Executive Summary

*Excellence and Engagement: An Academic Plan for UCLA* gives voice to UCLA’s aspiration to be “nothing less than [an] exemplar of the American public research university for the 21st century, dedicated to public values as well as world-changing research and education.” Realization of that aspiration depends on the campus’s ability to leverage technology in service of innovative and ground-breaking research. The faculty-led Institute for Digital Research and Education (IDRE) provides the program voice for UCLA’s cyberinfrastructure planning and strategy efforts, translating faculty input from the main and medical campuses to policies for the computing and storage services, strategic planning input for the cyberinfrastructure needed for research, and directions for research within cyberinfrastructure itself. An institutional strategy for the planning and deployment of information technology resources was first articulated in the *UCLA IT Strategic Plan: 2009-2018* based on input from a campus-wide information technology planning task force. This plan has since been followed by a Research Informatics Strategic Planning (RISP) effort to ‘identify current and future research directions to anticipate the types of data that researcher will be using and how it is collected, process, accessed, analyzed, leveraged, and shared.’

UCLA is unique in that cyberinfrastructure decisions are driven by both large-scale planning initiatives such as RISP and continuous interactions between faculty and campus IT personnel. The faculty involved within the ongoing RISP effort provided campus-wide validation on several key infrastructure areas included the need to establish shared resources that extend informatics and research capacity; enable a broad base of researchers with access to tools, services, and support; respond to the challenges created by mobile computing and social networking; and provide support for big data in order to create accelerated and novel opportunities for non-traditional research analysis and decision making. Perhaps most critical for faculty engaged in data-driven research is the need for a flexible research network based on a scalable Science DMZ architecture over a point-to-point solution.

UCLA’s strategic plans are responsive to the changing nature of technology-enabled research, advances in computing technologies, and the organizational structure of the campus. The computing environment at UCLA is balanced among seven organizational entities. Information Technology Services (ITS) supports the campus through enterprise applications, information management, collaboration solutions, computing platforms, storage, data center facilities, and the campus-wide voice and data networks. The Office of Information Technology (OIT) focuses on developing and operating – through IDRE’s Research Technology Group (RTG) – shared campus-wide computing and storage services and facilities with an emphasis toward research. The Office of Instructional Development (OID) provides faculty with expertise related to instructional media and technology. Academic computing units provide research and instructional support to faculty and students at the school, division, and/or department level. The David Geffen School of Medicine Information Technology Services group supports UCLA’s medical researchers and maintains their research data. And, finally, the Information Technology Services unit of the University of California Office of the President (UCOP) provides leadership,
in partnership with the campuses, for University-wide strategic computing initiatives and policies.

UCLA’s overall vision is to capitalize on the strengths of the associated IT entities and build a core set of end-to-end, cross-unit IT infrastructure capabilities that blend local and consolidated services to provide high-quality, highly responsive, and shared IT services that are robust, secure, recoverable, cost efficient, and scalable. This core would include a comprehensive architecture of compute clusters, cloud-based storage, large-scale data archives, and data collection systems linked via the deployment of a high-bandwidth network and integrated through the use of efficient scientific workflow technologies. Such a system will provide the UCLA campus with the ability to more easily migrate data from source to storage, take full advantage of available data and compute resources, process data through submission of scientific workflows from anywhere, and to continuously identify and address impediments to modern transformative research involving large, complex multidimensional data sets now and into the future.

