THE UH-ATT LAB: STATE OF THE ART TRAINING CENTER FOR COMMUNICATIONS

Sergio Chacon, Driss Benhaddou, Mequanint Moges,
Engineering Technology Department
University of Houston
schacon@uh.edu, dbenhaddou@uh.edu, mmoges@uh.edu

Abstract
The University of Houston's College of Technology AT&T Laboratory (UH-AT&T-Lab) was developed in November 2006 consisting of a state-of-the-art training center and advanced campus-wide research and education telecommunications network. Thanks to a grant from Southwestern Bell Communications (SBC), now AT&T, and in collaboration with Fujitsu Communications, Cisco Systems, Juniper Networks, EMC, VMWare, and others, the mission of the UH AT&T Lab has been to serve as a world class technological hub for research, training, education, and community outreach.

This paper presents the important design considerations such as technological connectivity, operations and maintenance, and security policies in the training center and the UH-COT-NET infrastructure. In addition it presents some of the instructional support it is providing not only to current students but also to individuals who may seek training opportunities for professional certification.

The UH AT&T Lab training center, with its workstations, videoconference area, and telecommunications room, is used for a variety of training and educational activities. Seminar and lecture series, technical training courses, technical certification workshops, videoconferences, and student educational activities are some of the events organized in the Lab. The telecommunications room in the Lab serves as the hub that facilitates communication and provides access to devices used in world-class research and education initiatives within and outside the institution.

1.   Introduction

The University of Houston College of Technology Research and Education Network (UH-COT-NET) is a college wide high-speed network that interconnects the college research and education laboratories to regional and National Networks. With its 2 Gbps connectivity to Lonestar Education and Research Network (LEARN), it provides capabilities to peer with Internet2 IP and ION networks, and Europe's GEANT2 network. The UH COT NET is also connected to the AT&T backbone through its U-Verse connection. Through this connectivity, Engineering Technology faculty and students engage in research projects [1-3] and undergraduate and graduate students learn by working in real-life scenarios and using modern network equipment.

The laboratory was created in November 2006 thanks to a grant from Southwestern Bell Communications Inc., now AT&T. The mission of the UH AT&T Lab is to become an international technology hub by providing technical training and education on networking technologies to UH and non-UH students, promoting and collaborating in research projects with other research institutions, and serving the community by involving schools and non-profit organizations in educational initiatives related to telecommunications and computer networking. With these goals in mind, resources were allocated to build a state-of-the-art training center, the UH AT&T Lab, and to upgrade and expand the Optical Networking Research Lab's telecommunications network, now called UH-COT-NET, to provide the UH AT&T Lab with connectivity to regional and international networks.

This paper has been divided in two sections. The first section describes the UH AT&T Lab and its operation and maintenance, how it is used for training and education, its industrial partnerships, research collaboration efforts, and involvement in outreach projects. The second section gives an overview of the UHCOTNET and how its telecommunication infrastructure has evolved since its creation, its connectivity to regional and international research and education networks.

2.   UH AT&T Lab

The UH AT&T Lab is located in rooms 110-H and its telecommunications room next door in room 110-J in the Technology Annex Building in the University of Houston. Figure 1 provides a view of both rooms 110H and J. The training center in room 110-H is equipped with sixteen (16) Dell Optiplex GX620 workstations for students and one (1) in the podium for the instructor running Windows XP. Each workstation is provided with connection to the campus Internet and to the UHCOTNET testbed. In addition, each workstation has the necessary software for the technical or educational workshops including VMWare, VoIP tools, and network analyzers. The lab has projector, screen, HD Plasma TV, sound system, mobile HD Polycom videoconference equipment and conference table that sits 10 people.

Fig. 1. UH AT&T Lab, rooms 110H and J

The Telecommunications room 110-J connects the UH AT&T Lab to UH Internet, UH COTNET and UH AT&T Lab equipment that includes Cisco Systems routers and switches, Juniper Networks routers, Fujitsu SONET multiplexer, AT&T U-Verse, Linux and Windows servers, DHCP, DNS, VPN and RADIUS servers used for production, projects and workshops. Figure 2 shows the telecommunications room and some of the equipment.

