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Chapter XIV

Collaboration and Virtual Early Prototyping Using the Distributed Building Site Metaphor

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Rapid Prototyping within a virtual environment offers new possibilities of working. In order to reduce the design time and define better specifications, concurrent engineering shall be addressed at the early stage of a concept phase. The presentation defines different concepts namely Virtual Prototyping, Rapid Prototyping and Virtual Early Prototyping. VEP improves the Rapid Prototyping providing important leverage on the problem of collaboration.

The state of art shows that the current solutions offer a limited collaboration. Within the context of an extended team, the solutions do not address how to move easily from one style of working to another one. They do not define how to manage the rapid design of a complex product. Moreover, the different propositions suffer mainly from the client-server approach that is inefficient in many ways and limits the openness of the system. One explains also that the Internet protocols are best suited to develop collaborative services within a VEP system. That state of art enables us to explain that CORBA, MPEG-4 and multimedia protocols are not adapted to solve the problem of collaboration.

A case study is used to show that our solution enables an efficient collaboration. The chapter presents a global methodology enabling different styles of work. Thus, an extended team manages easily the concurrent design of a complex product. A way to start a project among a geographically dispersed team is proposed. It enables to manage different design teams in a secure way over the Internet. Afterwards, the different teams reach a kick-off meeting to set-up the initial proposal of the specification. Then, each team works on a system design in a distributed and collaborative way. Thus, private works are merged and consolidated easily. Work reviews solve the interdependencies between the different

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systems. At last, a project review enables us to conciliate the different proposals into a satisfying solution. Our solution provides practical advantages, namely a design in context to avoid speculation by default, a method breaking down the complexity, a decrease of the design time and an increase of the quality.

The case study is derived into a set of general requirements for a VEP tool. Thus, the major functional services are identified.

Afterwards, the chapter presents a new solution to satisfy the VEP requirements. It proposes new collaboration services that can be used to distribute a virtual scene between the designers. Our solution, called the Distributed Building Site Metaphor, enables project management, meeting management, parallel working, disconnected work and meeting work, real-time validation, real-time modification, real-time conciliation, real-time awareness, easy motion between these styles of work, consistency, security and persistency.

In contrast with the other solutions, our services enable parallel work while preserving consistency. These services do not require or implement a reliable multicasting. They are fully distributed and do not require any specific quality of service from the under laying network. DBSM can add collaboration to any stand-alone application.

INTRODUCTION

Motivation

Virtual Early Prototyping enables concurrent engineering at the early stage of a product design. Most of the time, an important part of a product cost is charged during the design phase. But tools to reduce the time to design a product and to examine different design alternatives are missing. VEP addresses the concept phase of a product development where most of the design choices are made. So, the concept phase is critical for the quality and the cost of the product. A VEP tool must authorize different designers to make quickly the best virtual prototype through a large set of design alternatives. So, the workers must work to explore quickly and easily different design alternatives. The concept design activities of a complex system can be performed in project-oriented teams that have important and tight deadlines. Concept design is not limited to a single enterprise. Members of a global design force can include partners, suppliers, contractors and customers. That global design force is organized into several design teams responsible for the different systems. The best specifications must be defined by these different teams through successive iterations while mixing easily individual works, alternatives for the different systems and conciliation milestones to reach a global specification. That extended team must collaborate freely and easily, without forcing a given enterprise to have more privilege and information than others. At the same time, the design environment must provide the ability to respect the responsibilities and expertise of the different members.

Collaborative systems focus on natural social interactions that let people easily move between different styles of work. They propose metaphors like Greenberg (1998) that ease people's transitions across the different styles of work. Generally, the room metaphor is considered as a container for several documents and space where workers meet. Thus, workers easily move from one room to another and can introduce documents in the different rooms. But, these collaboration metaphors do not address the way designers can collaborate at the concept phase of complex engineering products. Moreover, these collaborative systems do not manage virtual shared worlds.