



Responding to Critical Educational Needs: Information Systems and Technology

Ralph D. Semmel and Charles R. Westgate

Information technology is advancing at a phenomenal rate. Although traditional graduate programs in computer science and business have dealt with aspects of this evolving discipline, few have focused specifically on the design and integration of complex information systems. To address this need, the Milton S. Eisenhower Research and Technology Development Center at the Applied Physics Laboratory has been instrumental in the creation of a new graduate program in information systems and technology. The program, designed to appeal to a diverse audience, will provide professionals with both a systems perspective and the technical skills needed to develop effective solutions for complex information processing and decision support problems. (Keywords: Graduate education, Information systems, Information technology, Whiting School of Engineering.)

INTRODUCTION

The Milton S. Eisenhower Research and Technology Development Center has long been committed to supporting graduate education in science and technology. Serving both as faculty members and program administrators, Research and Technology Development Center personnel have distinguished themselves in numerous Hopkins programs. Within the Whiting School of Engineering, for example, staff members currently serve as Chair or Vice-Chair of three part-time graduate programs, participate as program committee members in five programs, and have teaching appointments in six programs.

During the past year, the Research and Technology Development Center has played a central role in the

establishment of a new Master of Science program in information systems and technology (IS&T), which is being offered by the Whiting School of Engineering as part of its Part-Time Programs in Engineering and Applied Science. With roots in computer science, telecommunications, and technical management, the program is designed to provide formal educational opportunities leading to advanced degrees for working professionals.

As a discipline, IS&T is concerned with the analysis, design, development, and integration of systems that enable the effective and efficient use of information. Practitioners in the field employ techniques and methods for creating and managing automated systems that

solve real-world problems. The IS&T program is designed to satisfy the increasing demand by students and industry for a course of study that provides a technically sound education in the rapidly expanding field of information technology (IT). By providing a broad-based education in the field, the IS&T program enables students to design effective information processing systems, develop efficient computer and communications networks, conduct complex systems analyses, and create sophisticated decision support systems.

ANTICIPATED NEEDS

The IS&T program today is in a position similar to that of the computer science program 25 years ago. Started in 1971, the computer science program was designed to encourage scientists and engineers to enter a new and rapidly growing field desperately in need of professionals. Now supporting a more mature discipline, the computer science program offers almost 80 courses in 8 concentrations and has close to 1000 students attending classes each semester.

The IS&T program has also been created to support an expanding field with a critical need for professionals. However, the audience today is far more eclectic than it was 25 years ago for computer science. In particular, rapid advances in information technology are driving people with extremely diverse backgrounds into the field. Thus, in addition to scientists and engineers, technically oriented business people must acquire significant IT expertise to design and effectively use complex information systems. Similarly, professionals from education, medicine, journalism, and other disparate areas are becoming increasingly reliant upon information technology to dramatically redefine and perform their jobs.

Projected growth rates of employment opportunities for information technology professionals are astounding. For example, recent Bureau of Labor statistical data indicate that opportunities for systems analysts between 1992 and 2005 will grow by 110%.¹ Moreover, the same data indicate that the need for computer engineers and scientists will grow by 112%. These two categories represent the two greatest increases of the 10 most rapidly growing occupations in the United States. Articles in various newspapers and trade journals have also indicated the extensive and increasing demand for information technology professionals, citing growth rates between 25 and 50% per year.^{2,3} As designed, the IS&T program will provide the critical education needed to enable graduates to fill systems analysis positions and, because of its engineering orientation, will prepare graduates to fill a significant number of applied computer science positions as well.

In Maryland, the demand for IT professionals is particularly acute. The Maryland Plan for Postsecond-

ary Education, for example, has identified the need for more engineering program opportunities in the Washington–Baltimore region and specifically identifies information technology as one of five critical areas.⁴ The new IS&T program supplements related programs offered in the region, presenting information technology from a systems perspective and bridging the gap between traditional engineering and business programs. In particular, the IS&T program offers greater technical depth than is found in business curricula and provides greater focus on developing and managing systems than is found in computer science programs. Figure 1 indicates the relationship of the IS&T program to several other Whiting School of Engineering programs as well as to traditional master of business administration programs. Although the figure is not meant to indicate the degree of overlap, it does highlight the niche filled by the IS&T program.

The relevance of the IS&T degree has also been examined with local business and government leaders, technical and training managers, and current and prospective students. Response has been uniformly positive, and industry representatives, in particular, have expressed interest both in hiring new information technology professionals and in having employees attend Hopkins for formal instruction regarding the construction of complex information systems.

THE CURRICULUM

Although the bounds delineating information technology are still evolving, it is evident that the scope of the discipline is immense. Consequently, the Master of Science program in IS&T is designed to be broad-based. The program balances theory with practice, offers an extensive set of traditional and state-of-the-art courses, and provides the flexibility to accommodate students with varying backgrounds. A variety of courses are offered, including decision support systems, telecommunications and networking, systems analysis and

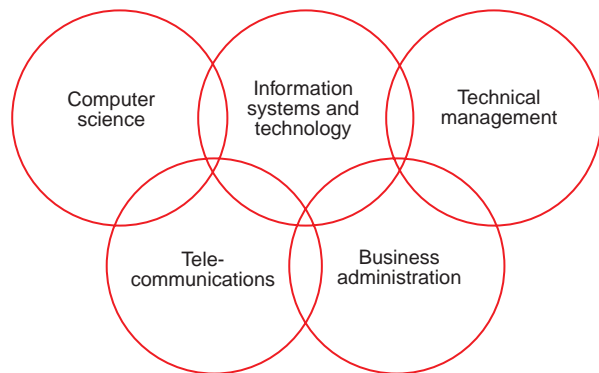


Figure 1. Relationship among selected graduate programs.

design, software development, database and multimedia systems, human-computer interaction, distributed systems, and project management. In addition, courses in computer science, electrical engineering, and technical management may be taken by students wishing to pursue related topics.

