

# CLOUD & AUTONOMIC COMPUTING CENTER

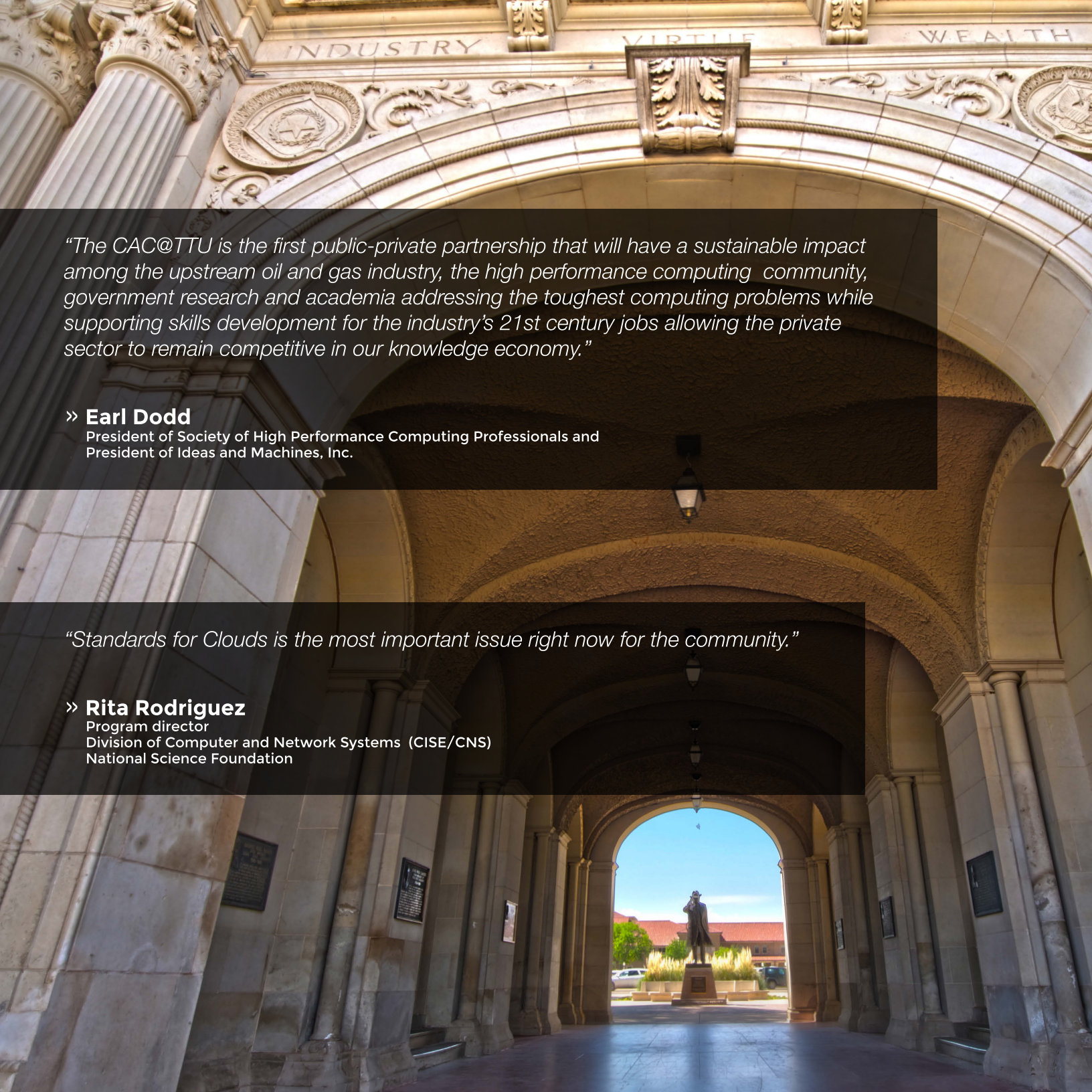


TEXAS TECH  
UNIVERSITY



Cloud and Autonomic Computing Center





*"The CAC@TTU is the first public-private partnership that will have a sustainable impact among the upstream oil and gas industry, the high performance computing community, government research and academia addressing the toughest computing problems while supporting skills development for the industry's 21st century jobs allowing the private sector to remain competitive in our knowledge economy."*

» **Earl Dodd**

President of Society of High Performance Computing Professionals and  
President of Ideas and Machines, Inc.

