Mobile System for Video Streaming of Lectures

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***Abstract* – The purpose of this paper is to introduce a mobile technical solution for IP video streaming that is usable for live broadcasts of lectures over the IP-based networks. The main unit has to be complemented with ad-hoc cabling and peripherals respecting the needs of each specific event. We use the example of an international conference about e-learning technical infrastructure to describe the use of our system for broadcast of a short movie, simultaneous presentation in three auditoriums and streaming (with MPEG-2 recording) of individual lectures within the conference, according to the demands of its organizers, in two languages (English and Czech). The paper introduces detailed description of this exceptional technical solution that was appreciated by the organizers as well as by participants of the said e-learning conference.**

Index Terms – e-Support, Video streaming, Mobile studio

INTRODUCTION

Our Data Communication workgroup at the Department of Telecommunication Engineering operates a complex set of devices for acquisition and streaming of video signals over IP networks. Logically, the group was asked to prepare the audio/video system for the international conference EMTECH 2007, co-organized by the Department, the main purpose of which was to present innovative technical solutions for e-learning; moreover, the joint event was the international festival of short technical movies TECHFILM 2007. The organizers demanded all-day video projection of the festival movies in three parallel theaters, and also processing, streaming and recording of specialized lectures at the morning sessions in two language alternatives. Another requirement was to edit the recordings and prepare the version for electronic proceedings and for download from the conference web pages.

VIDEO PROJECTION

A simple configuration was chosen for the projection of festival movies, which was characterized by simple preparation and control. The technology was identical in all three theaters: data projector, projection screen and DVD recorder. The sound system consisted of column loudspeakers and AV switcher/amplifier. The simple control of the system was important because of frequent changing of DVDs with the festival movies; altogether, 80 titles from 20 countries all around the world were performed during 5 days. Most of the movies were addressing history, art, education, environment, health, power engineering and science. [1]

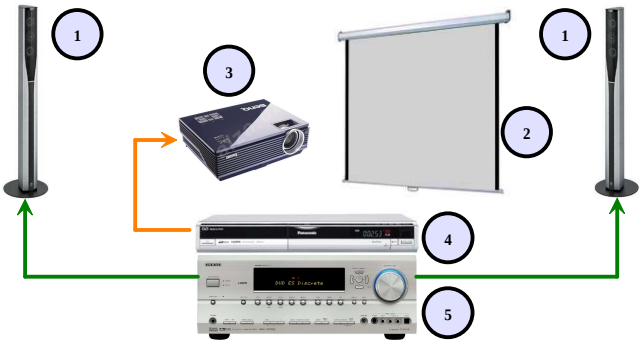

FIGURE 1
AV SYSTEM FOR VIDEO PROJECTION
1 – SOUND SYSTEM, 2 – SCREEN, 3 – DATA PROJECTOR,
4 – DVD PLAYER, 5 – AV SWITCHER/AMPLIFIER

STREAMING AND RECORDING

Streaming and recording was performed with the mobile streaming system (defined by the dashed line in Figure 2). The system had to be specially adapted for the event in order to enable multi-language recording – parallel audio switcher, DVD recorder and streaming PC were added. The acquisition of tributary video signals was performed by two three-chip camcorders (Sony DCR-VX2000E and Panasonic VSK 0499) and a VGA–PAL converter (Kramer VP-701SC). The first camera takes the detail of a lecturer, the second one serves for other scenes (mostly questions from the auditorium). The VGA–PAL converter takes the presentation from the lecturer's laptop computer, passing it also to the beamer projecting the slides to the screen. The signal from both cameras is brought to the editing workplace in digital form through IEEE 1394 interfaces. The output signal of the VGA–PAL converter is in the Y/C (S-video) format.

The audio tributary signals are acquired by four wireless microphones – two of them are microports (tie microphones) for lecturers, so that they can be easily passed from speaker to speaker, and two are hand ones (one for the moderator, one for questions etc.). Switching of tributary audio signals is performed by Behringer 1002 switcher, the output of which is used as two tributary signals – one of them, together with another tributary signal from the interpreter's workplace (providing simultaneous interpreting into English) as a source for mixing of the original and interpreted sound (the original being set to the 20% of the level of the interpreted version); the second one is brought to the AV editing center mixing the audio and video to the IEEE 1394digital output.

