

# INTERNET SECURITY MANAGEMENT

## *A Challenging Joint Postgraduate Curriculum Design*

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**Abstract:** This paper describes the design of a joint program in Internet Security Management between the Schools of Information Systems and Computer Science. An overview of the curriculum is given, and the roles played by each School in the teaching of the courses described. The advantages and hurdles of designing offerings across independent Schools are also discussed.

**Key words:** Internet Security, Internet Security Management, Curriculum Design, Postgraduate Studies

## 1. INTRODUCTION

With the growth in cybercrime comes a realization that organizations need to address the security of their information and associated information systems networks. The call for more educational programs in information security has emerged from both the private and public sectors, government agencies promoting specialist education and business organizations with a professional need for information security expertise.

A media release in February 2001 by Senator the Hon Richard Alston, Minister for Communications, Information Technology and the Arts (NOIE, 2001a), states that Information Security is a major national priority in Australia. In addition, the draft Report on E-Security R&D in Australia released by the National Office for the Information Economy states that “The [Australian] Government has a clear role to protect information infrastructure, which is critical to national security, and protect the public

from criminal or malicious activity occurring through electronic mediums, primarily the Internet.” (NOIE, 2001b).

In response to these national priorities and the needs of industry and government, Curtin University has designed a postgraduate program in Internet Security Management. The program is run jointly by the School of Computing and the School of Information Systems, and attempts to balance the technical, conceptual and human skills required to meet the above challenge.

In order to meet these growing demands, two Schools within Curtin University of Technology in Perth, Western Australia, joined forces to offer postgraduate studies specializing in Internet Security Management. The curriculum aims to produce graduates with generic, technical and management skills in the field of Internet security.

The aim of this paper is to discuss the design of the postgraduate curriculum in Internet security management across two academic schools in differing faculties within a university. The advantages of a joint program are discussed along with the problems encountered in the design process.

## **2. OVERVIEW OF THE INTERNET SECURITY MANAGEMENT PROGRAMS**

The new programs are designed for students who have completed a Bachelor degree in a computing related discipline. Students embarking on the programs require an understanding of computer programming, operating systems, networks and computer architecture.

The programs incorporate studies designed to develop students’ conceptual and practical skills. Students are encouraged to think ‘outside the box’ in problem solving and applying security solutions. Numerous educational theories supporting learning by experience, action and reflection (eg Bloom et al., 1956; Kolb, 1984; Argyris, 1982) form the basis of the program design.

The units of study within the new programs are designed to meet the needs of students not only in the technical network and security aspects but also management skills. In particular graduates from the computer science discipline have requested more problem solving and management skills, whereas graduates from the information systems discipline have requested more network and security technical skills.

The new programs are offered at three levels:

- Postgraduate Diploma in Internet Security Management
- Master of Internet Security Management - professional masters degree

- Master of Commerce (Internet Security Management) – masters degree by coursework

The structure of the programs is illustrated in Table 1.

The programs include management units of study in problem solving, organizational behavior and change management, information security management and project and risk management. Technical areas covered relating to the security of Internet and electronic commerce include network and communications security, database security, distributed computing security, computer forensics, encryption and software security, web programming languages and tools, web site management and engineering, business intelligence and cyberwarfare, electronic commerce security, and Internet law. Two additional advanced units listed as options are machine perception and artificial intelligence – these two units of study encompass the application of advanced technology to the security industry, particularly pattern recognition, neural networks and speech recognition. For example, two of the areas students can apply this knowledge is the design of intrusion detection systems and biometrics. These two units also run as part of the computer science programs and are very popular with the students.

The new programs have been designed to meet a demand for both technical and management skills in a business environment where organizations are becoming more reliant upon global networks and electronic business environments. The numerous optional units ensure the programs are flexible and allow students to choose the most beneficial content for their needs.

## **2.1 Postgraduate Diploma in Internet Security Management**

This program is designed for students who wish to enhance skills and knowledge in the design and management of Internet security and electronic commerce in business organizations. The program comprises eight units of study each carrying 25 credit points, totaling 200 credit points. The postgraduate diploma course can be completed in one year (two semesters) of full-time study or two years of part-time study.

