POSTER: 3D Geo_visualization Service for Grid oriented Applications of Natural Disasters

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ABSTRACT

Our basic aim is to design a framework that will define a unified way of cooperation between Grid visualization applications and visualization clients. Working with the Grid technology implies increased complexity on one hand, and user demands for high interactivity on the other. The duration of the computations in the Grid environment being exceedingly long, the user naturally wants to see the intermediate results and requires means to modify the running computations if the intermediate results are not satisfactory. Framework is building of lot of tools. This paper describes concrete only one of tool included in framework – 3D Geo_visualization tool for visualization of the running Grid applications to rendering their intermediate or final results in the client application.

Keywords
Virtual Reality, GRID applications, Natural Disasters, 3D_visualization tool

1. INTRODUCTION

Grid applications, by their nature, are very time consuming. Unfortunately, the existing Grid infrastructure supports particularly batch applications; the support for interactive applications is only in its experimental phase. However, the time-consuming nature of Grid applications makes the users to demand the support to be able to check the state of the running application and modify it if the progression is not satisfactory. This encompasses two things; first, to be able to monitor the progress of the computation, by the means of application statistics, and second, to be able to see the actual intermediate results the application has provided so far. Unfortunately, the current situation is far less pleasurable: the user has to wait until the whole application finishes and only then he can run the visualization job, which will present him the data in the form of imagery. Having to wait until the application finishes only to see the computation went wrong can be very irritating.

Majority of Grid applications can be extended to contain a subsystem that would, on a demand or in regular time intervals, provide some information about the status of the computation; the phase of the computation or a progress indicator are typical examples of such information. There is a category of tasks in which the time of computation cannot be estimated in advance (some optimalization of tasks, cipher breaking, etc.); for such applications, the progress indicator can be based on statistically obtained data about similar tasks. If the application is running on more cluster nodes (which is nearly almost a rule in the Grid environment) the user might want to observe the computational load and the degree of completeness at each node. In such event it is considerable to create visualization services, which are able to prepare visualization outputs for clients quickly. This paper is describing such visualization services developed and tested in our institute, concrete a 3D visualization tool for GRID oriented Natural Disasters applications. The purpose of 3D Viz. tool is to model and display intermediate or final results of various simulations of natural disasters like fire spread in time, its intensity and erosion or floods in time or landslides as well. The output of the tool is various scenes of terrain by different simulations outputs. Output of the tool can also be the files representing the virtual reality of natural disaster and also files, which are generated as input for VR-Systems. 3D tool was tested with output from applications, which were solved in our institute and

also by data from applications of the MEDIGRID project. Particular demonstrations in this article are from fire in part near Mediterranean Sea at south. Exactly in Marseille industrial port at southeast. The second is from large fire in Krompla region [2], which is part of Slovensky Raj. Flood demonstrations are from Povazie, the region around the river Vah. For applications oriented on Grid computing was tool included to Visualization service (see Fig. 8).

2. RELATED WORK

There are several tools designed for visualizing natural disasters [7]. However, these tools lack common criteria for visualizations, unification of data formats, and a common approach to visualization. The integration of formats and a common solution for visualization of natural disasters, which has been solved in our visual service, allowed to created a visualization service for grid applications. As the applications computing natural disasters work with a large amount of data, grid computing is used frequently. Providing a visualization service could be considered a big contribution. This has been proved by increasing interest of experts working on international projects.

3. ARCHITECTURE OF TOOL

3D visualization tool consists of several modules. The modules are divided into three groups according to what kind of output is generated. The functionality of each group is represent by the appropriate schema. (schema 1, schema 2, schema 3).

- Models of terrain or model of environment.
- Models of simulations.
- Virtual reality models

The first group of modules is used for the creation of 3D terrain or environment models. The following modules has been created: CONVERTOR, TERRAIN, IVFIX and CONVERTTOWRL. Process represent Schema 1 (see Fig. 1).
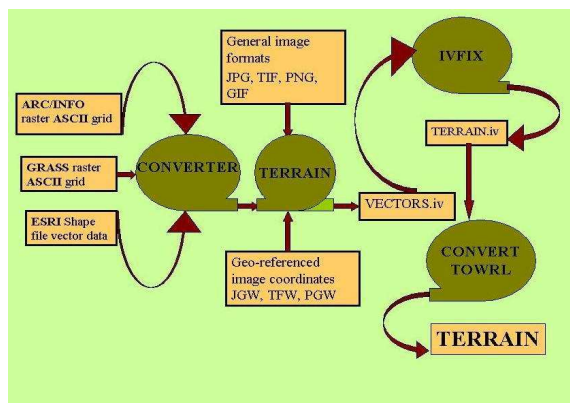

Figure 1.Schema 1.

