Cooperative Design for Artistic Performances

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Abstract. ALTERNE (Alternative Realities in Networked Environments) platform aims at providing a high level of integration between various techniques supporting mixed reality, graphics, interaction and behavioral models. This paper focuses on two collaborative aspects the platform provides. First, it contains a virtual object repository, which allows artists to share their ideas and support collaboration on projects based on ALTERNE platform. Second, it enables direct and remote access for public visitors to the artistic installations so that all concurrent visitors can cooperate on the exploration of the installation.

1 Introduction

ALTERNE (Alternative Realities in Networked Environments) aims to construct a *collaborative alternative reality* platform to support the development of digital, interactive and participatory artistic activities. We define alternative reality as a generalization of virtual and mixed reality beyond the common "space-based" simulation. While traditional virtual reality essentially addresses the construction of visually realistic synthetic worlds, ALTERNE supports additional layers that will make it possible to explore other concepts such as: causality, relations between time and space, alternative laws of physics, alternative life forms, etc., in a more radical fashion [1, 2].

ALTERNE platform supports artistic VR installations that will be accessed either directly or remotely. The availability of the remote access is import since the physical size of the installation will always limit the number of direct spectators and we want the installations to be open for the widest possible public [3].

In general, ALTERNE platform provides two collaboration stages, one for the artists and second for the visitors. In the first stage several artists can cooperate together on the creation of an installation. In the second stage several direct and remote visitors can interact together and explore the installations mutually influencing each other.

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Section 2 describes architecture of the ALTERNE platform, its building blocks and connections between them. Section 3 discusses both collaboration aspects of the platform and Section 4 concludes the work.

2 ALTERNE Architecture

At the heart of the ALTERNE system is a *Visualization Server* (VS), which is connected to some display device (i.e. SAS Cube) as well as to *Lightweight Clients* (LC) via *General Variables* (GV) server. Lightweight Clients influence the content displayed in SAS Cube through the visualization server. The content which is displayed by the server originates in the *Virtual Object Management Server* (VOMS), where all past exhibitions as well as 3D models, animations, etc. and related material (conversion tools, HOWTO documents, FAQs) are stored. Artists take an advantage of this service during the design stage of their artwork. The basic block scheme of the ALTERNE system is shown in the Figure 1.

