



**HAL**  
open science

## Coupling Parallel Simulation and Parallel Visualization on PC Clusters

Florence Zara, Vincentjean-Marc Vincent, François Faure

► **To cite this version:**

Florence Zara, Vincentjean-Marc Vincent, François Faure. Coupling Parallel Simulation and Parallel Visualization on PC Clusters. Commodity Clusters For Virtual Reality, VR 2003, 2003, Los Angeles, United States. inria-00517241

**HAL Id: inria-00517241**

**<https://inria.hal.science/inria-00517241v1>**

Submitted on 14 Sep 2010

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Coupling Parallel Simulation and Parallel Visualization on PC Clusters

Florence Zara<sup>1</sup>, Jean-Marc Vincent<sup>1</sup>, François Faure<sup>2</sup>

Laboratoire Informatique et Distribution (ID-IMAG), Projet APACHE<sup>1</sup>  
Laboratoire GRAVIR-IMAG, Equipe EVASION<sup>2</sup>  
(CNRS, INPG, INRIA, UJF) \*  
Grenoble, France

Progresses in hardware and software technologies make possible the use of parallel platforms for image synthesis. New parallel programming environments help developers in parallelizing efficiently their applications. In particular, complex physical simulation with massive data sets could be managed with reasonable response time. Moreover a parallel visualization improves significantly the reactivity of the application.

Our goal is to couple a parallel simulation code and a multi-display visualization and test it on a PC cluster. The simulation is parallelized with the parallel programming environment Athapascan [3,2], and rendering computations are distributed by Net Juggler [1] on graphics nodes. Practically, we focus on physical simulation of deformable objects, and more precisely on clothes, that are discretized in a large number of interactive particules.

A cloth is modeled as a mesh of particles linked up by springs. This object is partitioned in elementary tasks [4]. At each time step, physical simulation consists of two steps of Newton's equation integration. The tasks are executed by the Athapascan environment and enable computation of the new position of the object. In this phase, the scheduler automatically manages data locality in order to minimize communication costs. Finally, a communication scheme has been implemented between the computation tasks and Net Juggler rendering tasks avoiding global synchronizations. It enables a good overlapping between computation and visualization tasks, and consequently optimizes the resource use.

Many experiments have been conducted with various numbers of particles, processors or graphics cards. Our implementation supports up to a million of particles (about 3s for one frame on two nodes). Visualization by Net Juggler on up to 3 graphics cards has been done without difficulty.

In this work, we combine synchronized parallel I/O for rendering and asynchronous parallel simulation code. We believe that, for such an environment, interactivity is reachable with more powerful computing clusters. Visualization scalability, by increasing the number of graphics cards, is possible with our software architecture but have not been already tested. From a scientific point of view, we have to go further into the analysis of the interaction between the simulation flow and the visualization constraints. Moreover to control this flow, new methodologies have to be developed to tune many parameters.

## References

1. J. Allard, L. Lecointre, V. Gouranton, E. Melin, and B. Raffin. Net juggler guide. Technical Report RR-LIFO-2001-02, LIFO, Orléans, France, June 2001.
2. T. Gautier, R. Revire, and F. Zara. Cluster computing with athapascan. Submitted to Euro-Par 2003, august 2003.
3. J.-L. Roch and *et al.* Athapascan: Api for asynchronous parallel programming. Technical Report RR-XXX, INRIA Rhône-Alpes, projet APACHE, feb 2003.
4. F. Zara, F. Faure, and J-M. Vincent. Physical cloth simulation on a PC cluster. In X. Pueyo D. Bartz and E. Reinhard, editors, *Fourth Eurographics Workshop on Parallel Graphics and Visualization 2002*, pages 105–112, Blaubeuren, Germany, September 2002.

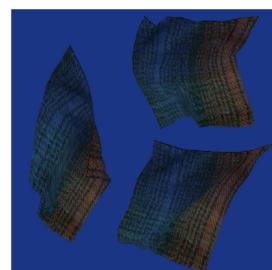


Fig.1: Pieces of cloth of 100 particles.

\* This work is partly financed by the contract of the "Thématique Prioritaire n°4 "Sciences et technologies de l'information, outils et applications" de la région Rhône-Alpes."