Introducing Information Security Courses in the ECE Curriculum

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Abstract

Federal organizations such as the National Science Foundation and the National Security Agency are encouraging universities and community colleges throughout the nation to offer graduate and undergraduate programs in Information Assurance and Security. Today, there are more than 100 universities and colleges that offer degree programs and courses in information security. At Wichita State University, the Electrical and Computer Engineering (ECE) department took the lead in introducing Information Assurance and Security related courses in the curriculum. This presentation is aimed at sharing our experiences in enhancing the ECE curriculum at Wichita State University, our efforts in getting the curriculum certified by the Committee on National Security, and our collaborations with the neighboring universities and community colleges to bring awareness of information security in the community.

1. Introduction

This paper discusses our experiences in introducing information assurance and security (IAS) curriculum in the ECE department at Wichita State University. While providing specific details of implementation at WSU, this paper also provides a general strategy and outlines the steps that one can follow to develop such degree or certificate programs. It discusses the steps involved in introducing IAS curriculum, outlines the infrastructure development process, explains the importance of collaborations with local law enforcement agencies and partnerships with community colleges and points out the significance of outreach programs and workshops.

2. Strengths of the Department

The first step involves collecting information about the courses and specializations that are currently being offered in the department in which one wants to introduce IAS curriculum. It is important to learn about the other departments in the college or university that offer courses related to Information Security. It is possible that colleges such as Business Management, Law, and Biology may already be offering courses that one will be able to take advantage of. Information Assurance and Security is a truly multi-disciplinary field and it requires several faculty members from different disciplines to develop a strong program.

At WSU, the IAS curriculum development is a joint effort between ECE and CS departments at WSU. The ECE department at WSU has core strength in the area of Networks. The Advanced Networking Research Center (ANRC), with the state-of-the

art infrastructure and commercial tools such as those for simulating large scale networks, is fully functional and being used for graduate and undergraduate research and training purposes[1]. There are several core courses such as Data Communication, Routing and Switching I and II, and Voice over IP that are being offered by the ECE department. In addition, with the addition of several new faculty members, the department planned to offer new courses in wireless networks. There is significant ongoing research work in areas such as ad-hoc wireless networks, voice over IP, and network performance analysis. The CS department also has several related courses such as Data Communications, Databases, and Internet Application Development. So, it is a natural choice for WSU to focus on Networks and offer a specialization in Network Security with a breadth of fundamental topics covering all other areas of Information Security.

The joint effort between ECE and CS departments resulted in the introduction of two new courses: Information Assurance and Security, and Computer Forensics. In addition all networking courses in the CS and ECE departments were enhanced to include security modules.

3. Knowing the Neighbors

The National Security Agency (NSA) and the Department of Homeland Security (DHS) jointly call for applications annually and designate institutions meeting the required criteria as National Centers of Academic Excellence in Information Assurance Education (CAEIAE) [3]. As of today, there are 67 CAEIAS institutions across 27 states and the District of Columbia. In addition, there are 128 institutions which have IAS curriculum certified by the Committee on National Security Systems (CNSS) [4].

If one of these institutions happens to be within the vicinity, it is strongly advised to partner with such an institution. Especially, institutions designated as Centers of Academic Excellence are already well established with several IAS related education, training and research programs. Associating with such CAEIAE institutions and partnering with the teaching and research faculty at these centers will tremendously reduce the amount of initial preparations that are needed to offer IAS courses and training programs at your own institution.

The University of Tulsa, in Oklahoma is one of the first few universities that received the CAEIAE designation. Being close to the University of Tulsa has been very beneficial for us. Our association with the faculty at the Center for Information Security, University of Tulsa helped us to jump start the initiatives in introducing IAS curriculum at Wichita State University. This association also provided us an opportunity to participate in the activities of International Federation on Information Processing (IFIP) digital forensics working group (WG 11.9)[5]. The working group activities include discussions on existing training and research programs at various academic and federal organizations, standards and certification processes, internships opportunities and training programs for students in the areas related to Information Security.

4. Enrollment Statistics

Student enrollment statistics are required to estimate the frequency of course offerings. In addition, the statistics also allow us to estimate the number of students that will graduate each semester with IAS specialization. The estimated figures will be useful to coordinate internship, co-op and placement opportunities to eligible students at various federal organizations.

