

CyberShARE Center of Excellence:

Sharing resources through Cyberinfrastructure to Advance Research and Education



PIs: Ann Gates¹, Aaron Velasco², Craig Tweedie³, Leticia Velasquez⁴,
Miguel Argaez⁴, Paulo Pinheiro da Silva¹, Vladik Kreinovich¹

The University of Texas at El Paso

1 – Computer Science Department, 2 – Geological Sciences Department, 3 – Environmental Sciences Department, 4 – Mathematical Sciences Department

The Cyber-ShARE Center is a research center, housed and supported at UTEP, consisting of computer resources and infrastructure, graduate and undergraduate students, interdisciplinary curriculum support, and a research atmosphere that fosters collaboration among earth, environmental, math, and computer scientists. The mission of the Cyber-ShARE Center is to advance and integrate education and research in uncertainty, trust, and optimization in support of cyberinfrastructures to (a) develop and promote scientist-centered software services, middleware, and tools that help scientists use technologies such as provenance management, ontologies, and workflows; and (b) promote collaborative and interdisciplinary research approaches to advance the state-of-the-art in earth and environmental sciences. The core values of the Cyber-ShARE Center are to champion diversity by actively recruiting and involving students, teachers, and faculty from underserved groups; excel in cyberinfrastructure research with integrity and accountability; promote cooperation among people from different backgrounds and disciplines; and serve as a catalyst of change. A description of the main three projects of Cyber-ShARE is described below.

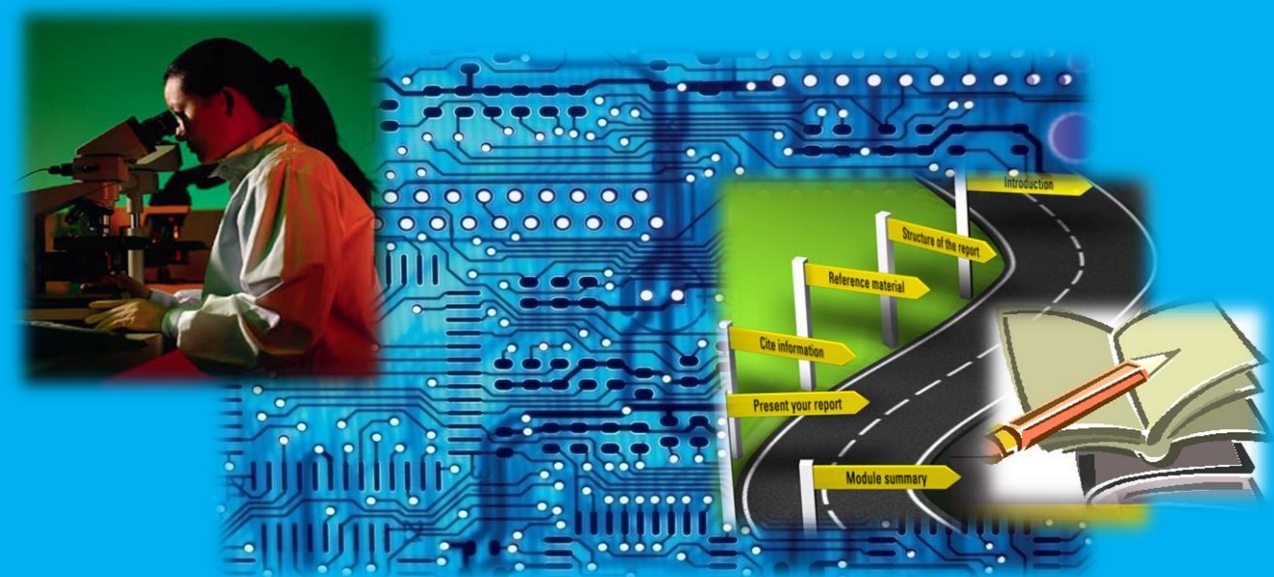
A Quest to Understand and Trust Scientific Results

Computer Science Project

Paulo Pinheiro da Silva, Vladik Kreinovich,
and Ann Gates

The goal of this project is to improve user confidence in scientific results obtained through cyberinfrastructure by enhancing the results with provenance information, trust recommendations, and levels of uncertainty.

