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EIAGRID: In-field optimization of seismic data acquisition by real-time subsurface imaging using a remote GRID computing environment.

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The constant growth of contaminated sites, the unsustainable use of natural resources, and, last but not least, the hydrological risk related to extreme meteorological events and increased climate variability are major environmental issues of today. Finding solutions for these complex problems requires an integrated cross-disciplinary approach, providing a unified basis for environmental science and engineering. In computer science, grid computing is emerging worldwide as a formidable tool allowing distributed computation and data management with administratively-distant resources. Utilizing these modern High Performance Computing (HPC) technologies, the GRIDA3 project bundles several applications from different fields of geoscience aiming to support decision making for reasonable and responsible land use and resource management. In this abstract we present a geophysical application called EIAGRID that uses grid computing facilities to perform real-time subsurface imaging by on-the-fly processing of seismic field data and fast optimization of the processing workflow.
Even though, seismic reflection profiling has a broad application range spanning from shallow targets in a few meters depth to targets in a depth of several kilometers, it is primarily used by the hydrocarbon industry and hardly for environmental purposes. The complexity of data acquisition and processing poses severe problems for environmental and geotechnical engineering: Professional seismic processing software is expensive to buy and demands large experience from the user. In-field processing equipment needed for real-time data Quality Control (QC) and immediate optimization of the acquisition parameters is often not available for this kind of studies. As a result, the data quality will be suboptimal. In the worst case, a crucial parameter such as receiver spacing, maximum offset, or recording time turns out later to be inappropriate and the complete acquisition campaign has to be repeated.
The EIAGRID portal provides an innovative solution to this problem combining state-of-the-art data processing methods and modern remote grid computing technology. In field-processing equipment is substituted by remote access to high performance grid computing facilities. The latter can be ubiquitously controlled by a user-friendly web-browser interface accessed from the field by any mobile computer using wireless data transmission technology such as UMTS (Universal Mobile Telecommunications System) or HSUPA/HSDPA (High-Speed Uplink/Downlink Packet Access). The complexity of data-manipulation and processing and thus also the time demanding user interaction is minimized by a data-driven, and highly automated velocity analysis and imaging approach based on the Common-Reflection-Surface (CRS) stack. Furthermore, the huge computing power provided by the grid deployment allows parallel testing of alternative processing sequences and parameter settings, a feature which considerably reduces the turn-around times. A shared data storage using georeferencing tools and data grid technology is under current development. It will allow to publish already accomplished projects, making results, processing workflows and parameter settings available in a transparent and reproducible way. Creating a unified database shared by all users will facilitate complex studies and enable the use of data-crossing techniques to incorporate results of other environmental applications hosted on the GRIDA3 portal.