

# The Ken Kennedy Institute for Information Technology

## *Fiscal Year 2014 Annual Report*

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# **Ken Kennedy Institute for Information Technology Fiscal Year 14 Annual Report**

## **Executive Summary**

Fiscal Year 14 represented another high point for the Ken Kennedy Institute for Information Technology (Ken Kennedy Institute or K2I) at Rice University. In addition to significant growth in our successful graduate fellowship program and the annual Rice Oil & Gas High Performance Computing Workshop (OG-HPC Workshop), we were also notified of an award from the National Science Foundation's (NSF) Major Research Instrumentation (MRI) program for the acquisition of Big-Data Private-Cloud Research Cyberinfrastructure (BDPC). We also made new awards in the Enriching Rice through Information Technology (ERIT) seed funding program, and we are continuing to work with the University to develop Rice's research cyberinfrastructure, a critical effort that will help sustain our infrastructure endeavor and support continued success for our researchers for years to come.

The Ken Kennedy Institute has successfully worked with faculty since 2002 to build Rice's shared computational infrastructure. Today K2I, in partnership with Rice's Information Technology division, supports the computational research needs of 150 faculty members and over 500 users. Since K2I started Rice on the path of shared computing in 2002 we have helped bring over \$20M in infrastructure funding to Rice through a number of successful grant proposals and industry partnerships. While there is no exact way to quantify the secondary impact of this success, we estimate that over 50% of Rice's annual research expenditures significantly benefit from these awards and that the infrastructure has been critical to Rice's research growth. We are happy to report that we were able to extend this track record in FY14 when we received notice of the Big-Data Private-Cloud Research Cyberinfrastructure award in the amount of \$400,000 from the NSF MRI program.

Because of the importance of infrastructure K2I, in partnership with IT, is leading an effort to engage with consultants from International Data Corporation (IDC) to help develop a long-term sustainable business and operational model for Rice's shared research computing infrastructure. This engagement is being undertaken in response to the IT Task Force findings on research computing that specifically requested that we: (1) develop a five-year strategy and funding plan, (2) initiate a total-cost-of-ownership study, and (3) develop a business model and support for utilizing cloud-based infrastructure. The outcome of the IDC engagement will be a set of recommendations related to sustainability, support and operation of shared research cyberinfrastructure.

The 2014 OG-HPC Workshop, our flagship industry engagement effort, was the most successful to date, with 500 attendees - up from 330 in 2013, and over 30 sponsor

companies - up from 23 in 2013. As a result of the successful partnership established between the energy industry and the IT industry, we netted \$120,000 from this one event alone. On top of that, several of our energy industry partners also provided \$80,000 in fellowship support. This money will be used to fund enhancement graduate fellowships for students already in our program as well as provide “booster fellowships” to help Rice attract the best talent into our computational science and engineering degree programs. In addition to \$200,000 in fellowship support, the OG-HPC Workshop continues to build and solidify Rice’s relationships and reputation as a leader with the energy industry as well as with the IT industry. The Ken Kennedy Institute and Rice are viewed as a convener and enabler of a critical community that drives return on investment in both energy and IT.

Through the Enriching Rice through Information Technology (ERIT) seed funding program we awarded faculty over \$172,000. The ERIT program aims to incubate and support innovative projects that promote the use of **computing, visualization, and information technology** to accelerate innovations in research, scholarships and education.

Finally, K2I continues to engage with and support the local community at Rice and in Houston with a variety of lectures and monthly networking opportunities. We see our power in building and maintaining strong relationships across the community at Rice, the Texas Medical Center, and Houston as a critical part of our mission. For the Ken Kennedy Institute to continue to deliver value to Rice’s research mission it is not sufficient to be working successfully inside Rice, but we must also be recognized and be an asset for external partners.

## External Collaboration

### **2014 Rice Oil & Gas HPC Workshop (\$120,000 Raised)**

The [7<sup>th</sup> annual Rice Oil & Gas HPC Workshop](#) held on March 6, 2014 proved to be a huge success with 500 attendees (up from 330 in 2013). The day afforded many networking opportunities and has helped to open the door for collaboration between Rice and industry. As one of very few conferences focused on the engagement with the HPC industry and the oil & gas industry, the Workshop has become the premier meeting place for networking and discussion focused on computing and information technology challenges and needs in the oil and gas industry. As the result of our having a record breaking 31 sponsors (up from 23 in 2013), K2I will be able to award a record number of supplemental graduate fellowships next academic year.

### **MEST Conference**

Medicine, Energy, Space and Technology (MEST) is an innovation conference that incorporates major advancements in the fields of medicine, energy, space, and technology with a particular emphasis on applications, technology development, and entrepreneurship in medicine. MEST provides a platform for information exchange and learning that can clear the pathway to collaboration and new discoveries and ventures.

