

The Ken Kennedy Institute for Information Technology

Fiscal Year 2018 Annual Report

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KENNEDY**
INSTITUTE FOR INFORMATION TECHNOLOGY

Executive Summary

Fiscal Year 2018 (FY18) was another dynamic and successful year for the Ken Kennedy Institute. Throughout the year, the institute works to develop collaborative efforts across Rice and the Houston information technology, computation- and data-science community. This includes organizing networking events such as conferences, workshops, symposia, and lectures; training and education (boot camps and tutorials); and supporting faculty engagements and proposal development. The Institute also works closely with the Office of Information Technology, continuing to develop and improve Rice's research computing and data infrastructure. The Ken Kennedy Institute is constantly looking for opportunities "outside the box" – the next wave – to support the intellectual community of 160 members, and offers many "stages" for engagement amongst faculty, across universities, and with industry. In FY18, we embarked on many endeavors to strengthen our organization that included:

- Partnered with faculty and OIT to prepare and submit two large federal (NSF & NIH) infrastructure grant proposals.
- Partnered with IBB, SCI and RSI to develop the LIFT proposal "Destination Rice."
- Continued awarding graduate fellowships by leveraging our industry networks:
 - Computational Science & Engineering Supplemental fellowships to help recruit high-achieving students in the application pool (funded by annual Oil & Gas HPC Conference sponsorship).
 - Continue running our well-established and highly successful industry-funded Graduate (enhancement) Fellowship program for students already at Rice (named fellowships funded by industry partners).
- Hosted 11th Rice Oil & Gas High Performance Computing Conference. This was the 3rd year with over 500 attendees.
- Hosted inaugural Rice Data Science Conference with 400 attendees.
- Co-hosted the Enaxis Leadership Forum where C-Level executives, futurists, and academia came together to exchange ideas and experiences on digital readiness, advanced analytics, artificial intelligence and future workforce readiness.
- Prepared and hosted a two week-long boot camps open to external and internal participants:
 - HPC Boot Camp (the 9th time), May 21-25, 2018 (19 participants)
 - Data Science Boot Camp (the 6th time), August 6-10, 2018 (51 participants)
- Hosted/co-Hosted nine Distinguished Lectures and eight monthly member networking luncheons in support of community development.
- Enhanced the Institute's and Rice's visibility by leveraging our Facebook and Twitter profiles combined with targeted marketing, and printed materials for events.

Institute Space and Leadership

The Ken Kennedy Institute is housed in Duncan Hall where it occupies three offices (the 1084-1085 office suite and office 1088). No other space is currently dedicated to or managed by the Institute. The Director of the institute are Moshe Y. Vardi, Karen Ostrum George Distinguished Service Professor in Computational Engineering (office in CS) and the co-Director is Keith Cooper L. John & Ann H. Doerr Chair, Computational Engineering, Professor, Computer Science (office in CS). Jan E. Odegard joined the Institute in 2002 as the Executive Director, and has since March of 2015 also served, in a 20% capacity, as an Associate Vice President in the Office of Information Technology in charge of research computing. The Institute is supported by two professional staff members: Victoria Langlais, Associate Director and Deborah Heath, Marketing and Events Specialist.

Institute Membership

The Ken Kennedy Institute's membership is comprised of 160 Rice faculty members, 75 associate members who are part of the greater campus population, and 20 non-Rice "adjunct" members who are affiliated with industry, the Texas Medical Center, or other organizations outside of Rice University. In addition to these three communities about 3,000 people subscribe to our mailing lists to receive information about events organized by the Institute.

Internal Engagement and Community Building

From our roots in Computer Science, Electrical and Computer Engineering, Computational and Applied Mathematics, and Statistics, we have grown to encompass faculty from all the schools at Rice spanning engineering, natural sciences, humanities, social sciences, business, architecture and music. The Ken Kennedy Institute is currently the virtual home of over 160 faculty members and senior researchers from across Rice University. Institute members receive most of their funding from federal agencies such as the National Science Foundation, the Defense Advanced Research Projects Agency, the Department of Energy's Office of Science and the National Institutes of Health. In addition to these funding sources, we work closely with members to develop funding opportunities and partnerships with industry and private foundations.

