Towards a Direct 3D Interactive Groupware Framework

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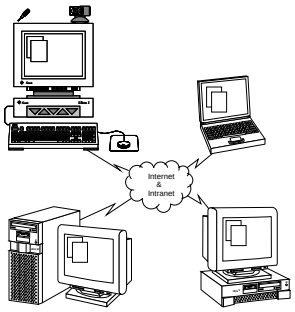
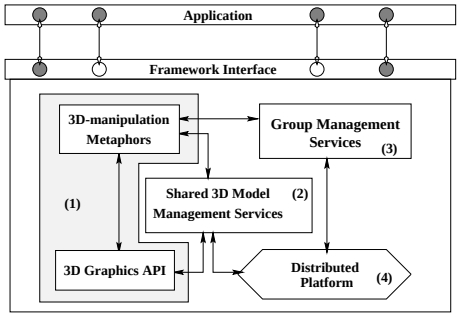
Abstract. We propose an object-oriented 3D interactive groupware framework to support the construction of 3D collaborative graphics applications with direct 3D manipulation facilities.

Motivation

Collaboration among geographically distributed partners in 3D graphics applications occurs dominantly in a asynchronous mode. The usual way to exchange information is either via faxes and emails (sending drawings) or via files (transfering design requirements or descriptions).

We have thought a scenario with two or more instances of a 3D interactive graphics application running in different locations to perform a set of tasks on the same 3D scene. This scenario demands indeed a multi-user collaborative 3D application, where information is distributed through the network and shared by the group of users geographically dispersed.





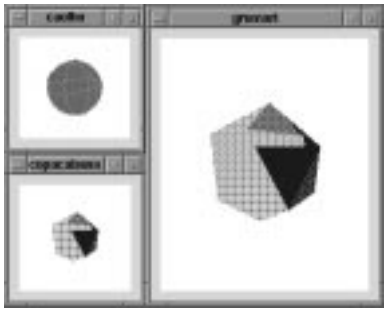
Basic Ideas

Since there are several paradigms and technologies focusing on distribution and graphics facilities, we decided to work on a framework that acts as a skeleton holding them together. This framework consists of (1) 3D-graphical services to provide graphics facilities, (2) 3D-model management services to provide concurrency control and consistency mechanisms, (3) group management services to coordinate team work, and (4) a distributed platform to distribute information through the network. Its variable aspects, which are flexibly defined by the application developer, are: 3D-model representation, group coordination policies, user interface, communication granularity, and 3D metaphors for group interaction.

We have adopted a replicated system architecture to improve the system response. 3D-manipulation and group metaphors have been considered to support direct manipulations and to improve awareness of collaboration, respectively. Whenever possible, `desgin patterns`, such as observer, singleton, abstract factory, and mediator, have been used to improve reusability, modularity, and flexibility of the system.

Current Status

We have implemented a subset of the framework facilities: a session service (control access to work), and a floor control service (prevent and resolve resource contention). CORBA (standards for a distributed platform) and OpenGL (3D graphics API) were used. A 3D-manipulation framework, MTK, was used to implement manipulation and group metaphors. Additionally, a simple application – geometrical transformations on an icosahedron – was implemented to validate the framework.



Future Works

We plan to include innovative group metaphors, customizable group management policies, a historic system to improve consistency mechanism and undo functionalities, and transaction services to update the model (replicas) atomically.