditional technologies for each of the fields they originate from. At the same time, a combination of approaches from different areas opens up new ways to engineering more effective and functional services.

This paper proposes an approach to the construction of a multiple camera live streaming contribution set and a streaming service based on the equipment used in the IPTV, CCTV and virtual networking.

CURRENT STATE

Broadcasts significantly differ between single- and multiple camera input, also between localized sources and distributed videoconference. Depending on these conditions different technologies and equipment sets are used.

In the case of video conferencing the technologies used have mostly IP-telephony background — they are based on SIP, H.323 and linked directly or through a dedicated conferencing server. In this case viewer's experience is far from the one from watching a TV programme.

Single camera broadcasts stream the signal from the camera as an H.264 stream to the server using RTMP. This allows to output a stream from almost any network, without having to worry about the availability of broadcast devices from the Internet. Similarly work most of the live streaming mobile applications that contribute to popular streaming platforms.

Multi-camera broadcasts are usually mixed to a single video program output at the site and live streamed to Internet, so they are not much different from the single-camera case in the sense of streaming technology, just quire installation of additional equipment and accommodation of staff.

Typical customers for live streaming services are: television, radio stations, event holders and digital agencies, video production companies. Webinars and video conferences are a special form of broadcasts. Each of these customer fields have their specific requirements and conditions of work.

Traditionally, interactive video communication and broadcasting use different technologies, hardware, software and communication protocols. As a rule, it is easy to find the means to transmit video to the Internet, and same way it is easy to arrange videoconference in a small group, but to organize a videoconference with live broadcast to the Internet and recording, directed visuals, with the TV-level video quality – it is technically difficult task.

The TV industry has traditionally neglected the public internet as a medium for delivering video streams. High requirements for the quality of the video involves the use of dedicated communication channels, often — the satellite. However, it has become impossible for television to compete with the online media on the efficiency and cost of obtaining content and broadcast of major TV channels began to include Skype and mobile video to their news programs.

Television as video technology can be divided into ordinary (including satellite and terrestrial), let's call it the TV, and IPTV — TV streaming in local area, corporate and ISP networks. IPTV features some additional features, including elements of interactivity, but we will focus on the method of delivery of video — a digital stream, like video broadcasts on the Internet, although it passed to the service provider's network, corporate network and so on.

There is a market where the number of cameras is much larger than all the TV channels — video surveillance. It is not usually mentioned when talking about live streaming to internet, because its name itself (Closed Circuit Television — CCTV) suggests that it is a closed system, not on for mass viewers.

So, considering the scope of the video broadcasting, we will rely on technological solutions in web video communications, TV, IPTV and CCTV.

ARCHITECTURE

To understand the difference between architectures used in various fields of video, we need to mark out the main features of the used streaming protocols.

Video content itself has almost been unified in the recent years: the codec is H.264, gradually appears support of H.265 featuring up to 50% traffic saving. Previously used MPEG-2 codec can still be found, as it is possible to meet other legacy formats and devices. Significant difference can be found in video content delivery methods.

We will not consider TV broadcasting systems, just focus on web video broadcasting, IPTV and CCTV.

When the video feed is sent from a mobile phone to any video streaming public service, stream is transmitted using RTMP. In this case, the transmitting device has the address of the streaming server, and a broadcast key. The server located at this address, uses the key to specify the channel (or user account) and displays the stream on the appropriate page or player. Streaming server knows nothing about the source of the stream, also it is not possible to change settings of the stream from the server's side, it cannot stop or start the stream.

At the same time, such broadcast is available from almost any network: direct IP or open ports on the router are not required in this case.

In CCTV systems cameras and recorders use RTSP. The source (e.g., a camera) acts as a server. The recipient (player, streaming server) requests the source to start the stream and only after that the stream is sent through the network. That is, the traffic in the network appears only in the presence of "viewers".

If a source has multiple viewers accessing its address, it will have to send multiple streams. Typically, these sources are not designed to service many spectators.

Video surveillance systems usually support Onvif standard. This standard describes standardized requests to the devices, auto discovery in the network and other useful features.

