Interactive Multimedia Solutions Developed for the Opening of the New Stage of the Alexandrinsky Theatre

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Abstract. This paper focuses on teamwork by the National Research University of Information Technologies, Mechanics and Optics (NRU ITMO) and the Aleksandrinsky Theatre in preparation of opening of the New Stage of the Alexandrinsky Theatre. The Russian State Pushkin Academy Drama Theatre, also known as the Alexandrinsky Theatre, is the oldest national theatre in Russia. Many famous Russian actors performed on the Alexandrinsky's stage and many great directors. May 2013 marked the opening of the New Stage of the Alexandrinsky Theatre. The theatre complex comprises three buildings: the new stages building, a media center, and the building housing a center of theatre education. Several plays shown simultaneously on multiple stages within the new complex's buildings constituted the opening gala of the New Stage of the Alexandrinsky Theatre. The works of Fyodor Dostoyevsky were the plays' unifying theme. NRU ITMO employees developed several interactive theatre project solutions implemented for the opening of the Alexandrinsky Theatre's New Stage.

Keywords: Theatre, Multimedia, Information Technologies, NRU ITMO, SPbGU

1 Introduction

The Russian State Pushkin Academy Drama Theatre, also known as the Alexandrinsky Theatre, is the oldest national theatre in Russia. It was founded in 1756 by the Senate's decree. The history of the Alexandrinsky Theatre is closely linked to some of the most prominent exponents of Russian culture. Among the theatre's visitors were Alexander Pushkin, Mikhail Lermontov, Nikolai Gogol, Ivan Turgenev, Fyodor Dostoyevsky, Leo Tolstoy, Anton Chekhov, and Pyotr Tchaikovsky. It was the Alexandrinsky Theatre where almost all important classic works of Russian theatre premiered.

Many famous Russian actors performed on the Alexandrinsky's stage and many great directors, such as Vsevolod Meyerhold, Leonid Vivien, Grigori Kozintsev, Georgy Tovstonogov, Nikolay Akimov, worked there. Prominent artists, such as Alexandre Benois, Konstantin Korovin, Aleksandr Golovin, Nathan Altman, and great composers, such as Alexander Glazunov, Dmitri Shostakovich, and Rodion

Shchedrin, collaborated with the theatre. Today, Valery Fokin, decorated with the People's Artist of Russia award, is at the helm of the Alexandrinsky.

May 2013 marked the opening of the New Stage of the Alexandrinsky Theatre. The theatre complex, created with the support of the Russian government, comprises three buildings: the new stages building, a media center, and the building housing a center of theatre education. The main stage (the "transformer stage") is equipped with a mechanism allowing it to change its spatial configuration dynamically. Unique theatre equipment, including modern computer hardware, is installed at the media center and throughout the educational facilities. The New Stage's computer network is linked to the Internet via a high-speed channel. This allows for new theatrical expressive devices to be incorporated into theatre productions, including those involving interactive multimedia solutions and Internet technologies.

The plays produced for the opening of the New Stage were all related to the works of the great Russian writer Fyodor Dostoyevsky, an inveterate theatregoer and a frequent visitor to the Alexandrinsky. The great writer became a symbol of the new theatre complex. At the same time, the plays also incorporated new and unique technologies afforded to the directors and actors by the New Stage's high-tech facilities.

2 The New Stage's Technology and Equipment

Approximately 150 video connection points were placed around the stages and in the halls of the theatre complex, allowing more than fifty IP cameras to be moved between them as needed. Each IP camera is capable of processing multiple independ-ent video streams of varying resolutions (up to Full HD) and can be controlled re-motely. All camera connection points and Wi-Fi hotspots located throughout the complex are linked to a Gigabit local area network, which is divided into several sub-networks. Along with a system of servers and routers, Wowza Media Sever, which enables controlling multimedia streams, as well as performing conversion, archival, and other operations with them, was chosen to play the role of the technological core of the Internet-based video broadcasting system. For content delivery to the end user, the theatre's local area network is connected to the Internet via a 10-Gigabit channel.

In order to manage end users' access to the interactive solutions that were built, an Internet portal prototype was developed by the present article's authors' colleagues. The use of dynamic content organization and alternative classifiers allowed the developers to forgo multi-layered menus, the traditional means of portal navigation. An alternative approach, based on flexible project systems and social network functionality, was adopted as the basis for the portal's prototype organization. Each project leader, having acquired administrative permissions, was able to determine the list of the project's participants, the types of tools used for the project's information support, the contents and the means of publishing project information on the Internet, and so on. Projects were created for all plays shown at the opening of the New Stage of the Alexandrinsky Theatre. The portal prototype provided access to multiple streams of the interactive Internet broadcast of these shows.

