

A 3D Collaborative Modeler Based on the Emerging MPEG-4 MU Standard

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Abstract. This work presents the implementation of a 3D collaborative modeler based on the emerging MPEG-4 MU (multi-user) standard. With this modeler, 3D graphic scenes in MPEG-4 format can be created in real-time, by multiple participants, in synchronous collaborative sessions.

1. Introduction

A 3D collaborative modeler based on the multi-user MPEG standard is being implemented which supports multiple users interaction in the joint task of creating and modifying 3D graphic scenes in MPEG-4 format. The 3D modeler is a Collaborative Virtual Environment – CVE which generates scenes that can be visualized in any MPEG-4 terminal through the MPEG-4 Player. Important issues in the development of CVEs include: session management, scene synchronization and concurrency control. These issues are supported in the 3D modeler through the MUTech Session Controller – MSC and MUTech Bookkeeper – MBK, both components implemented by the Networked Virtual Reality Lab at Federal University of S. Carlos, whose interface and functionalities were defined by the emerging MPEG-4 MU standard. Some details of the implementation are presented below.

2. Project Management

A project can be created, open or modified. Groups of users can be added to or removed from a project. The project owner can establish policies, such as who can access what. These policies can be used to configure sessions, before they are set-up. Roles are created which can be used either to enforce concurrency control policies or to establish access rights.

3. Support to the Requirements of CVEs

Session management in the 3D modeler is realized by the MSC component. When a participating user wishes to join a shared environment, the MSC is responsible for allowing or denying her entrance, based on the policies set up by the project creator. If the user is allowed to join a session, she is assigned to a zone and enabled to interact with other users and with the shared objects.

The synchronization of the scenes among the terminals of the participating users is supported by the Pilot/Drone mechanism along with the BIFS-Command

protocol [1]. In the 3D modeler, every shared object has a corresponding Pilot. When a modification is made on a shared object node, an action is triggered: the Pilot for the modified object propagates the modification to its corresponding Drones, one per participating user terminal. This means that the updating messages (BIFS-Commands) managed by the MBK component will be sent to all participating users. The modification of the shared object state is encoded by a BIFS-Encoder followed by the generation of a BIFS-Command. The BIFS-Command is encapsulated in an MU-Command and transmitted to the MBK which will broadcast the modification to the corresponding user terminals.

Concurrency control is implemented through the integration of two mechanisms: Pilot/Drone and locking. For a user to be able to make a modification in a scene object, he must request the “piloting” of the shared object by sending a request message to the MBK component. The MBK will then locate the object Pilot. The Pilot of the shared object, which attends multiple requests in a *first come first served* fashion, may answer to that request by accepting or denying the piloting transfer. This acceptance/denial is based on access rights policies set up by the project owner. Once the request is accepted the object is “locked” so that no other user may be piloting the same object – only one user can be editing an object at a particular time.

4. Conclusions

The strengths of this 3D modeler based on the MPEG-4 MU standard are threefold: scene updating is made more efficiently since the modifications are encoded in a binary format (through BIFS commands); a standardized solution is used to fulfill complex and challenging requirements of CVEs and; multiple users can take part in a project session by using the modeler while other users can act as observers by using a ubiquitous MPEG-4 terminal.

References

- [1] FPDAM of ISO/IEC 14496-1/AMD4. MPEG-4 Systems. N5285, Shanghai, October, 2002.