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IFAC-PapersOnLine 49-30 (2016) 092–097

Videoconference in education: "Mconf" and "Multipresence" Systems

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Abstract: The objective of this paper is to present two low cost videoconference applications being developed in Brazil that can be used also in education: *Mconf* and *Multipresence*. Mconf is an open source, distributed, scalable and federated global web conferencing system, interoperable with SIP and mobile devices. The Multipresence system allow interoperation of many technologies to comply with a multitude of devices and communication standards, such as the following: Telepresence room in high definition (Full HD); Ultra-telepresence room in ultra-high definition (UHD 4K); Content sharing among the participants (simultaneous upload, rearrangement and visualization of images, texts and applications); Legacy videoconferencing systems; High definition videoconferencing through a personal computer application program; Web conferencing (web browser); Mobile devices and SIP phones.

Keywords: Multimedia; distance learning; learning systems; web conferencing; video conferencing.

1. INTRODUCTION

Deployment of videoconference systems have been growing rapidly for the last years, and deployments nowadays are fairly common, avoiding thousands of trips daily. Video conferencing systems can be organized into at least four groups which are related to this paper: Room, Telepresence, Desktop and Web.

Room videoconference systems (also called legacy videoconference systems) are normally hardware based and located in meeting rooms or classrooms. Participants are expected to manually activate and call a remote number in order to begin interacting. Examples are Cisco, Polycom, Lifesize, among others.

Telepresence videoconference systems are a variation of room systems in that the room environment and the equipments are set in order to produce the sensation that all participants are in the same room.

Desktop videoconference systems are a variation of room systems in that instead of dedicated hardware equipment to perform the videoconference, they use software installed in the computer and off-the-shelf webcams. Examples are Vidyo, Skype and Vsee, among many.

Web-based videoconference systems, or web conferencing systems, run within a web browser. The advantage for users is the simplicity of deployment: users need only to open a hypertext link within their browser to launch the system, not worrying about, for instance, opening ports in the corporative firewall. Another advantage is the interoperability among different operational systems: users may be running Chrome in Linux, Internet Explorer in Windows, Safari in MacOS, and so on, but everyone still has the same experience.

This paper presents two low cost applications in the field of videoconference that were developed by the authors.

One is a web conferencing system called Mconf, intended mainly for educational purposes and group meetings. Some differentials of Mconf over other web conferencing systems are: a) It is open source; b) It is federated; c) Its architecture is distributed and coordinated by a load balancer, allowing scalability among different servers; d) It has integration with Moodle; e) The system automatically generates a link to the recordings, resulting in a zero effort approach to access them; f) The usage statistics are easy to use and the system has also a dashboard; g) It has web and mobile clients; h) It has a global network deployed and a free web portal, allowing anyone to use it immediately, regardless of race, social status or religion.

The other application is called Multipresence, and is a mix of all groups presented previously: it integrates room videoconference systems, telepresence systems, web conferencing systems, mobile systems, and ultra-high definition systems. Besides, it allows collaboration among the participants through some different applications, and the most prominent is SAGE2 (Scalable Amplified Group Environment) (Sage, 2015).

10.1016/j.ifacol.2016.11.134

One differential of Multipresence over other systems, besides the integration model explained above, is the possibility to adapt the physical space according to the user needs.

Regarding the physical space, meeting rooms, as well as classrooms, can be transformed in multimedia spaces that foster collaboration. Computers, projectors, large displays, videoconference systems and wi-fi networks are examples of IT infrastructures commonly used in modern rooms. Active Learning spaces are changing the design of classrooms, and new ideas are flourishing to allow collaboration and interaction as well as plenary talks. Fig. 1 shows one of these new designs from University of Windsor (Finkelstein, 2015).

Fig. 1. Plenary room used for collaboration.

However, the investment to transform a traditional classroom in a digital learning space must be spent efficiently to justify the invested resources. The cost of any physical space depends on how often it is used. Keeping an idle physical structure has a high associated cost.

The interoperation of many technologies proposed by the multipresence system enables different applications in the same room, like local and remote classes, local and remote group dynamics, meetings in U, board meetings, among others. Each application has its own communication demands in terms of quality, interoperation and collaboration.

The next sections discuss in further details the Mconf system and the Multipresence system.

2. THE MCONF SYSTEM

Mconf is a complete web conferencing system, with features such as real-time sharing of voice, video, slides, desktop, and chat. It provides a distributed and scalable solution for communication that proves to be useful in several distinguished scenarios, such as class meetings, group meetings, events streaming, thesis and dissertation presentations, among others. An in depth view of Mconf system can be seen in the global Mconf portal (http://mconf.org).

Fig. 2 shows the Mconf architecture. On the left we can see the users connecting to the web portal of their own institution (or a known generic portal like https://mconf.org). When a user wants to create a new web conferencing room, he/she connects to the web portal and clicks a button to open the room. The web portal asks the Load Balancer which is the best Mconf-Live server (the web conference server) to use. The Load Balancer has information of every Mconf-Live server gathered by the monitoring servers and, based on the geographical information of the user combined with the CPU load and available bandwidth of the different servers, chooses the best one to start the new web conferencing room, informing the web portal, which contacts directly this server and opens the room there. The Mconf-Live server is a customized version of BigBlueButton (http://bigbluebutton.org/), and the Brazilian Mconf team works together and aligned with the predominantly Canadian BigBlueButton team. Improvements made in Brazil are integrated in BigBlueButton and vice-versa.

This architecture allows hundreds of servers, hundreds of web portals and thousands of users simultaneously. The challenge is to manage such a network, which is out of scope of this paper, but is detailed in Roesler (2013).

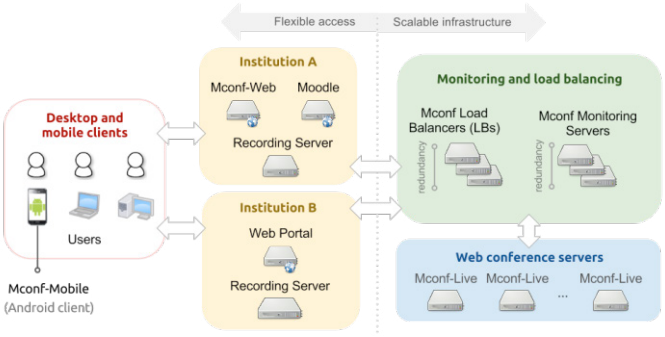

Fig. 2. Mconf architecture.

Mconf has three main components: 1) the web conferencing server Mconf-Live; 2) the web portal, that is the entry point to the system; 3) the monitoring and load balancing infrastructure. These components are explained in the subsections below.

2.1 Mconf-Live

Mconf-Live is the web conferencing component of Mconf, the server where the web conferences are held. This component provides the following features: real-time sharing of voice, video, presentations, desktop, shared notes and chat. It also allows the recording of sessions for playback on demand.

Mconf has a mobile client for the Android platform called Mconf-Mobile. The application allows users to connect to a meeting using a mobile Android phone/tablet and it includes most of the functionalities present in the desktop client.

2.2 The web portal

The web portal, called Mconf-Web, is the entry point of Mconf. It is a web application that authenticates users and provides means for them to create and access their web