On the other hand, in order to maintain broadcast from a surveillance camera, it should be visible to the recipient. It means an open port on the network is required to access a camera from outside (e.g. from a remote server). Onvif also only works in local network.

Comparing RTMP [1] and RTSP [2], it is important to note that:

- RTMP has been developed for Adobe Flash server and Flash technology is currently obsolete, Flash players are no longer supported by browsers.
- The minimum delay between the source and the player while RTMP streaming is in average 2 seconds. RTMP streams transmitted simultaneously are not guaranteed to come synchronized.
- There are alternative ways to deliver video streams to web viewers, but they all have their own drawbacks. HLS and MPEG-DASH transfer chunked stream over HTTP and then assemble it back on the viewer's side, that gives better accessibility for restricted networks and does need anything except HTTP on viewers' computers, but they add 20-40 seconds delay. Much promising WebRTC is not yet supported on some of popular browsers and is more difficult in integration at the moment, but it is believed to be a good solution in the nearest future.
- RTSP is used in CCTV where noticeable delays are unacceptable. Typically, the delay between the camera and monitor on hardware decoder does not exceed 0.3 s. RTSP is not directly supported by browsers.

In fact, RTSP carries video stream, audio stream and commands [3]. Media stream is transmitted over RTP protocol, commands — over RTCP. RTP is also used separately as a transport stream. They cannot be controlled by the recipient, it only "listens" to the address specified on the transmitting device.

RTMP suits well to stream from arbitrary devices located in a custom network to a custom server or to any of the streaming web services or content delivery networks. Streaming servers normally provide transcoding to HLS and provide multi-bitrate option for viewers.

In this architecture, we get the simplicity of sending a stream from site, but its drawback is that we cannot control the source. It is not critical while streaming a single source from a stable network, but once synchronization between multiple streams is required, or real-time delivery is required, another approach is offered.

Once multiple cameras work on a site, their streams (or signals, is speaking about non-IP cameras) should be mixed to result in a single output signal or stream, this is performed on video switchers. Traditionally, SDI or HDMI video cables are connected to the switcher, that is also working on site, and its output is captured and converted to stream, then sent to a streaming server. But the main idea is that we do the switching on server's side in the internet. In general, there is no difference whether the sources are located in one room or over the seas.

The idea to have all streams switched on the server after they have passed over internet imposes two important requirements on the streams: minimum delay and synchronization. Noticeable unsync can occur even with a delay of 1-2 frames.

To keep streams in sync RTSP provides built-in timestamp [2]. This allows software switcher to keep inputs synchronized.

To have RTSP sources available, it is needed to provide access through firewalls at each location. In general, this is not possible, in particular broadcasters will have to negotiate with IT-services of each site. There is an opening port automation feature that uses DLNA protocol, better known as a protocol for home media devices, but it only works with home routers, and enterprise systems ignore its requests to open ports.

Another way to access the RTSP sources is to collect all sources and recipients in a single virtual network. In this case, no need to open ports, but the structure of the whole complicated system and Onvif discovery treats connected devices as local.

RESULTS AND CONCLUSIONS

RTSP stream delivery over VPN has been tested on On-Air.Pro live streaming service. Initially, this service was created to broadcast layouts from multiple sources (for example, to broadcast a lecture showing presentation and camera) using RTMP, but the streams came without synchronization and the difference in the delay could change while the broadcast, reaching 8-10 seconds in unstable network conditions.

Also, sometimes a reconfiguration of the encoder is needed and, if it is a separate device, it is almost impossible to locate it in foreign LAN, it is not accessible from WAN.

The main results gained from the proposed architecture:

1. RTSP streaming devices are used as video and audio sources. There can be surveillance video cameras, IPTV encoders, and software (for example, the VLC can capture the screen, file or web camera and give to the RTP / RTSP stream).
2. OpenVPN network is used to gather all involved units to a virtual LAN so that both RTSP and Onvif could work properly. Network connection can be established by a router with a network client, or the client software on a computer.

