Information Assurance Concentration in the Master of Management Information Systems (MIS) at the University of Nebraska at Omaha

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Abstract

The growth and availability of the Internet created serious vulnerabilities in connected systems. In response to this, the Federal Government has created several programs. Significant among those is the National Security Telecommunications and Information Systems Security Policy and the implementing directives that specify training standards for various professional positions related to telecommunications and information systems security.

In response to the directives of the National Security Telecommunications and Information Systems Security Committee (NSTISSC) and to the results of independent research, the faculty of the College of Information Science and Technology at the University of Nebraska at Omaha decided to implement a concentration in Information Assurance as an option in the Master of Science in Management Information Systems Program. To cover the subject matter indicated by NSTISSC directives and by security incidents described in the press, four courses have been established and a fifth is in preparation: ISQA 8530—Electronic Commerce Security, ISQA 8540—Computer Security Management, ISQA 8560—Information Warfare and Security, ISQA 8570—Information Security Policy, Privacy, and Ethics, and ISQA 8580—Computer Security Investigations (under development).

After developing these courses, an additional measure was undertaken to determine the coverage of the NSTISSC standards in these four courses. A spreadsheet was created to reflect the content coverage of the NSTISSC standards. The study determined the courses of the Information Assurance concentration provide substantial coverage of the requirements of NSTISSI No. 4013 - National Training Standard for System Administration in Information Systems Security.

Keywords: curriculum, information assurance, information security, and security standards

1. BACKGROUND

In the early 1990s, several government agencies recognized a need to address the vulnerabilities created in the new information age. Several forms of legislation were implemented to create three very important organizations/commissions/programs: NSTISSC (National Security Telecommunications and Information Systems Security), PCCIP (President's Commission on Critical Infrastructure Protection), and Federal Cyber Service: Scholarship for Service (SFS).

In July 1996, by Presidential Executive Order 13010, the PCCIP (President's Commission on Critical Infrastructure Protection) was created. This commission was tasked to formulate a comprehensive national strategy for protecting the infrastructures we all depend on from physical and "cyber" threats [1]. The PCCIP advises and assists the President of the United States by

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recommending a national strategy for protecting and assuring critical infrastructures from physical and cyber threats. The Commission identified eight critical infrastructures: telecommunications, electrical power systems, gas and oil, banking and finance, transportation, water supply systems, government services and emergency services. [2]

The National Security Telecommunications and Information Systems Security Committee (NSTISSC) was established by National Security Directive 42 (NSD-42) and issued on July 5, 1990 [3]. The NSTISSC provides a forum for discussion of policy issues, sets national policy, and promulgates direction, operational procedures, and guidance for the security of national security systems through the NSTISSC Issuance System. [4]

One of the primary functions of NSTISSC is to develop and issue national policy and standards. Among the current NTISS/NSTISS Standards being incorporated into educational programs are:

> NSTISSI No. 4011 – National Training Standard for Information Systems Security (INFOSEC) Professionals, June 20,1994
>
> NSTISSI No. 4012 - National Training Standard for Designated Approving Authority (DAA), August 1997
>
> NSTISSI No. 4013 - National Training Standard for System Administration in Information Systems Security, August 1997
>
> NSTISSI No. 4014 - National Training Standard for Information Systems Security Officers (ISSO), August 1997
>
> NSTISSI No. 4015 - National Training Standard for Systems Certifiers, dated December 2000 [5]

Another key program developed was the Federal Cyber Service. This program seeks to increase the number of qualified students entering the fields of information assurance and computer security and to increase the capacity of the United States higher education enterprise to continue to produce professionals in these fields [6]. The program has three tracks:

> Scholarship Track Scholarship - recipients will become part of the Federal Cyber Service of Government's information infrastructure. After their two-year scholarships, the recipients will be required to work for a federal agency for two years as their Federal Cyber Service commitment.
>
> Faculty Development Track - provides funds for institutions with Center of Academic Excellence in Information Assurance Education (CAE/IAE) certification, or equivalent institutions, to conduct regional and national faculty development seminars for faculty teams from non-CAE/IAE institutions.
>
> Institutional Development Track - provides funds for institutions not currently eligible for the Scholarship Track to develop institutional capacity in the information assurance and computer security area [6]

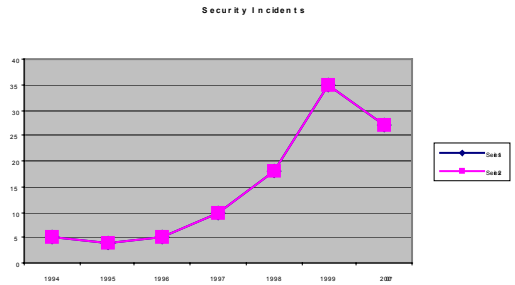
After reviewing these policies and programs, there remained a need to determine the demand that could be expected from the business community. To estimate the demand, a research study was conducted to determine the numbers and types of security incidents being experienced by businesses and government agencies.