Fig. 2. Telecommunications Room 110-J

2.1 Operation and Maintenance

The UH AT&T Lab PI and Lab Manager are in charge of the operation and maintenance of the lab. Because the lab is used for many projects and events sometimes running at the same time, a scheduling and equipment assignment system is kept to better allocate resources and maintain them. The College of Technology IT works together with the PI and Lab Manager in workstation maintenance and security aspects of the operation of the lab. Student access to the lab resources requires previous authorization by faculty or lab manager. Students in technical workshops are given specific access to only the equipment and software they need.

2.2 Training and Education

The UH AT&T Lab hosts a variety of technical seminars and workshops and educational events. Technical certification workshops, technology seminars, training courses, research project presentations, and other special events are among some of the events hosted. Reservations for the events are made in advance and a list of upcoming events is maintained and posted in the Lab's website [4]. In most cases, technical workshops and training courses are scheduled six or even twelve months in advance.

Educational activities, such as visits and projects implementations, in the Lab by UH students are coordinated by faculty and the lab manager. These activities are mainly for students working on class-specific research projects in networking and telecommunications. For instance, students are asked to study the equipment found in a Central Office (CO)–type environment and come up with possible architectural alternatives that can be designed. Among the Engineering Technology undergraduate and graduate courses that use it are Telecommunications, Data Communications, Network Routing, Computer Networks and Network Security. The project based courses defined above have been very successful in transferring real world knowledge to students and also resulted in conference publications [2-3].

2.3 Industrial Partners and Research
Every year more than 25 technology workshops and seminars given in the UH AT&T Lab are organized in collaboration with industrial partners. The Lab offers technical certifications with Cisco Systems (CCNA), Juniper Networks (JNCIA-ER), EMC (Information Management and Storage), VMWare (Server Virtualization ESXi Server). The International Society of Instrumentation (ISA) has been partnering with the Lab for almost three years offering courses in Control Systems, Automation, and Industrial Instrumentation (see Fig. 3). A new certification course will be offered in 2010 in association with the Institute of Electrical and Electronics Engineers (IEEE), the Wireless Engineering Certification (WCET), an international certification for professional engineers. Another certification in the works with AT&T, UH and Houston Community College is the Mobile Learning Certification (MLearning), the first certification of its kind in the world in which students will learn how to design and use mobile devices for instructional purposes.

Fig. 3. ISA Workshop

Also, the UH AT&T Lab's technical collaboration with other research and educational institutions are presented in the Lab. Internet2 and Lonestar Education and Research Network members have worked with UH faculty in research projects that have involved the UH AT&T Lab. Fig. 4 shows one such project is the DRAGON project (now ION).

Fig. 4. DRAGON Workshop Dec 2009

The Lab has participated in various demonstrations of the project at international level such as Super Computing Austin 2008, Internet2 Member Meeting 2009, and a demonstration of DRAGON in collaboration with Texas A&M, University of Texas, LEARN, and Masaryk University, Czech Republic transmitting High-Definition Videoconference using Co-Universe between Brno and College Station, Texas. A diagram of the demonstration is shown in Fig. 5. In addition, the Lab has hosted two DRAGON workshops in 2007 and 2008 and is looking to use its ION network to provide additional ION workshops in 2010.
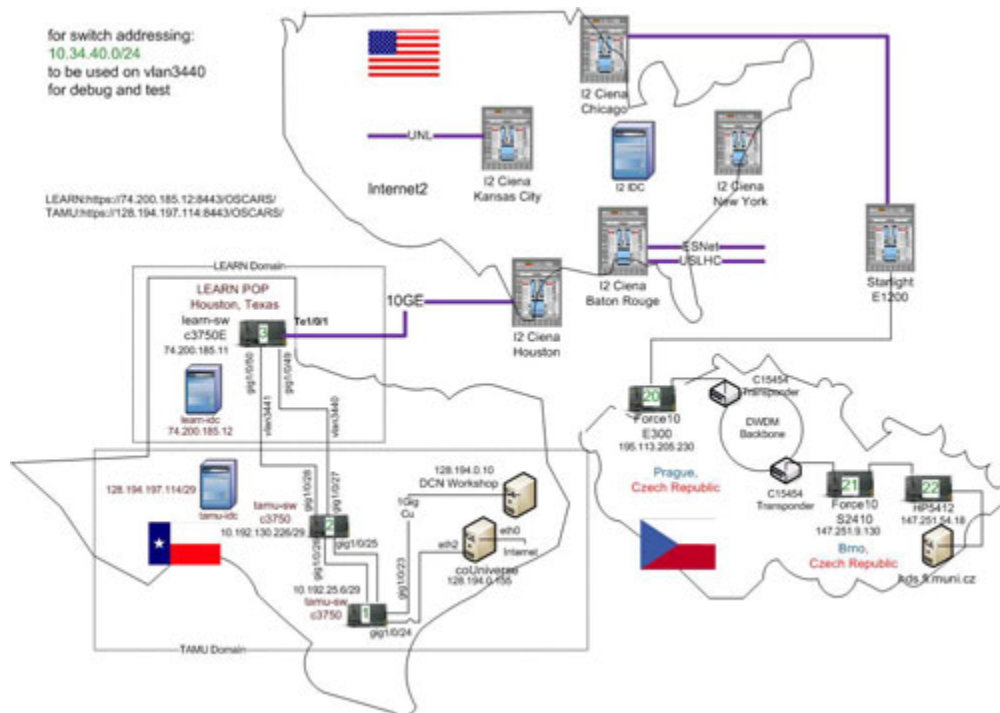

