

The Ken Kennedy Institute for Information Technology

Fiscal Year 2016 Annual Report

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KENNEDY
INSTITUTE FOR INFORMATION TECHNOLOGY

Executive Summary

During Fiscal Year 2016, the Ken Kennedy Institute sustained its momentum in terms of developing new collaborative efforts and achieving scalable returns on investment. As a “service institute,” we have been recognized for our efforts to build and support a sustainable and robust shared computing research infrastructure for Rice’s research community. We also continued to provide multiple platforms for intellectual engagement amongst faculty, other universities, students and industry. In FY16, we embarked on many endeavors to strengthen our organization that included:

- Continuing our graduate fellowship program:
 - Computational Science & Engineering Supplemental fellowships to help recruit high achieving students in the application pool (funded by HPC Conference revenues).
 - Continue running our well-established and highly successful industry funded Graduate (enhancement) Fellowship program for students already at Rice (named fellowships funded by industry).
- Strengthened our industry engagement with another record year for the annual Rice Oil & Gas High Performance Computing Conference (previously the OG-HPC Workshop).
- Hosted two Faculty Data Science Meetups. These events are networking opportunities designed to help faculty discover and explore data “science” research challenges, opportunities, tools, and infrastructure at Rice University.
- Managed the Billing Application Service Center Software (BASCS) web application. This software application reduces the manpower required to manage billing for shared computing services.
- Delivered two-week long training classes (previously called summer institutes, now renamed to Boot Camps) open to external and internal participants:
 - HPC Boot Camp (the 7th in the series)
 - Data Science Boot Camp (the 3rd in the series)
- Hosted 4 Distinguished Lecture and 8 monthly member luncheons in support of community development.
- Hosted a Amazon “AWS Hackathon”
- Hosted the NorTex Data Science Summit
- Increased visibility of Institute faculty member led research by featuring more than 30 news stories on our webpages and email distribution lists.

Institute Space and Leadership

The Ken Kennedy Institute is located in Duncan Hall where we occupy three offices (rooms 1084, 1085 and 1088). No other space is currently dedicated to the Institute. The Director (since 2001) of the institute is Moshe Y. Vardi, Karen Ostrum George Distinguished Service Professor in Computational Engineering. Keith Cooper L. John & Ann H. Doerr Chair, Computational Engineering, Professor, Computer Science joined the leadership team on July 1, 2016 as Co-Director. The Executive Director, Jan E. Odegard joined the institute in 2002. The institute has two staff members supporting the operation of the Institute, Victoria Langlais, Institute Administrator and Deborah Heath, Administrative Assistant.

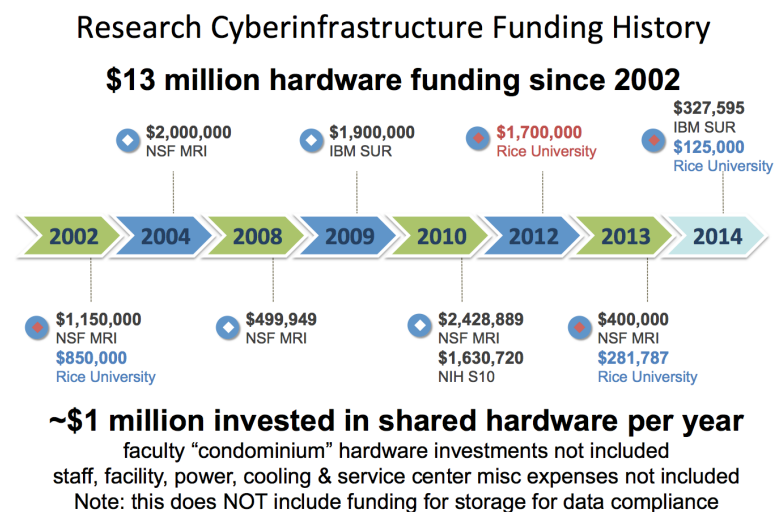
Institute Membership

The Ken Kennedy Institute's Membership is comprised of 160 Rice faculty members, 70 associate members who are part of the greater campus population, and 20 non-Rice members who are affiliated with industry, the Texas Medical Center, or other organizations outside of Rice University.