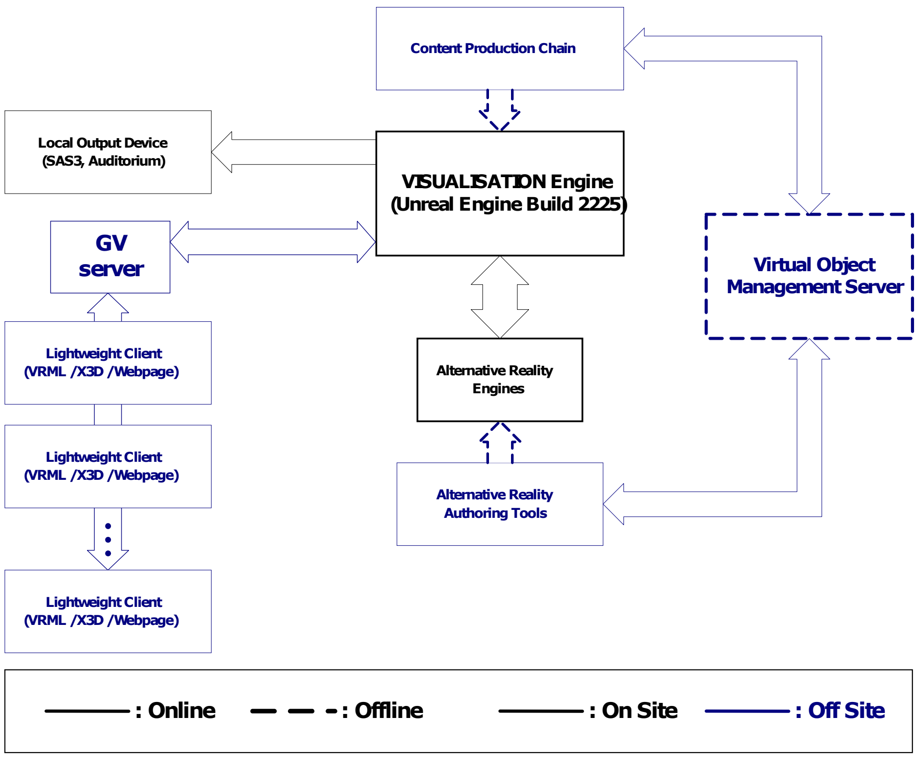

Fig. 1. Schematic view of the ALTERNE architecture

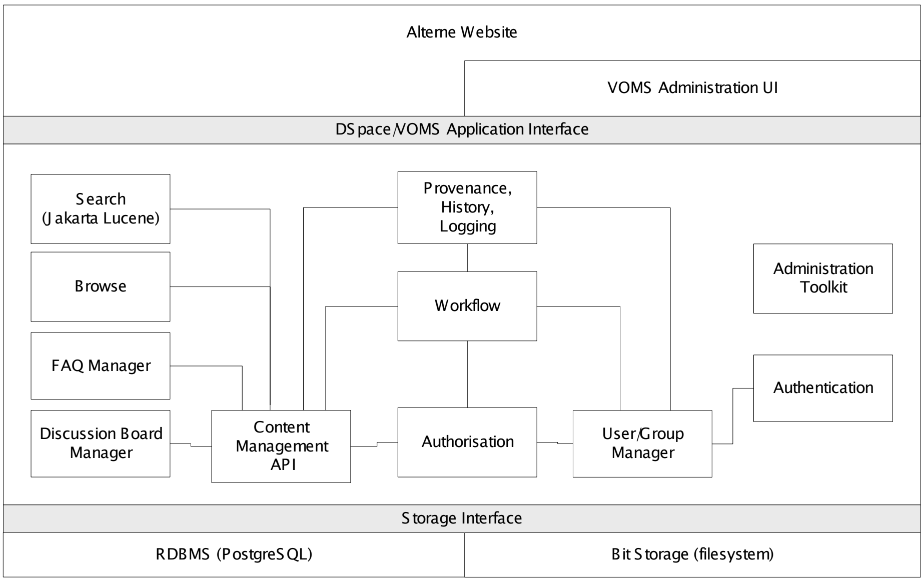

Fig. 2. Architecture of the Virtual Object Management Server

VOMS has been built on the top of DSpace, an open-source digital asset management system created at MIT [4]. Figure 2 displays the VOMS architecture that has been derived from DSpace. The server is separated into three distinct layers: The lower level is the storage layer. It consists of a relational database for storing meta-data and a "bit stream" storage module for storing the digital assets. The central layer of the system contains modules that implement the business logic of the system. This part of the repository server implements the behavior of the repository itself. The top layer is the services layer, which consists solely of web user interface.

Content of the VOMS is organized into a two-level hierarchy. The highest level, called a community level in the DSpace notation, will cover particular ALTERNE-based projects. Every community is then organized into one or more collections which contain logically-related material used in a specific project.

The indexing and search abilities are based on metadata associated with every asset stored in the system. VOMS internally uses the Dublin Core metadata format to describe the stored assets. Dublin Core belongs to rather simple structured generic metadata format. Its elements are intended to be optional, repeatable and extensible [5]. This way it can be easily tailored to the needs of describing different digital asset types.

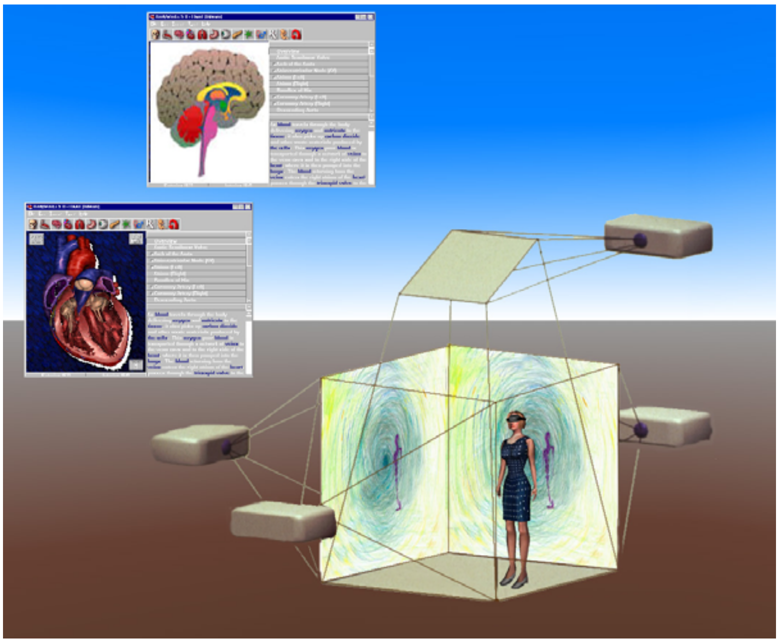

Fig. 3. Lightweight Client in 3D mode displaying 2D projections from CAVE (the projectors are shown for illustrative purpose only). Two GUI windows contain controls to change properties of the installation.

