UC SANTA BARBARA

Office of the Chief Information Officer
UC Santa Barbara
Santa Barbara, CA 93106
cio.ucsb.edu

UCSB Cyberinfrastructure Plan (2015)

The core mission of the University of California Santa Barbara is to be a leading research institution that also provides a comprehensive liberal arts learning experience (UCSB Mission). To achieve that mission, UCSB must leverage technology in service of innovative teaching and groundbreaking research.

In the past few decades, many research areas have achieved prominence at UCSB, even though it is a relatively young campus. Part of the success has come from the fact that faculty work collaboratively across disciplines, often changing the direction of their work quickly, without mind to administrative or other boundaries. UCSB's cyberinfrastructure has evolved within this model. Research infrastructure was built in place for specific projects while support was often done at the "edges," close to the researchers. The network infrastructure followed in the footsteps of telephony. However, to prepare UCSB's cyberinfrastructure for the next generation of research and teaching, consolidating commodity services and providing clearly stated institutional IT goals will provide an efficient path forward. This Cyberinfrastructure (CI) plan aims to provide the vision to enable researchers and instructors across all disciplines to investigate complex challenges by supporting the creation of a collaborative, integrated, sustainable, and secure advanced cyberinfrastructure for UCSB.

Currently, UCSB is undergoing a consolidation process with the formation of Enterprise Technology Services (ETS) and the modernization of information technology services in support of the university's mission. High-Performance Computing (HPC) now has a home for researchers across campus in the Center for Scientific Computing, and specialized research computing is also done locally (e.g. ERI, NCEAS, and several science and engineering departments). Overarching IT support groups (e.g. LSIT, LSCG, ECI) handle core IT administrative and basic research services in many units. Meanwhile, individual research units and departments provide specialized and focused support and services to their users, as requested by their faculty and necessary to achieving the mission of these units. Many of these IT operations are considered 'centers of excellence' in their particular areas. UCSB should capitalize on the strengths and solutions of the entire UC system and existing IT entities to build a core set of end-to-end IT infrastructure capabilities that allow for stronger collaborations between local and consolidated services. These collaborations would build on the strengths of the centralized divisions of ETS while allowing departmental-level centers of excellence to continue to meet their unique needs. While a specific plan to finance these projects is beyond the scope of this document, as with any other physical infrastructure on campus (e.g. water), some of these services should be provided free of charge. Indeed, most of

these services should be considered base support that the university provides, with the understanding that people who fall outside of the typical use-pattern should pay for the added services required (e.g. a person who has tens of terabytes of data to store). Of course, to provide top-tier services some mode of financial sustainability must be found for these projects.

Networking

Perhaps no piece of IT better represents cyberinfrastructure than networking, as it is required for virtually every electronic device on campus, in any unit. The campus backbone currently consists of a core ring of 10Gbit/sec routers and switches. Most departments are connected to this backbone via 1Gbps building switches, with a handful connected at 10Gbps (funded by those departments that provide the higher-speed switches). The campus connects to the CENIC network at the Public Safety Building.

Ongoing Projects:

- Campus recently installed new border routers, positioning us to upgrade the speed of the campus connection to CENIC to 100Gbit/sec.
- Continue to expand and improve campus wireless coverage. While some units may need to run their own wireless network for discipline-specific reasons, they should also provide general access via a UCSBNetID.

Future Directions:

- Replace campus fiber to enable updates to campus networking. Currently, there is not enough single-mode fiber for the campus backbone, and the layout is suboptimal, requiring multiple jumpers to link buildings.
- With the UC participating in the Pacific Research Platform, a Science DMZ will be deployed at UCSB, initially in the North Hall Data Center.
- Upgrade building switches to 10Gbps.
- IPv6 and SDN will be rolled out on a case-by-case basis to individual units until it becomes standard.

Security (at various levels)

Security for cyberinfrastructure-enabled research spans many areas, from security of individual devices, to authentication, to intellectual property (IP). The campus has a thorough Information Security Plan, which currently guides specific IT Security issues as well as future plans. IT Security should be guided by the Information Security Plan, and this CI plan only covers major initiatives that impact most faculty and researchers.

Ongoing Projects:

- *Authentication/Identity Management* - Campus is a member of InCommon. Expand the use of the UCSBNetID to other campus systems for uniformity. Campus is working to implement the Central Authentication Service (CAS). These steps will allow UCSB to have federated identity to better enable multi-institution collaborations (e.g. eduroam).
- *Secure Server* - the campus has implemented a secure computing research environment (SCRE) that enables researchers to use sensitive data in a secure environment that complies with most federal guidelines. This program is being more widely advertised and adoption should continue.
- *BYOD* - The explosion of mobile devices and the "Internet of Things" presents ongoing security and collaboration issues. UCSB's expanding wireless network enables the use of such devices, and policy and tools are needed to enable successful implementation.