Internal Collaboration

Shared Computing Infrastructure

Since 2002, the Ken Kennedy Institute has successfully worked with faculty to build Rice's shared computational infrastructure. Today, the Institute, in partnership with Rice's Office of Information Technology, supports the computational research needs of more than 170 faculty members and over 600 shared-computing users. In any given month about 250 users working with 70 PIs use the systems to support their research. While the Institute is



not a research institute that actually engages in doing research, the Ken Kennedy Institute has benefited Rice as a leading service organization that has helped raise over \$13 million since 2002 in research computing infrastructure funding through a number of successful grant proposals and industry partnerships.

We could not operate and continue to build upon our shared computing infrastructure without the technical support of Rice's Office of Information

Technology, the financial support of Rice University, industry sponsors such as IBM, and that of external organizations, such as the National Science Foundation (NSF). On average, the Institute has invested approximately \$1 million per year in average in Rice's research Cyberinfrastructure.

Building on the success and the new partnership between Ken Kennedy Institute and the Office of Information Technology, we just made a significant step towards longer term infrastructure sustainability with the approval of \$1.6 million over the next 4 years (starting in FY17). This funding will support building scalable research data storage infrastructure, scalable research computing (HPC and VM) infrastructure, and support for associated annual growth of the core enabling scale-out storage and compute growth. This funding complements annual service center funding as well as any grant and condominium funding obtained by faculty. The emphasis is on designing scalable infrastructure, enabling Rice to be even more competitive for grant funding.

Data Science Faculty Meetup

September 24, 2015

Approximately 160 people attended the first Data Science MeetUp on September 24th, 2015. There were over 50 posters on display representing research from the School of Engineering, Jones Business School, Natural Sciences, Social Sciences, Humanities, the Kinder Institute, and Fondren Library. The main focus of the meetup was on researchers sharing their research ideas and challenges with colleagues with the idea of finding potential areas of collaboration.

April 13, 2016

Approximately 80 people attended the second Data Science Meetup on April 13, 2016 at the BRC. There were over 30 posters on display representing research from the School of Engineering, Natural Sciences, Social Sciences, Humanities, and the Kinder Institute. In effort to make the event even more impactful and user friendly to navigate, we organized posters by the following categories:

- Presenting Tools to Help Analyze & Understand Data
- Presenting Data Problems to be Solved
- Broader Platforms for Data Management and Analytics
- Combination of all Categories

We are looking forward to planning the next Data Science MeetUp, scheduled for October 13, 2016 (MARK YOUR CALENDAR and SAVE THE DATE NOW). In addition to the poster display, we will explore other ways to support networking and further improving the information flow between participants.