*"Standards for Clouds is the most important issue right now for the community."*

» **Rita Rodriguez**

Program director  
Division of Computer and Network Systems (CISE/CNS)  
National Science Foundation



# TEXAS TECH UNIVERSITY

**T**exas Tech is undergoing unprecedented growth as it positions itself to become the next Tier One university in Texas.

In 2012 the university was designated a National Research University by the state. With the designation and funds that come with it, Texas Tech is poised to become a true national research or AAU-like university.

With its School of Law and close proximity to sister institution, the Texas Tech University Health Sciences Center, Texas Tech creates unique interdisciplinary educational opportunities and a wealth of potential collaborative research possibilities. With a focus on transdisciplinary research, scholarship and creative activity, Texas Tech offers 150 undergraduate, 100 master's and more than 50 doctoral degree programs.

With more than 32,000 students, Texas Tech is a true state university, with more than 73% of our Texas students coming from more than 100 miles outside of Lubbock.

Texas Tech, located in Lubbock, on the Texas South Plains, admitted its first students in 1925. The university is the flagship institution of the Texas Tech University System. The Texas Tech University Health Sciences Center and Angelo State University in San Angelo are the other components of the system.

# CLOUD AND AUTONOMIC COMPUTING CENTER

The Cloud and Autonomic Computing Center (CAC) Industry/University Cooperative Research Center was established in January 2008 to focus on cloud computing systems and applications and the use of autonomic computing methods for the management of these and other IT systems.

The CAC is organized as part of the National Science Foundation Industry/University Cooperative Research Centers

Program. Other university members include: the University of Florida; the University of Arizona; Rutgers, the State University of New Jersey; and Mississippi State University.

The Center is governed through an Industry Advisory Board consisting of its industry members, which selects research topics and sets Center priorities.





The Cloud and Autonomic Computing Center at Texas Tech University (CAC@TTU) was established in 2012 after receiving a grant from the National Science Foundation Industry/University Cooperative Research Centers Program. Texas Tech joins the four existing universities in the Cloud and Autonomic Computing Center with a vision to add significant expertise in cloud standards and data-intensive scaled computing in various fields to the CAC program.

The mission of the CAC@TTU is to provide a practical and collaborative work arena for development and coordination of standards and techniques that are specifically applicable to cloud and other forms of advanced distributed computing.

Our institutional goals are to identify and foster industry-academia-government partnerships on topics directly related to emerging cloud standards, to identify and develop coordinated efforts on reference implementations and to create a trained workforce capable of sustaining the activities and opportunities created through this joint effort.

The CAC@TTU is focused on helping its industry members accelerate adoption of cloud methods, standards and services by finding ways to utilize new technology while managing risk factors such as information security, privacy, compliance and regulation.

The CAC@TTU, with support from the university's High Performance Computing Center, provides expertise in cloud security and standards, machine learning, data mining, parallel and distributed computing, business intelligence, Big Data, and general cloud application development.

In keeping with the university's emphasis on transformative transdisciplinary research, CAC@TTU brings together experts from multiple fields, including basic sciences, engineering, business, health sciences, informatics and law, to support industry/university research partnerships that strengthen the CAC Center's goals in a wide variety of advanced distributed computing topics.

# HIGH PERFORMANCE COMPUTING CENTER

**T**he Texas Tech Information Technology Division's High Performance Computing Center (HPCC) provides computational and research resources for the university, including several high performance computing clusters and a grid computing environment. HPCC clusters have been ranked among the TOP500.org worldwide most powerful supercomputers since 2009. The most recent cluster Hrothgar, consisting of 7680 cores, was deployed in 2010 and runs at full capacity daily in support of Texas Tech researchers in areas such as quantum chemistry, molecular dynamics, weather forecasting, bioinformatics, fluid flow, electrical pulse power, petroleum reservoir modeling, and climate change.

HPCC's sophisticated clusters and grids are supported by a highly skilled staff of research associates and programmers who design and operate them at maximum efficiency. HPCC staff also provide an assortment of high performance software and tools, assist Texas Tech researchers in integrating and optimizing custom codes, and work with researchers to develop and prepare new grant opportunities involving computationally-based research.

