SDSC staff, along with the entire campus community, stepped up en masse to the auction tables in early April, raising $1,134.50 for United Way's 2016 campaign. SDSC Facilities Manager Sandy Davey organized the two-day event in the SDSC West Lobby, where participants entered silent bids for a wide range of items, from artwork and jewelry to blenders and bicycles.

"We had an amazing turnout this year from many parts of campus, and surpassed our goal of $1,000," said Davey, who serves as a department coordinator for the charity. "It's very gratifying to see so many people including SDSCers support this cause, and we hope to reach a higher goal next year!"

The majority of funds raised—almost $900—is going toward supporting and enhancing the lives of San Diego-area children and their families, while the remainder will support the charity's Women United Fund and its Environmental Choice program. Kudos to Sandy for organizing this fun event for such a worthy cause!
In the previous issue of SDSC’s Innovators newsletter I outlined our ongoing work developing a comprehensive strategic plan. One element of that plan is how we continue to best serve the greater UC research community. Let me share some thoughts on that.

Last spring we formalized our UC-wide engagement activities under a program called ‘UC@SDSC’. We created a UC External Advisory Board made up of vice chancellors, deans, and professors from all 10 campuses as well as administrators from the three UC-managed DOE labs to help us identify new multi-campus collaborations that leverage SDSC’s resources and expertise. One year later, the results are impressive. While this space doesn’t allow me to fully describe each one, here are a few highlights:

**HPC@UC:** Launched last month, HPC@UC provides UC researchers access to SDSC’s high-performance computing resources, including Comet and Gordon, and expertise. HPC@UC is intended to broaden the base of UC researchers who use advanced computing while seeding promising computational research. To date, we have made awards to six researchers totaling 1.4 million core computing hours and seven terabytes of storage. They are: Vishwanathan Swaminathan (UCSC), machine learning; Brant Robertson (UCSC), astrophysics; Jeremie Mouginot/Rignot Research Group (UCI), earth systems science; Hao Lui/Saroosh Sarooshian (UC), civil and environmental engineering; and Bathe Cauchy (UCLA), materials science/civil engineering. Shawn Strande is leading the HPC@UC initiative.

**NSF West Big Data Innovation Hub (WBDIH):** In November the NSF established four regional Big Data Innovation Hubs throughout the U.S. The Western region is comprised of 13 states. Principal investigators for the WBDIH include myself; Michael Franklin, Chair of UCB’s Computer Sciences Division; and Ed Lazowska, Chair of the University of Washington’s Computer Science & Engineering Department. The Hub’s purpose is to connect, educate, and facilitate multi-state, multi-sector partnerships in the area of big data innovation. Cross-cutting themes focus on development and application of big data technologies. Thematic spokes include areas such as managing natural resources and hazards, metro data science, and precision medicine. Christine Kirkpatrick and I are leading this initiative.

**SDSC Health Cyberinfrastructure:** Thanks to Sandeep Chandra’s efforts, our Health Cyberinfrastructure is collaborating with the UC Medical Centers to provide HIPAA-compliant hosting for the UC Clinical Data Warehouse. Participating campuses include UCD, UCI, UCLA, UCSF, and UCSD, with Atul Butte, head of the new UCSF Institute for Computational Health Sciences, leading the project. Sandeep’s group is also working with UCOP’s Risk Services and the UC Medical Centers on using Hadoop technology to manage the organization’s liability program. Following successful validation in the Sherlock Cloud’s HIPAA-compliant environment, that project will enter production later this year.

I’m confident that with the help of our UC colleagues, we will continue to brainstorm new ideas and partnerships to keep our remarkable momentum going.

Michael L. Norman
SDSC Director
**Comet Assists in UC San Diego Autism Study**

The types of gene mutations that contribute to autism are more diverse than previously thought, report researchers at the UC San Diego School of Medicine in the current issue of *The American Journal of Human Genetics*. The findings, reached with the aid of SDSC’s Comet supercomputer, represent a significant advance in efforts to unravel the genetic basis of autism spectrum disorder (ASD). Researchers enrolled hundreds of volunteers from families with one child affected by ASD and, using Comet, sequenced the complete genomes of every family member including the parents and typically developing siblings. “Comet provided the added computer power and flexibility needed to implement a rapid whole genome sequencing analysis pipeline required for this project,” said Mahidhar Tatineni, director of SDSC’s User Service Group. SDSC Distinguished Scientist Wayne Pfeiffer also participated in this project.

Read more at http://goo.gl/xN4h65

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**SDSC’s Comet, Gordon, and CIPRES Gateway Help Define New ‘Tree of Life’**

An outline for a new tree of life, depicting the evolution of life on this planet that included more than 1,000 new types of bacteria and Archaea lurking in the Earth’s nooks and crannies, was made possible with the help of supercomputing resources and a phylogenetics “gateway” created at SDSC. The new tree, published online April 11 in the new journal *Nature Microbiology*, reinforced once again that the life we see around us—plants, animals, humans, and other so-called eukaryotes—represents a tiny percentage of the world’s biodiversity. “The CIPRES Science Gateway was critical to our work,” said Laura Hug, who computed the trees at the University of California Berkeley and is now a biology faculty member at the University of Waterloo, Canada. “No run had successfully finished prior to our introduction to CIPRES.” CIPRES (CyberInfrastructure for Phylogenetic REsearch, is a web-based portal or gateway that allows researchers to explore evolutionary relationships between species. SDSC Researcher Mark Miller is principal investigator of the CIPRES Gateway.