Table 1: Structure of the Internet Security Management Programs

Study Plan Full-time	Postgraduate Diploma in Internet Security Management	Master of Internet Security Management	Master of Commerce (Internet Security Management)
Year 1 Sem 1	<ul style="list-style-type: none"> <li>- Network &amp; Communications Security</li> <li>- Information Security Management</li> <li>- Problem Solving</li> <li>- Organizational Behavior</li> <li>Or</li> <li>- JAVA Programming</li> </ul>	<ul style="list-style-type: none"> <li>- Network &amp; Communications Security</li> <li>- Information Security Management</li> <li>- Problem Solving</li> <li>- Organizational Behavior</li> <li>Or</li> <li>- JAVA Programming</li> </ul>	<ul style="list-style-type: none"> <li>- Network &amp; Communications Security</li> <li>- Information Security Management</li> <li>- Problem Solving</li> <li>- Organizational Behavior</li> <li>Or</li> <li>- JAVA Programming</li> </ul>
Year 1 Sem 2	<ul style="list-style-type: none"> <li>- Project &amp; Risk Management</li> <li>- Database Design &amp; Security</li> <li>- Distributed Computing Security</li> <li>- Research Methods</li> </ul>	<ul style="list-style-type: none"> <li>- Project &amp; Risk Management</li> <li>- Database Design &amp; Security</li> <li>- Distributed Computing Security</li> <li>- Research Methods</li> </ul>	<ul style="list-style-type: none"> <li>- Project &amp; Risk Management</li> <li>- Database Design &amp; Security</li> <li>- Distributed Computing Security</li> <li>- Research Methods</li> </ul>
Year 2 Sem 1		Computer Forensics 1 Optional Unit Plus Either: Security Project (50 credits = 2 units) or 2 Optional Units	Computer Forensics 3 Optional Units
Year 2 Sem 2			Security Project & Dissertation (100 credits = 4 units)
Sem = Semester		Optional Units: Encryption & Software Security Networking & Mobile Communications Advanced JAVA Programming XML Programming Business Intelligence & Cyberwarfare Electronic Commerce Security Web Site Management Web Site Engineering Internet Law Machine Perception Artificial & Machine Intelligence	

The units of study cover information security management, problem-solving, computer networks and communications, organizational behavior, JAVA programming, research methods, project management, distributed computing and database design and security.

The postgraduate diploma articulates to either the Master of Internet Security Management or the Master of Commerce (Internet Security Management).

## **2.2 Master of Internet Security Management**

This course is a professional masters degree containing a total of twelve units of study. It is designed for computing professionals who wish to take leadership roles in the management of Internet security. Students need a computing-related degree plus a minimum of two years' relevant industry experience to enter this program. This course can be completed in eighteen months (three semesters) of full-time study or three years of part-time study.

The first eight units of the Master of Internet Security Management are the same as the Postgraduate Diploma course, with four additional units required to complete the degree. Computer forensics is a core unit of study in the masters program, and students may choose three optional units or undertake a research project. Optional study units include encryption and software security, business intelligence and cyberwarfare, web site management, electronic commerce security, XML programming, JAVA programming, Internet law, networking and mobile communications, machine perception and artificial intelligence.

There is no direct articulation from this professional masters to other masters degrees or doctorates. Students wishing to progress to doctoral studies are advised to enroll in the masters by coursework program in section 2.3, or a masters by research, in preference to this program.

## **2.3 Master of Commerce (Internet Security Management)**

This course is designed for students who wish to continue their studies in Internet security management to gain further knowledge and skills in managing Internet security and electronic commerce environments. Unlike the professional masters degree students do not need relevant industry experience to undertake this course. The total program is 200 credit points containing a mix of eight coursework and research units. The Master of Commerce (ISM) consists of two stages, the first stage is the Postgraduate Diploma in ISM, the second stage is the Masters component. The Masters component has a duration of one year (two semesters) of full-time study or two years of part-time study.

The first eight units of study in stage one are the same as the Postgraduate Diploma in ISM above. The Masters stage comprises a unit of study on computer forensics and a choose of three other units of study from software security and encryption, business intelligence and cyberwarfare, web site management, electronic commerce security, XML programming, JAVA programming, Internet law, networking and mobile communications, machine perception and artificial intelligence.

The final component is a substantial research project in a security related area, resulting in a dissertation. The size of the research project must be equivalent to four units, or one full-time semester of study. This project is written up as a research dissertation, assessed by two examiners, and published by the university, thus satisfying the entrance requirements for doctoral studies.

### **3. COLLABORATION ON THE JOINT PROGRAM DESIGN**

There are many advantages and challenges in a joint program of this nature. This project has required the commitment of both schools to the time and resources required to design, develop and run these programs. The content has been based upon a shared understanding that an Internet Security Management professional needs to be holistic in approach, requiring generic, technical and practical skills. In addition, the joint offerings have provided students the opportunity to gain a much broader set of skills and knowledge. Computer Science students are exposed to computing in a business and organizational context, while Information Systems students acquire a greater depth of technical knowledge and expertise. The need for a graduate with a more rounded skill-set is thus met.

Recognition of each other's strengths and expertise has emerged from the curriculum design process. Agreement on the technical and management content has proven to be a challenge, particularly with regard to pre-requisite knowledge for the technical areas and sequencing of the courses. Difficulties arose where students with an IT undergraduate degree were considered to have insufficient technical knowledge to undertake some of the Computer Science owned units. Some of the advanced Computer Science units required a number of pre-requisite units only offered by that School. In addition, units are usually offered in either semester 1 or semester 2, not both. This added complexity to the sequencing of units to be studied, juggling units containing pre-requisite knowledge with the semesters offered. Fortunately, the two schools currently work closely together, recognizing duplications in units of study, and allowing students to undertake optional units in the other school.

