Multi-conference rooms: architectural and technological view

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Abstract

Meeting rooms, as well as classrooms, can be transformed in multimedia spaces that amplify collaboration and education. Computers, projectors, large displays, videoconference systems and wi-fi networks are examples of Information Technologies infrastructures commonly installed in modern rooms. 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. For example, a US$100,000.00 regular classroom can cost more than a US$500,000.00 one. How? Suppose the cheaper room is used eight hours a month, while the more expensive one is used eighty hours a month. Over five years (or 60 months), the per-hour cost of the cheaper room will be US$100,000.00 / (60 * 8) = US$208.33, while the per-hour cost of the more expensive one will be US$500,000.00 / (60 * 80) = US$104.17, i.e., half the cost of the first. The bottom line is that keeping an idle physical structure has a high associated cost. The objective of this paper is to present an architectural and technological view of a new system called "multipresence" which adapts to various physical environment settings, and enables the interoperability of various technologies.

Keywords

Mobile conferencing; ultra-high definition; web conferencing; telepresence; multipurpose rooms.#

1. Introduction

The spread of video conferencing systems has grown rapidly in recent years, and its use is currently quite common, preventing thousands of trips daily. The most common models are currently the videoconferencing room systems, telepresence, desktop, web conferencing and virtual reality. A more detailed view can be seen in Roesler (2012).

The problem arises when there is a need to interoperate all systems in the same conversation, using also an online integrated multi collaboration tool. For example, one would like to use a room system and collaborate with a fellow at home, and with other colleague using a mobile device, and with others through a telepresence room. All of them should be able to see each other, as well as exchange files, documents, images, among others.

Besides the technological aspect, the room should be able to adapt to different situations, i.e.,

there should be possible to rapidly change the physical layout of the room to cope with different uses, increasing its occupancy rate and reducing its per-hour cost.

This paper presents the multipresence system, which deals with both physical and technological aspects of a multiuse room. In terms of applications, the proposed room enables local and remote classes, local and remote group dynamics, meetings in U, board meetings, among others, as seen in Figure 1.

Figure 1. Different uses for the proposed room.

Section 2 presents the physical view of the room, detailing how it deals with rapid layout changes. Section 3 presents the technological view of the room, detailing its architecture and functionalities. Section 4 presents the final remarks of the paper.

2. Physical view of the proposed room

Physically, one must have the possibility to move chairs, computers and monitors in the room, as well as energy and logic, in order to compose multiple environments. Figure 2 through Figure 6 show examples of possible configurations, where one can observe the flexibility to move furniture, electrical and logical. It is important to emphasize that the room can be used for meetings with participants present plus remote meetings, i.e., the TVs are used to videoconference in different resolutions (depending on the remote side) and for documents collaboration (all participants – local and remote – can see the same documents in the room TVs).

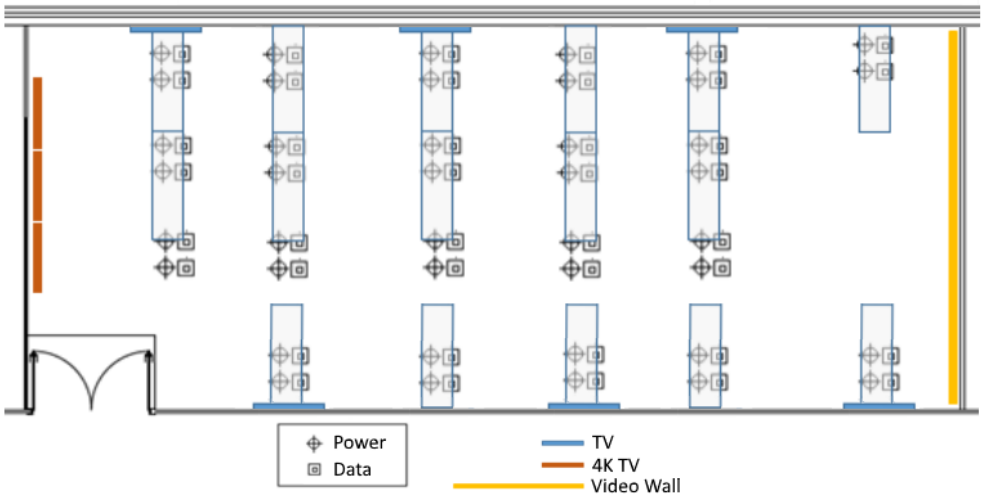

Figure 2. Multi-purpose room configured for a 24 students classroom (plus *n* remote students).