Community Engagement

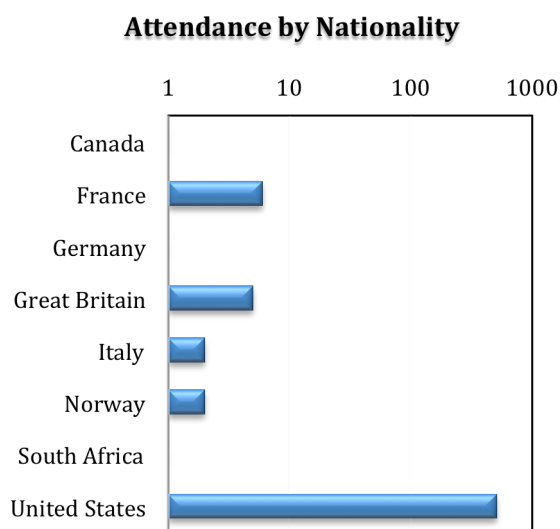
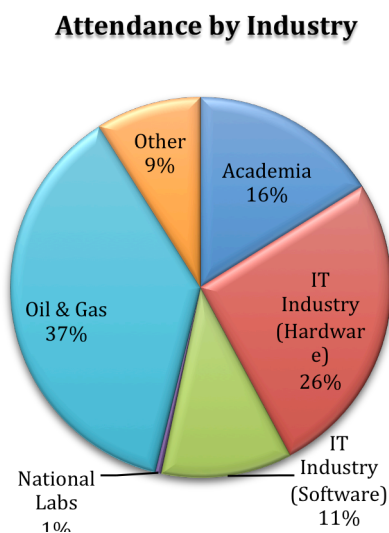
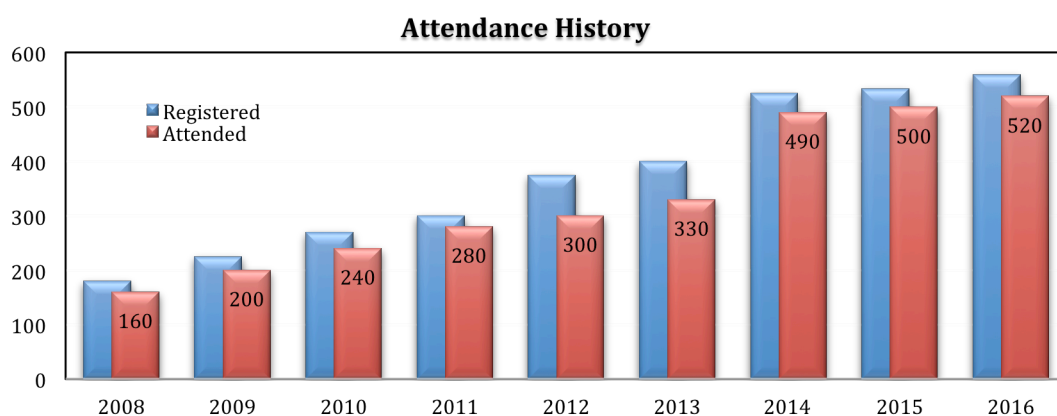
The Ken Kennedy Institute continues to engage with and support the local community at Rice and in Houston with a variety of educational workshops, public lectures, and monthly networking opportunities. We see our power in relationship building at the forefront of intellectual ambitions. We believe it is critical to our mission to continue building and maintaining strong relationships across the community at Rice, the Texas Medical Center, and Houston.

External Collaboration

2016 Oil and Gas High Performance Computing Conference

The Oil and Gas High Performance Computing Conference (OG-HPC Conference) continues to be a flagship industry engagement for the Institute and Rice University.

Given the tumultuous times in the Oil & Gas industry, the program committee was not sure what to expect in terms of participation for this year's conference. Would registration hit an all time low after growing for eight straight years? Short of a dramatic oil price rebound, images of Wile E. Coyote in mid air had been suggested after the 2015 record year with 500 attending. Surprisingly, all concerns were unfounded and with 520 attending, 2016 was another record year. Equally satisfying, was the fact the sponsors were there in force. The demographic also remained largely unchanged with 37% attending from the Oil & Gas industry, matching the percentage attending from the IT industry. As the result of the sponsorships this year, we were able to raise approximately \$120,000. These funds will be used for the Computational Science & Engineering Enhancement Fellowship program.



We look forward to the continued success of the conference. With the 10-year anniversary in 2017 (March 15-16), the program committee is already planning for a memorable event celebrating the past as well as planning for the future.

HPC Boot Camp

The 7th annual 2016 HPC Boot Camp hosted by the Ken Kennedy Institute addressed continued training and education in the “art” of high-performance computing and scientific programming. While the main driver for the Boot Camp has been participation from the oil and gas industry, the curriculum is broadly applicable to any field engaged in scientific computing where there is a need to harness more of the computing power offered by modern servers and clusters. This year we had 18 participants complete the course. While industry paid full cost, the Ken Kennedy Institute heavily subsidized participation from Rice, TMC and the Gulf Coast Consortia.

Data Science Boot Camp

2016 marked the 3rd time the Ken Kennedy Institute hosted a data-science training event. It was offered as a four-day training program. The program was designed to attract attendees that needed the skills required to start leveraging the latest data analytics methods and tools with their data. Eighteen participants completed the program. The participants were largely from the Texas Medical Center including Baylor, MD Anderson and The University of Texas Health Sciences Center in Houston. Several Rice students and staff members also completed the course. While industry pay full cost, the Ken Kennedy Institute heavily subsidized participation from Rice, TMC and the Gulf Coast Consortia.