At WSU, the student population is high. This aspect, coupled with the demand for network related courses among students, provide a significant need and demand for IAS courses. Hence, the courses are offered on a fairly regular basis. All the network and information security related courses are offered at least once each year. The graduate student population consists of several international students providing the desirable diversity in class rooms. Given that there is significant demand for Information Security Professionals in federal as well as civilian organizations, the enrollment figures for IAS courses are usually high.

5. Infrastructure

Information Assurance and Security courses are required to be practical-oriented. In addition to including theoretical issues such as cryptography, and formal models for Information Assurance and Security, it is important to design a set of hands-on exercises that are intended to make students understand security vulnerabilities in various networking elements and solutions to protect the network.

The laboratory exercises may range from configuring routers, setting up firewalls with different configurations and options, simulating denial of service attacks, hardening the network, intrusion detection, to detailed forensic analysis and investigation of hosts and network components. Students should be able to freely use any tool that they want to test in the security laboratory.

In order to be able to experiment with various operating systems, network configurations, and tools, the systems in the laboratory should be connected as an independent local area network and this network should be isolated from the rest of the campus network or the internet. It will prevent any unintentional traffic from entering into the campus network.

The initial funding for setting up such a laboratory has been provided by the ECE department. The budget for the initial set-up consisting of four desktop computers and one server including the network components is under $10,000. This infrastructure was enhanced with the funds from the Capacity Building grant obtained from National Science Foundation to include additional desk top PCs, hard drives, licenses for forensic software, wireless access points and interfaces. The funds also allowed us to establish the Center for Information Security at WSU $_2$.

6. Partnerships

Partnerships with local community colleges and local law enforcement agencies are important for several reasons. Community colleges offer two year and four year degree programs suitable for working professionals. Significant number of professionals get their degrees from community colleges. Thus collaboration between universities and community colleges provide more opportunities and choices for students. This collaboration should be aimed at offering complementary courses, facilitating transfer of credits between four year and two year degree programs, and providing the necessary training for students to take up the challenges in the real world.

Partnerships with law enforcement agencies such as the City Police Department, Federal Bureau of Investigation, and Regional Computer Forensic Laboratories (RCFL) will be very helpful in providing real-world experiences for students. In addition, each university has to take advantage of its local law-enforcement facilities that might be unique to its location.

At Wichita State University, we collaborate with the missing children's unit of Wichita Police Department. The detectives from this division were invited to our classrooms to talk about their forensics analysis tools techniques. In addition, plans are underway to establish partnerships with Kansas RCFL located in Kansas City, MO [6].

It is also important to establish links with local community colleges to provide more opportunities and choices for students. According to the latest report about 40% of American students attend community colleges [7]. This is a strong enough motivation for establishing collaborations between community colleges and universities. There are several community colleges in Kansas. Our initial meetings with Butler Community college were fruitful. New courses, certificate programs, and training programs specifically targeted for community colleges will be developed as this collaborations progress into working relationships.

7. Workshops and Outreach Programs

Workshops will provide avenues to share and exchange ideas between groups with different requirements and objectives. When organized with relatively small number of participants, workshops facilitate fruitful discussions on topics of common interest among the participants and provide opportunities to work together as a team. For example, a two day workshop with participants from federal agencies and academic institutions will be an excellent means to discuss the ways and means of providing the necessary education and training required to handle the challenges that law-enforcement officers have to face while handling the real-world computer crimes.

Finally, outreach programs aimed at encouraging local high school students to pursue higher education in information security related fields are very important for IAS programs at Universities. Such outreach programs establish a strong link between high schools, local community colleges and universities. Through such programs, high school

students should be encouraged to visit university research laboratories, work side by side with undergraduate and graduate students and learn about the security problems and state-of-the art solutions.

8. Summary

In this paper, the steps in introducing Information Assurance and Security programs at universities and community colleges are outlined based on our own experiences. The importance of collaborations with local community colleges and law enforcement agencies, and the significance of workshops and outreach programs are discussed in detail.

Acknowledgements

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