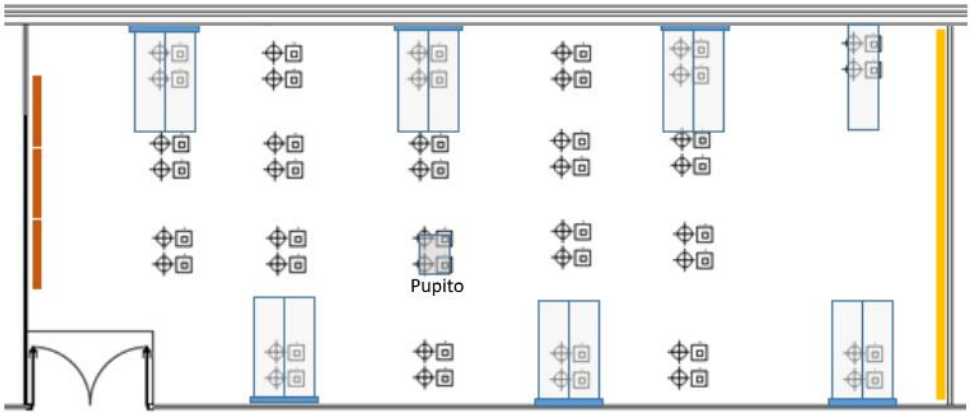

Figure 3. Multi-purpose room configured for 24 students group dynamic (local and remote).

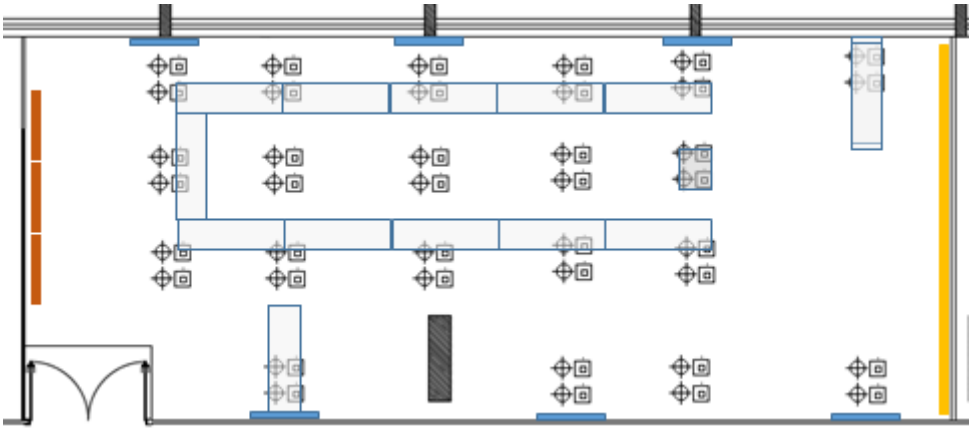

Figure 4. Multi-purpose room configured for "U" meeting (local and remote).

