Annual Report

The Institute for Next Generation IT Systems (ITng) is a joint university/government industry research organization located within NC State University’s College of Engineering.

Mission statement: to provide a forum for collaboration between partners, faculty and students to research solutions that address current and evolving IT challenges. The Institute works at the intersection of research, practice and policy to address IT needs. ITng focuses on four key areas: Health & Well Being, Educational Innovation, Energy and Environment.

The Institute, which is staffed with seasoned IT professionals, listens carefully to present and emerging needs to cover areas such as:

- Security
- Cloud Technologies
- Computing Infrastructure
- Software Development
- Proof-of-Concept Infrastructure

A key part of the Institute is its professional data center quality lab, also known as the Oscar lab. The Open Systems Collaboration and Research (OSCAR) Lab is an active lab and datacenter facility that supports projects for ITng Research and Services. OSCAR houses equipment and expertise capable of constructing innovative test beds to further the state of the art in IT. With more than 2,000 square feet of raised floor space with 32 tons of cooling, the facility also provides ample conditioned power service (i.e. UPS protected) with generator backup and full network connectivity to the national Research & Education Networks (RENs). The Red Hat Corporation has generously supported the lab space. The OSCAR lab can and does support many of ITng’s infrastructure needs.
**Personnel**

The organization began this fiscal year with four full time employees: **John Bass**, the director of the Oscar lab & a senior technical engineer with extensive involvement in software engineering and networking; **James Hall**, a senior technical engineer with extensive experience in both software and hardware development, Lee **Ann Clark** the business officer for the Institute; **John Streck**, the Interim director of ITng & a senior technical engineer and finally; **Dennis Kekas**, the Executive Director of the institute. Additionally there are a number of student interns (which averages to approximately 7 continuously engaged) and as needed specialized skills from University Temporary Services (UTS).

Near the end of 2013, the organization hired another full time staff person (Ryan Kilby) specifically to fill the need for a skilled software engineer with capabilities to expand the quantity of projects that can be undertaken simultaneously by the Service Center can (a key necessity for sustainability and growth).

Other personnel engaged in the continuous operation of the Institute are **Drs. Mladen Vouk, Rudra Dutta, Laurie Williams, David Wright**; support from CSC financial staff notably **Ann Hunt & Jami Boylan**. The Institute also funds a number of **RAs** (research assistant) as part of various on going grant activities.

**Collaborations**

ITng organization is spread primarily between two locations, offices in Monteith Research Center (MRC) and the Oscar lab/offices in the Venture-3 complex. It enjoys interdisciplinary collaborations with faculty across North Carolina State University with notable joint engagement with the Computer Science, Electrical and Computer Engineering, College of Management, Materials Engineering, the College of Natural Resources; with faculty and staff in Dr. Lomax’s Springboard facility, the faculty and staff of Laboratory for Analytical Sciences, the Friday Institute, the Institute for Advanced Analytics to name a few. The Institute also collaborates with Agencies in NC state government and partners with Centennial Development as subject matter experts in discussions with their current or prospective clients.
Notable Achievements

For this past annum, the Institute has seen a number of changes including the completion of the highly productive SOSI grant, the beginning of a new partnership with the Laboratory for Analytical Sciences, infusion of significant capital investments to Oscar lab (new systems and re-engineered work spaces) and the needed growth in the technical staff.

- New Systems and computational platforms ($1M plus additions) as part of Oscar lab named to be the LAS outside lab facility:
  - Computational systems (IBM Flex and Power Platforms)
  - Enterprise Class Storage (NetApp filer with over 90TB of storage & EMC Isilon with 200TB of storage)
  - New network core (Cisco 4500 & 5548 10Gb L2/L3 switches)
  - Data Center UPS (APC enterprise level UPS)
  - IBM BlueGene/P (expected May ’14)

- Completed install & upgrade of the CentMesh network:
  - Nodes installed and upgrades to base systems completed for code and hardware.

- Doubled the collaboration space in the Oscar lab
  - Expanded the collaboration space to afford the lab to engage twice the number of students in a highly interactive environment.