The day-long event, jointly sponsored by [Platform Houston](#) and several science and engineering research institutes at [Rice](#), brought together many of the best minds from the diverse array of disciplines to foster connections, and explore how to break down barriers and accelerate research, discovery and entrepreneurship. The conference was the brainchild of Simrit Parmar, founder of Platform Houston and an assistant professor at [The University of Texas MD Anderson Cancer Center](#) and Jan Odegard, Executive Director of Rice's [Ken Kennedy Institute for Information Technology](#) (K2I). More than 200 attendees spanned the targeted verticals, including members of Houston's burgeoning start-up community.

### **electronic Health Research Institute (eHRI)**

The electronic Health Research Institute (eHRI) is a collaborative research initiative under development by the University of Texas MD Anderson Cancer Center, the Ken Kennedy Institute for Information Technology at Rice University, and the Center for Space Medicine at Baylor College of Medicine. The primary focus of **eHRI** is to serve as a catalyst for the advancement, integration, and translation of technology research to enable distance delivery of healthcare.

## Student support

### **Graduate Fellowships (\$120,000 Awarded)**

We awarded fifteen supplemental [graduate fellowships](#) during FY14 to students across Computer Science (CS), Computational & Applied Mathematics (CAAM), Earth

Science (ESCI), Electrical & Computer Engineering (ECE) and Mechanical Engineering & Material Science.

These fellowships are made possible by the sponsorship from the energy industry (BP, Chevron, ExxonMobil, Shell, and Schlumberger) as well as from income from the Rice Oil & Gas HPC Workshop, the Numerical Algorithm Group (NAG), the Ken Kennedy-Cray fellowship endowment and the Andrew Ladd Memorial Excellence Fund.

### **Booster Fellowships (up to 10) \$7,500 Fellowships**

New this year we offered up to ten (10) \$7,500 two-year “booster fellowships” to CS, CAAM, ECE, and ESCI, as a pilot to assist in recruiting very well qualified graduate student applicants. Of these ten offers a total of six students accepted admission and will be graduate students at Rice this fall. This money was added on top of the regular departmental stipend as a recruiting incentive. These fellowships were made possible by the Rice OG-HPC Workshop and based on the success we had this program will be continued moving forward. We will be working with departments to ensure that this is being leveraged to also promote our programs.

### **Seed funding Innovation Awards**

#### **Enriching Rice through Information Technology (\$172,981 Awarded)**

In 2013/14 KZI awarded over \$172,000 in seed funding in the [Enriching Rice through Information Technology \(ERIT\)](#) program. We made a total of 6 awards in 2013/14. The ERIT program aims to incubate and support innovative projects that promote the use of **computing**, **visualization**, and **information technology** to accelerate innovations in research, scholarships and education. Funding for this program is provided by the Sheafor/Lindsay Innovation Fund. Additional funding for the ERIT program in 2013/14 was provided by AMD.

The 2013/14 recipients were:

1. Marcia O'Malley, Lydia Kavraki, Mark Moll, “Baxter: a humanoid robot for enhancing robotics research and education at Rice,” \$27,600
2. Fares El Dahdah, “Imagine Rio: Mapping Social, Urban, and Topographic Change in 2D and 3D,” \$49,140.00
3. Jacob T. Robinson, Caleb Kemere and Ashok Veeraraghavan, “Rice Shared Neural Data Initiative,” \$41,241
4. Alan Cox, Chris Jermaine and Eugene Ng, “NetML: A Distributed, APU-Optimized Platform for Machine Learning Over Big Data,” \$25,000 [funded by AMD]
5. John Mellor-Crummey, “Designing a Standard API for Performance Analysis on Heterogenous System Architectures,” \$25,000 [funded by AMD]
6. Jeffrey Fleisher, “Virtual Reconstruction of Ancient Cities: A Proposal for Collaborative Teaching,” \$5,000

## **Collaborative Advances in Biomedical Computing (CABC)**

We are currently preparing the next call for proposals for the Collaborative Advances in Biomedical Computing (CABC) program. Managed by the Ken Kennedy Institute for Information Technology at Rice, Collaborative Advances in Biomedical Computing (CABC) is a seed-funding program aimed at supporting members of the Rice research community looking to form new collaborations and partnerships with researchers in the Texas Medical Center (TMC). The CABC program seeks to be a catalyst for research collaboration focusing on computing and computational science and engineering as a key enabler for biomedical research. The goal is to encourage and support new projects that bridge information technology/high performance computing research at Rice and biomedical and health - care related research in the TMC. Projects with applications to cancer research are strongly encouraged.