Future Directions:

- *Data Access Control* - Many machines are set up by students or in units with limited or thin technical support staff. There have been numerous successful break-ins to these systems, resulting in a security risk in instances when computers have sensitive or valuable IP data on them. There needs to be a mechanism to better secure these systems, whether behind firewalls, or having staff act as backup systems administrators.
- *Tools for Backups* - While many machines are backed up by local IT staff or end users, there is no campus-wide solution or service. Data loss is a large risk for units with minimal IT support or funding. The storage component of the solution is partially addressed below, but software and support, where necessary, should be provided centrally.
- *Additional IT Security Support* - While ETS actively identifies break-in attempts or successes, technical support from ETS should increase to address security issues both before and after they occur. For example, additional technical support from ETS in both securing local departments' networks and systems as well as in cleanup and forensic work on systems that have been compromised.

Data Centers/High-Performance Computing

Campus has the recently renovated North Hall Data Center (NHDC), as well as several smaller satellite data centers (CoE, Elings Hall, etc.). Costs for these centers are covered by either units that require their own data centers (DCs) or by campus (for NHDC). Specifically dedicated Data Center hosting enables efficient use of space and electricity on campus. High-Performance Computing is spread across campus in centers of excellence. However, departments and research units outside of traditional HPC centers are increasingly utilizing HPC for groundbreaking research. This transition is in its infancy, thus the moderate numbers of researchers necessitates shared HPC resources.

Ongoing Projects:

- *Resource Relocation* - Continue advocating for moving small, locally operated systems from converted office space into North Hall. This will increase the reliability of the environment for the computers, and may also free up valuable space within individual departments.
- *XSEDE Access* - Outreach and training by the campus SuperComputing consultant enables researchers across campus to gain access to XSEDE resources.

Future Directions:

- *HPC for Underrepresented Units* - Leverage cost-sharing and institutional support for shared HPC resources to serve smaller computationally challenged departments and research units.

Data Storage and Curation

Data centers provide means to do research; networks allow source data to be acquired and results to be communicated; and security allows all this to be done with integrity. The fourth major component of cyberinfrastructure is data curation, or the management of data throughout its lifecycle to ensure its continued accessibility and usefulness.

Today data curation is, literally, an unfunded mandate. Funding agencies now require data management plans to accompany proposals, but there is neither a unified means nor a single funding source by which that management can be accomplished. In many cases, researchers are left looking for appropriate repository solutions, and most researchers will need assistance in preparing data and metadata for submission.

Much preliminary work on the campus's needs regarding curation has already been performed by the Data Curation @ UCSB project. The initiatives in the plan (e.g. the Library Pilot Project, establishing a Data Community, Data Citation Support, and others) should be undertaken, with the Data Curation @ UCSB final report being the guide.

Future Directions (not necessarily covered in the Data Curation @ UCSB report):

- *Large-scale storage* - Even before curation, researchers need access to large-scale storage. Perhaps this is best pursued at the unit level, where the expertise and knowledge of the specific research problems (and, thus, best technical solutions) reside.

There could, however, be economies of scale in fostering stronger collaborations in this area. Smaller-scale storage for desktops/students is covered in the next section.

- *Departmental and other campus data curation efforts* - While the Library is the natural focal point for data curation on campus, it is recognized by all that the Library cannot address the needs of every department and discipline. The work of data curation must be federated, both externally (with discipline-specific repositories and federal initiatives) and internally, with departmental efforts. Two fields stand out as particularly needy:
    - Geosciences: The data curation problems encountered by the geosciences are formidable due to large data volumes and complex computational processes.
    - Humanities: A number of humanists employ computational techniques in their research, yet their departments are, technologically speaking, among the least supportive and most poorly funded.
- *Coordination with systemwide services* - To spend its resources most effectively, campus should ensure that local efforts do not duplicate services being developed and supported by the California Digital Library. Working synergistically will allow UCSB to build on the systemwide efforts to address localized needs.
- *Utilization of ADRL* - Leverage the work done by Alexandria Digital Research Library (ADRL) to develop processes and pathways for researchers to curate and archive their data in the ADRL.
- *Administrative data storage* - Enable long-term data storage for administrative audit purposes.

Ongoing and Completed Campus IT Initiatives

Faculty require basic desktop computing and collaboration tools for both teaching and research. While these services are well provided in certain areas of campus, the hardware and other tools (e.g. word processing, printing) should be more uniformly available. Some of the collaboration tools are in progress, as described below, but hardware acquisition and replacement cycles should be defined at a campus level.

Ongoing Projects:

- *Google Apps* - ETS is moving forward with a campus-wide email/calendar system.
- *File sharing Services* - Campus (ETS and LSIT) is currently working on a proposal for the use of "box" services for file sharing for all UCSB members. The agreement would have the appropriate university protections, as well as HIPPA, FERPA, etc., compliance.
- *Software and Site Licenses* - In addition to local units' purchasing of software, the campus generally has bought software either by volume purchases or site licenses, depending on the level of interest, cost, etc. This is supported by a FTE in LSIT, and this model should continue and grow to replace the loss of SoftwareDepot. Expanding volume purchases to site licenses will result in reduced efforts in tracking usage/billing/installation/etc., and for expanded use of software for both research and

teaching (e.g. MatLab). Open-source alternatives should also be investigated as warranted.

Future Directions:

- Leverage the size of the UC to provide basic desktop and productivity tools to all faculty and staff, enabled by the appropriate technology, whether hardware, virtualization, cloud services, etc.