Center for Environmental & Applied Fluid Mechanics

"VAPOR: A Desktop Environment for Interactive Exploration of Large Scale CFD Simulation Data"

Presented by

Dr. John Clyne
National Center for Atmospheric Research

Emerging petascale computing platforms promise unprecedented opportunities for large-scale numerical simulation, but will also pose extraordinary challenges for data analysis and visualization. While CPU and GPU performance has advanced at a rate meeting or exceeding Moore's law, other computing technologies, notably storage bandwidths, have lagged far behind. Frequently the bottleneck in interactive exploration of time-evolving simulation outputs is not the speed at which the CPU or GPU can process them, but simply the rate at which we can recover the data from disk. While massively parallel visualization and analysis platforms have been shown to be capable of operating on some of the largest data sets generated today these systems are costly, difficult to maintain, lack robust application software environments, and are available only to a fortunate few. We have chosen a different path to addressing the problem of visualizing and analyzing large data. Instead of relying on brute force computing we employ an intelligent wavelet based encoding strategy that permits hierarchical data access, permitting researchers to make speed/quality tradeoffs to accommodate the resources at hand. Highly interactively visual and quantitative analysis of data sets up to 20483 have been demonstrated with our methods using only a single workstation. We have incorporated our technique into an open source, community CFD analysis tool, VAPOR (www.vapor.ucar.edu), now used by researchers worldwide. In addition to its unique data representation, also distinctive to VAPOR are its quantitative analysis capabilities and its domain specific focus on the CFD community. In this talk I will give an overview of VAPOR and its current data analysis capabilities. I will also discuss development plans and research directions focused on supporting future petascale computing.

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