

21ST CENTURY SIMULATION: EXPLOITING HIGH PERFORMANCE COMPUTING AND DATA ANALYSIS

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This paper identifies, defines, and analyzes the limitations imposed on Modeling and Simulation by outmoded paradigms in computer utilization and data analysis. The authors then discuss two emerging capabilities to overcome these limitations: High Performance Parallel Computing and Advanced Data Analysis. First, parallel computing, in supercomputers and Linux clusters, has proven effective by providing users an advantage in computing power. This has been characterized as a ten-year lead over the use of single-processor computers. Second, advanced data analysis techniques are both necessitated and enabled by this leap in computing power. JFCOM's JESPP project is one of the few simulation initiatives to effectively embrace these concepts. The challenges facing the defense analyst today have grown to include the need to consider operations among non-combatant populations, to focus on impacts to civilian infrastructure, to differentiate combatants from non-combatants, and to understand non-linear, asymmetric warfare. These requirements stretch both current computational techniques and data analysis methodologies. In this paper, documented examples and potential solutions will be advanced. The authors discuss the paths to successful implementation based on their experience. Reviewed technologies include parallel computing, cluster computing, grid computing, data logging, OpsResearch, database advances, data mining, evolutionary computing, genetic algorithms, and Monte Carlo sensitivity analyses. The modeling and simulation community has significant potential to provide more opportunities for training and analysis. Simulations must include increasingly sophisticated environments, better emulations of foes, and more realistic civilian populations. Overcoming the implementation challenges will produce dramatically better insights, for trainees and analysts. High Performance Parallel Computing and Advanced Data Analysis promise increased understanding of future vulnerabilities to help avoid unneeded mission failures and unacceptable personnel losses. The authors set forth road maps for rapid prototyping and adoption of advanced capabilities. They discuss the beneficial impact of embracing these technologies, as well as risk mitigation required to ensure success.

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