This will address the complex problem of using provenance as the key enabler for integrating trust management and uncertainty management in distributed environments like the grid. The project will support research leading to a uniform way of representing uncertainty and trust. Uncertainty models embedded in provenance will be comprehensive enough to support the computation of several dimensions of uncertainty including error, accuracy, and reliability. Trust models embedded in provenance will be rich enough to support the computation of trust recommendations that can describe several aspects of trust including distrust, partial trust, ignorance, and inconsistencies.



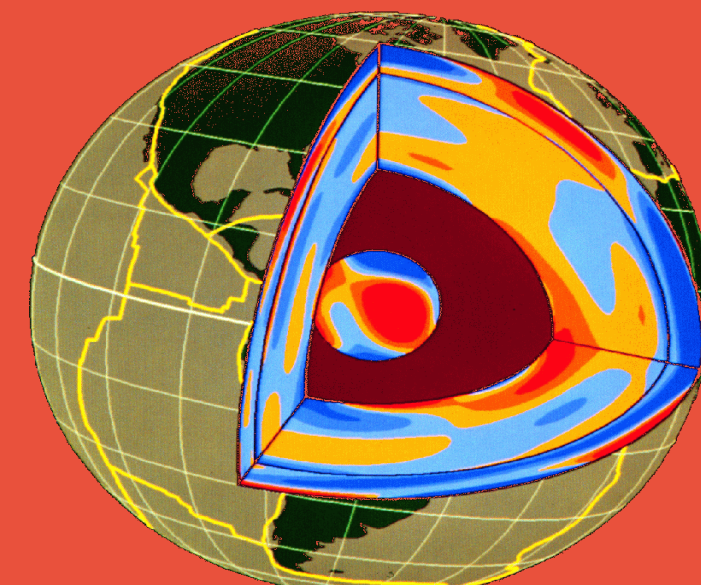
Geoscience-Integrated Analysis for Development of 3-D Models of Earth Structure

Earth Science Project

Aaron Velasco, Leticia Velazquez,
Miguel Argaez, and Vladik Kreinovich

The goal of this project is to determine physical properties of the Earth by advancing data fusion of distinct information sources by developing and applying techniques and approaches for integrating data with varying accuracy and sensitivity.

Analysis of individual geophysical and geological data sets may lead to inconsistent models, mostly due to mischaracterization of errors. The team will apply current and novel techniques from optimization and trust models research (e.g., data assimilation and inversion methods using sensor information) that will advance our understanding of fundamental Earth processes and have an impact on similar projects that collect or analyze large amounts of geophysical data, e.g., EarthScope and environmental sciences.



Advancing the Utility of Cyberinfrastructure in the Environmental Sciences

Environmental Science Project

Craig Tweedie and Vladik Kreinovich

The goal of this project is to address the challenge of optimizing data streams and sensor arrays in ecological and environmental networks through case studies targeting improved characterization of environmental phenomena and processes.

Increasingly, the environmental sciences are: (1) shifting towards more data-driven science, where researchers need to trust the integrity of data collected by other researchers and multidisciplinary scientific networks to answer 'BIG' picture questions; (2) increasing the utilization of advanced field-based instrument technologies; and subsequently, (3) increasing the need for optimizing data streams, instituting quality assurance procedures, and managing, archiving and integrating large volumes of multivariate data from field-based and other instrument platforms (e.g., satellite). This project will contribute techniques for gathering and analyzing data, methods for uncertainty modeling, and knowledge related to multi-parameter data querying, trust, and uncertainty.



Opportunities

The combination of cyberinfrastructure and human resources, i.e., scientists, educators, and students, underpins the collaborative and synergistically beneficial environment that has been established in Cyber-ShARE. Cyberinfrastructure and its mobilizing effect on sharing knowledge, methods, techniques, and approaches is central to Cyber-ShARE's mission of creating a cooperative environment for interdisciplinary research. A common thread through the projects is the use of provenance for encoding trust and uncertainty. The projects provide an environment for validating and verifying new tools and technologies that will ultimately be disseminated within and outside of UTEP through existing and new cyberinfrastructure.

Some key opportunities championed by Cyber-ShARE are:

- Share knowledge within and across domains
- Cross train and better prepare the next generation of scientists in Earth and Environmental Sciences
- Improve diversity in people, interests, problems and solutions
- Link other disciplines where cyberinfrastructure solutions have been developed for similar problems