Texas Tech also partners with other state and national high-performance computing centers and initiatives, such as the University of Texas TACC (Lonestar 4) and the Extreme Science and Engineering Discovery Environment, providing researchers access to some of the world's most advanced computing resources. These additional resources are required to meet the increasingly diverse computational needs of researchers at Texas Tech.



# FACULTY MEMBERS

## COMPUTER SCIENCE



**Rattikorn Hewett, Ph.D.**

Chairperson in the Department  
of Computer Science

- Areas of expertise*
- » Security and privacy in cloud environments
  - » Intelligent data management & understanding
  - » Automated web service composition



**Mohan Sridharan, Ph.D.**

Assistant professor in the  
Department of Computer Science

- Areas of expertise*
- » Learning and estimation in big data domains
  - » Stochastic machine learning
  - » Robotics and AI



**Noe Lopez-Benitez, Ph.D.**

Associate professor in the  
Department of Computer Science

- Areas of expertise*
- » Cloud computing
  - » Parallel and distributed computing
  - » High-performance computing



**Eunseog Youn, Ph.D.**

Assistant professor in the  
Department of Computer Science

- Areas of expertise*
- » Large-scale machine learning
  - » Feature selection
  - » Text mining
  - » Bioinformatics



**Yong Chen, Ph.D.**

Assistant professor in the  
Department of Computer Science

- Areas of expertise*
- » Cloud computing storage systems
  - » Data management and data centers
  - » Cloud programming and software environments
  - » Cloud platform architecture and virtualization

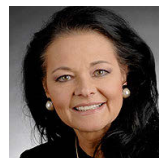


**Sunho Lim, Ph.D.**

Assistant professor in the  
Department of Computer Science

- Areas of expertise*
- » Wireless networks and mobile computing
  - » Mobile data management
  - » Mobile software
  - » Network security

## SCHOOL OF LAW



**Victoria Sutton, Ph.D.**

Paul Whitfield Horn professor  
in the School of Law

- Areas of expertise*
- » Biosecurity
  - » Emerging technologies
  - » Energy
  - » Constitutional law

## INDUSTRIAL ENGINEERING



**Timothy Matis, Ph.D.**

Associate professor in the  
Department of Industrial  
Engineering

*Areas of expertise*

- » Operations research
- » Stochastic processes
- » Queueing theory
- » Ad-hoc communication networks
- » Conceptual learning theories and virtual learning environments



**Ismael Regis de Farias Jr., Ph.D.**

Associate professor in the  
Department of Industrial Engineering

*Areas of expertise*

- » Mixed-integer programming, theory and computation
- » Nonlinear programming, theory and computation
- » Operations research probabilistic methods
- » Applied management science

## MATHEMATICS & STATISTICS



**Philip W. Smith, Ph.D.**

Senior director, High Performance  
Computing Center

*Areas of expertise*

- » Optimization
- » Design and implementation of parallel and serial codes
- » Code optimization
- » Numerical analysis and linear algebra

## MECHANICAL ENGINEERING



**Fazle Hussain, Ph.D.**

Professor in the Department of  
Mechanical Engineering

*Areas of expertise*

- » Fluid Flow, turbulence, & transport phenomena
- » Microseismology and inverse scattering
- » Modeling cancer tissue growth and targeted drug delivery
- » Atmospheric boundary layers and wind turbine aerodynamics



**Siva Parameswarn, Ph.D.**

Professor in the Department of  
Mechanical Engineering

*Areas of expertise*

- » Modeling HF oscillatory ventilators
- » Aerodynamics of ground vehicles
- » Wake development behind wind turbines
- » Designing efficient rooftop wind turbines

## PHYSICS



**Alan Sill, Ph.D.**

Adjunct Professor in the  
Department of Physics

*Areas of expertise*

- » High performance computing
- » Data-intensive scaled resource management
- » Large-scale distributed computing
- » Standards development

# FACULTY MEMBERS

## PETROLEUM ENGINEERING



### Marshall Watson, Ph.D., P.E.

Roy Butler Chair and chairman of the Bob L. Herd Department of Petroleum Engineering