Read more at http://goo.gl/LhuJts
Christine Kirkpatrick is SDSC’s Division Director for IT Systems & Services. Christine is also Deputy Director and co-PI for the NSF-funded West Big Data Innovation Hub, and Chair of the Technical Advisory Committee for the National Data Service. She specializes in enterprise architectures, integrations, and implementation of large-scale storage, cloud, and computational resources. A pioneer in web-based instruction, Kirkpatrick has extensive teaching experience coupled with expertise in developing associated technologies needed for effective online teaching. She holds a master’s degree in Architecture-based Enterprise Systems Engineering Leadership from UC San Diego’s Jacobs School of Engineering. Kirkpatrick joined UC San Diego in 1996 and has been with SDSC since 2012.

Q: What is your role as Division Director for IT Services?
Kirkpatrick: I head a staff of 30 responsible for everything infrastructure-related at SDSC that is not supercomputing. This includes enterprise networking, the platform and virtualization groups, storage, the Help Desk, cloud consulting and systems integration, and the data center.

Q: How did you become involved in IT?
Kirkpatrick: While in college I took a temp job in technical support with a software company in order to make extra cash. This was in the early days of IT when there was no such thing as a technical bookstore, let alone Google, to turn to for help. Through a lot of trial and error I became good at troubleshooting. My career has been built on this experience.
Q: You joined UC San Diego in 1996. What was your first job?  
Kirkpatrick: Academic Computing Services, where I was responsible for half of the campus’s computer labs. Managing hundreds of systems requires that things be done in programmatic ways, but this was in the days before there were tools to do so. As networking got better, taking on security issues certainly became important. When I joined UC San Diego there was no campus web office so I took this on and made web development part of my office as a recharge business. This allowed me to hire extra staff, which was invaluable during peak demand times.

Q: How did these experiences lead you to SDSC?  
Kirkpatrick: Along with my technical skills, I developed a knack for leading large IT projects and multiple units. Though my trouble-shooting skills, programming, and system internals cemented my IT career; it was my people and leadership skills that allowed me to rise in the organization. I can translate IT speak into civilian language and communicate back requirements. When SDSC posted its Division Director opening, I was formalizing my enterprise architecture credentials. It was the right time to come to SDSC.

Q: How can researchers leverage SDSC IT expertise to make their grant proposals more competitive?  
Kirkpatrick: Being focused on research computing, I understand the requirements of different funding agencies and know what they view favorably from a cost standpoint, such as cloud storage versus dedicated equipment. Our highest goal is to make sure that research grants come to UC San Diego and SDSC; we’re not afraid to recommend commercial options, even Google and Amazon, if that will best serve a need. Working with researchers in the pre-award phase, I can provide facilities write-up paragraphs on SDSC resources that can be plugged into proposals and assist with budget justifications and data management plans. Early involvement in a proposal also means that once a grant receives the green light, my division is ready to go.

Q: You were founding chair of the UC system’s Electronic Accessibility Leadership Team. How widespread is the issue of accessibility to the electronic environment?  
Kirkpatrick: One in 10 Americans has some kind of disability that affects their use of technology. This will only become more of an issue with an aging population as all of us start to experience eyesight and hearing problems. Researchers need to be aware of electronic accessibility issues because they have no way of knowing if the person reviewing their proposal needs some kind of accommodation. Fortunately, there are easy things that can be done to help a screen reader, such as making PDFs and survey instruments compatible to standards, transcribing and captioning videos to help the hearing impaired, and other ways to ensure files are more searchable and discoverable.

Q: You have extensive online teaching experience and leadership. How is this contributing to SDSC’s ability to offer a big data specialization through the Coursera Initiative?  
Kirkpatrick: I founded UC San Diego’s Instructional Web Development Center that offered tools and assistance to faculty using online web resources in their courses. I taught at Extension for more than a decade, where I wrote the curriculum and taught multiple courses, as well as helped launch the Teaching Online Certificate. We’ve been elated by the success of the Coursera initiative, which has reached nearly 350,000 students on every (populated) continent—from Uruguay to the Ivory Coast to Bangladesh.

Q: What do you do for relaxation?  
Kirkpatrick: Because I’m not one to sit around, I have a lot of hobbies. Out of the house, I enjoy travel and skiing. The bulk of my pastimes are what my family refers to as “Stay at Home Club” activities. They include quilting, sewing, embroidery, crafting, and cooking. I’m a fifth-generation Californian and when I learned that my great grandfather was once known as the Horseradish King of California, I rediscovered some of his recipes and learned how to make relishes and pickles. I also enjoy making preserves during peak local harvest season and am working on a canning cookbook. My sewing projects often take months or years to complete. A few years ago I used a medieval tapestry stitch to sew a portrait of Russia’s leader on a throw pillow, called the Putin Pillow. I may have invented political embroidery! It ties in to my undergraduate Political Science degree!
The first 3D structure of the Zika virus, determined by cryo-electron microscopy, was recently released in the Protein Data Bank (PDB), the single worldwide repository for the three-dimensional structures of large molecules and nucleic acids. In February 2016, the World Health Organization (WHO) declared the Zika virus a Public Health Emergency of International Concern (PHEIC).