A. Research Study on Security Incidents

Over the next six months, a log was created that recorded the reports of security incidents in the trade press, specifically ComputerWorld. ComputerWorld was selected as an available and representative member of the computer trade press, one that reflected significant events as well as the concerns of the computer community. Further, to the extent that the press can focus opinion, it was felt that through its reporting ComputerWorld could influence which issues would become major concerns of the computer community in the future.

The log included not only new reports recorded from current issues but also entries developed from the archives of ComputerWorld. ComputerWorld's searchable database of reports was examined for all security incidents over six years, up to October of 2000. The result was a small database with 105 entries. These entries covered the spectrum of computer security incidents, from e-mail floods to Trojan attacks, from outright intrusions to distributed denial of service incidents. The result parallels reports from other sources, namely that the number of security incidents seems to be increasing.

The graph clearly shows a dramatic increase in the number of security incidents reported in the press. The data for 2000 is incomplete, but it appears that it will match the number posted in 1999. Clearly, security is a concern. Moreover, the trend suggests that the future will demand a better understanding of security issues and practices from students who complete formal programs of education and that there will be a market for those who specialize in information assurance.



To determine the thrust of our effort to satisfy the expected demand, we reviewed the programs being offered in our region. Currently, NSTISS Instructions Nos. 4011, 4012, & 4015 are being incorporated into the University of Tulsa Computer Science graduate program [7]. When reviewing our current graduate program, it was determined that several of the proposed courses in the Information Assurance concentration for Master of Science in MIS would satisfy most or all of the requirements for NSTISSI No. 4013, National Training Standard for System Administration in Information Systems Security. The following narrative explains the core content of the MS in MIS program, the concentrations in E-Commerce and Information Assurance.

2. MASTER IN MANAGEMENT INFORMATION SYSTEMS (MIS)

The existing Master of Science in Management Information Systems was selected as a starting point. The prescribed coursework consists of eight required courses, which are described below, and four elective courses. The program had been designed to encourage students to use the elective courses to create a concentration in a specialty area, and courses exist that allow the student to build a concentration in Electronic Commerce. The coursework of the Master of Science in Management Information Systems and Electronic Commerce concentration courses follow.

ISQA 8060 - Research in Management Information Systems
This course covers research methods and their application to the development and evaluation of management information systems. Also covered is the relationship between organization theory and IS research. Students design a research study for an organization and apply the research techniques for the analysis of the project. A sampling of topics covered include: types of research, nature of measurement, information systems measures overview, reasons for measurement, measurement of human behavior, and characteristics of scientific research.

ISQA 8110 - Modern Software Design
This course gives the student an understanding of object-oriented software design. The student will understand the relationships between structured programming, data hiding, data abstraction, and object oriented programming. The student will understand the effect of program design attributes on the maintainability of a program. Finally, the student will apply an object-oriented analysis and design methodology to complete a major assignment.

ISQA 8210 - Management of Software Development
This course covers concepts and techniques from software engineering, management science, psychology, organization behavior, and organization change to identify, understand, and propose solutions to the problems of software project management. The purpose of the course is to prepare the student for leadership positions in software development and software maintenance. Additional topics include: software process maturity, waterfall and spiral process model, prototyping process model, PERT, function point estimation, and change management and design.

ISQA 8220 - Systems Analysis and Design
This course covers advanced systems analysis and design techniques. Emphasis will be placed on both the object-oriented and the structured approaches to systems analysis and design. A variety of life cycle models such as the Waterfall model, Rapid Prototyping Model, the Incremental Model, the Spiral model and Foundation model are presented, compared, and contrasted. The IEEE standards for performance of analysis and design activities are presented and discussed. All projects must be based on a software development standard such as the IEEE standards, the Department of Defense Standards, or ISO Standards or a combination of these standards.

