Technology to Support Scholarship and Research

Technology to support scholarship and research can generally be seen as developing from two sources: Divisional Liaisons and the Local IT Specialists they supervise, and the staff in Research and Faculty Partnerships (RFP). Locally, utilizing the DL Council at a locus of information exchange, academic divisions leverage one another's expertise and developed services to meet common needs. Research and Faculty partnerships (2 fte) works strategically at the campus level to leverage local, regional and national partnerships to extend and improve research infrastructure.

Two efforts are undertaken to develop technology in support of scholarship and research. First, through the development and creative application of state-of-the-art information technology ITS, in collaboration with faculty, enables new avenues of research and approaches to instruction that leverage the power of IT in support of the information intensive activities of research and education. Second, by monitoring funding opportunities for the integration of information technology into academic activities and for the implementation of new IT infrastructure, ITS can help fund improvements in the campus infrastructure, alleviating some of the pressure on state and research overhead funds.

Development of this technology is largely an opportunistic endeavor. Two dialogs are maintained to identify opportunities. An internal dialog with faculty focuses on identifying new opportunities for ITS to facilitate research activities involving information technology. Another external dialog with both the campus' IT service providers and the broader IT industry focuses on identifying new technology of possible use in the campus environment. These efforts typically identify either a one-off project that marries existing campus research strength with available technology and ITS resources to exploit a specific opportunity, or a new technology that has the potential to benefit a range of research activities on campus.

NOTE: IN THE FOLLOWING I ONLY DISCUSS ACCOMPLISHMENTS OF RESEARCH & FACULTY PARTNERSHIPS… SOMEONE NEEDS TO FILL THIS IN FOR THE DLs/LITS.

<u>Current status</u>

During the five years since the consolidation of all campus IT staff into the single Division, ITS has had a number of notable accomplishments in support of scholarship and research. This section lists these accomplishments, with brief descriptions, and reviews current activities that show promise of further accomplishments in the near future.

Dark Fiber. Soon after consolidation, RFP identified the critical need for dark fiber to the UCSC campus (the only UC campus lacking such infrastructure). With support of then Vice Provost IT (VPIT) Merkley, we launched an effort to simultaneously articulate and communicate the effort to the campus community, and to develop a viable solution. After a multi-year effort we found a solution, and the campus leadership and faculty worked with UCOP to obtain funding. RFP managed the project to build the infrastructure, which concluded earlier this year

with the completion of this new infrastructure that is critical to the future of the campuses academic mission.

The Pleiades Cluster. In early 2005, through on-going dialog with faculty, we became aware of an NSF Major Research Infrastructure (MRI) solicitation that could fund the computing needs of the Astrophysics faculty, but which they were not going to apply for due to the difficulty they'd experienced installing and managing a previous cluster they'd obtained through such a program. ITS, in cooperation with the Vice Chancellor Research and EVC, partnered with the Astrophysics faculty in what was, ultimately, a successful proposal for a new $1.2M compute cluster. As a part of this project RFP coordinated the technical support and data center renovation needed for the new cluster. At the time the pleiades cluster was provisioned (March 2007), it was ranked as the 118th fastest computer in the world on the "Top500" list (www.top500.org).
Hosting the CBSE Web Cluster. Late in 2005 we became aware of on-going problems of the CBSE Web cluster (the cluster that implements http://genome.ucsc.edu, for which the CBSE group is world renown), which was having significant, on-going stability problems (mostly related to power). After some discussions, RFP coordinated the move of the CBSE cluster from a locally maintained facility in Baskin Engineering to the campuses data center. In a subsequent (approximately 1 year later) conversation with Professor Haussler he indicated that, before the move, problems with the Genome cluster were a monthly issue for him, and that since the move he hadn't had to think of it at all.

Optiputer Visualization Wall. In early discussions (2007) with Astrophysics faculty and subsequent visits to visualization facilities at Stanford, NASA/Ames, and CalIT2 at UCSD, we uncovered the need for visualization capabilities by many research groups on campus, and the availability of packaged technology from CalIT2 to implement this technology. After investigation into the possibility of funding such a facility (on the order of $150K) we became aware of Moveable Equipment funds for the Engineering 2 building, originally targeted for a graphics related facility, that were about to expire. Working with Professors Mantey and Pang and the CBSE group in SoE, RFP supported the purchase of an Optiputer cluster by SoE through the contribution of systems support expertise and time by the engineer responsible for maintaining the pleiades cluster described above. In exchange for this support SoE agreed to allow campus access to the system. Since its provisioning, users of the system have included Astrophysics, the Dance program in Arts, and History faculty from Social Sciences. Work continues to develop this facility for new uses. The pleiades system was used as a model for another cluster purchased by a group of AMS faculty.

In addition, following are a number of activities currently underway that show promise of further accomplishments in the near future.

