

Design, Analysis, and Evaluation of a Data Structure for Distributed Virtual Environments

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Abstract

This work deals with the problem of rendering a geometric virtual 3D scene. The size of virtual scenes that are rendered in real time is limited by the hardware. Algorithms are used to reduce the complexity of larger scenes. We render only the objects of the neighbourhood of the user. If the user moves through the scene, additional objects must be loaded. This work presents a data structure for management and rendering of distributed virtual scenes. The data structure supports navigation and manipulation of virtual scenes by several users. The theoretical analysis shows that all operations of the users (navigation, manipulation) are executed independently of the size of the scene. The data structure is implemented in a prototypical walkthrough system. The scene can be stored in the main memory, on a hard disk, and across the network. The experimental evaluation of the implementation investigates the creation of the scene and the running time of the operations. The experiments confirm our theoretical results.