Completed Cyberinfrastructure Upgrades
The major campus cyberinfrastructure improvements completed in the past ten years focused on resources to augment the support and services provided at the local level, common computing and storage offerings, and the consolidation of redundant systems. In this same time frame, UCLA partnered with the Corporation for Education Network Initiatives in California (CENIC) to establish connections to the other University of California campuses and other California institutions. In summary, over the past ten years, the UCLA IT organizations have:

- Established a 100Gbps connection to CENIC’s CalREN-HPR/L2 network, providing high-bandwidth connectivity to the other campuses of the University of California, other California institutions, and national and international research networks (including Pacific Wave, Internet2, National Lambda Rail, ESnet, etc.).
- Established a 10Gbps connection to the California OpenFlow Testbed Network (COTN) operated by CENIC to facilitate software-defined networking investigations and experimentation. (This enabled UCLA to connect its InstaGENI rack to the GENI meso-scale network.)
- Developed shared research computing facilities that include the UCLA Shared Hoffman2 Cluster which currently has 1,276 64-bit nodes (13,304 processors), the Dawson 2 GPU cluster (capable of 192 Tflop with 288 GPUs) and the Brain Mapping Institute cluster (3,328 cores).
- Developed Cloud Archival Storage Service (CASS) a multi-petabyte virtualized NAS for research and other big data. Critical goals for this effort included protecting UCLA’s research data and provide faculty with efficient and affordable storage linked to the high-performance computing cluster.
- BCP 38 - UCLA has implemented all standard filters. Outbound from campus: all packets are blocked that do not have a source IP address that has been assigned to UCLA. Inbound from campus departments and managed subnets: all packets are blocked which do not originate from address space assigned to that department or...
subnet. Inbound to campus: all packets are blocked originating from campus address space, reserved address space, private address space, and unallocated address space. The above filters are applied to both IPv4 and IPv6 traffic.

❖ Upgraded the entire fiber optic backbone for the campus. The core fiber infrastructure now consists of 864 strand single-mode ribbon fiber cables and 96 strand ribbon fiber cables into all research buildings.

❖ UCLA is an active member of InCommon and operates an Identity Provider and is a Certificate Service subscriber. The UCLA Logon ID also satisfies the standards of the InCommon Federation and the University of California’s UCTrust, and can therefore be used to identify an individual as a member of the UCLA community, and thus eligible to gain access to electronic resources outside of UCLA.

❖ Deployed IPv6 throughout the campus backbone network, on major public-facing services (e.g. www.ucla.edu, smtp.ucla.edu, etc.), portions of student housing, and on the campus eduroam wireless network.

❖ Deployed PerfSONAR network performance monitoring extensively across UCLA’s border, core and Science DMZ networks.

❖ Expanded IDRE’s research data centers (installation of the POD, a high-density containerized data center) to support expected growth in high-performance computing in a space and power efficient manner.

❖ Promoted campus use of eScholarship, the UC-wide open-access repository for UC-affiliated research and publications (UCLA is currently the largest contributor to eScholarship, with almost 20,000 open-access research titles). Through eScholarship, research from all ten campuses of the UC system is made available to the public as a means of increasing their reach and visibility.

❖ Consolidated the bulk of the campus learning systems into a single platform for web-based collaboration and learning. After a detailed assessment of functional and technical requirements, the campus based their Common Collaboration and Learning Environment (CCLE) on Moodle, an open-source learning management system.

❖ Consolidated campus faculty-staff e-mail into an enterprise solution; student e-mail was outsourced to Google gMail.

❖ Created the UCLA Campus Data Warehouse, “a read-only central repository of integrated, timely, and consistent data for reporting and analysis” (ITS CDW website), and upgraded the Contracts and Grants Administration systems.

❖ Built out Library storage capabilities and expanded online access to academic and research databases.

❖ Worked with partner institutions like UC Berkeley and UC San Diego to establish off-site disaster recovery facilities to provide business continuity in the event of all encompassing, localized, or personal events.
Ongoing campus Cyberinfrastructure upgrades
Campus cyberinfrastructure improvements currently underway fall into two categories. The first involves the installation and implementation of the 'next-generation' hardware and software solutions needed to replace or upgrade existing systems in order to support evolving academic and computing standards. The second category involves the development of robust systems and facilities to accommodate escalating demands for compute power, network speed, security, storage capacity, data access, and technology-enabled research and pedagogy. The UCLA IT organizations are currently:

❖ Formalizing the campus Science DMZ, updating our implementation to match current community standards and expectations, and implementing prototype software defined networking (SDN) capabilities on campus to support large research data flows in and out of the campus data center.