AWS Internet of Things Hackathon for Oil & Gas

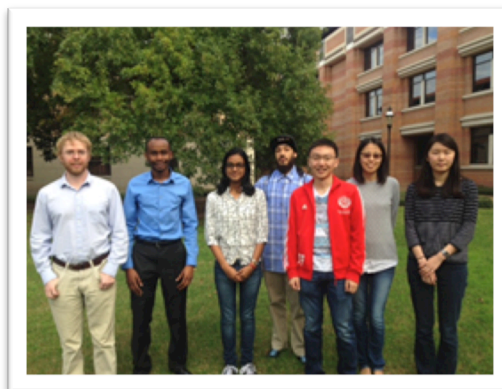
The Ken Kennedy Institute hosted the Amazon AWS Internet of Things (IoT) Hackathon for Oil & Gas August 26, 2015. Developers, AWS engineers and IoT cloud experts taught techniques on connecting to the latest IoT devices from leading hardware vendors to the AWS Cloud. Approximately 30 people attended the HackaThon including several people from Rice.

Student support

Graduate Fellowships (\$57,500 Awarded)

We awarded eight supplemental graduate fellowships during FY16 to students across Computer Science (CS), Computational & Applied Mathematics (CAAM), Statistics (STAT) and Earth Science (ES).

These fellowships are made possible by the sponsorship from the energy industry (BP, ExxonMobil, Shell, and Schlumberger), from Cray as the Cray-Kennedy Graduate Fellowship, and the Andrew Ladd Memorial Excellence Fund.



Ken Kennedy Institute Computational Science & Engineering Fellowships

This year we continued to expand our Supplemental Fellowship program by offering up to sixteen (16) \$7,500 four-year “supplemental fellowships” to CS, CAAM, ECE, and ESCI, in recruiting very well qualified graduate student applicants. The fellowships also require a department match of an equal amount therefore the total award is \$15,000 per student over four years. Of these sixteen offers Rice only attracted two students that will be graduate students at Rice this fall. The money was added on top of the regular departmental stipend as a recruiting incentive. These fellowships were made possible by the Rice OG-HPC Conference. The low yield in 2016 is evidence that departments are reaching for the absolute best students. This program will be continued moving forward and with two students this year we have helped attract a total of nine top computational S&E students to Rice since the program started in 2015. We will be working closely with departments, as well as with OGPS, to develop our recruiting strategy and how to best leverage the funding.

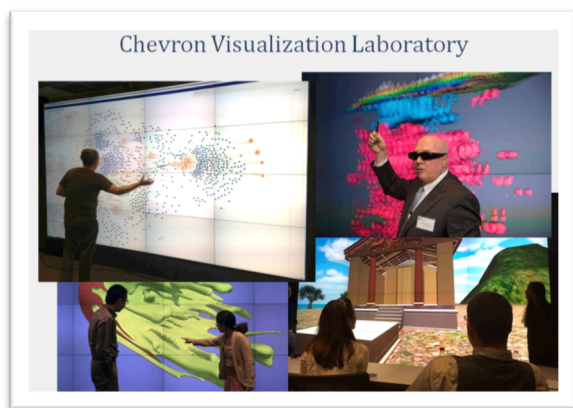
Research Cyberinfrastructure

Research CyberInfrastructure

Direct government funding and research grants continues to be our largest funding source for HPC resources, and we estimate that over 60% of Rice’s annual research expenditures significantly benefit from cyber-infrastructure awards by agencies such as the NSF, NIH and DOE. Infrastructure awards as a result of the Ken Kennedy Institute leadership and coordination since 2002 have been a critical enabler for Rice’s growth in research expenditures and have also helped Rice maintain the recognition as a tier 1 HPC institution. The Ken Kennedy Institute, in collaboration with the Vice President and CIO at Rice University, is working with faculty to expand Rice’s shared research cyberinfrastructure. Current projects include exploratory cloud offerings as well as scalable data storage offerings.