Most frequently used formats of input data for terrains are: ARC/INFO raster ASCII grid, GRASS raster ASCII grid , ESRI Shape files vector data . Data can be exported to the TERRAIN module. Terrain module computes vectors and creates quad mesh for terrain models. Then modified IVFIX module creates Indexed face sets. Indexed face sets files are converted by module CONVERTTOWRL, to VRML. We created CONVERTTOWRL module according to the requirements of 3D tool. The final model of terrain is a VRML file TERRAIN.wrl. Examples of terrain created by the tool: *Marseille industrial port* (see Fig. 2)
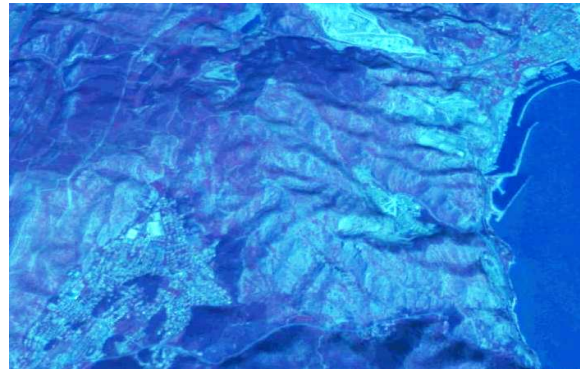

Figure 2. Marsaille industial port_Terrain

Models of simulations

The second group of modules of the 3D tool is designed to generate simulation models. The following modules were created: CONVERTER, CLASSIFIER, COLOR SOTER, TIME SORTER and VIRTUAL SORTER and GENERATORS for static or dynamic outputs. Creation process representet Schema 2. (see Fig. 3).
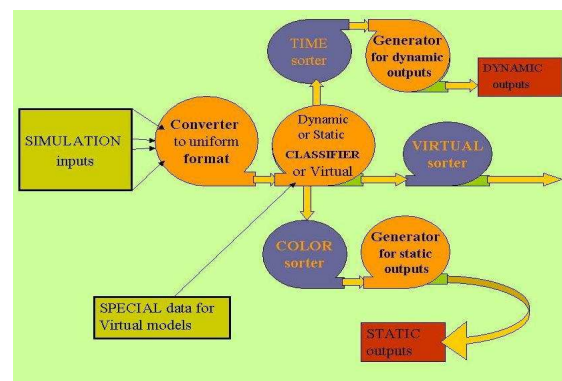

Figure 3. Schema 2.

The Input data for the second part of the 3D tool are output data from simulators in different formats. The module CONVERTER converts the data into a single format. The data input to the CLASSIFIER module. CLASSIFIER sorts the data and exports them to the

COLOR sorter and the TIME sorter and some of them, which are used for Virtual models to VIRTUAL sorter. The outputs Data obtained from the sorters are used as input for GENERATORS. Final visualization consists of a terrain model and of some simulation models. For example visualization of *fire spread in time* (see Fig. 4.) consists of TERRAIN.wrl and Firespread.wrl files.
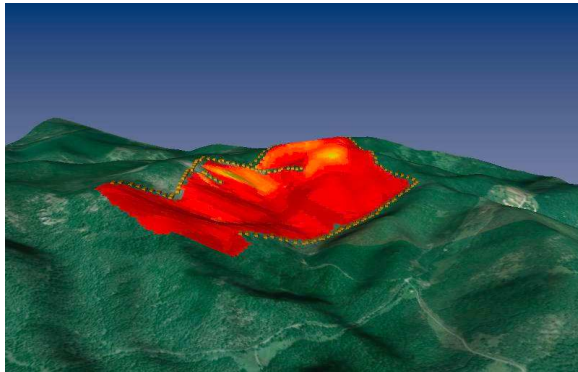

Figure 4. Dynamic model – Fire spread

Virtual reality models

The third group of modules is designed to generate models suitable for virtual reality applications. The following modules were created: DATA SORTER, VIRTUAL TERRAIN SORTER, VIRTUAL SIMULATION SORTER and several GENERATORS. Process of creation Virtual models represent Schema 3. (see Fig. 5).
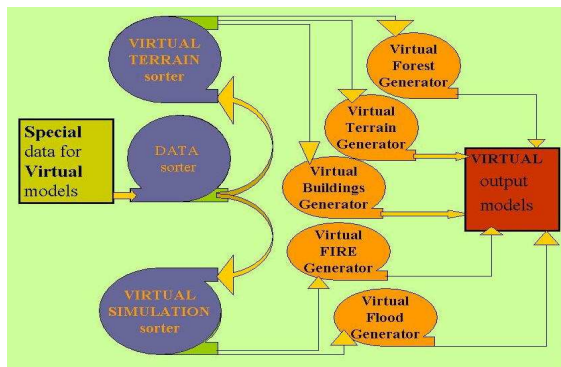

Figure 5. Schema 3.