Member Community Networking Luncheons

- Kathy Ensor (09.08.17)
"An Overview of the Kinder Institute Urban Data Platform"
- Ashutosh Sabharwal (10.06.17)
"Rice Scalable Health Labs: Bio-Behavioral Sensing"
- Yael Hochberg (11.03.17)
"Entrepreneurship at Rice: A vision for entrepreneurship education in 2020"
- Jan E. Odegard (12.01.17)
"The Research Data Facility: What is it?"
- Bill Fulton (02.02.18)
"Kinder Institute for Urban Research: An Introduction"
- Philip Bedient (03.02.18)
"Big Data and Bigger Storms"

- Asha Rajagopal (04.06.18)
“Technology Transfer: Reflections and Future Directions”
- Jesse Chan (05.04.18)
“Simulating waves and fluids: accuracy, stability, and high performance computing”

Shared Computing Infrastructure

Since 2002, the Ken Kennedy Institute has successfully worked with faculty to fund and build Rice’s shared cyberinfrastructure. Today, the Institute, in partnership with Rice’s Office of Information Technology, supports the computational research needs of more than 190 faculty members and over 600 users. In any given month, 250 of these users consume significant computing and storage resources.

The Institute could not operate and continue to build upon its shared computing infrastructure without the technical support of Rice’s Office of Information Technology, the financial support of Rice University, funding from the National Science Foundation (NSF), the National Institute of Health (NIH) and support by industry partners. While we continue partnering to write infrastructure grant proposals, the competition is becoming increasingly tough with less government funding available. Since 2002 the Institute has helped fund, on average, \$1 million per year of research computing infrastructure at Rice. This has helped Rice sustain a healthy computational infrastructure, serving as a catalyst for research and maintaining Rice’s ability to be competitive for research funding.

Proposal Development and Support

The Ken Kennedy Institute assisted in writing, coordinating and submitting the following NSF proposals:

- ***NSF MRI proposal (\$1,428,556) - Declined***
MRI: Acquisition of Data Analysis and Visualization CyberInfrastructure for Computational Science, Engineering and Data Analytics Applications (DAVinCI-2)
- ***NIH S10 HEI proposal (\$599,900) pending:***
Cyberinfrastructure for Accelerating Data-Intensive Biomedical, Behavioral and Public-Health Research (BioU-2)

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 FY18 this included operating of the Shared Computing Service Center. During FY15 we successfully deployed the Billing Application Service Center Software (BASCS) web application that helped automate large portions of the billing process and includes web pages for department staff or principal investigator (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.

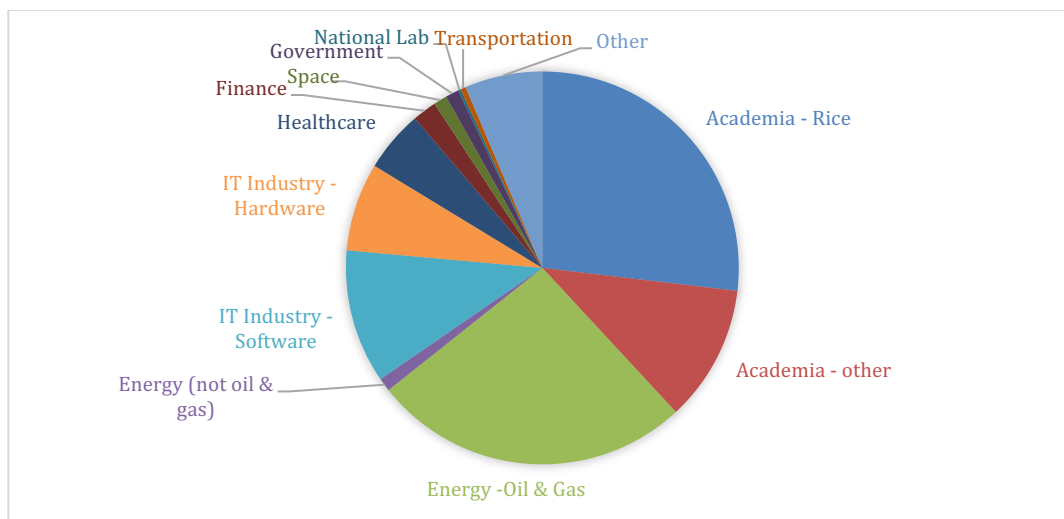
External Engagement

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. The Institute's power lies in its ability to build and strengthen relationships at the forefront of intellectual ambitions. Critical to its mission is the Institute's efforts to continue building and maintaining strong relationships across the community at Rice, the Texas Medical Center, and the greater Houston area.

2017 Data Science Conference (October 9-10, 2017)

The inaugural Data Science Conference was held at Rice University October 9 & 10, 2017. The overarching goal of the conference was to bring together data science professionals from a variety of backgrounds and industries. It is clear that data science is rapidly evolving as an essential interdisciplinary field, where advances often result from combinations of ideas from several disciplines. The conference served as a venue for professionals and practitioners working in machine learning, deep learning, data mining, artificial intelligence, or big data problems to come together in order to share ideas and research. The theme for this year's conference was "learning and exploring the interfaces."