- Finished the Trusted Smart Room
  - Multi-media conference room finished and ready to come on line
  - Tested interaction with the Titan scope in MRC AIF scope
  - First pass completed of software upgrades to VCL software to allow federated reservations of multiple assets via the VCL cloud management software.
  - Additional integration work of other assets to the XaaS offering on hold until lab up-fit for the LAS infrastructure support is completed.
• Hosted the 1st CentMesh (UAV) Challenge
  o Planned and executed the first programmable UAV use of the CentMesh network
  o Successful student challenge in their use of programming skills to program a hexa-copter to execute autonomously a given task. This was covered by local press and was very successful.

• Oscar projects
  o People First Tourism project – Completed 3rd generation of website (peoplefirsttourism.com). Awarded RISF grant from Chancellor. Currently conducting workshops for UX, Analytics, and Social innovation business model; in discussions with Institute for Non-Profits and OTT for business spinoff; and currently developing an enhanced texting interface in partnership with Bandwidth.com.
  o PDSS project with Pentair – Developing 2nd generation of the Pentair Data Storage System (PDSS – developed in ITng), a sensor data storage, management and analytics platform deployed in swimming pool and aquaculture systems. This version of PDSS will include a customer premise Linux box to aggregate sensor data from the customer premise and push data to the PDSS backend.
  o NeTS+ project (Dr. Dutta) – Developing an s/w architecture to support Dr Dutta’s NeTS+ ChoiceNet concept (marketplace of interoperable network components and services used to construct more sophisticated network services in an economically optimized fashion). This project will leverage compute assets on the GENI network.
  o Construct an Open Stack cloud infrastructure for LAS – Currently building a self-service machine deployment system for LAS using OpenStack.
  o Researching emerging open source projects for LAS compute workflow – Apache Mesos (compute cluster job management supports Hadoop, Spark, MPI, etc.), Apache Spark (streamed data cluster computing framework), Storm (streamed data cluster computing framework from Twitter and Groupon), Shark (SQL interface to Spark), Druid (massive i/o streaming storage), and Docker (Linux containers with union file system).
  o Instrument the lab for continuously monitoring – All switch interfaces, UPSes, storage, and services are monitored with Cacti, Centreon, and Netapp monitoring s/w. Working to incorporate active monitoring of Computer Room Air Conditioner (CRAC) units to determine utilization trends of these units.
o Developing datacenter management web app – Will be used to manage components in a datacenter for inventory control, connectivity, capacity management, and location.
o Developed sustainable policies, procedures and practices for part time student hiring and onboarding into OSCAR lab.
o DELTA OAAI – Working with DELTA and Marist University to build, integrate, and deploy an instance of the Open Academic Analytics Initiative (OAAI) system to identify academically at-risk students early enough in the semester to intervene for a more positive outcome.
o Market Based Conservation Initiative (MBCI) Web Application Implementation – Designed and built a web application to automate the process of landowners applying for participation in Navy/Marines offset conservation funding for strategic lands under the Marines training flight paths. This work was funded by a grant in the College of Natural Resources.
o Modernization of the Transportation Information Management System (TIMS) – The TIMS system is used statewide to develop bus routes for public school systems. ITng helped re-architect this system to be centralized and cloud-based instead of installed locally in 115 school systems.
o Lenovo tools development – Created a web application, which leverages Google App Engine to make standard education-domain surveys developed by the Friday Institute available to all school districts.
o Built LAS computing infrastructure – Stood up Netapp 3170 and migrated all data from a decommissioned Netapp. Built Active Directory Domain Controller system for LAS. Stood up and configured IBM Flex system for use in LAS. Stood up and configured networking infrastructure to support the above systems.
o 6fusion Collaborative Infrastructure Support – Hosted 6fusion systems for collaborative testing and development.
o DELTA Syllabus Builder – In discussions with DELTA to architect, design, and build a syllabus builder feature into wolfware to automate the tedious data entry of course information, schedule, and gradebook.
o Centmesh Systems Support – Built, tested and deployed current systems. Repaired factory defect in all PCs. Created new boot option to leverage Aruba production AP network.
o IAA Systems Hosting – In discussions with IAA to host their critical systems in OSCAR lab.

R & D engagement areas

- LAS – engagement with the LAS instrumentation working group
- Cloud development – building expertise for development of new cloud platforms, specifically Open Stack implementation requested by the Cloud class.
- Working with the NCSU School of management, the IBM Power Systems development team to exercise key analytic software of IBM clouds on x86 & Power systems.
- Participating in the IBM Power8 Early Ship Program