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EXPLORER, A VISUALIZATION SYSTEM FOR RESERVOIR SIMULATIONS

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Abstract. In this paper, we introduce Explorer, a visualization system for reservoir simulations. It is designed for large-scale data sets and many technologies have been used during its implementation, such as a 3-layer Client-Commware-Server (CCS) structure, Object-Oriented method, VTK based rendering and etc. Compared with current commercial softwares, Explorer has many features including more data formats support, many user-defined properties and full support for Chinese characters.

Key Words. visualization system, post-processing, reservoir simulation,

1. Introduction

A visualization system is essential to reservoir simulation applications, which makes it possible for both simulation and reservoir engineers to find out what is inside the outputs produced by computing programs. Explorer is such a visualization system for both sequential and parallel reservoir simulators.

With the rapid progress in computing technology, such as CPU speed, disk capacity, network bandwidth and also the software improvements, reservoir simulation systems nowadays can generate large amounts of data (on the order of several hundred gigabytes to terabytes), and it has brought great challenges to current visualization systems, including data accessing, transmitting, processing and displaying. Explorer has made a lot of effort to achieve high performance when handling large-scale data sets.

In the following parts, we first introduce the so-called Client-Commware-Server structure[1]. Compared with the traditional Client-Server structure which is widely used in scientific visualization systems, this 3-layer structure can decrease the interactions between the server for computing and the client for visualization and make the whole system more independent and flexible. Then we discuss how the Object-Oriented method is applied in Explorer. There are all together 4 kinds of objects in Explorer: GUI objects, project administrator objects, document objects and rendering objects. After that, several aspects of Explorer will be mentioned, including a dictionary-like keyword parser, time-varying data manipulation, VTK based rendering and Chinese character handling in OpenGL windows. The last part of this paper is the conclusions and related work in the future.

2. The Client-Commware-Server Architecture

Most visualization systems use the Client-Server architecture (see Figure 1). The computations run on the server and the visualization systems run on the client.

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They are connected by networks. (Sometimes the two parts may be located in the same machine.)

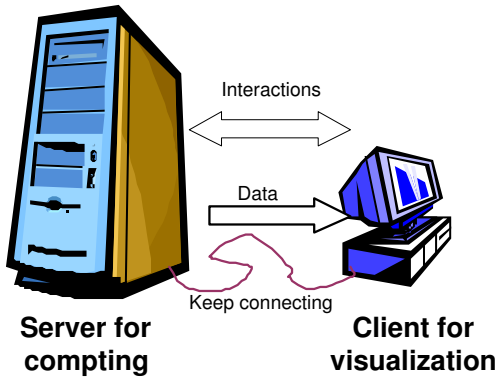

Figure 1 visualization system based on client-server structure

The C-S architecture has many good aspects. First, as we all know, numerical computation and the visualization have different demands of computer abilities. One needs powerful floating calculation ability while the other needs powerful graphics processing ability. Normally these two kinds of abilities are hard and no need to be provided by the same machine. By using the C-S structure, the numerical computation and visualization can be accomplished on different hardwares. Besides that, most applications need some kinds of interactions between the computation and the visualization, such as stopping, restarting or modifying the computation according to the visualization results, and the network between the server and the client provides a tunnel for this communication.

The problem of the traditional C-S structure rests with its high reliance between the two parts. It is hard to modify only a single part and not to affect the other one, because they are tied in an inflexible way. The main difficulty relies on the complexity of current networks and the operating systems and that is why we introduce the 3-layer Client-Commware-Server (C-C-S) architecture (see Figure 2).

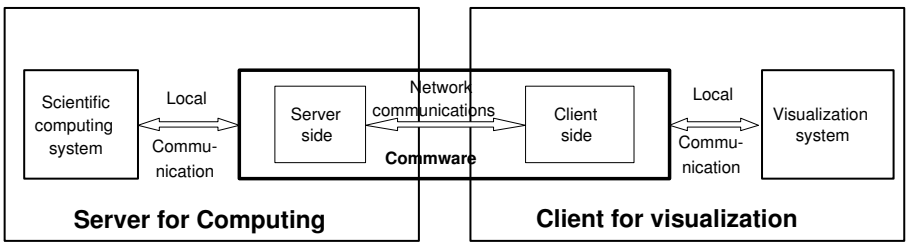

Figure 2 visualization system based on client-commware-server structure

Actually the name commware is borrowed from the well-known "middleware", and to some extend the commware is a kind of middleware which is in charge of the communications between the client and the server. Commware contains 2 parts: one part is located on the server for computing and the other is on the client for visualization. It hides all the details about the communications across different platforms and networks which both the server and the client side don't need to take into account.