A Wireless Networking Curriculum Model for Network Engineering Technology Programs

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ABSTRACT

Wireless networking is experiencing explosive growth, both in market size and the number of new standards and technologies. Effectively educating students, both at the undergraduate and graduate level, with the abilities to evaluate, implement, and integrate wireless networks should be a key part of any information technology (IT) education program for the foreseeable future. The Computer & Information Technology Department (CIT) at Purdue University is in a unique position to fulfill this educational need through its wireless networking curriculum. This curriculum currently offers three courses within the network engineering technology program, covering topics from 802.11 networking to 3G cellular, wireless network security and management to WWAN technologies. Each course includes trend analysis of wireless networking in order to effectively prepare students for employment in this area. This paper discusses the existing wireless networking curriculum by providing a brief perspective of previous course content and detailing each current course in the areas of prerequisite knowledge, intended audience, course content, and lecture/laboratory integration.

Keywords: hands-on learning; IT education; lecture and laboratory learning; wireless network education

BACKGROUND AND HISTORY

Constant analysis of material presented in a course is critical for its success. As a market evolves, it is important to monitor, report, and reflect those changes through the course material. In this instance, the explosion of the wireless networking sector provided a wealth of new information. The wireless networking industry has a historical growth rate greater than 10% per year and grew by nearly 15% in 2005. Additionally, the market is expected to increase an additional 35% by the year 2010.
The CIT department currently offers two baccalaureate degrees. The first is a BS in information systems technology (IST) and the second degree offering is a BS in network engineering technology (NET). Each of these degrees accounts for roughly half of the student population of the department, which is currently at 550 students. Additionally, there are several areas of specialization within each degree that allow students to concentrate their studies on a specific focus within the IT field. This breakdown can be seen in the CIT degrees and specializations table below. The students who are progressing towards a BS in NET are the primary audience of the courses detailed in this paper.

In 2002, there was only one course being taught that covered wireless technologies. This course, however, concentrated heavily on wireless communications instead of wireless networking technologies. The course relied heavily on the mathematics and science behind signal propagation and the radio interface, as well as the standards and working groups of the telecommunications industry. While these fundamentals are important for students to understand (Reisman, 2005), a movement towards the applications of these fundamentals to businesses and industries was needed (Goscinski et al., 2005). Additionally, the laboratory component had very little correlation to the material presented in lecture. The laboratory objectives that the students were completing were not sufficient in providing a solid understanding of wireless networking, and it was not supplying them with the information and knowledge of the emerging technologies of the time. The desire was to move the course away from a largely signal engineering-based course to a network engineering course, in order to equip the students with the necessary knowledge and experience for the current wireless network environment.

The original course has been modified and is now the first of three wireless networking courses that are taught in the CIT department. It is listed as CIT 346—Wireless Networks and is offered as a junior-level course. CIT 346 now provides the fundamentals of 802.11-based wireless networks, basic signaling, and modulation technologies and the importance of proper network design and implementation. Also, the laboratory component is tied directly to the material presented in lecture. The laboratory experience also has been improved by explicitly stating assignment objectives (what tasks are to be accomplished) and requiring responses to “knowledge items” (what knowledge should be gained by accomplishing the specified tasks). This requires each student to be able to directly apply material covered during the lecture to the specific tasks performed during the weekly laboratory assignments. For example, in one laboratory assignment, students are to build a multi-access point wireless network and perform a seamless handoff from one AP to another AP, using a client device, while a second client device runs frame/packet capture software to record the traffic. The “knowledge item” for this exercise is for each student to be able to identify the frames required to successfully complete the handoff and be able to

Figure 1. CIT degrees and specializations

<table>
<thead>
<tr>
<th>Areas of Specialization</th>
<th>IST</th>
<th>NET</th>
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<tbody>
<tr>
<td>B.S. Degrees</td>
<td>Wireless Networking</td>
<td>Network Security &amp; Forensics</td>
</tr>
<tr>
<td>Database</td>
<td>Systems Integration</td>
<td>Application Development</td>
</tr>
<tr>
<td>Administration</td>
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