The planning committee was extremely pleased with both the number and diversity of attendees. Over 450 people registered for the conference and 400 picked up their name-badge. As can be seen in the chart below, attendees represented a broad set of stakeholders. In addition to the event being so well attended, we had 15 industry sponsors sign up, demonstrating the external interest for supporting community building and engagement around data science. To see the full program, go to <http://2017ricedsconference.rice.edu/program/>

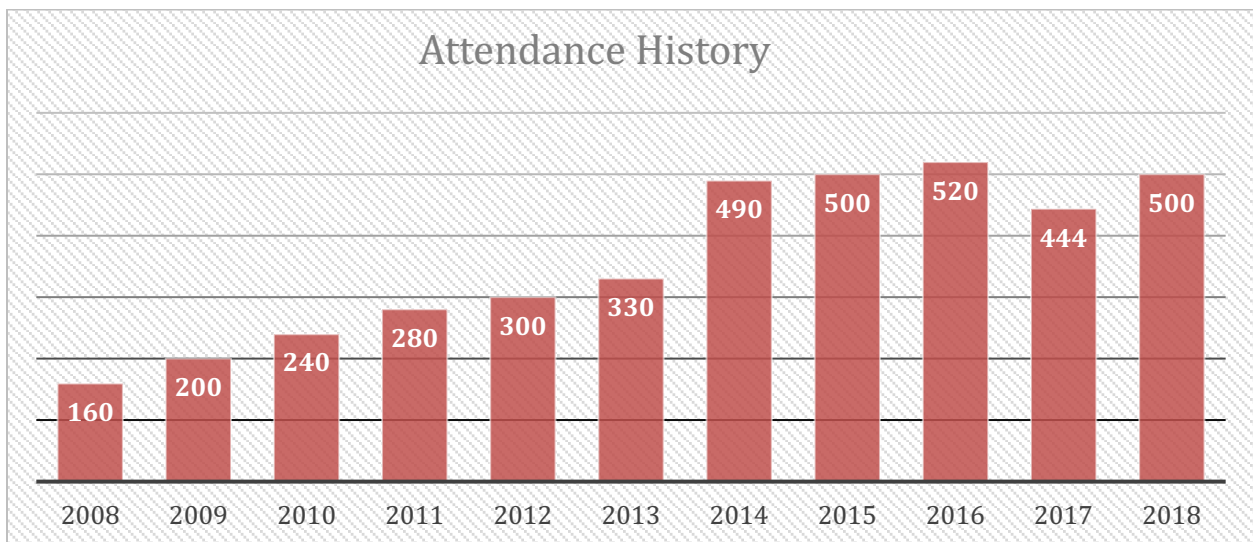
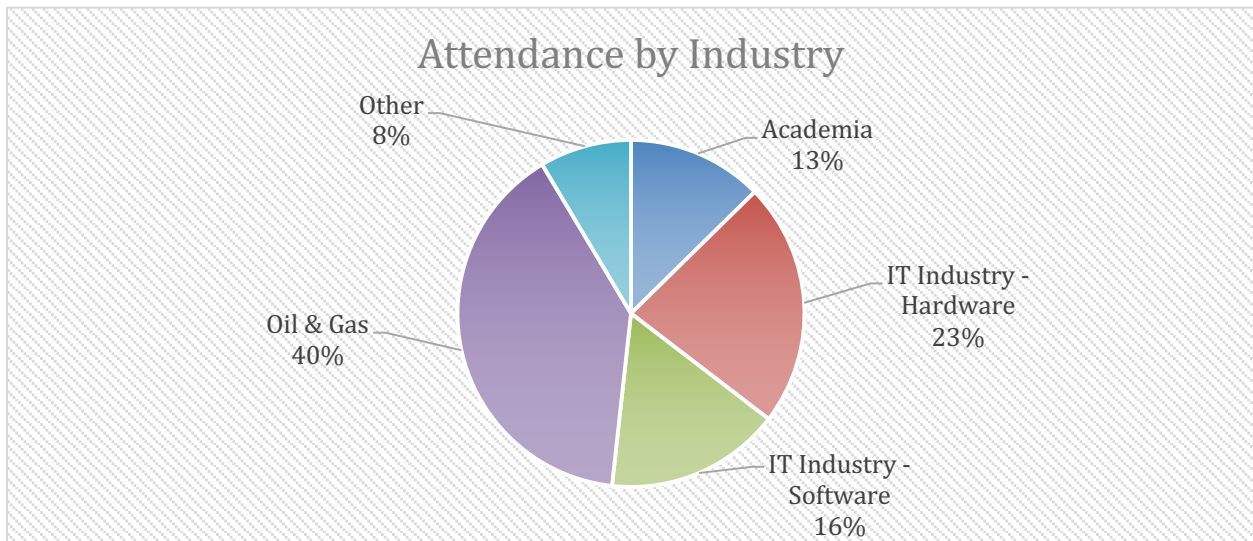