3 Interactive Theatre Project Solutions Implemented for the Opening of the Alexandrinsky Theatre's New Stage

Several plays shown simultaneously on multiple stages within the new complex's buildings constituted the opening gala of the New Stage of the Alexandrinsky Theatre. The works of Fyodor Dostoyevsky were the plays' unifying theme.

To allow the viewers to have an immersive experience of theatrical performances that took place on different stages and in the halls of the theatre complex, the authors of the present work developed a prototype system capable of multi-stream broadcasting of all performances, allowing them to be viewed on desktop or mobile computers. A new project, STREAM, was created, allowing Internet viewers to monitor feeds from 24 cameras set to broadcast, in multicast mode, the opening ceremonies of the New Stage. In total, 50 stationary Full HD IP cameras, four reporter's iPads, two reporter's iPhones, and several Skype feeds were active in the auditoriums and halls of the New Stage during the opening.

A prototype of multi-stream control system was developed in order to manage 24-stream broadcasts in real time. This control system was implemented as a web application, enabling the administrator to select active streams for any project (including STREAM) and, using a high-level drag-and-drop interface (see Fig. 1), add attributes and comments to them. At the same time, a scheduling mechanism was implemented to solve resource allocation conflicts (situations where the same resources were requested by different projects). This made possible an uninterrupted 32-hour broadcast of the performances at the opening of the New Stage.
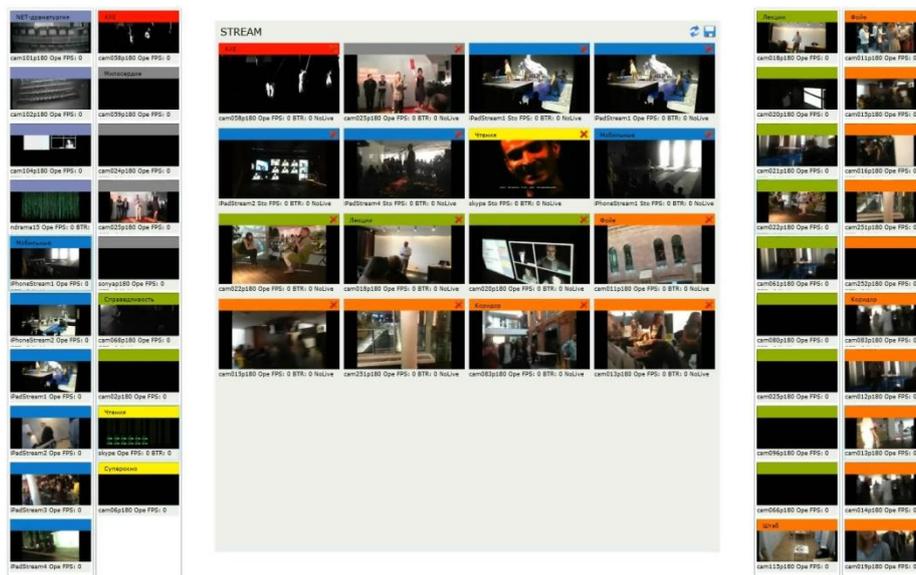

Fig. 1. Prototype interface screenshot for the management of video streams forming the project STREAM (center)

A client-side web application prototype allowing the Internet viewer and portal visitor to access and switch between current video streams was developed for the STREAM project (see Fig. 2). The main problem of multi-stream broadcasting–the optimization of simultaneous HD-quality video and audio feeds–was resolved using a combination of custom-developed solutions and Microsoft's Smooth Streaming technology.
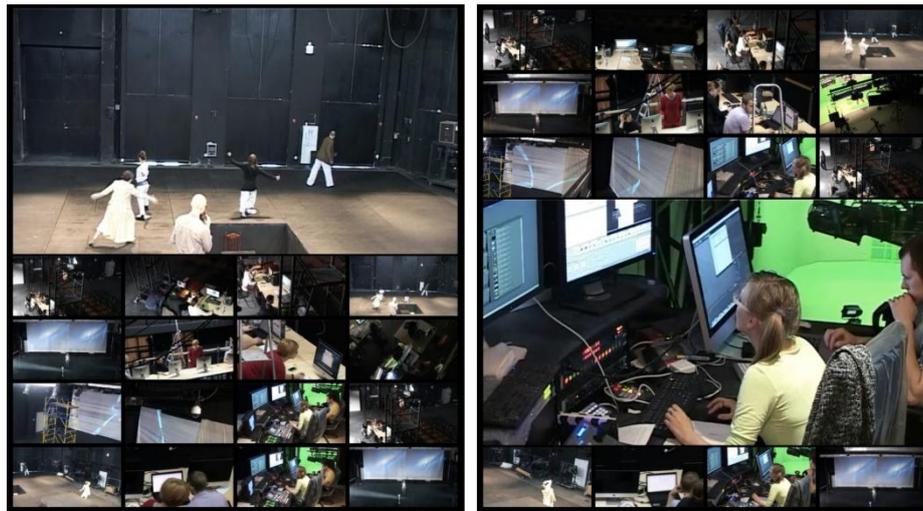

Fig. 2. Screenshots of the user interface for viewing the project STREAM

The AKHE project involved real-time processing of streams from 20 cameras. Based on those feeds, visual effects synchronized with the performance were generated. Processed fragments of the video were sent onto the stage and the screen (see Fig. 3). The fragments' recording, processing, synchronization, and screen broadcasting was being managed by a computer program developed by the authors of the present work.