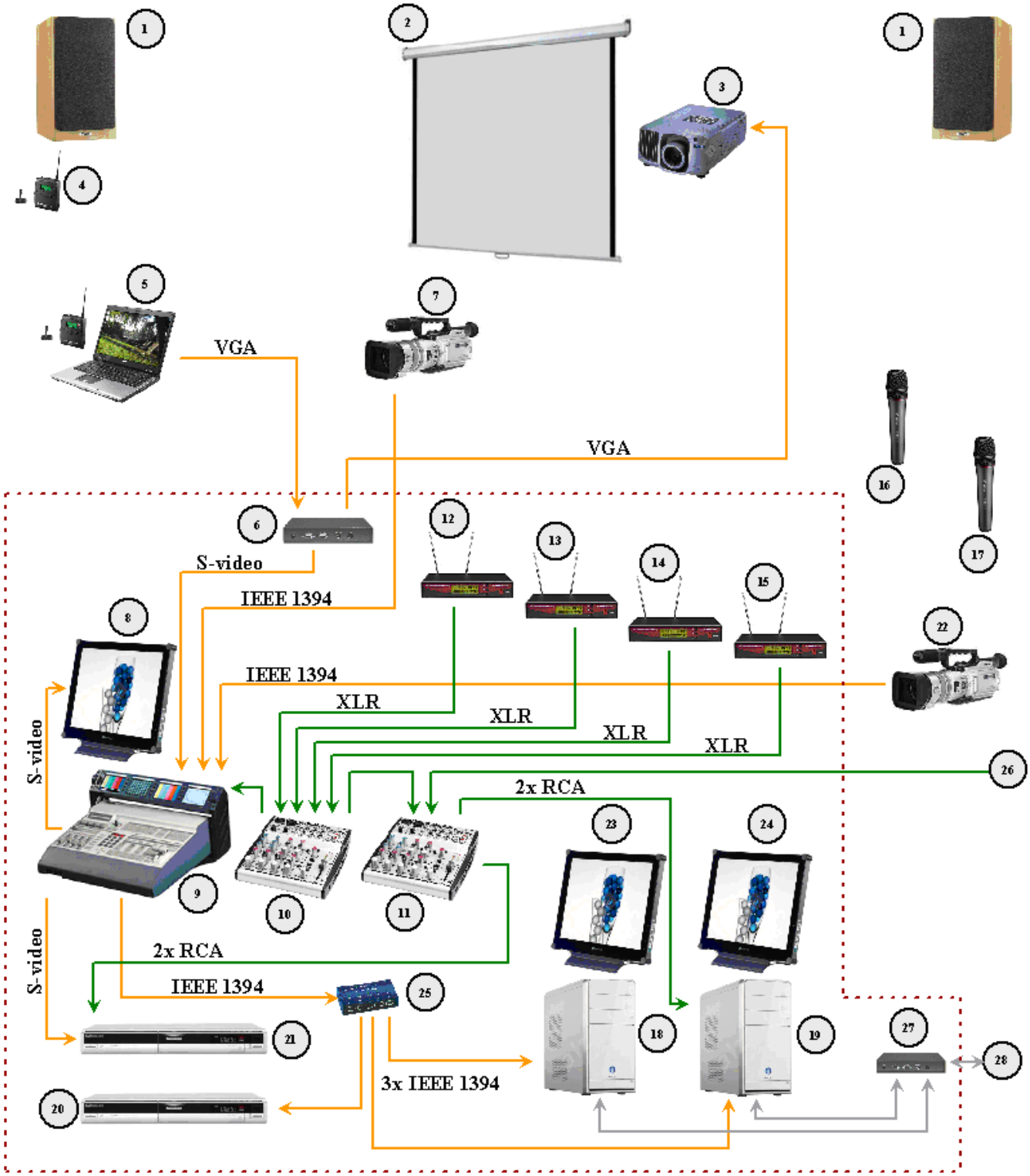

FIGURE 2

SYSTEM FOR STREAMING AND RECORDING OF LECTURES

1 – SOUND SYSTEM, 2 – SCREEN (BACK PROJECTION), 3 – DATA PROJECTOR, 4 – ALTERNATIVE MICROPORT (1ST LECTURER), 5 – NOTEBOOK + MICROPORT (2ND LECTURER), 6 – SIGNAL CONVERTER VGA–PAL (S-VIDEO), 7 – 1ST CAMCORDER (TAKING THE LECTURER), 8 – MONITOR OF THE VIDEO OUTPUT, 9 – EDITING SWITCHER WITH MONITORS OF TRIBUTARY VIDEO SIGNALS, 10 – AUDIO SWITCHING OF THE ORIGINAL TRIBUTARY SIGNALS FOR RECORDING, 11 – AUDIO SWITCHING OF THE ORIGINAL AND INTERPRETED TRIBUTARY SIGNALS FOR RECORDING, 12 – WIRELESS AUDIO SET RECEIVER (1ST LECTURER), 13 – WIRELESS AUDIO SET RECEIVER (2ND LECTURER), 14 – WIRELESS AUDIO SET RECEIVER (MODERATOR), 15 – WIRELESS AUDIO SET RECEIVER (QUESTIONS FROM THE AUDITORIUM), 16 – MODERATOR'S MICROPHONE, 17 – MICROPHONE FOR QUESTIONS FROM THE AUDITORIUM, 18 – PC FOR STREAM WITH ORIGINAL SOUND, 19 – PC FOR STREAM WITH INTERPRETED SOUND, 20 – DVD RECORDER FOR RECORDING WITH ORIGINAL SOUND, 21 – DVD RECORDER FOR RECORDING WITH INTERPRETED SOUND, 22 – 2ND CAMCORDER (TAKING THE AUDITORIUM DURING QUESTIONS), 23 – PC MONITOR, 24 – PC MONITOR, 25 – IEEE1394 DISTRIBUTOR (1 IN – 4 OUT), 26 – SOUND SIGNAL FROM THE INTERPRETER, 27 – ETHERNET SWITCH, 28 – CONNECTION TO A 100MBPS NETWORK TOWARDS STREAMING SERVER AT CESNET

The AV editing device (Datavideo SE-800) is fully digital, with integrated monitors of tributary signals. It is supplemented by another monitor that continuously displays the output image. The system provides digital inputs and a digital output (IEEE 1394) and besides usual effects it offers also picture in picture (PiP), which is very useful for slide presentations (see Figure 