Abstract

The team identifies the confluence of two major tsunamis of societal change: the emergence of dramatically enhanced capabilities in high performance computation (HPC) and the impending shift of transportation technologies. They assert that the pre-nascent developments 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 needs, a compelling data visualization strategy to communicate experimental insights to a range of target audiences and inherent apologetics mechanism to respond to factions who seek individual 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 that will, nevertheless, have major impact on the industrial societies.

This community currently faces two major challenges in achieving the goals of developing a robust HPC experimental design that will both allow for the seamless incorporation of emerging technologies and techniques as well as to construct a virtually unassailable Verification, Validation and Test (VV&T) strategy that is compelling to both the professional science community and the lay community. The composition of the team was deemed as critical. 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. 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. 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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