Fig. 3. AKHE: scenes from the performance

In the NET DRAMA project, the very process of playwriting was turned into performance: four playwrights were creating a new play in real time. A draft of the script appearing on the screen was being edited simultaneously by the playwrights working in a collaborative mode (see Fig. 4). The viewer sitting in the audience or watching on the Internet could view the emotions on the playwrights' faces, the changes in the draft of the script that are being made by them, the chat exchanges serving as a link between the playwrights as they develop the script, and the online comments posted by visitors via the Internet portal. In order to allow both the participants and the audience to visualize and interpret the play's contents, the authors of the present work developed an application with an intuitive user interface.
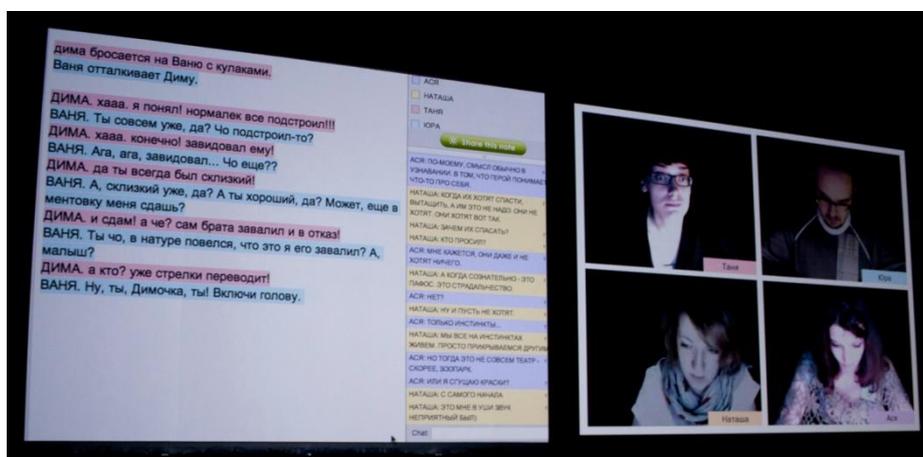

Fig. 4. Scene from the show NET DRAMA

INTERACTIVE HALL was another project, which featured a pseudo-holographic system with motion-sensor controls based on a Microsoft Kinect sensor. This system allowed audience members in the hall to obtain information on play developments from all stages involved in the opening events of the New Stage of the Alexandrinsky Theatre (see Fig. 5).

Fig. 5. Information system in the hall of the New Stage

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But it was the experimental project "READING" that saw the highest number of performers and devices involved. There, a group of actors and volunteers were performing by continually reading aloud Dostoyevsky's "Crime and Punishment". Spatially, the readers were located in different places, connected via a variety of connectivity methods (IP cameras, webcams, etc.). Given the novel's size, its reading took about 38 hours. Even with advance preparations and rehearsals, due to the participant's diverging reading speeds, it was impossible to pinpoint the exact timing of the beginning of any particular excerpt. Thus, in order to ensure an uninterrupted experience for the viewer, a software application capable of seamless switching between readers' streams was developed.

In order to enable cross-platform mobile access to multi-stream video broadcasts, a solution allowing an automatic detection of the user's location zone (whether the user is located within the local area network or on the public Internet), operating system, and browser, and, based on these criteria, the setting of correct IP addresses, formats, stream bit rates, and other user interface parameters, was developed for the portal prototype. This solution was tested on the most common operating systems (Windows, Linux, MacOS, Windows Phone, iOS, Android) and browsers. It was therefore determined that all current requirements for cross-platform software compatibility are met.

During the opening events, the Wowza media server was receiving about 150 video streams at varying bit rates; at peak times, it was handling up to 400 external connections. Up to 60 streams were being archived. Our analysis of network traffic and server loads showed that the developed system has spare capacity allowing it to handle at least five-fold increases in traffic. The use of external "cloud" computing resources and virtual networks, arranged to allow for growing system capacities dynamically, proved to be unnecessary.

4   Conclusion

The present level of communication and multimedia technology allows you to organize online broadcast of such high quality that it is possible to speak of the remote presence of spectators at a theatrical performance. This allows the Russian theaters interact with audiences around the world. The important thing is that the theater is directly involved in the organization of broadcasting. No less important is the ability to use modern technology directly into a theatrical performance. Described experience of using multimedia and communication technologies in theatrical activity is the first step, followed by the next steps.

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