ISQA 8310 - Data Communications
This course provides a comprehensive review of data and computer communications for business information systems within the framework of the ISO OSI model, evolving techniques for effective data communications, telecommunications infrastructure and services, and the design and management of organizational data and voice communications resources. This class maintains strong emphasis on the business and managerial perspective on the technology. Additional

topics include: communications architecture, local area networks, wide area networks, high-speed networking, internetworking, computer/telephony integration, networking management and security, and TCP/IP.

ISQA 4380/8386 - Managing the Client/Server Environment
The course gives students grounding in the concepts, issues, and tools needed to manage client/server environments. It focuses on client/server technologies, the issues faced in building and managing client/server systems, and the strategic relationship between business process and the information systems architecture. Students will build a client/server system. Additional topics include: middleware, distributed data systems, standards, distributed object-oriented computing, the internet and client/server computing, enterprise application integration, client/server systems performance, and enterprise systems management.

ISQA 8410 - Database Management
The course has a two-pronged focus: the role of the data administrator and the relational database model. Focus on the foundations, issues, costs, benefits, and problem areas of database and database administration. The course will emphasize strategic planning, modeling, and administration of a database environment. Current database management systems (DBMS) software will be used to supplement the course. A sample of the course topics include: the relational model, data definition language, data manipulation language, data control language, entity-relationship diagramming, logical and physical database design, data and database administration, and data warehousing.

ISQA 8810 - IT Project Fundamentals
The course will integrate concepts and techniques from management science, psychology, organizational behavior, and administration change to identify, understand, and propose solutions to the problems of project management. The purpose of the course is to prepare the graduate for project participation and leadership. A sample of course topics include: fundamentals and the issue of project scope, project time, project cost, project quality, communications, procurement, human resources, and risk management. [8]

A. MS IN MIS - E-COMMERCE CONCENTRATION

MIS program may now opt to take a concentration in electronic commerce. A concentration will appear on your transcript. The e-commerce concentration consists of four courses, one required course and three electives to be picked from the list below. Additional electives may be added to this list in the future.

ISQA 8186 - Electronic Commerce (required)
ISQA 8196 - Process Re-engineering with IT (elective)
ISQA 8525 - Graphical User Interface Design (elective)
ISQA 8700 - Data Warehousing: Theory and Practice (elective)
ISQA 8080 - Seminar in MIS (elective - the seminar topic MUST be related to e-commerce.)

B. MS IN MIS – PROPOSED INFORMATION ASSURANCE CONCENTRATION

It was felt that an offering of four or five elective courses would allow the student to form a strong Information Assurance concentration. In addition, there was a motivation to create courses that would be complementary to and accepted in the existing program and that would spread awareness and understanding to students outside the Information Assurance field.

Five courses were developed for the concentration in Information Assurance. The courses are listed below and four brief course outlines follow:

ISQA 8530 – Electronic Commerce Security
ISQA 8540 – Computer Security Management
ISQA 8560 – Information Warfare and Security
ISQA 8570 – Information Security Policy, Privacy, and Ethics
ISQA 8580 – Computer Security Investigations (under development)

ISQA 8530
E-COMMERCE SECURITY

COURSE DESCRIPTION
Overview of content and purpose of the course
The course will integrate concepts, principles and technologies from business, telecommunications, and computer science to identify, understand, and propose solutions to the security threats to e-commerce. The purpose of this course is to prepare the student to specify and select security alternatives for e-commerce sites.

CONTENT AND ORGANIZATION
List of topics to be covered in chronological sequence
1. The scope and nature of e-commerce,
2. Security threats to e-commerce,

3. Fundamentals of the Internet,
4. Legal aspects of commerce,
5. Information security technologies,
6. Personnel vulnerabilities,
7. Security aspects of the Internet,
8. Client-side vulnerabilities,
9. Transmission vulnerabilities,
10. Server-side vulnerabilities,
11. Operating system vulnerabilities,
12. Certificates,
13. Public-key infrastructures,
14. Non-repudiation,
15. Certification practices.

ISQA 8540
COMPUTER SECURITY MANAGEMENT

COURSE DESCRIPTION

Overview of content and purpose of the course

The course will integrate concepts and techniques from management, computer science, and organizational behavior to identify, understand, and propose solutions to the problems of computer security and security administration. The purpose of the course is to prepare the student for leadership positions in computer system management.