The virus infection during pregnancy can cause a serious birth defect called microcephaly, where a baby’s head and brain are smaller than expected when compared to babies of the same sex and age, according to the Center for Disease Control and Prevention. Public availability of the Zika virus atomic coordinates to medical researchers worldwide will accelerate new antiviral drug and vaccine development. RCSB PDB (rcsb.org) provides access to this Zika structure and other data for research and education worldwide.

Co-located at Rutgers, The State University of New Jersey; and SDSC in conjunction with UC San Diego’s Skaggs School of Pharmacy and Pharmaceutical Sciences, PDB supports online access to these structures to help researchers understand many facets of biomedicine, agriculture, and ecology, from protein synthesis and biological energy to fighting disease. “SDSC has provided safe haven for the PDB since it arrived at UC San Diego in the late 1990s,” says SDSC Director Michael Norman. “It was the project that initially got us involved in data science, and it remains an important element in our ‘big data’ strategy.”
HPC@UC: SDSC Providing UC Researchers with High-Performance Computing Resources and Expertise

In early April SDSC announced a new initiative designed to assist UC researchers by providing them with access to the Center’s advanced computational resources, including Comet and Gordon, as well as data storage and expert assistance. Called HPC@UC, the program is being offered in partnership with the UC Vice Chancellors of Research as well as campus CIOs.

“HPC@UC is a key part of SDSC’s mission to provide the UC research community with some of the most advanced computational systems offered anywhere today,” said SDSC Deputy Director Shawn Strande. “Initial response to the program has been overwhelmingly positive, with more than a dozen inquiries/applications from researchers at UC Santa Barbara, UC Irvine, UC Santa Cruz, UC Davis, and UCLA, covering domains from astrophysics and climate modeling to machine learning and statistics. Already, we have awarded some 1.4 million core hours of computing time and seven terabytes of storage, and expect those numbers to steadily increase.”

Specifically, HPC@UC is designed to:

• Broaden the base of UC researchers who use advanced computing
• Seed promising computational research
• Facilitate collaborations between SDSC and UC researchers
• Provide UC researchers access to cyberinfrastructure that complements what is available at their campus
• Help UC researchers be successful when pursuing larger allocation requests through the National Science Foundation’s eXtreme Science and Engineering Discovery Environment program (XSEDE), and other national computing programs

Learn more about SDSC’s HPC@UC program at www.sdsc.edu/collaborate/hpc_at_uc.html
SDSC and the Internet of Things

It is widely believed that the next major growth area in big data will be the emergence of the “Internet of Things” or IoT – a massive proliferation of Internet-connected embedded devices that communicate and are enabled by sensors continuously streaming data back to clouds for monitoring and analysis.

SDSC recently took a step forward in research and development in the IoT with its inauguration of the industry-sponsored “SyGMA” lab at SDSC. SyGMA stands for Synchrophasor Grid Monitoring and Automation, and is under the able leadership of Professor Raymond de Callafon, with UC San Diego’s Department of Mechanical and Aerospace Engineering.

According to the Smartgrid.gov website, synchrophasors are numerical values that represent both the magnitude and phase angle of the alternating current sine waves found in electrical distribution systems, and are time-synchronized (via the Global Positioning System) for accuracy. Synchrophasors are produced by high-speed sensors called Phasor Measurement Units (PMUs) that are 100 times faster than traditional Supervisory Control and Data Acquisition (SCADA) systems. PMU measurements record grid conditions with great accuracy and offer insight into grid stability or stress. Synchrophasor technology is used for real-time operations and off-line engineering analyses to improve grid reliability, efficiency, and lower operating costs. The proliferation of Internet-connected PMU sensors throughout the electric grid is an embodiment of the IoT and will help lead to the realization of the “smart grid.”

As a control systems theoretician and expert, de Callafon is directing research into the application of control systems theory to maintain electric grid stability by collecting and analyzing PMU data to create control signals that are injected back into the grid to cancel or dampen emerging instabilities. Additionally, research conducted by the SyGMA lab will improve the overall understanding of how to collect, store, and analyze time-series data from the vast sensor networks that will eventually comprise the IoT.

As an industry-sponsored facility, the SyGMA lab is supported by San Diego Gas & Electric (SDG&E), part of Sempra Energy; National Instruments; and OSIsoft, a manufacturer of application software for real-time data infrastructure solutions. The SyGMA lab will also have access to a sophisticated Real-Time Digital Simulator (RTDS) that SDG&E uses to model and experiment with the dynamic behavior of electric power systems.

Ron Hawkins
SDSC Director of Industry Relations