

# Employing High Performance Computing to Realize a Cyber Quick-Reaction Training Environment

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## Abstract

While it is a supportable assertion that the conceptualization and realization of force modeling and simulation (FMS) strategies are well understood for kinetic warfare, the same assumption does not yet hold true for non-kinetic warfare, *e.g.* cyber warfare. The development of a strategy with respect FMS cyber warfare is still evolving. To date, successful annual cyber exercises, such as Cyber Flag and Cyber Guard, offer promising introductions into the development of FSM tactics and strategy. The fact remains that these large-scale exercises cost millions of dollars to implement and support. However, with the expansion of open source tools and the enhancement of hardware services, such as a High Performance Computing (HPC) configuration, a cost-effective and adaptive solution is not only desirable but also tenable. In response to this, we propose a Cyber Quick-Reaction Training Environment (CQRTE). The CQRTE concept is base on the philosophical tenets of McRaven's highly regarded *The Theory of Special Operations*, which was an examination of eight important treatises on small warfare operation and strategy.

This paper focuses on our research and development (R&D) efforts, which used HPC to stand up a low-cost fully operable cyberspace training and exercise environment. To the best of our knowledge, it is the first of its kind. The proposed project would demonstrate how CQRTE could effectively model warfare principles within the context of cyberspace operations and, when combined, these principles can achieve *relative superiority*. The success of the envisioned CQRTE can serve as a guiding beacon for those combatant organizations whose mission-set requires continuous training and modeling, as well as the development of tools and tactics in the cyberspace domain.

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