2018 Oil and Gas High Performance Computing Conference (March 12-13, 2018)

The relevant question at the 11th annual Oil & Gas HPC Conference was: What is the role of exascale computing (e.g., a system with capability to perform a billion-billion calculations per second) and how can it transform our industry? In response to this question this year's two-day conference included two tutorial sessions, three keynotes, 10 plenary talks, 12 papers (selected from 30 submitted abstracts) in two parallel sessions and 25 student

poster presentations. The annual conference drew 500 attendees and continues to make a significant contribution to networking and collaboration by providing a forum for practitioners in the industry to connect with peers, technology providers and academia on topics relevant to the oil and gas industry. To see the full program, go to <http://rice2018oghpc.rice.edu/program/>

Registration remained steady from 2017 with 500 people attending this year. Additionally, the sponsors for this event attended in force again this year, with a total of 29 sponsor companies represented. The demographic distribution of attendees was in line with 2017 with 40% attending from the Oil & Gas industry.



As a result of the sponsorships this year, the conference's gross was approximately \$175,000. After covering operational costs, all funds will be used to support the Computational Science & Engineering Enhancement (CS&E) Fellowship program. The

Institute looks forward to the continued success of the conference with plans to host the 12th annual conference on March 4 & 5, 2019.

Distinguished Lectures (lectures open to the public)

- Jim Whitehurst, CEO, Red Hat
“How Digital Transformation is Changing the Corporation”
- Jeff Dean, Senior Fellow, Google
“Building Intelligent Computer Systems with Large Scale Deep Learning”
- Stanley Williams, Senior Fellow, Founding Director Quantum Science Research Laboratory, HP Labs
“Nonlinear Dynamics and Imaging of Current Density and Electric Field Bifurcations Caused by Electronic Instabilities”
- Vincent Poor, Michael Henry Strater University Professor, Princeton University
“Smart Grid: Energy Meets Information”
- Eszter Hargittai, Professor, University of Zurich
“Web of Opportunity or Web of Uncertainty? Why Internet Skills Matter”
- Doug Burger, Distinguished Engineer, Microsoft
“A New Era in Computer Architecture”
- Tom Mitchell, E. Fredkin University Professor, Carnegie Mellon University
“Conversational Machine Learning”
- Klara Nahrstedt, Ralph M. and Catherine V. Fisher Professor, University of Illinois at Urbana-Champaign
“Real-Time Micro-Service Operating Infrastructure for Scientific Workflows”
- Victoria Stodden, Associate Professor, University of Illinois at Urbana-Champaign
“Paradigms for Data Science: Reproducibility, Transparency, and Generalizability”

Support for life-long learning

HPC Boot Camp (May 22-26, 2018)

The 9th Annual 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 HPC 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 19 participants completed the HPC Boot Camp course. While participants from industry paid full cost to attend the course, the Ken Kennedy Institute heavily subsidized participation from Rice, TMC and the Gulf Coast Consortia.

Instructors:

- Max Grossman, Research Scientist, Computer Science
- John Mellor-Crummey, Professor, Computer Science

Data Science Boot Camp (August 6-10, 2018)

The 6th annual Data Science Boot Camp was hosted at the BioScience Research Collobarative building. Again this year the Data Science Boot Camp was offered as a five-

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. The 51 participants that completed the program were from companies such as: BP, Chevron, Dell EMC, ExxonMobil, Shell, and Statoil. Several Rice University and Texas Medical Center students and staff members also completed the course. While participants from industry paid full cost to attend the course, the Ken Kennedy Institute heavily subsidized participation for academic affiliation.