## **Research Cyberinfrastructure**

### **Big-Data Private-Cloud Research Infrastructure**

The Ken Kennedy Institute for Information Technology, in collaboration with the Office of the Vice Provost for Information Technology (VPIT) at Rice University, is working with faculty to expand Rice's shared research cyberinfrastructure. The current project, "Big-Data Private-Cloud (BDPC) Research Cyberinfrastructure," is made possible by funding in the amount of \$400,000 from the Major Research Instrumentation program from the National Science Foundation and by funding from Rice University.

Our goal is to deploy and operate a production-local-cloud infrastructure built to support a large and growing volume of throughput and big-data computing workflows. BDPC will serve as the Rice "on-ramp" to external cloud infrastructures thus enabling cloud bursting. Specifically, BDPC will be a local infrastructure that will support experiments. BDPC will also enable the development of expertise in operating and utilizing cloud bursting in support of research computing. While our users have wide-ranging computational needs, the local BDPC software and hardware infrastructure will be designed to support big-data throughput computational needs that can address a growing demand for data-centric computing for Rice and our collaborative partners.

### **Chevron Visualization Lab**

The NSF-funded DAVinCI visualization wall at Rice's Chevron Visualization Laboratory (the "Viz Lab") enables scientists to interact with data in three dimensions to probe details in ways that were not possible until now. The 200-inch wall (measured diagonally) lets users display and analyze images of all types, from atoms to galaxies, to archeological structures and sites. This "studio" is expected to help researchers in Earth science, biomedicine, engineering, art, architecture, anthropology, sociology and other fields gain extraordinarily clear pictures of their data sets, be they bacteria, bridges, or populations.

The visualization lab is open and staffed for walk in support, questions, as well as tours for anyone on campus interested in visualization. In addition to regular office hours Erik Engquist, the Viz Lab manager, hosts monthly tutorials for students, researchers and faculty. Visitors, including prospective graduate students and prospective faculty members, are regularly given tours and demonstrations.

Several classes on campus utilize the Viz Lab capabilities such as; Freshman Seminar in Local Biology, Seismic Reflection Data Interpretation, Seismology, Intro to Digital Humanities, and Virtual Reconstruction of Historical Cities. The visualization wall also supported several student projects including the Imperial Barrel Award Competition in Earth Science, the Interactive Poster Session and Earth Science thesis proposal defenses. In addition to classroom and student support, the Viz Lab also supports many faculty led research groups such as Dr. Shahsavari in Civil and Environmental Engineering, Dr. Mellor-Crummey in Computer Science and Drs. Levander, Droxler & Sawyer in Earth Science.

The Viz Lab also hosted several outreach events throughout the year, such as the Qutub Art Reception, Houston Health Museum Summer program tours, Rice Empower tours and video/visualizations for edX . The following groups at Rice also brought visitors to the lab; Ken Kennedy Institute, Energy Environment Initiative, Office of Development, Rice Space Institute, Earth Sciences and Civil Environmental Engineering.

#### **International Data Corporation Consultants**

Rice University seeks a firm that can help perform analysis and benchmarking against comparable institutions and market trends with the objective of providing recommendations related to sustainability of shared research cyberinfrastructure.

With this engagement, Rice specifically seeks to develop a better understanding of how to build a robust and sustainable shared research cyberinfrastructure. Specifically, the statement of work will focus on:

1. Helping Rice understand how comparable academic institutions invest in and manage shared research cyberinfrastructure, specifically in the area of high-performance computing
2. Determining what and how much Rice needs to invest in its shared research cyberinfrastructure enterprise annually in order to build or maintain its competitive advantage
3. Understanding the potential roles of (private/commercial/federal/regional) cloud infrastructure in supporting Rice's research mission
4. Developing a strategy for how to understand and manage total cost of ownership while maximizing benefits to the user community for shared research cyberinfrastructure
5. The role of user fees in the financial model and management of shared research cyberinfrastructure

## Research Computing Service Center Operation

K2I has assumed the responsibility of administering, managing and charging for access to shared computing infrastructure ((1) Shared Computing Service Center and (2) BlueGene/P Service Center). To support this we have hired a part time staff member. Additionally, we entered into a contract to develop software that will help automate portions of the billing process and including departmental fund reallocation.

The Billing Application Service Center Software (BASCS) Project is being developed to provide detailed billing functionality and to support university-wide service center(s) that are operating shared research infrastructure. There are multiple service centers at Rice today, but there are three specific centers that are being used to conceptualize the BASCS specifications: (1) the Shared Computing Service Center, (2) the BlueGene/P Service Center, and (3) the Shared Equipment Authority (SEA) Service Center. While SEA was included in the conceptualization the first BASCS release will not be ready to support it since key components outside the scope of billing will first need to be addressed. The BASCS software is projected to be operational by mid summer.

