

## INDUSTRIAL PERSPECTIVE ON MODIFICATIONS TO TELECOMMUNICATIONS PROGRAMS

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### *Abstract*

*In an ever evolving technological world, there is a need for university and college programs to keep up with the developments in industry. This is especially true for those educational institutions that offer programs in the engineering technologies, engineering, and computer related fields. Since the graduates from these institutions form the pool of new employees for industry, it is important that industry contributes ideas on the preparation of the graduates. Industry constantly functions at the cutting edge of technology. As such, it can be expected that suggestions from industry will be based on the current technological applications. In order for graduates to be sufficiently well prepared for the work place, they will need to be instructed on the latest developments in industry. It is for these reasons that many programs utilize Industrial Advisory Committees who can provide an industrial perspective to the institutions. These committees form an essential component to the administration of academic programs.*

*Due to the more complex nature of the telecommunications equipment these days, the current industry requirement calls for a change of emphasis in the preparation of graduates. While they still need to understand the equipment in terms of how they function and how to assemble them, it has become paramount that the graduates are proficient in operating the equipment. The central core of modern telecommunications equipment is a computer, and this calls for a graduate who is not only computer literate, but has the expertise of an information technology specialist. This paper will look at how two institutions have utilized the industrial perspective to modify their program offerings to suit the current requirements of the Telecommunications industry.*

### **I. Introduction**

In recent past, the Telecommunications industry saw phenomenal growth due to developments in computing, and the fact that computers were incorporated in telecommunications hardware. Wireless applications, a necessary component in telecommunications, are experiencing resurgence along with the growth of the telecommunications industry. The initial growth needed the type of graduates who could support the construction of the telecommunications infrastructure. These graduates were practical oriented individuals who had the capabilities of putting together the modules and components of equipment, connecting them and making sure that they worked effectively as an assembled unit.

While the understanding of active components such as transistors and passive components such as resistors, inductors and capacitors was useful, the training of these graduates was not based solely on this. Training of these graduates was based rather on the modular and system levels. For this, the students were taught the functions and hence applications of the modules and the interfaces needed to connect them together, taking into account the different standards employed in industry. The students were taught the various types of equipment needed to measure factors such as voltage and current levels, and frequency of operation for different transmissions. This formed the major component of the experiential training given to these students.

The current requirement in industry is one which calls for a change in emphasis in the preparation of graduates. While they need to understand all the aspects of training described above, it has become paramount that the graduates are proficient in operating the equipment. This calls for not simply being able to ascertain that the safe operational levels are achieved, but also understanding the significance of the levels. This would be important in the training format described above, and is crucial in the operational aspect of training. The operational level may not be looked upon as the next level, but rather as an extension to the format already in existence.

Market forces being driven by consumer demands are currently elevating the status of wireless applications to a place of prominence among technologies that are receiving industrial attention. Today, it is not inconceivable that a person may employ a hand-held device to perform many functions and applications such as telephone conversation, and reception and transmission of electronic mail while the person is mobile. Wireless applications must therefore form an important component of a comprehensive telecommunications program.

Due to the prohibitive costs involved in all-optic systems, the progression to these applications is being preceded by an intermediate process, which is electro-optic<sup>2</sup> applications, and this area is receiving considerable attention in industry. This application integrates the efficiency of electronic/electrical systems and the vast bandwidths that can be achieved with fiber optics. Other technologies in association with this area that are proving to be valuable are infrared and laser applications. Theoretical and experimental approaches being used in this area are leading to practical applications of great benefit. This area calls for curriculum support that can be achieved through emerging degree programs.

## **II. Computer Applications**

In discussing the telecommunications infrastructure, it helps to begin with telephony as the basic network. The multi-tasking ability of the computer made it a very useful component of the network by facilitating the multi-function expectation of the network. The computer is thus the central component from which other functions are derived. Technical employees of service providers have to be graduates who not only are computer literate, but have the expertise of information technology specialists. This aspect of training also requires a good understanding of protocols in relation to the standards in use. In characterizing this occupation in the telecommunications industry, the U.S. Department of Labor Bureau of Labor Statistics in their SIC (Standard Industrial Classification) 481, 482, 489 titled Telecommunications<sup>1</sup>, defined these employees as “Computer software engineers and network systems and data communications

analysts who design, develop, test, and debug software products.” The source goes on to state that the systems these employees work with “include computer-assisted engineering programs for schematic cabling projects, modeling programs for cellular and satellite systems, and programs for telephone options such as voice mail, electronic mail, and call waiting.” The same source defines the telecommunications specialists as those who coordinate installation of the systems and provide follow-up maintenance and training. These employees are the traditional telecommunications graduates trained to support the construction of the telecommunications infrastructure.

With respect to the training of these employees, the source quoted above writes “While there is no universally accepted way to prepare for a job as a computer professional, most employers place a premium on some formal college education. Computer software engineers usually hold a degree in computer science or in software engineering. For systems analyst, computer scientist, or database administrator positions, many employers seek applicants who have a bachelor’s degree in computer science, information science, or management information systems.” The above describes the traditional approach that has been used to train operators employed in the telecommunications industry. This in part, is the force behind the decision to create a telecommunications program that incorporates computer hardware and computer software components with the traditionally accepted topics such as different types of modulation, multiplexing, transmission and reception of information.