Faculty members are drawn from APL, the Whiting School of Engineering, and research and development organizations in the Washington-Baltimore area such as IBM, MITRE, Lockheed Martin, and the Naval Research Laboratory. Given the breadth of the field, efforts have been made to ensure that the research and development interests of the faculty span the entire spectrum of information systems and technology.

The M.S. degree requires the completion of 10 courses drawn from offerings unique to the information systems discipline (e.g., decision support systems and human factors), applied computer science courses (e.g., software engineering and computer security), and selected technical management courses (e.g., system engineering and project management). Of the 10 required courses, 8 must be IS&T offerings or cross-listed with IS&T. Two electives may be selected from other Whiting School programs.

To appeal to an eclectic audience, technical prerequisites have been kept to a minimum. However, a technically oriented undergraduate degree is preferred, and students must have taken 1 year of undergraduate mathematics (e.g., 1 semester of calculus and 1 semester of statistics) and 1 year of undergraduate computer science (i.e., 1 semester of structured or object-oriented programming, preferably using C++, and 1 semester of data structures). To accommodate a diverse group of students, courses satisfying both computer science prerequisites are offered through the IS&T and computer science programs.

The boxed insert presents a sample program plan that could be completed in 2 years. Of the courses listed, the first three are foundational and must be taken by all students. These courses form a common core of knowledge that all graduates of the IS&T program must possess. The first and third courses are unique to the IS&T program, and the second is drawn from the computer science curriculum. The first course, Foundations of Networking and Telecommunications, covers fundamentals of voice, data, image, and video communications required by distributed information processing systems. The second course, Foundations of Software Engineering, provides a basis for enabling students to work in teams to analyze and develop solutions to complex problems requiring coordinated software development efforts. Finally, Foundations of Decision Support Systems introduces students to the architectures and capabilities of management-support and knowledge-based systems for modeling and decision making for unstructured problems. The remaining

courses are drawn from IS&T, computer science, and technical management and provide students with broad exposure to several information technology areas.

SUMMARY

Information technology permeates all aspects of modern society, yet existing educational programs have not been designed to provide students with the skills needed to develop effective and efficient solutions to real-world information processing problems. Recognizing the need for a targeted curriculum, the Research and Technology Development Center has been instrumental in creating a new graduate program in information systems and technology. Building upon APL's strengths and upon existing programs in computer science, telecommunications, and technical management,

SAMPLE PROGRAM PLAN LEADING TO A MASTER OF SCIENCE DEGREE IN INFORMATION SYSTEMS AND TECHNOLOGY

Year 1

Fall

- Foundations of Networking and Telecommunications¹
- Foundations of Software Engineering²

Spring

- Foundations of Decision Support Systems¹
- Internetworking Fundamentals¹

Summer

- Quantitative Approaches for Decision Analysis¹

Year 2

Fall

- Database Systems³
- Introduction to Systems Engineering⁴

Spring

- Human Factors in Information Systems¹
- Enterprise Security and Privacy²

Summer

- Distributed Systems¹

¹New course in IS&T program.

²Existing course in computer science program.

³Modified course from computer science program.

⁴Existing course in technical management program.

the program provides students with both a systems perspective and the deep technical skills needed to design, develop, and integrate large and complex information systems.

As currently organized, the IS&T program fills an important niche between traditional computer science programs and graduate programs in business and management. As a result, it will appeal to a broad range of technically oriented professionals. In fact, considerable positive feedback has already been received from indus-

try, government, and students, and significant growth is expected during the next several years.

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THE AUTHORS



RALPH D. SEMMEL is a member of APL's Principal Professional Staff and Supervisor of the Advanced Signal and Information Processing Group of the Milton S. Eisenhower Research and Technology Development Center. He received a B.S. in engineering from the U.S. Military Academy in 1978, an M.S. in systems management from the University of Southern California in 1981, an M.S. in computer science from The Johns Hopkins University in 1985, and a Ph.D. in computer science from the University of Maryland, Baltimore, in 1992. He has published more than 40 papers in the areas of database systems, artificial intelligence, and software engineering, and is currently investigating automated query formulation over distributed and heterogeneous systems. Dr. Semmel also serves as Chair of both the computer science and the information systems and technology programs in the Whiting School of Engineering Part-Time Programs in Engineering and Applied Science. His e-mail address is Ralph.Semmel@jhuapl.edu.



CHARLES R. WESTGATE is the Associate Dean for Academic Affairs for the Whiting School of Engineering and the William B. Kouwenhoven Professor of Electrical Engineering. He also holds a joint appointment on APL's Principal Professional Staff. He received his B.E.E. degree from Rensselaer Polytechnic Institute and his M.A. and Ph.D. degrees from Princeton University. Since 1966, he has been a faculty member in the Electrical and Computer Engineering Department on the Homewood campus of Hopkins. His current research activities are focused on high-speed and microwave circuits. He has taught in the Whiting School of Engineering Part-Time Programs, most recently with M. Lee Edwards in a course on microwave circuits. His e-mail address is cwestgate@jhu.edu.