- Areas of expertise*
- » Reserves definitions and application
  - » Production optimization
  - » Coal bed methane
  - » Unconventional reservoir analysis



### Mohamed Soliman, Ph.D., P.E.

George P. Livermore Chair and Professor in the Bob L. Herd Dept. of Petroleum Engineering

- Areas of expertise*
- » Fracturing
  - » Reservoir engineering
  - » Well test analysis
  - » Conformance



### M. Rafiqul Awal, Ph.D.

Assistant professor in the Bob L. Herd Department of Petroleum Engineering

- Areas of expertise*
- » Micro-borehole drilling
  - » CO<sub>2</sub>-EOR and chemical flooding
  - » Reservoir simulation
  - » Advanced well completion



### Ravi Vadapalli, Ph.D.

Adjunct Professor in the Department of Petroleum Engineering

- Areas of expertise*
- » High performance computing
  - » Reservoir modeling
  - » Cancer radiotherapy informatics
  - » Cloud and autonomic computing

## RAWLS COLLEGE OF BUSINESS



### Peter H. Westfall, Ph.D.

Paul Whitfield Horn Professor of Statistics in the Rawls College of Business Administration

- Areas of expertise*
- » Advanced analytics
  - » Business intelligence
  - » Statistics
  - » Biostatistics
  - » Bioinformatics



### Zhangxi Lin, Ph.D.

Associate professor in the Department of ISQS

- Areas of expertise*
- » Big data analytics
  - » Business intelligence
  - » Information systems
  - » Electronic commerce



### Mayukh Dass, Ph.D.

Assistant Professor of Marketing in the Rawls College of Business

- Areas of expertise*
- » Brand analytics
  - » Business strategy analysis
  - » Dynamic environment modeling
  - » Network analysis

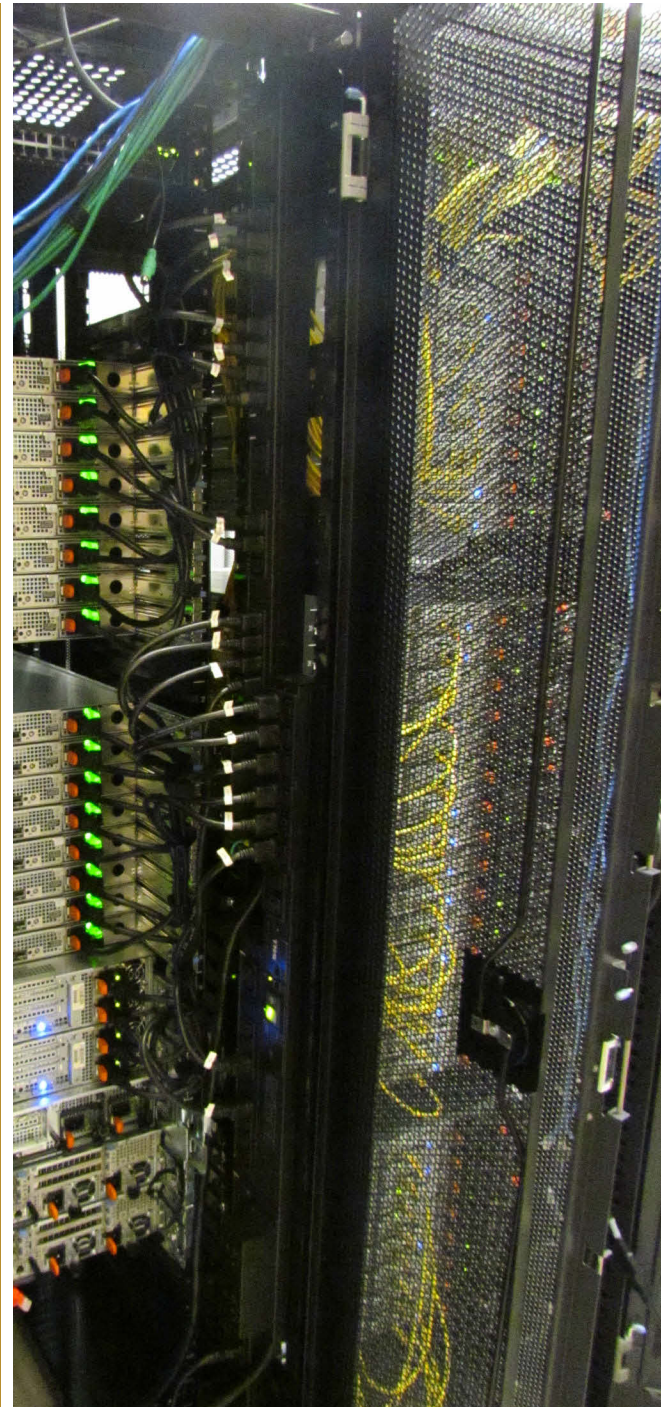
# STANDARDS ORGANIZATIONS AND PARTNERSHIPS