As input Special data values can be for example values from Grown maps (Grown maps owners are Forestry). These data provide sufficient information for building up a concrete virtual forest composed of quads. For creating concrete forest we used Sibyla system [3]. Then by using 3D tool the same terrain, which has been covered by ortophotomap before is now covered by just prepared concrete virtual forest. Finally red faces representing fire were replaced by virtual fire textures using Virtual fire generator module (see Fig. 6). Since models from the 3D tool are files in VRML format. They can be shown by

VRML browsers and viewers as well as by CAVE for (see Fig. 7). In collaboration with Institute of Graphics and Parallel Processing of Johannes Kepler University Linz we are able to view some of the Virtual scenes in a CAVE system.
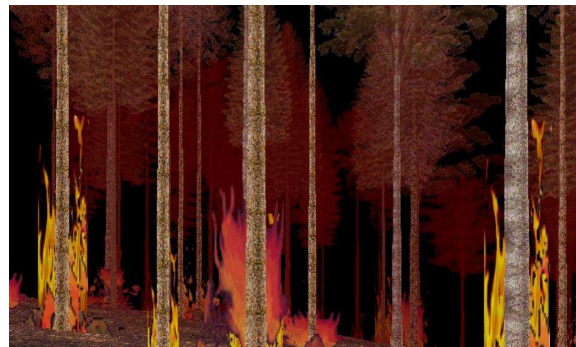

Figure 6. Virtual Fire in Krompla hill

Using the inVRs framework for collaborative immersive visualization

In order to provide a deep insight of the displayed datasets the *inVRs* framework is used for immersive visualization [4]. *inVRs* offers the possibility to render virtual environments in stereoscopic 3D graphics on a variety multi-display output devices like the CAVE [5], curved screens or powerwall installations. The framework consists of independent modules for navigation, interaction and network communication, which are interconnected via its system core. Inside the core databases host objects and user information, like the datasets provided by preprocessing steps. To render the graphical display of *inVRs* applications OpenSG [6] is used as a scene graph. Users are able to navigate trough the scenes depending on their chosen travel methodology and observe the scene as if they are standing inside. Different interaction methodologies can be chosen at the startup of the application. In the case of these visualizations switching of the different simulation steps is performed either automatically by starting an animation sequence or manually by pressing buttons to advance in the simulation. A valuable feature of the framework allows geographically dislocated users to collaboratively view and manipulate the datasets. To implement collaborative visualization the network module of the framework interconnects a set of clients in a peer-to-peer communication topology. The users are visualized by abstract avatars, which indicate the viewing orientation of the remote users. Position tracking is incorporated for pointing at distinct areas of the datasets. The gathered transformation of the users input device is transmitted via the network and visualized as a virtual pointer at the remote participants' site. To increase the immersion in the VE simple shaders have been

developed to improve the display quality of the water areas of the datasets. Additionally shaders are used to increase depth perception. The vertex normals of the terrain datasets are scaled in the vertical axis, which leads to a higher contrast if lighting is applied in the scene.

Figure 7. Visualization in CAVE

4. VISUALIZATION SERVICE

The Visualization Service is a common job submission service used to run the modeling by scripts. The service will produces visualization outputs and make them available them for the portal. The results of 3D visualizations require an additional VRML browser plugin installed. It is represent Schema 4. (see Fig. 8). Visual service was used and evaluated during the MEDIGRID project. In a future it can be incorporated in related projects of the domain of disasters management
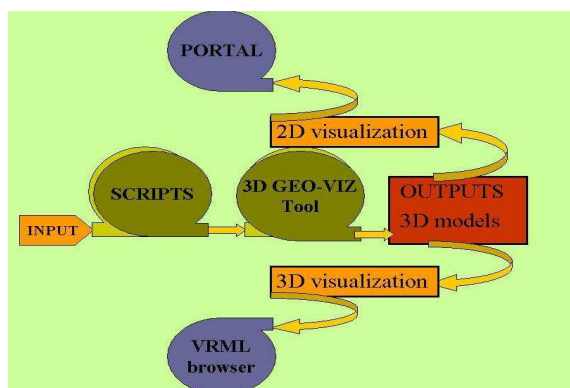

Figure 8. Schema 4.

5. CONCLUSION

Our 3D visualization tool has several approaches. It supports the most frequently used file formats. The 3D tool offers different levels of complexity for the visualization of natural disasters ranging from fast and simplified display up to scenes with a high polygon count. Output files are in format VRML (Virtual Reality Modelling Language), which are displayable by commonly available applications like Internet browsers, Freewrl, Blaxxun contact, Cortona client, Openwrl, VRED as well as in the CAVE. The tool can be used as a virtual service for a huge variety of GRID oriented disaster applications [1].

6. ACKNOWLEDGMENTS

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