Funding of staff and teaching resources within a university is a complicated matter. Sharing staff and resources across two different schools in different faculties is quite complex. The larger the body, the slower it moves, and the university is a unique organism. In order to work within the restricted University systems, the two Schools have agreed to share the teaching equally. Units offered by each school utilize resources from that

school – for example, a unit owned by the School of Information Systems is taught by staff within that school using classrooms and laboratories under the control of that school. This is not the desired approach, however, as team teaching involving staff from both schools would have been the preferred teaching mode.

The new program has raised the requirement within both schools for isolated laboratories to carry out practical work and it has been necessary to hire appropriate laboratories from other schools within Curtin University for the initial running of some of the new units. New laboratories are currently being fitted to meet the requirements of the new programs. Administration of joint programs across more than one school is best handled by only one of the stakeholders. The School of Information Systems will administer the new program as the infrastructure and systems to handle the required administration are already in place within that school.

The university requires the overall program design to be approved by both Schools before being presented to the University Senate for final approval. The two schools have held numerous meetings to design the structure of the three programs, define the required content, develop a logical sequence, plan semester offerings and resolve problems relating to overlapping content and prerequisite knowledge. Industry partners common to both Schools were also part of the curriculum design team.

Table 2: Sample of Security Management Programs at other Universities

University	Degree Name	Duration	Security Contents
University of Glamorgan (GLAM, 2002)	MSc in Information Security & Computer Crime	1 year full-time	Security Management, Project Management & Research Methods, Network & Distributed Systems Security, Cryptography & E-commerce, Computer Law & Criminology, Computer Forensics
Royal Holloway University of London (RHUL, 2000)	MSc in Information Security	1 year full-time	Security Management, Cryptography, Network Security, Computer Security (O/S), Secure E-Commerce, Standards & Evaluation Criteria, Advanced Cryptography, Database Security, Computer Crime, Project
London School of Economics University of	MSc in Information Systems Security	2 years part-time	Security of Information, Secure Electronic commerce, Modeling Secure Business Systems,

London (LSE, 2002)	& Access		Global Consequence of IT, Issues in Information Systems Security, Information Security and the Law, Models for Open Access
University of Westminster (WMIN, 2002)	MSc in Information Technology Security	1 year full-time 2 years part-time	Security Awareness, Threats, Countermeasures, Standards & Procedures, Legal & Ethical Aspects, Risk Analysis, Business Needs, Policy & Planning, Security Analysis, Post-incident Reviews, Security Management, Computer Forensics, Security, Project Module
University of Leicester (LE, 2002)	MSc in Security Management	1 year full-time 2 years part-time	Intro to Security Management, Crime and the Workplace, Research Methods in Security Management, Managing Risk and Security, Law, Procedures & Security Management, Management, Organizations & Security, Dissertation
Edith Cowan University (ECU, 2002)	MSc in Computer Security	2 years full-time	Information Security, Computer Security, Database Security, Network Security, Research Preparation, Thesis (5 <sup>th</sup> Year), Computer Security Thesis (6 <sup>th</sup> Year)

#### 4. SIMILAR PROGRAMS

In the design of the new programs a search was conducted on similar programs run at other universities. The content of the programs investigated was quite diverse. Table 2 illustrates a small sample of the programs at other institutions that were studied.

Programs generally focused upon one of the following areas - security management, risk management, law and crime, cryptography, network security, electronic commerce security, computer forensics or information warfare. Many of the programs concentrated solely on the technical aspects and these appeared to be offered by computer science and engineering-related faculties. It was interesting to note, however, that studies in network



security, cryptography, electronic commerce security and security management were common inclusions.

Only a few institutions offered courses in risk analysis or computer forensics. Several included project or research courses but no research methodology or project preparation courses. None of the courses investigated appeared to offer studies in conceptual skills, problem solving or change management. Programs specializing in electronic commerce security appeared to have the closest match in content to the proposed programs at Curtin University.

The growing number of programs offered at universities around the globe indicates that this is an area of growth in education. The reliance upon computer networks, global communications and the Internet (for engaging in electronic commerce in particular) together with the rising rate of crime associated with these mechanisms provide a demand for education and training in the Internet security area.

## 5. CONCLUSION

The design of the new programs and their formal approval by the university has taken eighteen months. The new programs will be running in 2003/4 provided the university's final seal of approval is granted. The effective life of the three programs is estimated at 3-4 years, provided the unit content is regularly updated. Although the design and approval process has been time-consuming the resultant programs are promising to be in high demand.

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