Fig. 5. Demonstration HD Videoconference, UH TAMU I2 Masaryk

In April 2009, the UH AT&T Lab became the first research lab in a university to have U-Verse, AT&T converged system for the delivery of HD TV, Internet access, and VoIP. Prior to the deployment of U-Verse in the UH Calhoun Lofts, a 1000-unit professional student facility in UH Campus, it was deployed experimentally in the UH AT&T Lab. After overcoming some technical issues and performing some test, U-Verse was successfully installed in the Lofts in August 2009. U-Verse is the Lab's connection to the AT&T backbone and to its TV and VoIP services.

3. Outreach

The UH AT&T Lab is involved in two major outreach programs with the Federal Government thru the Department of Commerce's Economic Development Administration (EDA) and with AT&T Hacemos, a Hispanic AT&T Employee Organization that helps under-privileged Hispanics with scholarships and sponsorships. EDA provides the Lab funding to promote technical training to Hispanics who pursue a better quality of life through education. This funding helps the Lab by sponsoring training seminars and participation in technical certification

workshops. In addition, the Lab is organizing specially-designed technical certification workshops for high school students from low-income areas of Houston in collaboration with AT&T Hacemos.

4.   UHCOTNET

The activities in the UH AT&T Lab could not have been possible without the UHCOTNET. Before becoming a college-wide network, the network was a one-location local central office unit in the Wireless and Optical Networking (WON) [5]. With funding from AT&T and the College of Technology, the WON has been extended to develop the UH-COT-NET. Fig. 6 shows a diagram of the topology of the network. The diagram includes three main locations with layer-3 connectivity to LEARN and Internet2 thru the Texas Learning and Computational Center (TLC2) located in the UH Campus. The diagram also shows the UHCOTNET connection to Internet2 ION, a layer-2 nationwide dynamic circuit network.
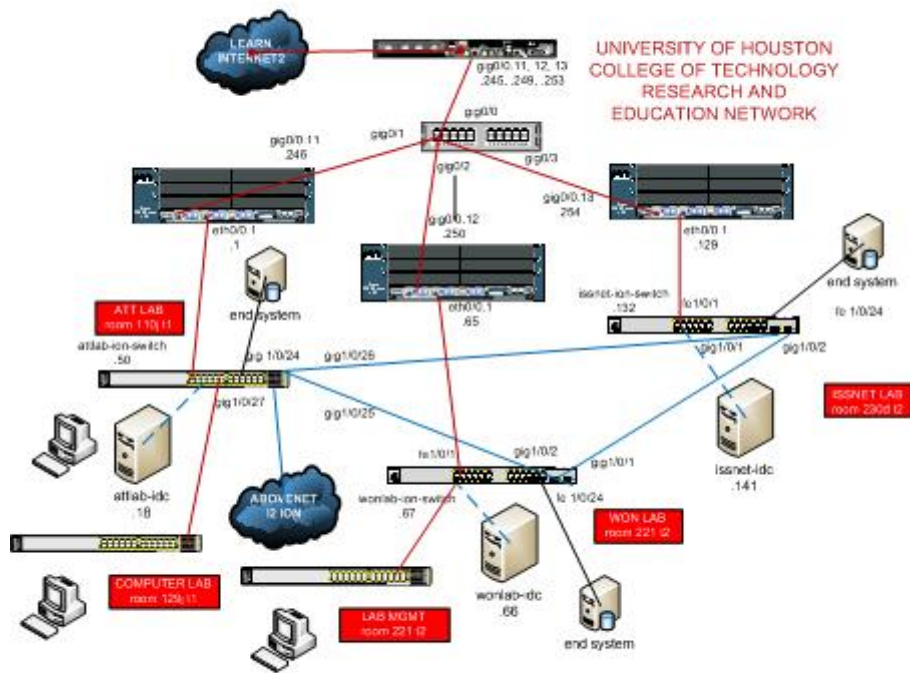