## K2I Sponsored and Co-Sponsored Public Lectures

### K2I Distinguished Lectures

- **Krishna Palem**, Kenneth and Audrey Kennedy Professor of Computing, the Department of Computer Science, George Brown School of Engineering, Rice University, “A Decade of Building Broken Chips”
- **Larry Smarr**, Director, Calit2, Harry E. Gruber Professor, Department of Computer Science and Engineering, Jacobs School of Engineering, University of California at San Diego, “Quantifying Your Superorganism Body Using Big Data Supercomputing”
- **Jeroen Tromp**, Professor of Geosciences and Applied and Computational Mathematics. Blair Professor of Geology, “Toward Exascale Seismic Imaging”

### Ken Kennedy Award Lecture

- **Mary Lou Soffa**, Vice President, Technology and Manufacturing Group, Director, Components Research, Intel, “Warehouse Scale Computers: Opportunities and Challenges”
- **Jack Dongarra**, American University Distinguished Professor of Computer Science in the Electrical Engineering and Computer Science Department at the University of Tennessee, “Algorithmics and Software Challenges at Extreme Scales”

### TSPP Lecture – Spring 2014

- **John Villasenor**, Nonresident senior fellow in Governance Studies and the Center for Technology Innovation at Brookings. Professor of Electrical Engineering and Public Policy at UCLA, “Drones in the United States”



### TCC Lecture

- **Dan Cohen**, Professor at the University of Wisconsin-Madison  
“Engineering the Future of Education,” Cancelled due to illness. Will be rescheduled Fall 2014

### Additional Lectures

- **Kevin Guthrie**, Founding President of JSTOR (1995) and Ithaka (2004), “The Rules of the Game: Reflections on the Impact of Digital Networks on Teaching and Learning”
- **Joseph Teran**, Associate Professor, Mathematics Department, UCLA, “Scientific Computing for Movie Effects and Virtual Surgery”
- **Yann Lecun**, Director of AI Research, Facebook, This lecture will be rescheduled for Fall 14

### K2I Member Luncheons

#### *Fall 2013 (average attendance: 50)*

- **Caleb Kamere**, Assistant Professor, Electrical & Computer Engineering, Rice University, “Towards Real-Time Manipulation of Learning and Memory”
- **Peter Wolynes**, D.R. Bullard-Welch Foundation Professor of Chemistry, Professor, Physics & Astronomy, Chemistry, Rice University, “Recent Successes of the Energy Landscape Theory of Protein Folding”
- **Moshe Vardi**, Karen Ostrum George Distinguished Service Professor, Computer Science Director, Ken Kennedy Institute for Information Technology, Rice University, “If machines are capable of doing almost any work humans can do, what will humans do?”
- **B.J. Almond**, Senior Director of News and Media Relations, Rice University  
“Deadlines and Headlines”

#### *Spring 2014 (Average Attendance: 50)*

- **Jacob T. Robinson**, Assistant Professor, Departments of ECE and BioE, Rice University, “ Nanotechnology for Interrogating Neurons and Neural Circuits”
- **Elmer V. Bernstam**, Professor--School of Biomedical Informatics, University of Texas-Health Science Center at Houston
- **Cindy Farach-Carson**, Professor, Biochemistry & Cell Biology and Bioengineering, Vice Provost for Translational Bioscience, Biochemistry and Cell Biology, Rice University, “Passport to the TMC and BRC Updates”
- **Erik Engquist**, Manager, Chevron Visualization Laboratory, Rice University, “Data Analysis and Visualization”

## Miscellaneous

### **Master of Computational Science and Engineering Degree Program**

K2I coordinated the application review and Rice offered admission to three students to the Master of Science in Computational Engineering (MCSE) Professional Masters Program, a joint program between Computer Science, Computational and Applied Mathematics and Statistics.

### **Sponsorships**

- Provided \$1,000 in prize money for the 2014 Rice Undergraduate Research Symposium (RURS) and recruited a panel of six industry judges to evaluate and determine the K2I winners.
- Supported the 2014 Robotics: Science & Systems Conference with a \$750 lunch sponsorship.
- Supported the 2014 Personal Learning Conference with \$2,500.
- Intel Training – K2I sponsored the room at the BioScience Research Collaborative (BRC) for this free open-to-the-public training about Intel's latest software developments. We had over 40 attendees from Rice and local industry. Instructors and refreshments were provided by Intel. In return of K2I's sponsorship we were granted a free license extension for the Intel software suite that we are paying for annually for our shared computing infrastructure.