2.1 Lightweight Clients

The primary aim of the Lightweight Clients (LCs) is to enable remote exploration and control of artistic installations. LCs are connected to the installation(s) via the Internet and they mediate the experience of an immersed visitor to virtual visitors. The virtual visitors can perceive the installation in three modes:

1. 2D environment with video and audio streaming from the installation
2. 3D environment with 2D video produced by CAVE projectors and audio from the installation
3. 3D environment with 3D model of the installation

In addition to perceiving the installation, the virtual visitors are given means to change properties of the installation(s). The properties, their types and semantic actions are specified by the artists during the authoring process and proper GUIs are generated automatically. Depending on the LC's mode, the GUI can be 3D or 2D. However, we suggest using 3D GUI only for simple and intuitive properties since the manipulation of 3D controls is still very cumbersome.

Figure 3 shows a LC in 3D mode that uses video stream from CAVE projectors to display the installation venue with the immersed user (the second mode from the list above).

2.1.1 Integration of Lightweight Clients to the System

As the Figure 1 illustrates, LCs communicate with the visualization engine(s) through an intermediating element – General Variables (GV) server [6]. The server's role is to maintain consistency of installation properties at all clients. That means that all clients connected to an installation will see the same most recent properties. Since there is no response from the visualization engine (except the video and audio streaming), without the GV server the clients would not have any other means to synchronize values of the installation properties.

Another purpose of the GV server is to provide awareness among users by the help of avatars and communication channels (chat).

2.1.2 Overview of General Variables

The GV concept (Figure 4) was designed to formalize storing and distributing dynamic state in a client-server model. The fixed part of the VE state and its management is not covered by the concept since its implementation is closely tied with concrete application.

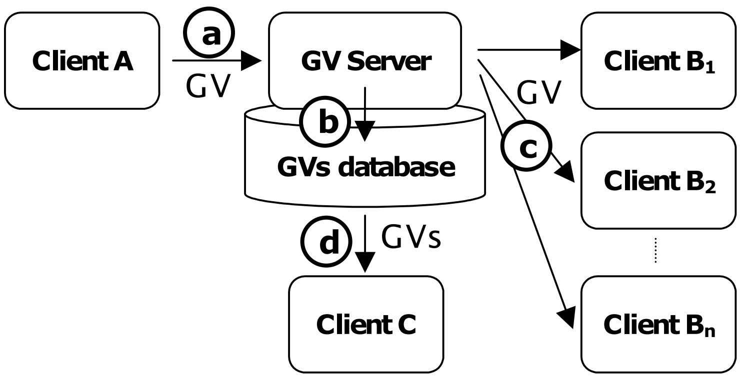

Fig. 4. General variables concept. Storage and distribution of general variables. a) sending a GV to a server, b) storing the GV in the GVs database, c) forwarding the GV to connected clients, d) sending the GVs database to a late join

If a user performs an interaction in the world (i.e. changes a property of the installation or his/her own position) the client sets a particular GV to some value. The value can be of arbitrary type (single value, array or heterogeneous structure). Then this new value is sent to a server (Figure 4a), which updates its GVs database (Figure 4b) and forwards the value to other connected clients (Figure 4c). They parse the value and perform the original action locally (i.e. update and display the new value of the property). If a new client (late join) connects to the system, the server sends it the content of the GVs database so that the client can update its state promptly (Figure 4d). In this scenario, the GVs database represents the dynamic state; GV values exchanged between the server and the clients correspond to dynamic state updates; and the content of GVs database sent to the late join represents the initial state.

3 Conclusion

ALTERNE project aims at construction of a novel kind of platform for the development of high-end digital arts productions and the teaching in domain of mixed reality installations. In this paper we described two collaborative aspects of the ALTERNE platform. Although the development of the platform began only recently, we have already produced several working prototype components that are now undergoing the debugging process.

4 Acknowledgements

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