Dynamic circuits. Following installation of the dark fiber to campus, RFP began an effort to identify new capabilities available with the fiber that might provide advantage to campus researchers. One technology we identified was dynamic circuits. Dynamic circuits are a new network service that allows researchers and network engineers to create dedicated, point-to-point circuits, either in real time or reserved in advance. Dynamic circuits provide support for new, demanding applications being developed for the Internet. They support the large data transfers and bandwidth-intensive applications that are becoming more critical to global scientific

collaboration in the genomics and nuclear physics communities. They also are critical for meeting the latency needs of advanced media and telepresence applications, such as those used for telemedicine, and remote performance in music and dance.

Dynamic circuit services currently in development by organizations such as CENIC and Internet2 will support the creation of circuits across network domains and international boundaries. This will allow the creation of circuits across regional, national, and international networks to connect researchers with their colleagues worldwide without the cost and setup time associated with dedicated circuits. To obtain the resources needed to provide these services (including funding and technical support) RFP has been coordinating campus efforts to apply for participation in the Dynamic Network System (DYNES) project run by Internet2, and in the CENIC Openflow Testbed Network (COTN).

The DYNES project is a collaborative effort by Internet2, Caltech, University of Michigan, and Vanderbilt University to develop and deploy the Dynamic Network System (DYNES), a nationwide cyber-instrument spanning about 40 US universities and 14 Internet2 connectors. DYNES will, in coordination with regional and campus network organizations, develop and deploy the signaling infrastructure to extend Internet2's existing ION dynamic circuit service to researcher's labs.

COTN is a project proposed by CENIC that will provide a 10-Gigabit Ethernet ring connecting several of the major points of presence (POPs) already in use by the CENIC network. Switches running the OpenFlow software (http://www.openflowswitch.org/) will be connected by this ring, and will be connected with the CalREN-HPR network and with similar OpenFlow testbeds in operation within Internet2 and NLR. It is expected that a number of other regional networks will develop similar OpenFlow testbeds as a result of this solicitation, allowing for a rich topology of interconnected switches to develop. COTN will be a dedicated, breakable research network. There will be no restrictions with regard to configuration control, traffic monitoring, etc., as would be the case in a network with production traffic. Access to COTN will be provided by means of the CalREN-HPR/L2 network, which UCSC is already connected to.

Center for Biomolecular Science & Engineering (CBSE) Genomics Institute. One of the efforts Prof David Haussler, Director of the CBSE, is pursuing to continue the evolution of the ground-breaking work done by his team in the CBSE is the creation of a Genomics Institute to develop a new personalized model of health care based on the use of a patient's genomes to develop customized courses of treatment. Recently this efforts has accelerated significantly due to the identification of potential funding sources for this multi-million dollar effort. RFP has been working closely with Prof Haussler in developing models for the IT infrastructure, specifically networking and data center facilities, to support the goals of the Genomics Institute. This effort has involved extensive collaboration, with the Center for IT Research in the Interest of Society (CITRIS, see www.citris-uc.org), the California Telehealth Network (see www.caltelehealth.org) and CENIC.

Central Coast Broadband Consortium (CCBC). Starting in 2005, RFP began representing the campus at meetings of parties interested in developing broadband in the tri-county area (Monterey, San Benito, and Santa Cruz counties), hosted by CSU Monterey Bay. In 2008

funding to leverage these meetings to a regional consortium were provided by the California Emerging Technology Fund. Brad initially served as the Chair of the Coordinating Council for the CCBC. The primary activity of the CCBC over the past two years has been to submit proposals to the National Telecommunications and Information Administration (NTIA) for American Recovery and Reinvestment Act (ARRA) funds for the development of regional broadband infrastructure. As a part of this infrastructure, UCSC would acquire the redundant dark fiber path it needs to ensure the full robustness of its network connectivity. The first proposal was not funded. However the second proposal, which was significantly improved (largely based on input which UCSC played a significant role in), has made it through the first review, and second "due diligence" phases. Final word on this funding is expected by the end of September 2010.

NSF Academic Research Infrastructure (ARI) Proposal. In early 2009, NSF (as a part of the ARRA funding) issued a solicitation for proposals for funding to upgrade the research infrastructure if the nation's universities. ITS coordinated the effort for UCSC to develop a proposal for this program, and the CT and RFP units took leadership roles for this effort. The campus submitted a proposal for $2M to cover the cost of upgrading inter-building fiber and network electronics to support 1Gb/s to the office and lab, 10Gb/s between buildings, and cable-plant upgrades to a select set of research labs to provide advanced network services. Unfortunately, this proposal did not receive funding. Based on feedback from the NSF Program Officer, the proposal reviewed well however, due to the large number of proposals submitted, we did not make the cutoff. The PO encouraged us to follow up with on other programs that were being developed for further infrastructure funding, which we are doing.