CONTENT AND ORGANIZATION

List of topics to be covered in chronological sequence

1. Overview of Computer Security,
2. Physical Protection,
3. Hardware Security Controls,
4. Software Controls,
5. Configuration Management,
6. Encryption Techniques,
7. Database Security,
8. Telecommunications Security,
9. Microcomputer Security,
10. Viruses
11. Legal Issues
12. Current Legislation
13. Ethical Use of Computers
14. Security Policy and Managerial Issues
15. Disaster Planning and Recovery
16. New Technologies and Trends

ISQA 8560
INFORMATION WARFARE AND SECURITY

COURSE DESCRIPTION

Overview of content and purpose of the course

This course will study the nature of information warfare, including computer crime and information terrorism, as it relates to international, national, economic, organizational, and personal security. Information warfare policy and ethical issues will be examined.

CONTENT AND ORGANIZATION

List of topics to be covered in chronological sequence

1. Overview of Information Warfare (IW)
2. Information Warfare in Context
3. Export Controls on Cryptography
4. Open Sources, Psyops and Perception Management
5. Insider Threat, Espionage
6. Signals Intelligence, Fraud, and Sabotage
7. Computer Break-ins, Hacking, Masquerading, Cyberplagues
8. Secrecy and Authentication
9. Monitors, Gatekeepers, Risk Management, Incident Handling
10. The IW Threat
11. Defensive IW Policy and Programs
12. Encryption Policy
13. IW Policy and Ethics

ISQA 8570
INFORMATION SECURITY POLICY, PRIVACY, AND ETHICS

COURSE DESCRIPTION

Overview of content and purpose of the course

The course will cover the development and need for information security policies, issues regarding privacy, and the application of computer ethics.

CONTENT AND ORGANIZATION

List of topics to be covered in chronological sequence

1. The Need for Security
2. The Importance of a Security Policy
3. Building a Foundation for the Policy
4. Analyzing Risks
5. Developing a Security Policy
6. Communicating Policy to Users
7. Implementing the Policy
8. The Problem with Content
9. The Problem with Privacy
10. Copyrights, Freedom of Speech, and Related Rights
11. Trademarks and Unfair Competition in Cyberspace
12. Patents, Trade Secrets, Antitrust, and Standards
13. Protecting Consumers and Their Privacy: Tools and Agents
14. Intellectual Property
15. Use of Computer Services
16. Privacy Rights
17. Ownership of Programs
18. Proprietary Resources

3. CONCLUSION

To evaluate the content of the courses and determine the thoroughness of the coverage, we constructed a spreadsheet of Appendix I of NSTISSI No. 4013 - National Training Standard for System Administration in Information Systems Security. The items of Appendix I were listed in the rows of the spreadsheet and the courses were listed as columns. When an individual item was addressed in a course, a 1 was placed in the row of the item and under the column of the course. The faculty members responsible for each course were asked to fill out the column for each course as they now teach it. An item of question was the exact meaning of the terms used in the Standard, for example, does "define" mean to specify and promulgate a listed item or does it mean to outline the essential elements of a listed item. It was felt that our students should be able to perform the latter, but that they would have no experience in actually writing and promulgating a policy or procedure. Pending resolution of this ambiguity, the faculty was directed to interpret these items conservatively. A column was inserted in which row summations could be calculated; a 0 would indicate no coverage and any positive number would indicate coverage of the item. The resulting spreadsheet is included as Appendix I of the paper.

We conclude that the courses of the Information Assurance concentration provide substantial coverage of the requirements of NSTISSI No. 4013 - National Training Standard for System Administration in Information Systems Security. Most of the items that are not covered are those peculiar to government operations and the evaluation scenario of the Standard. The spreadsheet does spotlight items that deserve further attention:

1) the need for a "local" environment in which students can put into practice many of the elements of the Standard, and

2) the lack of coverage of TEMPEST.

Some of the former may be covered in classroom or laboratory exercises after appropriate exercise material has been prepared. Coverage of TEMPEST materials may require outside assistance, such as USSTRATCOM.

This study demonstrates that the courses of the Information Assurance concentration provide substantial coverage of the requirements of NSTISSI No. 4013 - National Training Standard for System Administration in Information Systems Security. There is also coverage of topics relevant to the needs of the business community. The items of NSTISSI No. 4013 that are not covered are those peculiar to government operations and the evaluation scenario posited by that Standard. Based on these results, it is concluded that the courses of the Information Assurance concentration provide background and preparation for students to enter the field of Information Assurance in either business or government service.

Clearly, the construction of the spreadsheet has a two-fold benefit. It allows us to perform an evaluation of our current program, and it will support future improvements and ongoing evaluation.

4. REFERENCES

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V. APPENDIX

During the presentation, actual copies of the spreadsheet will be distributed to session participants. Additional requests can be requested through our email addresses.