❖ Enabling translational use of medical data for research through initiatives such as the NIH Big Data to Knowledge challenge and the Translational Informatics Platform currently under development by providing an integrated service of database, data analysis, workflow and computational resources.

❖ Developing HIPAA-compliant MedNet data storage and computational facility.

❖ Developing action items related to IT-related planning efforts through various campus initiatives including a research infrastructure summit focused on the humanities, arts, and related disciplines, and the Research Informatics Strategic Plan (campus-wide effort to quantify current research informatics needs).

❖ Expanding wireless network technology deployments across campus and upgrading all locations to the 802.11ac standard to provide greater speed, range, and availability.

❖ Developing strategies and infrastructure for hybrid and blended course offerings and fully-online courses.

❖ Designing and implementing Opus, an information system of record for academic appointees. Opus will simplify the academic review process, allow faculty to manage their profile data, ensure data fidelity.

❖ Improving academic unit support and services through a mix of initiatives that ranges from staff reorganization to hardware refreshes.

❖ Developing production-level hosting services through Information Technology Services and creating a single point of information about UCLA computing resources, collaborative tools, and research support services.

Ten-year Cyberinfrastructure Plan (to be completed by 2020)
The action items associated with UCLA’s long-term cyberinfrastructure plan have been developed through extensive discussions with relevant faculty through the RISP effort and ongoing IDRE activities on both the main and medical campuses. They are focused on the seamless integration of all aspects of technology into the academic workflow to facilitate and support innovative interdisciplinary and cross-institutional research at a level that is flexible,
scalable, and sustainable. This focus requires expansion of the campus’s current compute capabilities; compute and storage capacities; data access, management, and dissemination strategies; and networking capacity and speed. The cooperation and coordination of local, central, and administrative units are critical to the success of these efforts. In the next six years, UCLA’s IT community will:

❖ Connect key research facilities, data centers, and computational resources through a Science DMZ network at 100Gbps. The goal is to enable seamless service and support for research network requirements and establish a unified funding model for ongoing operations and maintenance.¹

❖ Enable the Science DMZ and key research buildings to support software-defined networking (SDN) to enable intelligent routing of large-scale data flows and low-latency-dependent traffic, and as the basis for advanced networking research.

❖ Create a cooperative research zone to foster collaboration that overlays existing academic structures to facilitate interdisciplinary work and data sharing.

❖ Based on RISP recommendations, provide a base level of no-cost, managed data storage in combination with enacting research data sharing plans to incentivize faculty researchers to register their data, provide metadata and documentation so their research is discoverable and usable, and store backup data in one of several campus-managed data storage services.

❖ Work with the UCLA Library to create an institutional data archive solution for long-term management and preservation of campus research data and IT assets and investments. This effort will develop services that add value to research data through curation; identify data commonalities; build a framework for a curation workflow service; and enhance data reuse, optimization, and discoverability.

❖ Coordinate upgrades to computing and telecommunications systems so that they may respond flexibly to changes in research, pedagogy, and our academic culture.

❖ Upgrade all departmental network links to the campus backbone network so that researchers who do not need to be connected to the Science DMZ may take full advantage of increased computing speeds.

❖ Incorporate Cyber-Physical Systems (CPS) into UCLA’s computing environment to facilitate ongoing research advances in smart manufacturing, embedded computing and communication systems, distributed sensor networks, mobile data collection, workflows, and pervasive computing.

❖ Deliver technical solutions as required by the UCLA Grand Challenges defined by the Chancellor and Office of the Vice Chancellor for Research. (The first Grand Challenge project is to make the Los Angeles region 100% sustainable in water and energy without harming biodiversity by the year 2050.)

¹ Funding will be providing through UCLA’s Technology Infrastructure Fee (TIF)(1) which pays for labor, equipment, maintenance and a planned upgrade cycle for critical common use infrastructure.