Implementing world wide mixed reality stages

Matej Mertik

Faculty of Information studies
in Novo mesto
Sevno 13, 8000 Novo mesto, Slovenia
`matej.mertik@fis.unm.si`

Daniel Stødle

Department of Computer Science
The Faculty of Science and Technology
University of Tromsø, 9037 Tromso, Norway
`daniels@cs.uit.no`

Abstract. *Mixed reality (MR) encompasses both augmented reality and augmented virtuality. It refers to the merging of real and virtual worlds to produce new environments and visualizations where physical and digital objects co-exist and interact in real time. One of the main challenges within new environments and visualization in MR space is to ensure low-latency and tight coupling of remote virtual and local physical realities. In this article we present Verdione, a collaborative research project that aims to develop robust video processing and dependable networking support for a world-wide mixed-reality stage at the World Opera.*

Keywords.   networks, remote virtual reality, mixed virtuality, low-latency, video and audio processing

1 Introduction

Real-time interaction between digital objects in a virtual environment is well known in the computer game industry [1, 2]. In recent years, these technologies have evolved to enable interaction with the real world, influencing every day activities and real-life aspects such as finance [3]. Second Life is a game where players inhabit a digital world, that demonstrates some of these interactions. However, communication in Second Life driven by real-world users is implemented only through digital objects and their virtual interactions. In Second Life, the link between the digital world and the real world is missing. Our goal is to mix virtual and physical environments, and create visualizations that co-exist with real-world actors at multiple geographical location in real-time [4]. The project Verdione funded

by the Norwegian Research Council with five participants - Simula Research Laboratory, University of Oslo, University of Tromsø, Telenor and Lividi - is a collaborative research project that aims to develop robust video processing and dependable networking support for a world-wide mixed-reality stage for the World Opera [5, 6]. In this article, we will present some characteristic, aims and challenges that a collaborative research is addressing in the Mixed reality (MR).

2 Research and methodology

The main goal of veridone research is to produce the technologies for the World Opera consortium. The World Opera consortium is a group of research, private, governmental and artistic institutions with a vision of a new way of opera production. The goal of the consortium is to offer a new joint opera performance across different geographical locations, where remote actors are virtually embedded into the local stage environment. The main challenge of Verdione is therefore focused on tightly coupled remote virtual and local physical realities. Some challenges include ultra-low latency, stable media synchronization and high audio-visual quality. Fig. 1 shows some key areas research in the Verdione project to achieve the goal of a mixed-reality stage in the World Opera.

Stable media synchronization requires exploitation of contextual knowledge ranging from screenplay-defined interaction in opera to location tracking that allows the discovery of changing dependencies between media streams to allocate limited network resources in the best possible way. Quality-of-service for streams is required and is
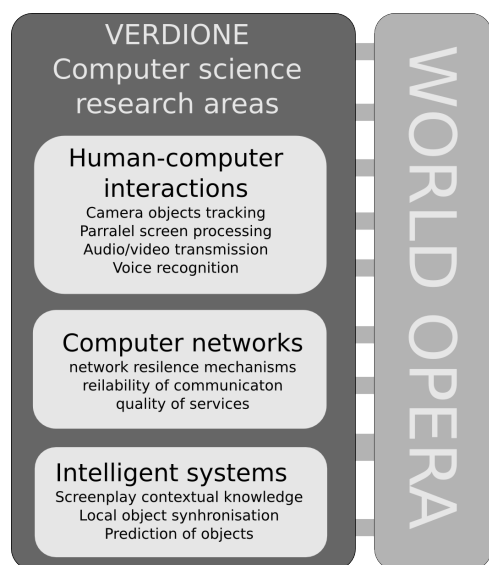
Figure 1: Key focus and the research area of the Verdione

taken into account when communication facilities adapt to changes in context or user requirements. There is an extreme importance in reliability of communication, which are addressed by improved network resilience mechanisms, and the provided services that will be subject to dependability mechanisms. A lot of network simulations in an experimental lab are used to investigate and evaluate possible solutions. Finally, one aim of the Verdione project is to implement a demonstration case, a real distributed opera performance - a task that involves both prototype implementations and production-grade system engineering.

3   Results and discussion

Verdione will develop a platform that allows artists who are distributed around the globe to interact with each other as though they were co-located. The platform will be applicable in different artistic genres that require auditive and visual interactions. The goal of Verdione is to make the platform robust enough to be used in rehearsals and also in real performances which include a critical audience. There are solutions already implemented that may provide a good starting point for future research. Basic infrastructure for audio latency was build and

tested for the World Opera based on the CCRMA built audio kernel development [7, 8]. The experience of users of the platform can only be of high quality and life-like if the perception of remote co-users satisfies enough senses, if the media types are presented in a well-coordinated and natural manner, and if they are of sufficient quality. Therefore, Verdione is developing technologies for network resilience and dependable communication infrastructures, information management and user interfaces and explore the artistic use of digital technology, especially in music and opera performances.

Verdione is exploring techniques that can open totally new levels of interaction between people over long distances. So far, two situations are the rule. In one case, such as video conferencing, remote interaction involves a very clear aspect of computer mediation in which users experience the distance from the communication partners. In the other case, which we find in virtual reality games, all users try to reach a high level of immersion into a virtual world and disassociation with their local, real environment. Verdione pushes forward towards cooperative applications that merge virtual elements into the real world, a combination we call mixed reality. The ultimate goal is for users to become immersed in a virtual reality that includes their local environment, and where user's arbitrary actions can be disseminated to their remote communication partners.

4   Acknowledgments

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