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G-FireStation: Fire simulation from desktop to grid

Overview :
CROSS-Fire is a research project, funded by the Portuguese NGI and led by UMinho, focused on topics related to decision making to control forest fires and on the porting to the grid of FireStation - a fire growth simulation application. G-FireStation exploits Grid capabilities in order to have a faster execution, to manage large data input/output files, to create a large data base of simulation results and to allow the interactive control of the simulations through a graphical user interface

Analysis :
Forest fires are typical CP emergency cases that require a fast and reliable risk management support system, with (near) real-time of availability of critical geo-referenced data. FireStation is an integrated system aimed at the simulation of fire growth over complex topography, where the fire growth simulation is a process of contagion between burning and non-burning cells based on Dijkstra dynamic programming algorithm. We started by developing a parallel MPI version also taking advantage of its parallel I/O facilities to reduce the overall time needed to process the huge volume of data. Currently G-FireStation integrates a rich set of gLite Grid tools and services most suited to our objectives: LFC file catalogue commands to manage large data files; AMGA metadata catalogue to create and have access to a database of the inputs/results of the previous execution simulations; and the WatchDog mechanism, to monitor the simulation and to provide data for an interactive control.

Impact :
The project, initially limited to the contour of the Portuguese NGI, is currently being extended to Europe and Latin America, as a result of UMinho participation in EELA-2. The extension will allow the study and investigation of the factors necessary to run CP applications in a larger grid infra-structure that spawns continents also permitting to evaluate inter-operability between different/complementary grid infra- structures. The work has strong relationships with G-RISICO that estimates distribution of wildland fire risk over the Italian territory. However, on contrary of G-FireStation - in which a process when is computing the fire spread from a burning cell in the border with another process, it has to calculate some predictions for cells that do not belong to its sub-terrain - RISICO works on a set partitioned on identical and algorithmically independent squared cells, only taking into account cell status without considering correlations between them.

Conclusions :

Now that G-Firestation has been integrated within the Grid Framework we plan to develop a complete graphical interface that mimics the original Microstation CAD environment. We also plan to exploit the potential of the Grid portal technology, in particular Genius, to allow fine control to the access of the simulator. Finally, we need to enable geospatial services that have already been implemented in the context of Cyclops project such as OGC WCS for data access and OGC WPS for processing.

URL :

hpps://pop.cp.di.uminho.pt/eela

Keywords :

Civil Protection, Forest fires, parallel computing, MPI, MPI-IO

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