The CAC@TTU research program is designed to take advantage of the strong track record already established by its associated researchers in multiple areas in partnership with industry-based standards development processes and organizations in order to maximize the practical applicability of work developed through this program.

Researchers in the CAC@TTU program are already active participants in multiple standards organizations and efforts, either directly as members or through formal liaison relationships, including the Open Grid Forum (OGF), Distributed Management Task Force (DMTF), Storage Networking Industry Association (SNIA), Cloud Security Alliance (CSA), Telecommunications Management Forum (TM Forum), International Standards Organization (ISO), and the International Telecommunications Union Telecommunications Standards branch (ITU-T). The site director for the CAC@TTU program also serves as vice president of standards for OGF.

CAC@TTU researchers have also participated actively in a number of international cloud and distributed computing standards roadmap efforts, including the cloud computing and Big Data working groups, workshops and forum activities of the U.S. National Institute of Standards and Technology (NIST), the European Union “Standards and Interoperability for eInfrastructure Implementation Initiative” (SIENA), and are among the principal organizers of the multi-organization Cloud Plugfest developer-oriented cloud software testing series.

The High Performance Computing Center also supports efforts that have led to the creation of the Open Science Grid (OSG) in the US and its global Worldwide Large Hadron Collider (WLCG), and OGF and other standards efforts that have recently become the basis for the largest and most powerful supercomputing network in the country, the Extreme Science and Engineering Discovery Environment (XSEDE).



# CAC @ TTU LEADERSHIP TEAM



**Alan Sill** //

Site director and principal investigator for the CAC@TTU. Sill is a senior scientist at the High Performance Computing Center and adjunct professor of physics. He currently serves as vice president (standards) for Open Grid Forum, an open standards community committed to improved adoption of advanced distributed computing. He is a current and past contributor to the creation of several large-scale international, national and regional cloud and grid research projects, including the Open Science Grid and Worldwide Large Hadron Collider Grid. He leads the Cloud Interoperability Testbed Project for FutureGrid, and is one of the principal planners for the ongoing Cloud Plugfest series of hands-on developer-oriented cloud testing conferences.



**Ravi Vadapalli** //

Co-principal investigator for the CAC@TTU. Vadapalli is a research scientist at the High Performance Computing Center and adjunct professor of petroleum engineering. He has extensive experience in advanced distributed computing, research development in both disciplinary and interdisciplinary areas through data-intensive computing. Vadapalli was one of the principal members of the developer team for the Texas Internet Grid for Research and Education, and led the demonstration of grid and cloud computing methods for the Petroleum Engineering Grid. He has also been deeply involved in development of methods for use of advanced high-performance computing for simulation and modeling in cancer radiotherapy and other related applications.



**Yong Chen** //

Co-principal investigator for the CAC@TTU. Chen is an assistant professor of computer science. He leads the Data-Intensive Scalable Computing Laboratory at Texas Tech and has broad research interests in parallel and distributed computing, high-performance computing, cloud computing, computer architectures and systems software. The focus of his recent work has been on building scalable computing systems for data-intensive applications in high-performance scientific computing and high-end enterprise computing. His group also has extensive expertise in hardware and software methods for data-intensive computing, and has made advances in hardware technologies for improving scalability and efficiency of scientific computing capabilities and Big Data applications, including dynamic active methods for high performance I/O in storage systems.



For more information visit  
[cac.hpcc.ttu.edu](http://cac.hpcc.ttu.edu)