

## ***Executive Overview***

UAB is a major international research university with over \$433M in external funding. The central UAB IT organization provides a 10-gigabit, VLAN-capable campus backbone with connections to the commodity Internet, Internet2 and Transit Rail, along with a dedicated 10 gigabit Ethernet research network for on-campus connectivity of core research assets. The CIS department maintains its own data center which houses over 300 servers, as well as nine research labs and six instructional lab facilities totaling over 175 workstations. CIS owns and operates several large HPC clusters, including 600-core, 256-core, 144-core and 64-core systems. The department has a permanent staff of professional system administrators as well as student IT assistants to support the department's IT operation.

## ***University-wide Facilities at The University of Alabama at Birmingham***

UAB is the only university in the state of Alabama to receive the highest categorization by the Carnegie Foundation (RU/VH – Research University/Very High). The University had over \$433M in external funding in 2007 and was ranked among the top 25 universities in the nation in NIH funding in 2008. An extensive support staff is available for grants and contracts administration and accounting.

UAB is the largest employer in the state of Alabama. Eight UAB Hospital specialty programs are among the nation's top 50 — six are in the top 25 — of the 16 categories evaluated at America's 4,861 hospitals this year by *U.S. News & World Report's "America's Best Hospitals 2009-10"* issue. UAB is also a leading member of Internet2 and SURAGrid.

## ***UAB Campus Network***

The campus network backbone is a 10 gigabit redundant Ethernet network with 480 gigabit/second backplanes on the core routers. For efficient management, a collapsed backbone design is used. Each campus building is connected using gigabit Ethernet links over single mode optical fiber. Within multi-floor buildings a gigabit Ethernet building backbone over multi mode optical fiber is used and Category 5 or better unshielded twisted pair wiring connects desktops to the network. Computer server clusters are connected to the building entrance using gigabit Ethernet. Each floor contains one or more switches connected to the building backbone using gigabit Ethernet. Desktops are connected at 100 megabit or 1 gigabit speeds.

The campus network is VLAN-aware and provides the capability to extend departmental networks to multiple, geographically-separated buildings on campus, or to any site on the Alabama Regional Optical Network (ARON) or the National Lambda Rail. The VLAN functionality also allows departments to utilize central IT services such as firewalling.

The campus also has a separate 10 gigabit fiber research network which currently connects the three data centers which house high performance computing clusters on campus (the UAB IT, CIS and Engineering data centers). This network supports the UABgrid initiative which aims to use the campus cluster resources for grid computing.

The campus wireless network blankets classrooms, common areas and most academic office and research buildings and is available free of charge to students, faculty and staff.

## ***UAB Connections to the Internet***

UAB connects to the commodity Internet, Internet2 and Transit Rail via a 10 gigabit Ethernet fiber connection on the ARON to Atlanta. Qwest provides our commodity Internet connection on a 1 gigabit Ethernet connection with 300 megabits of bandwidth currently available to the University. Our Internet2 network is provided by a 1 gigabit Ethernet connection to the Southern Crossroads (SoX) gigaPoP, and from there to the Abilene network. Our Transit Rail connection is via a 1 gigabit Ethernet connection which we share with Clemson and Georgia Tech. We also have a backup commodity Internet connection provided by DeltaCom via an OC3 link.

## ***Department of Computer and Information Sciences (CIS)***

### **Overview**

UAB CIS maintains a state-of-the-art IT infrastructure to support instruction and research. This includes a central server facility housing over 300 servers. There are also four instructional and two open computer labs with a total of over 130 workstations for classroom instruction and student use. Research facilities include one undergraduate and six graduate laboratories.



### **Datacenter**

UAB CIS IT manages five high performance computing clusters. Acquired in December 2010, the Red Mountain cluster is a hybrid compute/storage system with nearly 20 Teraflops of GPU processing power, over 5 Teraflops of general CPU processing, and half a Petabyte of storage.

Olympus is a 64-node compute cluster with each node consisting of two 3.2GHz Intel Xeon processors with 4GB of memory. The cluster includes a low-latency Infiniband network fabric in addition to a secondary gigabit Ethernet network fabric. It also provides 4 terabytes of storage managed by the IBRIX parallel file system. Olympus was deployed in 2005.

The visualization cluster is used to render the image on the viswall housed in the visualization lab (see Research Laboratories below). The five rendering nodes consist of dual-core, dual-processor AMD Opteron 270 servers with dual-head NVIDIA GeForce 7800 graphics adapters and 4GB of memory. A sixth similarly-configured node serves as the head node which contains 8GB of memory and serves as the master node for the visualization cluster. This system was installed in January 2006.

In Fall 2007 CIS entered into a partnership with UAB's Chemistry department to host a 75-node quad-core Xeon cluster (600 processing cores) named Ferrum. Each node consists of two quad-core Intel Xeon processors with 12GB of memory. The cluster has an Infiniband network fabric and 9TB of storage. Cluster performance is 4.7 teraflops/second. Compute cycles are shared between the two departments.