Instructors:

- Genevera Allen, Associate Professor, Statistics
- Chris Jermaine, Professor, Computer Science
- Devika Subramanian, Professor, Computer Science
- Michael Weylandt, Graduate Student, Statistics

CRA Summit on Technology and Jobs

This by-invitation summit organized in Washington DC was spearheaded by Moshe Vardi and brought together approximately 80 leaders in the industry. The focus for the Washington DC summit was to build on the extremely successful 10th annual De Lange Conference on Humans, Machines, and the Future of Work hosted by the Ken Kennedy Institute in collaboration with Scientia in December 2016. The issue of technology and jobs was put on the national agenda *in an informed and deliberate manner*. The summit brought together leading technologists, economists, and policy experts who offered their views on where technology is headed and what its impact may be, and on policy issues raised by these projections and possible policy responses. The summit was hosted by the Computing Research Association, as part of its mission to engage the computing research community to provide trusted, non-partisan input to policy thinkers and makers. For additional information on the DC summit go to <https://cra.org/events/summit-technology-jobs>

Enaxis Leadership Forum (February 1, 2018)

The Enaxis Leadership Forum, in collaboration with the Ken Kennedy Institute at Rice University, was an invitation-only event where C-Level executives, futurists, and academia met in a relaxed environment to exchange ideas and experiences on digital readiness, advanced analytics, artificial intelligence and future workforce readiness. Presenters from Rice University included K2I members Jan Odegard, Richard Baraniuk, Klara Jelincova and Marcia O'Malley. Approximately 150 industry leaders attended this daylong event.

Houston Exponential Data Science Sub-Committee

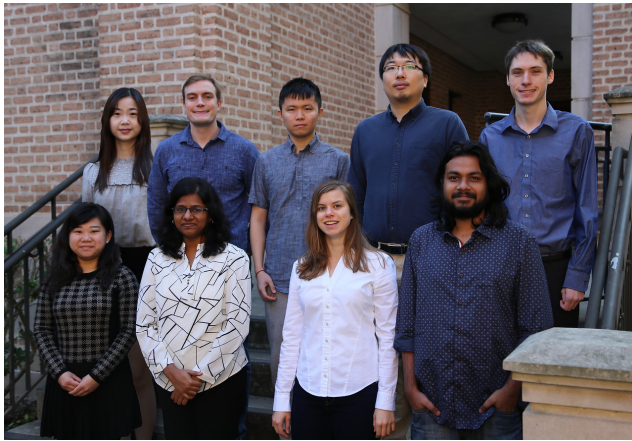
Jan Odegard was invited by the Houston Exponential (HX) to participate on the Data Science sub-committee to help inventory and develop opportunities for Houston in Data Science. This is one of four sub-committees with K2I members on them. The other three are Internet of Things, Cybersecurity (Dan Wallach), and Robotics (Marcia O'Malley).

Data Science Initiative – Faculty Search

Keith Cooper co-chaired with K2I member Rachel Kimbro, Sociology the Data Science Initiative faculty search committee. This search resulted in the hiring of 9 faculty members across the departments of BioSciences, Computer Science, Electrical & Computing Engineering, Physics, Sociology and Statistics.

Graduate Student Excellence and Education

Graduate Fellowships (\$65,000 Awarded in FY18)



The Ken Kennedy Institute awarded nine supplemental graduate fellowships during FY18 to students across Chemical & Biomolecular Engineering, Computer Science (CS), Computational & Applied Mathematics (CAAM), Electrical & Computer Engineering (ECE) and Material Science & NanoEngineering).

These fellowships are made possible by the sponsorships received from the energy industry (BP, ExxonMobil, Schlumberger), from Cray as the Cray-Kennedy Graduate

Fellowship, the Andrew Ladd Memorial Excellence Fund and the Oil & Gas HPC Conference.



Ken Kennedy Institute Computational Science & Engineering Fellowships

This year the Institute continued to expand its Supplemental Fellowship program by offering four-year “supplemental fellowships” each in the amount of \$7,500 to CS, CAAM, ECE, and ESCI, intended to recruit 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. These fellowships are made possible by funding from the Rice OG-HPC Conference.

The Supplemental Fellowships are meant to help recruit the “best-of-the-best” applicants, students that Rice might otherwise lose to competitive universities without this extra incentive for students to choose Rice. For the 2018/19 Academic Year, the Ken Kennedy Institute made 22 CS&E offers to applicants. Of these 22 offers, 6 students accepted. The Institute looks forward to welcoming these exceptional students to Rice in the Fall of 2018.

Master of Computational Science and Engineering Degree Program

The Ken Kennedy Institute assisted with the application review of applicants and Rice offered admission to 22 of the 88 students that applied to the Master of Science in Computational Engineering (MCSE). The Professional Master Program is a joint program between Computer Science, Computational and Applied Mathematics, Electrical and Computer Engineering, and Statistics. Of the 23 admission offers made, 4 students enrolled in the program.