3). Recording and streaming use a DVD recorder and a PC running Windows Media Encoder. Since the editing system has only one digital output, we have to use the IEEE 1394 distributor (1 in, 4 out). The first output (audio/video) is used for DVD recording (original), the second and third ones serve as inputs for a PC. [2]

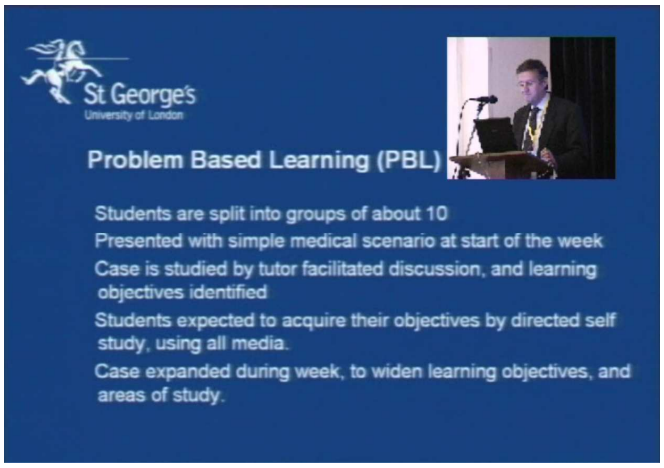

FIGURE 3
PICTURE IN PICTURE – A TYPICAL EFFECT USED IN OUR RECORDINGS

The Windows Media Encoder application encodes the signal from selected inputs into the WMV (Windows Media Video) format with the required parameters. Our stream offers two data rates: the first one is 890kbps (with 640 x 480 pixels resolution, 25 frames per second), and the second one 290kbps (320 x 240 pixels, 15 FPS). We were preparing also the second stream with the same parameters, but with different sound (interpretation vs. the original). The prepared streams were forwarded over a 100Mbps Ethernet network towards the streaming server operated by CESNET; any user could connect to it and watch the live broadcast from the event.

SUMMARY

High-quality modern equipment gathered into a mobile workplace that has been used for recording of various lectures (about 180 so far) on a routine basis enables us to prepare the complex footage from any event within the district of Prague. In cooperation with CESNET association we can use their streaming server for online (live) broadcasts in IP network. With respect to our experience we can conclude that hardware MPEG-2 and MPEG-4 encoders are crucial for the future of streaming.

REFERENCES

[1] EMTECH 2007 (online), http://emtech.cvut.cz/en/index_main.php

[2] Datavideo Technologies Co. (online), http://www.datavideo.info