Collaborative Problem Solving Environment for Flood Warning and Forecasting System

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Flood forecasting is a complex problem that requires cooperation of many scientists, users in different areas. Over the past few years, floods have caused widespread damages throughout the world. Most of the continents were heavily threatened. Therefore, modeling and simulation of flood forecasting in order to predict and to make necessary prevention is very important. For the next initiative in the major societal challenges of 6FP we propose to develop collaborative problem solving environment meant as a support system for establishment and operation of Virtual Organization for Flood Warning and Forecasting for international rivers associating a set of individuals and institutions involved in flood prevention and protection. The system will employ the Grid technology to seamlessly connect together the experts, data and computing resources needed for quick and correct flood management decisions. The main component of the system will be a highly automated early warning system based on hydro-meteorological (snowmelt) rainfall-runoff simulations. Moreover, the system will integrate the advanced communication techniques allowing the crisis management teams to consult the decisions with various experts. The experts will be able to run the simulations with changed parameters and analyze the impact (what-if analysis). The use of Grid resources is vital especially in the case of flood crisis when the simulations have to be performed as fast as possible.

Virtual organization will be based on a Problem Solving Environment, which is a computer system that provides all the computational facilities needed to solve a target class of problems. These features include advanced solution methods, automatic and semiautomatic selection of solution methods, and ways to easily incorporate novel solution methods. Moreover, PSEs use the language of the target class of problems, so users can run them without specialized knowledge of the underlying computer hardware or software. By exploiting modern technologies such as interactive color graphics, powerful processors, and networks of specialized services, PSEs can solve complex problems of flood warning and forecasting, support development and using of models. PSE brings together computer resources, virtual libraries, databases, visualization tools and expert systems. The human interface to these objects is problem-oriented and uses the language of the target class of problems, so its user can focus on the problem rather than on the technology used to solve it. Current trends present to us a new way of cooperative problem solving - Collaborative PSE, using the Internet technology to connect geographically separated researchers and users. For the Network of Excellence (NoE) we propose to work on the Collaborative Problem Solving Environment for Flood Warning and Forecasting for international rivers. Flood forecasting, when done precisely, is a computationally intensive problem, requiring considerable resources. Therefore, behind the user-friendly

interface to our PSE, we will use the Grid to run complex weather and water-flow simulations related to the earth observation.

The Virtual Organization will consists of:

- Data providers - these organizations provide the actual physical measurements of real weather conditions, upon which the predictive simulations are based. Such organizations are the Slovak Hydro-meteorological Institute, the organizations managing the actual target river, the organizations providing satellite images, radar observations, etc.
- Storage providers - these organizations will provide storage space, archives and databases to store all data needed in the CPSE. The data storage process will not be a trivial one. We need to store a huge amount of measured data, pre-simulated scenarios used for rapid situation evaluation, simulation configurations and terrain maps.
- Cycle providers - these organizations will provide the computational resources for our simulations. It will be a group of cluster maintainers, organizations owning supercomputers and pools of workstations.
- Portal - this is the gate to the whole PSE and a core of its management. It will be a place of communication between PSE users, simulation preparation, management, data evaluation and distribution. We are developing a web-based portal.
- Users - the organizations that will profit from the results of the simulations run using the resources provided by the rest of the virtual organization. This can be the Slovak Hydro-meteorological Institute, TV or radio broadcasters who are transmitting weather forecasts, insurance organizations assessing flood threats or common public interested in the products of our simulations.