### **III. Telecommunications Programs**

In order to address the growth and demands from the Telecommunications industry, several Telecommunications related programs have been developed at two-year and four-year institutions around the U.S. Many of these programs utilize Industrial Advisory Committees (IACs) to provide essential input on the latest trends in industry, and on industrial expectations of the graduates.

The four-year Bachelor of Science in Telecommunications Engineering Technology (BSTCET) program at Southern Polytechnic State University (SPSU) was approved in 1998<sup>3,4,5</sup> and was recently accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC-ABET). From its inception, the program recognized the trends in industry and the important role that computers played in the telecommunications industry. It has relied heavily on input from its IAC in the structuring of the curriculum.

The focus in this program has been on producing graduates with the requisite skills desired by industry. This program offers its students combined experiences in the hardware, software and management of telecommunications networks. The students get hands-on experiences in setting up telecommunications networks and all the various aspects related to the administration and management of such networks. Some of the specific skills that are developed include: programming applications in C++, JAVA, and HTML; LAN, WAN architecture and protocols; TCP/IP operation; Wireless technologies; Internetworking devices: routers, hubs, and switches; Windows Network Administration; Introduction to Linux; Network Protocol Analyzers; The World Wide Web; Data and Network Security. The BSTCET students are also required to take a

capstone design project course in which all the skills developed across the curriculum are utilized in a final project design. The most recent project involved the implementation, testing, and demonstration of a Voice-over-IP (VoIP) network designed for a fictional company. Students were required to utilize their technical as well as management skills in completing the project.

The program incorporates electives that allow students to develop more expertise in areas such as Wireless Communication Systems, and Fiber-Optic Communications Systems. These two areas have been identified as some of the fastest growth areas in the telecommunications industry.

Maintaining currency in the program curriculum requires continuous monitoring and input from industry. The BSTCET program at SPSU continues to utilize employer and graduate employee surveys in updating its program content to keep it in step with current industrial practice and direction. These surveys are conducted on a regular basis as part of the department's ABET re-accreditation procedures. With the advent of the use of outcomes-based program assessment for accreditation purposes, these surveys will continue to play an increasing role in measuring the success of the BSTCET program.

The Telecommunications Department of Pennsylvania State University (PSU) Wilkes-Barre campus has also relied on input from its IAC for curriculum development. In a recent IAC meeting, the direction industry is going in, and its impact on academic programs was extensively discussed. To give an example of some of the comments made, a representative from Commonwealth Telephone Enterprises stated *"the build-up of most telecommunications infrastructure is complete for most providers. The people needed are those who can operate the systems. Since computers support all the work being done, you need technicians who are computer savvy to run the systems"*. In responding to a question asking for an explanation of 'computer savvy' a representative from D & E Communications stated *"computer engineering would be nice, yes, but particularly programming because a good part of the work being done is software driven"*. A representative on a recruitment drive from ATX Communications stated *"it's a good thing getting your students - students in the Telecommunications program at Penn State - to be familiar with cutting edge technology, but someone who has taken some courses in IT (Information Technology) has a definite advantage because he can get into the software a bit more easily. Also data processing and security are two important areas.* Such comments have contributed to the new direction for the program being planned.

The department currently offers a two-year associate degree in Telecommunications Engineering Technology that is TAC-ABET accredited, and plans to expand its offerings to provide a four-year BS degree. The program content is based primarily on four areas; the traditional telecommunications topics, wireless communications, electro-optics, and information sciences and technology.

The traditional telecommunications topics will be those described above. The topics in wireless communications will cover subjects such as microwave, cellular, satellite applications and Wireless ATM (asynchronous transfer mode) Networks which will deal with titles such as Multiple Access Protocols for Wireless ATM Networks, Multimedia Conference Systems and User Mobility Management in Wireless Networks<sup>6</sup>, and Bluetooth. The section on electro-optics will treat topics such as light fundamentals, light sources and detectors, couplers, modulators,

noise detection, and system design<sup>7</sup>. The Information Sciences and Technology component will help to develop professionals who have an in-depth knowledge of computers and computer applications. This section will include work in database, networks, mathematics, programming, emerging technologies, organizations and information, integration of IT, human-computer interface, information policy and regulation, and information systems.

One of the objectives of the program is to produce a graduate who is competent in computer applications in relation to telecommunications applications. As an employee, the graduate will not only be good at operating the systems, but will also have the competency in fault-finding and correcting the problems that arise which can be corrected by use of software.

#### **IV Conclusion**

The need for industrial input to curriculum development is important to ensure that students are trained in current technology. For this reason, IAC suggestions are always given serious consideration by universities and colleges in updating, and preparing new program offerings. Such is the case at SPSU where the BSTCET program ensures that the skill set of the graduate includes computer applications and programming. This is also the case at PSU Wilkes-Barre campus where a new BS program in Telecommunications Engineering being planned is relying heavily on IAC input on computer applications requirements in industry. Considering the fact that computer usage has become a *de-facto* application tool currently in the telecommunications industry, the programs described above are demonstrating compliance with industrial views on the direction of telecommunications curricula.

#### **References**

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