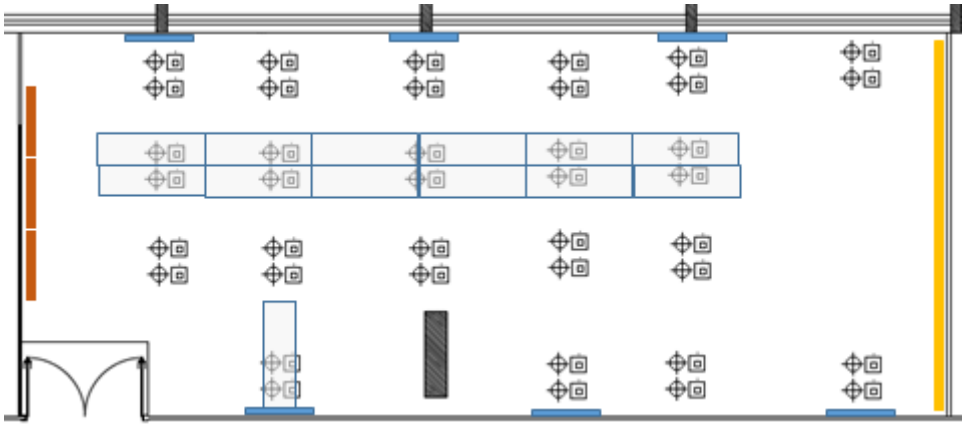

Figure 5. Multi-purpose room configured for board meetings (local and remote).

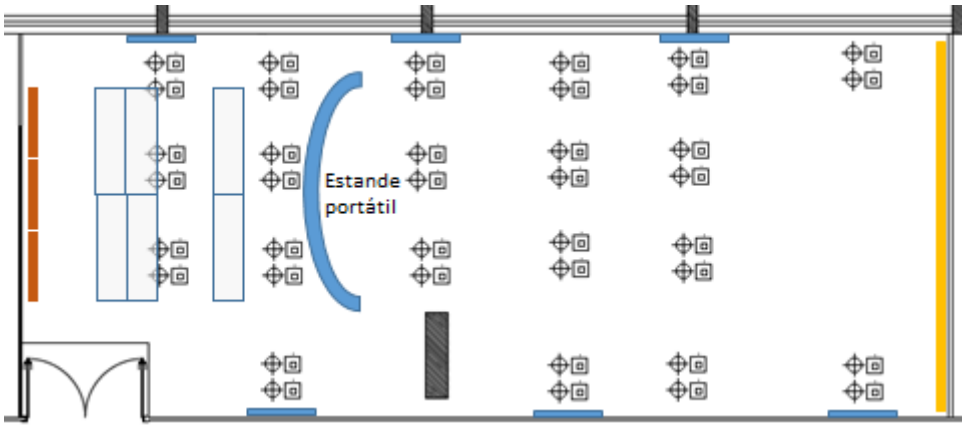

Figure 6. Multi-purpose room configured for telepresence.

3. Technological View of the proposed system

Ideally, the room should 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).
- ✓ Videoconferencing systems (Polycom, Cisco, and others).
- ✓ High definition videoconferencing through the personal computer application program.
- ✓ Web conferencing (web browser).
- ✓ Mobile devices.
- ✓ SIP phones.
- ✓ Telepresence room in high definition (Full HD).
- ✓ Ultra-telepresence room in ultra-high definition (UHD 4K).

The system can span over multiple rooms communicating through audio, video and content collaboration, as well as reaching individual users at home using a web browser or a mobile device.

3.1 System Modules

The multipresence system is totally modular, allowing the inclusion of equipment in an incremental way, and can range from a simple TV, notebook or mobile device, up to the model presented in Figure, which shows a model integrating telepresence, room

videoconference, web conferencing and slide presentation, where the focal point is a surgery in ultra-high definition. Figure shows other model where the focal point is a SAGE2 collaboration environment[1], with a 4K TV showing some reference images for the meeting or class.

Figure 7. Configuration with multiple displays.

Figure 8. Configuration with a video wall.

The innovation promoted by the system is the modularity and ubiquity offered, which is not seen in similar systems. Thus, 4K communications would be interacting with telepresence rooms in full HD, with room systems, stand-alone computers via web conferencing in lower-speed networks and mobile devices. The room is reconfigured quickly and easily depending on the need, optimizing space and allowing better use of resources.

The proposed multi-conference room is currently being deployed in an educational unit of RNP, which is the Brazilian NREN.

