Abstract

This paper addresses the confluence of two major "tsunamis" of societal change: the emergence of dramatically enhanced capabilities in high performance computation (HPC) and the impending displacement of transportation technologies. It asserts that the pre-nascent appearances of both of these emerging paradigms are also bifurcated into two major currents. Computation facing both hardware advances e.g. Quantum Computing and software approaches e.g. Deep Learning. The transportation future suggests a move toward alternative fuels and toward from self-piloted vehicles. Further, the team recognized a need for an enhancement of faith in the scientific method by both the public and in the decision-making strata. The team was assembled to consider the development of an experimental design to best address the following issues: a defensible experimental design, a malleable approach to facilitate incorporation of shifting capabilities, and a compelling data visualization strategy to communicate experimental insights to a range of target audiences. Another desirable feature would be an inherent apologetics mechanism to respond to factions who seek public and political goals, not scientific purity. The team was carefully crafted to be made up of technical personnel with no pronounced emotional investment in the final outcomes of these developments and this paper asserts no proposed final resolution of the issues. These will, nevertheless, have major impact on the industrial societies.

The HPC community currently faces two major challenges in achieving the goals of developing a robust HPC experimental design. The first is the difficulty of allowing for the seamless incorporation of emerging technologies and techniques as well as constructing a virtually unassailable Verification, Validation and Test (VV&T) strategy. It must be compelling to both the professional science community and the lay community. The paper first identifies the need for careful definition of the issues to be illuminated, past efforts to achieve these goals, and observed impediments to that achievement. The composition of the team was deemed as critical. Then the composition of the team is discussed, with special attention to the rationales for the inclusion of behavioral and neural scientists, data visualization researchers, industrial computer design developers, and theoretical physicists. This was an *ad-hoc* team, with no intention of gain or further collective activity.

The paper then turns to a quick review of the impacts of past evolutions in transportation and the painful disruptions occasioned thereby. Next there is a survey of the issues now beginning to be observed as the industrial societies as we move from fossil fuels to renewable or more efficient energy production and utilization. A quick attempt at quantifying the impacts in both time scales is presented. Then a review of some of the impacts of HPC will be presented, with the emphasis on the obstacles to efficient adoption of the power of HPC as was witnessed during some of the authors' five decades of work in computers. More difficult is assessing the timing of the advent of the new technologies and techniques that may enable the analyses proposed in the proffered experimental design template. That template is then laid out, explicated and justified.

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Abstract

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