In 2009 CIS partnered with the Department of Justice Sciences to obtain an 90 terabyte storage cluster in support of our Computer Forensics program. The front-end cluster consists of an 18-node dual-processor, quad-core Intel Xeon Nehalem architecture with 12GB of memory per node. Each node has a direct fiber connection to the storage SAN, which is a Compellent Series

30 SAN with 90TB of tiered storage featuring automated block-level data migration between tiers. This system was deployed into the UAB IT data center and is managed remotely by CIS.

All the clusters have access to the UABgrid via a dedicated 10 gigabit fiber research network. This distributed campus-wide computational infrastructure also includes clusters housed in other areas of campus. As of Summer 2009, these other assets include an IBM BlueGene cluster and a 128-node Intel Xeon cluster housed at the School of Engineering.

The CIS data center is a 720 square foot space featuring 12 server racks housed on raised flooring, with dedicated power circuits and a highly controlled operating environment served by a primary 30-ton air conditioning unit, two secondary 5-ton air conditioning units and remote environment sensor monitoring.

The production computing servers run Linux and Microsoft Windows operating systems and provide support for standard departmental services such as name service, user accounts and home directories, domain control, file serving, data backup, email, and web. Hardware assets for these services include two Dell PowerEdge 2950 Intel Xeon dual-processor, dual-core servers; four Dell PowerEdge 1950 Intel Xeon dual-processor, dual-core servers; five Dell PowerEdge 2850 Intel Xeon dual-processor, dual-core servers; four Dell PowerEdge 1850 Intel Xeon dual-processor, dual-core servers; one Dell PowerEdge Intel Xeon dual-processor server; five Dell PowerEdge 2650 Intel Xeon dual-processor servers and one Dell PowerEdge 1650 Intel Xeon server.

20 terabytes of storage is housed in various internal and external chassis for data storage. This storage is available via NFS, iSCSI and fiber channel connectivity to the servers. In addition, a Qualstar TLS-5433 SAIT tape library with approximately 30 terabyte capacity is available for data backup.

Much of the production computing infrastructure has been virtualized since 2007 and many of the core department services are served from virtual machines running from a farm of VMware Virtual Infrastructure 7 ESX servers with dynamic online load balancing and failover capability.

The data center also houses several of the CIS high performance computing clusters discussed above, which total over 245 servers.

## **Research Laboratories**

The department has nine research labs that house workstations for PhD students as well as communal workstations for R&D and laboratory guests. These include the High Performance Computing Lab, the Software Composition Lab, the Knowledge Discovery and Data Mining lab, the Collaborative Computing Lab, the Graphics Lab, the Visualization Wall Lab, the Computer Forensics Lab, the Natural Language Processing Lab and the Undergraduate Honors Research Lab. Together, these labs house approximately 45 workstations of varying age and capacity.

The Visualization Lab is a specialized lab founded in January 2006 that contains a 13 megapixel, nine tile visualization wall that measures approximately 10' wide by 8' high. The unified image is created by 9 DLP projectors connected via optical DVI cabling to the 5 rendering nodes in the visualization cluster (see Datacenter above). The nodes consist of dual-core, dual-processor AMD Opteron 270 servers with dual-head NVIDIA GeForce 7800 graphics adapters and 4GB of memory. A sixth similarly-configured node serves as the head node which contains 8GB of memory and serves as the master node for the visualization cluster.

## **Instructional and Open Laboratories**

Three instructional labs have been outfitted with student and instructor computer stations consisting of Dell Optiplex machines running the Microsoft Windows XP and Ubuntu Linux operating systems. These classrooms are equipped with 20-36 student stations each, including handicapped-accessible stations. Ceiling-mount projectors are also available in these rooms for computer-based instruction and seminar presentations. CIS intranet and Internet access is available from each station. In 2007, most rooms were outfitted with interactive pen displays at the instructor station, projector-integrated document cameras, and synchronization software to allow the instructor to control student PCs. These facilities are heavily utilized across the undergraduate, graduate and non-major curriculum as well as providing space for seminars hosted by both in-house and visiting faculty and students. These labs contain a mix of Dell Optiplex workstations, including GX780, GX755, GX745 and GX620 models.

Two open labs are available for undergraduate and graduate use for research or coursework completion. The labs are open seven days a week and contain a total of 28 Windows XP, Linux stations and Apple Macintosh stations. The labs contain a mix of Dell Optiplex and Apple iMac models.

## **Other IT Infrastructure**

The department has a Polycom VSX8000 series videoconferencing unit, which is housed on a mobile cart with a 42" plasma monitor and a 3-microphone audio system.

The department maintains a significant array of portable resources in order to support departmental curriculum and research. These resources include laptops and projectors available for faculty and student use on a checkout basis.

## **Network Connectivity**

The department network has gigabit Ethernet capability in all areas of the department. All servers and workstations are connected to the network at this speed. The department is linked to the UAB campus backbone at 100 megabits/second and to the campus research network via a 10 gigabit/second dedicated fiber link.

## **IT Management and Personnel**

The CIS Department has a full-time systems administrator, a half-time systems administrator specializing in cluster administration and a staff of 2-4 student IT assistants that perform all department IT functions. The staff manages all aspects of CIS IT, including procurement, deployment and maintenance of all department hardware, software and services.