4. About SAGE2

SAGE2 (Scalable Amplified Group Environment) is a web-based software tool that enhances collaboration, either for local discussions or adding an extra feature to video conferencing. SAGE2 enable users to share their screen and files over IP networks, creating a virtual board in the cyberspace where remote and local participants in a meeting can share and visualize content (Marrinan, 2014).

The original SAGE software, developed in 2004 by the Electronic Visualization Laboratory of University of Illinois at Chicago (EVL/UIC) was designed to enable groups to work in front of large displays walls in order to solve problems that required juxtaposing large volumes of information in ultra-high-resolution.

Since 2011 RNP is disseminating the usage of SAGE to universities and research laboratories in Brazil. Currently, SAGE2 is adopted by more than one hundred educational and research institutions worldwide. SAGE2 is freely available at http://www.sagecommons.org.

[1] Scalable Amplified Group Environment (www.sagecommons.org)

Conclusion

This paper presented an architectural and technological view of a multiuse room powered by a software developed in Federal University of Rio Grande do Sul and funded mainly by the Brazilian NREN, RNP.

The paper had two main goals: to present the multipresence system trying to disseminate it and spread its use; b) to propose a physical solution for multipurpose rooms using the multipresence system.

One word that defines the multipresence system is "integration", as it integrates many different technologies, allowing people to participate no matter where they are and what technological platforms they are using. So, people can communicate using mobile phones, tablets, notebooks, computers, symmetrical panels, asymmetrical panels, telepresence rooms, ultra-high definition communication, SIP based systems, and so on. Besides videoconference, the system allows transparent collaboration among these platforms through SAGE2.

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Biographies

Valter Roesler has a Bachelor´s degree in Electrical Engineering (1988), Master's degree (1993) and PhD degree (2003) in Computer Science. Today he is a professor at the Federal University of Rio Grande do Sul, Brazil. He has experience in Multimedia, Digital TV, Video Encoding, e-Health and Network Monitoring. He coordinates the PRAV laboratory (Projects in Audio and Video) – www.inf.ufrgs.br/prav, with about 30 researchers and projects related to Remote Education and e-Health, in traditional computers and mobile devices. He is the coordinator of the Multipresence project.

Felipe Cecagno has a Bachelor's degree in Computer Science from the Federal University of Rio Grande do Sul (2010). Since 2008 he works at PRAV Laboratory (Projects in Audio and Video) as researcher and developer on many projects related to Multimedia and Distance Education. He's a technical leader of the Mconf project since its beginning (2010). In early 2013 he co-founded Mconf Tecnologia, a Brazilian company that provides professional services on top of Mconf and related technologies.

Leandro Ciuffo is Manager of Research and Development projects at RNP. Since 2011 he works with user engagement in the scope of the FIBRE Future Internet testbed. He also

coordinates the RNP's R&D Programme on Advanced Applications for Remote Visualization, which includes streaming of ultra-high-definition media. From 2006 to 2009 he worked with Grid Computing and e-Science projects at INFN-Catania (Italy), being responsible for dissemination and user support activities. Leandro holds a M.Sc. in Computer Science from the Federal Fluminense University (UFF) in Brazil.

Renato Duarte started working at RNP (National Education and research Network) in 2006 and he has worked as IT Coordinator there since 2013. He works in the educational technology area. He graduated in Computer Science at Unicarioca in 2006. He specialized in IT Project at UFRJ.

Guilherme Longoni is the project manager of the Multipresence solution at Federal University of Rio Grande do Sul (UFRGS) in Brazil. From 2011 to 2014 he worked as software developer in MIR project (Multimidia Integrated Room), working with low latency Full-HD surgery transmissions. He is a computer science student at UFRGS.

Luiz Coelho is with RNP (National Education and Research Network). He is the director and national coordinator of Superior Network Training Institute (ESR). He has Professional degree in Project Management from IAG/Master of PUC/Rio and Bachelor's degree in Data Processing from Pontifical Catholic University of Rio de Janeiro.