

HiPEC: High Performance Computing Visualization System Supporting Networked Electronic Commerce Applications*

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Abstract. This paper presents the basic ideas and the technical background of the Esprit project HiPEC. The HiPEC Project aims at integrating HPCN technologies into an electronic commerce scenario to ease the interactive configuration of products and their photorealistic visualization by a high performance parallel rendering system.

1 Introduction

It is well accepted that electronic commerce systems will be of large benefit for the European industry if these technologies are actively used by companies and integrated into their business as soon as possible. Especially SMEs can benefit largely as market access and communication to suppliers and larger industries can be eased considerably using Internet technologies.

The main objective of the HiPEC project is to integrate advanced HPCN technologies to form a generic electronic commerce application. This application is aimed at giving a large number of SMEs a configuration and visualization tool to support the selling process within the showroom and to enlarge their business using the same tool also on the Internet. The enabling technology behind this tool is a high performance computing system as well as advanced networking technology. The HPC system is used to run the configuration and visualization system and networks give the end-users access to a HPC system to run the service from their showroom. It is the special aim of this project to make the service as general usable as possible. This means that open interfaces have to be used that allow a future integration of other components to customize the system to any special needs. The HPC equipment which is used for the electronic commerce application is provided as a service to the end-users in a way that allows the end-users to use these technologies via suitable communication networks. Thus, the end-users can have cost-efficient access to HPC technologies. The potential customers of these technologies are retailers of industrial products. The application range selected here is reselling of bathroom equipment. In

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a typical scenario, the customer can configure the bathroom equipment in an interactive configuration session. To ease the decision process of the customer, the configuration of the final product is supported by presenting the customer a photorealistic animation of the composed bathroom. As such a presentation has to be computed in short time with highest quality it is necessary to use a high performance computing system for the realistic image synthesis.

In section 2 the basic ideas of HiPEC will be discussed and a more detailed view on the technical background of the project is given.

2 Approach of the HiPEC Project

The HiPEC project aims at integrating HPCN technologies into an electronic commerce scenario to ease the interactive configuration of products. In the project scenario a retailer is equipped with a PC that is connected to the Internet. This PC holds a local database of product information from different manufacturers of bathroom equipment. Product information that was previously only available in books and brochures is digitized and loaded into the local database that can be frequently updated by the manufacturer of the bathroom equipment via the Internet.

A customer that wants to configure his bathroom can do this using a CAD program on the PC. During this selling process an employee of the reseller guides the selection of products and shows the different scenarios using the local CAD program on the PC. Using the local database selections can easily be made and different scenarios can be presented to the customer. Configuration of products is only one aspect. The other and even more important aspect is the visualization of a product. Customers want to have a visual impression of their product. This is of special importance in areas where furniture and other consumer goods are configured and offered to customers. As a high quality animation of products can lead to an increased attractivity the HiPEC project integrates a rendering service that generates photorealistic pictures of the selected product. As these animations can only be generated using HPC computing systems, a parallel computing system is used to generate these pictures. To generate this in highest quality, the architecture of the bathroom is loaded to a remote parallel computer system where a database is installed that contains detailed graphical models of all products. The model of the complete bathroom is build here and forwarded to the parallel system that generates a picture of highest quality. The encoded picture is send back to the PC to be printed and handed over to the customer. Thus, the HiPEC electronic commerce system contains the following components (see Figure 1).

User Interface and Configuration System

The User Interface and configuration system is installed on a PC in the showroom of the seller of the product. Together with the seller the customer configures the final product and has the possibility of using the remote high-end rendering service installed on the parallel computer system for a high-quality visualization.

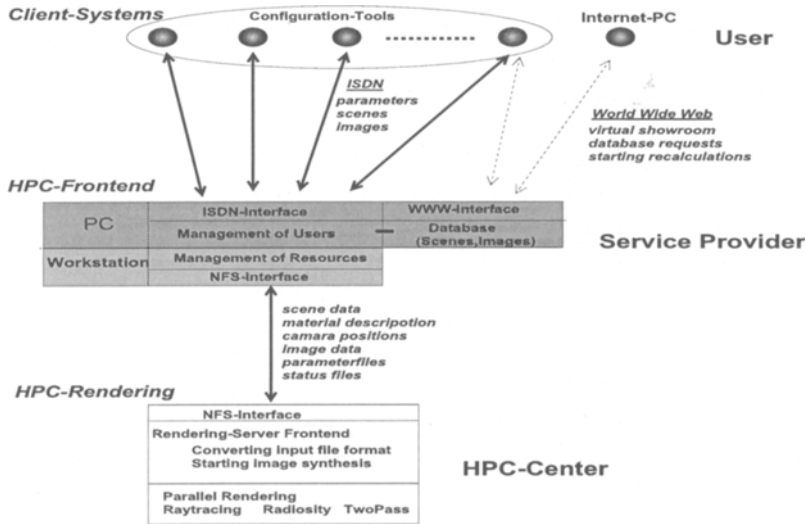


Fig. 1. Architecture of the HiPEC-System

This visualization might be only initiated at the end of the selling process or also in between to guide the user. The user is enabled to store generated product visualizations and configured products in a database. This database is used to set up a virtual showroom on the World Wide Web, which can be visited by potential customers from their PCs at home.

Communication network

The configuration and visualization service will be offered in the showroom of the retailers. Thus, communication networks will be used for different purposes. We will use ISDN dial-up lines to connect the PCs installed in the end-users showrooms to the parallel server. Using the database installed at the site of the parallel server, the bandwidth of these lines is large enough to support the application.

Service Broker

The electronic commerce application is achieved by a service broker which is installed on frontend computers to the HPC system. The service broker is responsible for managing the user accounts and for performing efficient job-scheduling of rendering jobs on the available hardware resources.

Database of product components

To generate a high quality animation, the complete product that is configured on the local PC has to be delivered to the parallel rendering server. To save communication bandwidth, the most important information about structure of the sub-components, structure of the surface of the object and other information are stored in a database that is located on a frontend PC connected to the parallel system. Using this database, the client system only has to communicate some

small information about the configuration. The complete scene that has to be animated is generated on the parallel computing system.

Parallel rendering system

Ray tracing and radiosity algorithms currently implemented in image synthesis systems provide the necessary rendering quality, but these methods are suffering from their extensive computational costs and their enormous memory requirements. Parallel computing and graphics are two fields of computer science that have much to offer each other. Efficient use of parallel computers requires algorithms where the same computation is performed repeatedly or where separate tasks are performed with little or no coordination, and most computer graphics tasks fit these needs well. On the other hand, most graphics applications have an insatiable appetite for raw computational power, and parallel computers are a good way to provide this power. It can be concluded that there is an obvious synergy between computer graphics and parallel computation. Several sophisticated methods for efficient parallel simulation of illumination effects in complex environments have been developed in the past [1][2] [4]. In the HiPEC approach the parallel rendering system is installed on a parallel computing platform that is located at the site of a service provider that provides the parallel computing service.

Over all, this application shows the benefits of networked HPC technologies in an electronic commerce application that goes beyond presenting products in the WWW. This technology is general, i.e. it can be applied to a large number of other applications and is presented here for a complete industrial area allowing to demonstrate the benefits of these technologies.

3 Conclusion

The HiPEC project integrates advanced HPC technology into a special electronic commerce application supporting the selling process within showrooms of retailers of bathroom furniture. So even SMEs can profit by the advantages of powerful HPC systems which are too expensive for a local installation. The design of the HiPEC system is kept as general as possible in order to allow the integration of other components to customize the system to the demands of additional electronic commerce applications.

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