

## Effective Data Logging and Display of Small Unit Simulations

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### ABSTRACT

There has been an unmet need for a supportable simulation capability for small cyber warfare units. As this nation becomes even increasingly dependent on networked computer systems, cyber threats become ever more dangerous. This requires a trained and agile response capability. While large cyber simulations are extant, *e.g.* Cyber Guard and Cyber Flag, they are costly, schedule-constrained and not easily tailored to small unit training requirements. That led to the conception, design and implementation the Cyber Quick-Reaction Training Environment. The designers recognized the necessity of having effective methods of capturing, logging, archiving and displaying the resultant data. Based on previous accomplishments in data management for the USJFCOM large-scale simulations, the team developed an effective approach to produce a practical system. This paper will cover hardware requirements, bandwidth specifications, software choices and system design techniques. More importantly, how parameters for these issues were set and how they impacted the implementation will be covered. The authors lay out the criticality of a high level approach to understanding which elements of the data need attention, as well as how to structure and visualize the data to produce insights that will otherwise go unnoticed. This is both an explication of how this critical cyber threat is being met, but it is also a paradigm case for organizational analysis driving data management design. The process is described in a way to allow the reader to instantiate this approach in responding to their own communities' needs. The tactic of minimizing costs, facilitating access and improving training by using open source software is presented. The various parameters of the performance and the experience during the simulated cyber event will be offered and analyzed. The paper will close with an analysis of the utility of this approach, its extensibility into other areas, and future research requirements.

### ABOUT THE AUTHORS

**Ke-Thia Yao** is a research scientist in the Computational Systems and Technology Division of the University of Southern California (USC) Information Sciences Institute (ISI). His primary research interest is helping people understand large complex systems and data sets. He has conducted data management research on the JESPP project with the goal of supporting very large-scale distributed military simulation involving millions of entities. Within the JESPP project he developed a suite of monitoring/logging/analysis tools to help users better understand the computational and behavioral properties of large-scale simulations. He received his B.S. degree in EECS from UC Berkeley, and his M.S. and Ph.D. degrees in Computer Science from Rutgers University.

**John J. Tran** is a Major in the California Air National Guard., where he focused on Object-oriented software engineering, large-scale software system design and implementation, and high performance parallel and scientific computing. He has worked at ISI, USC, the Stanford Linear Accelerator Center, Safetopia, and Intel Corporation. His current research centers on Linux cluster engineering, effective control of parallel programs, and communications fabrics for large-scale computation. His tours of duty included the White House Communications Agency and Kirkuk Regional Air Base (Iraq), where he was the Communications Squadron Commander. John is a PhD candidate in Computer Science at USC and is a programmer at the Aerospace Corporation. He received both his BS and MS Degrees in Computer Science and Engineering from the University of Notre Dame

**Robert F. Lucas** is a Deputy Director of the Information Sciences Institute at the University of Southern California and leads the Computational Sciences Division. He is a Research Associate Professor in the USC Department of Computer Science. At ISI he manages research in computer architectures, VLSI, compilers, and other software tools. He was the principal investigator on the JESPP project from 2002 to 2011, which first implemented GPU

acceleration in high performance computing for battlefield simulations. Prior to joining ISI, he did tours as the Director of High Performance Computing Research for NERSC at LBNL, the Deputy Director of DARPA's ITO, and a researcher at the Institute for Defense Analyses, supporting the National Security Agency. Dr. Lucas earned BS, MS, and PhD degrees in Electrical Engineering from Stanford University.

**Dan M. Davis** was the JESPP project director at ISI, USC, where he now consults on distributed DoD simulations. Earlier, as Assistant Director of the Center for Advanced Computing Research at Caltech, he managed Synthetic Forces Express, bringing HPC to DoD battlefield simulations. Other positions include having been a Director at the Maui High Performance Computing Center and a Software Engineer at the Jet Propulsion Laboratory and Martin Marietta. He saw duty in Vietnam as a USMC Cryptologist and retired as a Commander, U.S.N.R. He holds B.A. and J.D. degrees from the University of Colorado.

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**Douglas W. Hire** the Commander of a Cyber Operations Squadron in the California Air National Guard. Lieutenant Colonel Hire has also served as a Combat Communications Squadron Commander deploying in this capacity to overseas locations. He received his MS in Telecommunications Management from National University and has completed strategic studies at Air War College, Maxwell AFB, as well as Joint Forces Staff College, Norfolk VA.