Fig. 6. UHCOTNET

4.1 Connectivity to Regional and International Networks
UH-COT-NET connects to four UH research laboratories to regional and international high-speed research and education networks: 1) Research and Education Network of Houston (RENoH) [6] that connects Rice University, the Houston Medical Center, and NASA 2) the Lonestar Education and Research Network (LEARN) that connects member institutions in Texas, and 3) Internet2 with connections to most US universities and other important research labs. Both connections are 1 Gbps.

In addition, the UH-COT-NET connect to the AT&T Backbone through its U-Verse connection via wired and wireless. This connection provides HD TV and high-speed Internet to the UH AT&T Lab and other labs over twisted pair CAT3 and CAT5 wire as shown in Fig. 7.
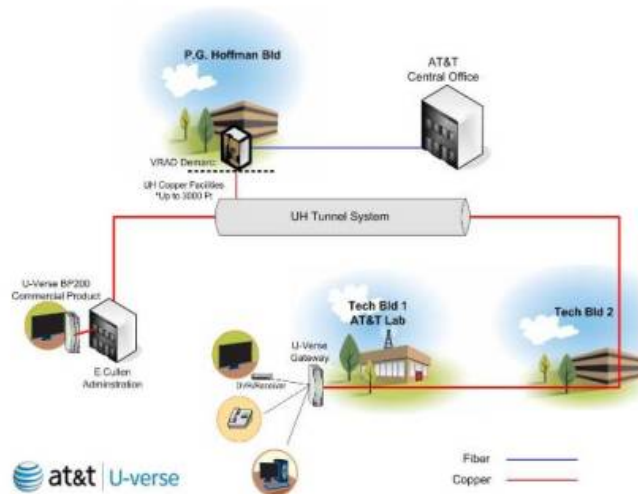

Fig. 7. UH AT&T Lab U-Verse

5. Conclusion

The University of Houston AT&T Lab is an international research and educational laboratory that provide state of the practice equipment used for multiple research and education project. With the current trend of technology change engaging faculty and students in a research based on the state of the art telecommunications network would be beneficial for the current high technology industry requirements.

6. References

[1] S. Chacon and D. Benhaddou, "Teaching Technology using Voice over IP," Proceedings of the 2007 ASEE GSW annual conference, February 2007, Baton Rouge, Louisiana, USA.
[2] S. Chacon and M. Moges, "Project Based Learning in Telecommunications: An Approach to Teaching New Technologies", Proceedings of the 2008 ASEE GSW annual conference, March 26-28, 2008 Albuquerque, New Mexico, USA.

[3] G. Rubendall, S. Chacon and M. Moges, "Telecommunication Design Based on T1/T3/SONET", ASEE GSW annual conference, March 26-28, 2008 Albuquerque, New Mexico, USA (poster presentation).

[4] UH ATT Lab website, http://tech.uh.edu/attlab/
[5] Wireless and optical Networking lab, http://tech.uh.edu/won
[6] Research & Education Network of Houston (RENoH), http://www.tlc2.uh.edu/RENoH