PSNC advanced multimedia and visualization infrastructures, services and applications

Extended Abstract

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ABSTRACT

Poznan Supercomputing and Networking Services (PSNC) offers advanced visualisation and multimedia infrastructures as a set of dedicated laboratories to conduct innovative research and development projects involving both academia and industry. In this short overview we present the existing facilities located at the PSNC campus in Poznan, Poland as well as short descriptions of example applications and networked services which have been recently developed.

CCS CONCEPTS

• **Human-centered computing → Visualization**; • **Computing methodologies → Graphics systems and interfaces**;

KEYWORDS

Collaboration in multi-user virtual environments, multimedia streaming, compression, and transmission of 3D content, 3D content acquisition

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1 INTRODUCTION

PSNC has created a set of visualisation and media laboratories providing the access to several installations and devices that could be used in the process of collaboration between PSNC and researchers focused on the 3D media technologies. The existing installation is composed of three types of visualisation installations as presented in Fig. 1.

- **CAVE1**: An immersive cubic 4-sided stereoscopic CAVE with dimensions 3.6m x 2.5m with resolution 2K x 2K per wall is equipped with advanced tracking system and associated with visualisation GPU cluster for real time image rendering;
- **CAVE2**: Immersive cylindrical tiled display is composed of 45x 4K TVs. The current resolution of the installation is 20K x 2K, however the total number of physical pixels that potentially be used is 373 MPix;
- **UHD Wall**: Immersive 8K high resolution display with video capture, processing, postproduction, streaming and display capabilities. The 6-meter-wide stitchless full-8K 60p wall is served by 12 blended BARCO projectors and image processors and can project also 8K 3D in 60p.

In addition to the installations, PSNC facilities include also 4 sets of 8K live cameras and stereoscopic rigs, computational clusters for 3D CG rendering, immersive audio installation composed of 25 microphones and 25 loudspeakers, motion capture system, laser 3D scanners, TV studio for video post-production as well as associated software for video editing, rendering and audio-visual processing. In general the PSNC laboratories can provide Ultra high resolution

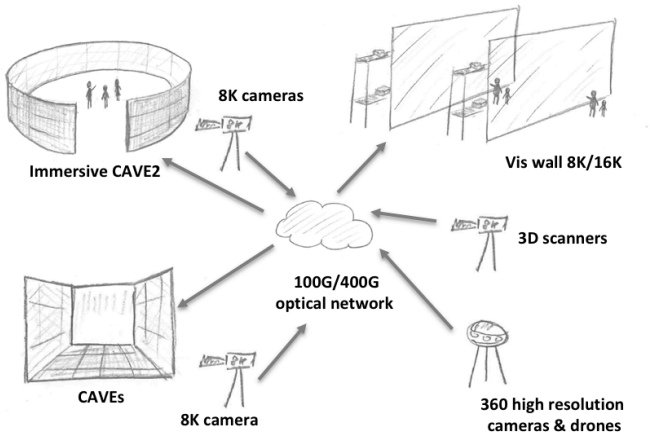

Figure 1: High-resolution CAVE2CAVE, immersive and visualization facilities integrated and accessible through optical networks at PSNC.

(16K, 8K, 8K 3D) visualization, real time encoding, decoding and live streaming, Real time VR and 3D graphics rendering for immersive spaces (cubic and cylindrical caves), multi-user interaction and visualization functionality.

2 LIVE 3D STREAMING @PSNC

Developing high-performance network protocols to exchange high-definition 3D visual data with as little delay as possible while synchronizing multiple data streams has been a huge research challenge for many PSNC researchers. Especially in interactive applications or applications related to 3D model visualization, when even the slightest delay affects the quality or comfort of work. Regarding the 3D content, three protocols are currently competing and under extensive research:

- Central server may compute every expected scenes and 2D or 3D stereoscopic view are dispatched through networks. The bandwidth is increased with the number of pixels and latency must be very low to support a fluid and real-time interaction;
- Full 3D model is shared and only edition events are exchanged through the network. Once the model is shared it expects low bandwidth and only latency should remain as low as possible;
- Full 3D model may be shared through compression and encoding techniques. Software and hardware based low latency compression technologies are under intensive investigation at PSNC.

A relevant part of the 3D world is also real time streaming of the 3D video content that can support realistic interpersonal communications, allowing remote users to share an activity. In most cases it is realized by capturing and generating in real-time the replica 3D representations of multiple geographically distributed users and placing them inside a common virtual space. Tele-immersion is a Future Internet application that could alter the way people communicate and interact, removing the barrier of physical location and distance, and create new pathways in the industries of entertainment, gaming, advertisement, broadcasting, health, learning etc.

3 AUGMENTED REALITY AND VIDEOCONFERENCE COLLABORATIVE WORKSPACE

The another interesting research activity has been conducted at PSNC in the TEFIS project. The project aimed to combine HD videoconferencing, 3D virtual models and motion tracking in an effort to obtain a new quality in the field of remote teaching. Through merging those technologies an impression of augmented reality has been successfully achieved in a fully distributed across Europe networked environment. The outcome of the integration process has been validated during a geographically distributed âĂIJbiology in EnglishâĂİ lesson of the future. Groups of students sitting in Swedish classrooms as well as individuals located at their homes will benefit from innovative, natural user interfaces in order to interact collaboratively with 3D models rendered in France imposed onto a video stream created at PSNC [1].

4 ADVANCED CONTENT CREATION IN IMMERSIFY

Advanced research on high resolution and immersive media, including encoding, streaming and displaying is impossible without advanced visualisation technologies comprising of VR caves, 8K high quality display walls, but also cutting-edge content creation devices such as 8K cameras, 3D rigs, VR cameras and laser scanners. Advanced research on high resolution and immersive media, including encoding, streaming and displaying is impossible without advanced visualisation technologies comprising of VR caves, 8K high quality display walls, but also cutting-edge content creation devices such as 8K cameras, 3D rigs, VR cameras and laser scanners. The Immersify project currently conducted at PSNC addresses both areas [2]. On one hand, partners provide advanced technologies and tools such as 8K display wall, cubic or cylindrical CAVE (PSNC), Deep Space 8K (Ars Electronica) or dome theatre (NVAB Visualisation Center C). On the other hand, Immersify focuses on producing showcase immersive content that demonstrates the creative possibilities of the new formats, and use it as a testing vehicle for the developed technologies. In order to produce high quality content for VR devices that is not CGI, real-life footage has to be obtained. PSNC provides the required infrastructure and expertise to create immersive media using latest video technologies (e.g. 8K, 3D, High Frame Rates, 360 video, laser 3D scanners), interactive content, and immersive content for giant screen. Within the Immersify project 8K and beyond high quality content will be produced with focus on extending current content genres.

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