Chevron Visualization Laboratory

Rice’s Chevron Visualization Laboratory, funded in part by a grant from NSF and a gift from Chevron, enables researchers to interact with data in more effective ways and to probe details and develop understanding. The 200-inch wall (measured diagonally) lets users display and analyze images of all types, from atoms to galaxies, to archeological structures and sites, to urban developments and planning. This “studio” is not only able to help researchers broadly across all fields of study, only limited by user’s imagination. On average the space is booked 10-15 hours per week with recurring events and frequented by others as needed to support visualization needs. The lab services extend past the physical facility and we help support and develop in-situ data visualization workflows.



Research Computing Service Center Operation

K2I continues to assume the responsibility of administering, managing and charging for access to Rice's shared computing infrastructure. During FY16 this included operating of the Shared Computing Service Center. During FY15 we successfully deployed the Billing Application Service Center Software (BASCS) web app that help automate large portions of the billing process and includes web pages for department staff or PIs to manage assignment for funds that will be charged for different PIs and users. In an effort to ensure a seamless transition and collect feedback on the software solutions, the Institute continues to administer BASCS training to all department administrators who have faculty using the shared computing infrastructure.

K2I Sponsored and Co-Sponsored Public Lectures

2015-2016 K2I Distinguished Lectures

- **Charles Leiserson**, Professor of Computer Science and Engineering at MIT, (9.29.15), "What the \$#@! Is Parallelism? (And Why Should Anyone Care?)"
- **Jonathan Dement**, Program Director for POWER Systems and OpenPOWER Innovation, (11.5.15), "The Challenge and Responsibility of Computer Science to Enable the "Genomics Disruption" in Health Care"
- **Mohit Aron**, Founder and CEO of Cohesity, Inc., (2.10.16), "The Entrepreneurial Journey"
- **Sami Saydjari**, President of the Cyber Defense Agency, (4.21.16), "Defending Cyberspace: A New Frontier – Rescheduled for Fall 16"

K2I Sponsored Monthly Member Luncheons

Fall 2015

- **Jan Odegard**, Executive Director, Rice Ken Kennedy Institute, Associate Vice President, Office of Information Technology & XD, Rice University, ""Moore's Law is Dying, What Now?" (09.5.14)
- **Ilinca Stanciulescu**, Assistant Professor, Department of Civil and Environmental Engineering, Department of Mechanical Engineering and Materials Science, Rice University, "Simulation of Complex Systems with Dynamic Instabilities" (10.2.15)
- **Karl Ecklund**, Associate Professor of Physics and Astronomy, (11.6.15), "Particle Physics at CERN's Large Hadron Collider"
- **Fares el Dah-Dah**, Professor and Director of the Humanities Research Center, (12.4.15), "Platforms of Knowledge"

Spring 2016

- **Rob Griffin**, Professor of Civil and Environmental Engineering and Department Chair, (2.5.16), "Simulation of Atmospheric Particulate Matter"

- **Matt Knepley**, Assistant Professor, Computational and Applied Mathematics, (3.11.16), "The Portable Extensible Toolkit for Scientific Computing"
- **Moshe Vardi**, Karen Ostrum George Distinguished Service Professor, Computer Engineering, Director of the Ken Kennedy Institute for Information Technology, (4.1.16), "The Automated-Reasoning Revolution: From Theory to Practice and Back"
- **George Phillips**, Professor of Biochemistry & Cell Biology and Chemistry, Associate Dean for Research, Associate Chair; **Jose Onuchic**, Harry C. & Olga K. Wiess Professor of Physics, Co-Director: Center for Theoretical Biological Physics, Professor Of Chemistry and BioSciences; and **Pedro Alvarez**, George R. Brown Professor, Professor of Materials Science and NanoEngineering (5.6.16), "How to Get Ready for and Prepare a Large Center Proposal"

Miscellaneous

Master of Computational Science and Engineering Degree Program

- K2I assisted with the application review and Rice offered admission to 23 of the 80 students that applied to the Master of Science in Computational Engineering (MCSE) Professional Masters Program, a joint program between Computer Science, Computational and Applied Mathematics and Statistics. Of the 23 admission offers made, seven students enrolled in the program.

Institute Sponsorship

- Provided \$8,000 to supported Computer Science and ECE with the Grace Hopper Conference.
- Assisted with the coordination of the September 2015 Mathworks MatLab Seminar.