3. Onvif support makes possible unified management of all compatible equipment. For example, any Onvif device can be found automatically on the network, configured: bitrate and other stream parameters, PTZ control, and even adjustments of the image parameters (white balance, exposure), to bring all the streams in a uniform view. These capabilities are available only for professional TV systems using television cameras (not general purpose camcorders).
4. The streams are synchronized and mixed on the server. To do this, the editor has the opportunity to see all the streams and to choose one of them on the air. More complex schemes of imaging (multi-screen, picture-in-picture, titration, logotyping, screensavers and transitions) are also available.
5. The resulting output image is given simultaneously to multiple social networks and external content delivery networks via RTMP or is distributed from its own content delivery network (CDN) via WebRTC / HLS.

Most of the features described are currently implemented and used broadcasts to social networks.

The results of stress testing have shown that the transfer of 4-5 streams at 3-4 Mbit/s each and receiving of them on a number of recipients (monitors, encoding servers) did not cause a significant load on the VPN server. All streams contained video 1080p, 25 frames per second.

REFERENCES

1. Real-Time Messaging Protocol (RTMP) specification 1.0 Adobe Systems Inc. http://www.adobe.com/devnet/rtmp.html
2. Durresi, R. Jain, RTP, RTCP, and RTSP – Internet Protocols for Real-Time Multimedia Communication. CRC Press LLC 2005 http://www.cse.wustl.edu/~jain/books/ftp/rtp.pdf
3. RFC2326 Real Time Streaming Protocol (RTSP) April, 1998. https://www.rfc-editor.org/rfc/rfc2326.txt

TECHNOLOGY OF DISTANCE LEARNING ON BASIS OF STANDARD APPLICATIONS

Demenkova T.A., Kozhevnikov G.S.
Moscow Technological University (MIREA)
+7 (925) 892-74-60, kgs33@rambler.ru

Abstract — The paper describes the problem of creation software for support of training of undergraduates and creation of the innovative project in the field of psychological testing for tasks of a three-stage education system. These programs solve a problem of increase in learning efficiency regarding independent training of the undergraduates, students, engineers and persons who are interested in CAD. Independent preparation allows to receive and set specific knowledge which gathers from different disciplines.

Keywords — system of distance learning; methods of design of digital devices; psychological testing.

INTRODUCTION

There are methods and tools in this article to learn masters in the "Informatics and Computer Facilities" direction on the basis of specially developed remote means which include possibilities of carrying out researches in the field of education psychology.

Design of digital devices on modern element base becomes more and more popular and gets into many spheres of industrial production. Training of specialists in this area demands studying of a great number of the disciplines relating directly to design process. It includes studying of languages of the description of the equipment VHDL, Verilog and another ones, concerning producer chips belong to different levels. Questions of control and diagnostics should be allocated in the separate direction in view of very wide range of tasks which solution always is a big problem for the developer. Acquisition of skills of work with modern computer-aided engineering systems demands long preparation and specific knowledge which gather from different disciplines.

In article the problem of creation of software of support of training of undergraduates in this direction which would allow to solve a problem of increase in learning efficiency regarding independent preparation is considered. Modern systems of distance learning are used as a basis.

PROBLEM STATEMENT

Article contains results of researches on creation of the innovative project in the field of psychological testing for education tasks. As a result of transition to a three-stage education system (a bachelor degree – a magistracy - a postgraduate study) in an education system there was a need to enter innovations into the developed structures as the target audience strongly differs now from that which was earlier. The problem is connected as well with the fact that, for example, many undergraduates have received preparation in different educational institutions and it is impossible to provide training without special adaptation of programs according

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Materials of
the International Scientific - Practical Conference
INFORMATION INNOVATIVE TECHNOLOGIES

Edited by S.U. Uvaysov;
Executive editor I.A. Ivanov

Printed in author's redaction

Computer layout:
S.M.Lishov, D.S.Panasik
Cover design: D.S.Panasik

Signed to print 20.03.1017
Format 60x84/8. Paper «Pioneer»
Conventional quires 82,3 Print run 500 copies Order № 37

Prepared for publication
Association of graduates and employees of AFEA named after prof. Zhukovsky,
Moscow, the 4th st. March 8, 6A.
Nasledie-vvia.ru

Printed in the printing house of HSE
Moscow, Kochnovsky fare, 3
hse.ru