Difference in Computing Degrees

North Carolina A&T State University has four different computer oriented degrees: Computer Science, Computer Engineering, Business Administration with a Management Information Systems concentration and Electronics Technology. The following description of the different computing degrees is taken from the "*Computing Curricula 2004 Overview Report*" available at http://www.acm.org/education/Overview_Draft_11-22-04.pdf

2.3.1. Computer Engineering

A BS in Computer Engineering is offered by the Electrical and Computer Engineering department in the College of Engineering. The department also offers, BS, MS and Ph.D. degrees in Electrical Engineering.

Computer engineering is concerned with the design and construction of computers, and computer based systems. It involves the study of hardware, software, communications, and the interaction among them. Its curriculum focuses on the theories, principles, and practices of relevant areas of traditional electrical engineering and mathematics, and applies them to the problems of designing computers and the many kinds of computer-based devices.

Computer engineering students study the design of digital hardware systems, including computers, communications systems, and devices that contain computers. They also study software development with a focus on the software used within and between digital devices (not the software programs directly used by computer users). The emphasis of the curriculum is on hardware more than software, and it has a very strong engineering flavor.

Currently, a dominant area within computing engineering is embedded systems, the development of devices that have software components embedded in hardware. For example, devices such as cell phones, digital audio players, digital video recorders, alarm systems, x-ray machines, and laser surgical tools all require integration of hardware and embedded software, and are all the result of computer engineering.

2.3.2. Computer Science

BS and MS degrees in Computer Science are offered by the Computer Science department in the College of Engineering.

Computer science spans a wide range, from its theoretical and algorithmic foundations to cutting-edge developments in robotics, computer vision, intelligent systems, bioinformatics, and other exciting areas. We can think of the work of computer scientists as falling into three categories:

- They design and implement software. Computer scientists take on challenging programming jobs. They also supervise other programmers, keeping them aware of new approaches.
- They devise new ways to use computers. Progress in the CS areas of networking, database, and human-computer-interface enabled the development of the World Wide Web. Now, researchers are working to make robots be practical aides that demonstrate intelligence, are using databases to create new knowledge, and are using computers to help decipher the secrets of our DNA.

- They develop effective ways to solve computing problems. For example, computer scientists develop the best possible ways to store information in databases, send data over networks, and display complex images. Their theoretical background allows them to determine the best performance possible, and their study of algorithms helps them develop new approaches that provide better performance.

Computer science spans the range from theory to programming. While other disciplines can produce graduates better prepared for specific jobs, computer science offers a comprehensive foundation that permits graduates to adapt to new technologies and new ideas.

2.3.3. Information Systems

A BS in Business Administration with a Management Information Systems concentration is offered by the Business Administration department in the School of Business.

Information systems specialists focus on integrating information technology solutions and business processes to meet the information needs of businesses and other enterprises, enabling them to achieve their objectives in an effective and efficient way. This discipline's perspective on "Information Technology" emphasizes *information*, and sees *technology* as an instrument to enable the generation, processing and distribution of needed information. Professionals in this discipline are primarily concerned with the information that computer systems can provide to aid an enterprise in defining and achieving its goals, and the processes that an enterprise can implement and improve using information technology. They must understand both technical and organizational factors, and must be able to help an organization determine how information and technology-enabled business processes can provide a competitive advantage.

The information systems specialist plays a key role in determining the requirements for an organization's information systems and is active in their specification, design, and implementation. As a result, such professionals require a sound understanding of organizational principles and practices so that they can serve as an effective bridge between the technical and management communities within an organization, enabling them to work in harmony to ensure that the organization has the information and the systems it needs to support its operations. Information systems professionals are also involved in designing technology-based organizational communication and collaboration systems.

A majority of *Information Systems* (IS) programs are located in business schools, and all IS degrees combine coursework in business and computing. A wide variety of IS programs exists under various labels which often reflect the nature of the program. For example, programs in Computer Information Systems usually have the strongest technology focus, whereas programs in Management Information Systems sometimes emphasize organizational and behavioral aspects of the IS discipline. The names of the degree programs are not always consistent.

2.3.4. Information Technology

Information technology is a label that has two meanings. In the broadest sense, the term "information technology" is often used to refer to all of computing. In academia, it refers to undergraduate degree programs that prepare students to meet the technology needs of business, government, healthcare, schools, and other kinds of organizations.

In the previous section, we said that *Information Systems* focuses on the “information” aspects of “information technology”. *Information Technology* is the complement of that perspective: its emphasis is on the technology itself more than on the information it conveys. IT is a new and rapidly growing discipline which started as a grass roots response to the practical, everyday needs of business and other organizations. Today, organizations of every kind are dependent on information technology. They need to have appropriate systems in place. Those systems must work properly, be secure, and be upgraded, maintained, and replaced as appropriate. People throughout an organization require support from IT staff who understand computer systems and their software, and are committed to solving whatever computer related problems they might have. Graduates of information technology programs address these needs.

Degree programs in Information Technology arose because degree programs in the other computing disciplines were not producing an adequate supply of graduates capable of handling these very real needs. IT programs exist to produce graduates who possess the right combination of knowledge and practical, hands-on expertise to take care of both an organization’s information technology infrastructure and the people who use it. IT specialists assume responsibility for selecting hardware and software products appropriate for an organization, integrating those products with organizational needs and infrastructure, and installing, customizing and maintaining those applications for the organization’s computer users. Examples of these responsibilities include: the installation of networks; network administration and security; the design of web pages; the development of multimedia resources; the installation of communication components; the oversight of email products; and the planning and management of the technology life-cycle by which an organization’s technology is maintained, upgraded, and replaced.

2.4. Snapshots: Graphical views of the computing disciplines

To help you understand the commonalities and differences among the computing disciplines, we have created graphical characterizations of them. They provide a simple view of how the various disciplines currently occupy the "problem space" of computing. They have the temporal flavor of snapshots as they represent established goals, not ambitions for the future.

The horizontal range runs from "Theory, Principles, Innovation" on the left, to "Application, Deployment, Configuration" on the right. Thus, someone who likes the idea of working in a laboratory to invent new things, or in a university to develop new principles will want to work in a discipline that occupies the space to the left. Conversely, someone who wants to work with people to help them choose and use appropriate technology or who wants to learn how to integrate off-the-shelf products to solve organizational problems will want an area that occupies space to the right. Because there are many, many kinds of jobs and tasks that fall between these two extremes, one should not just look only at the far left and far right, but rather consider the range of possibilities in between those extremes.

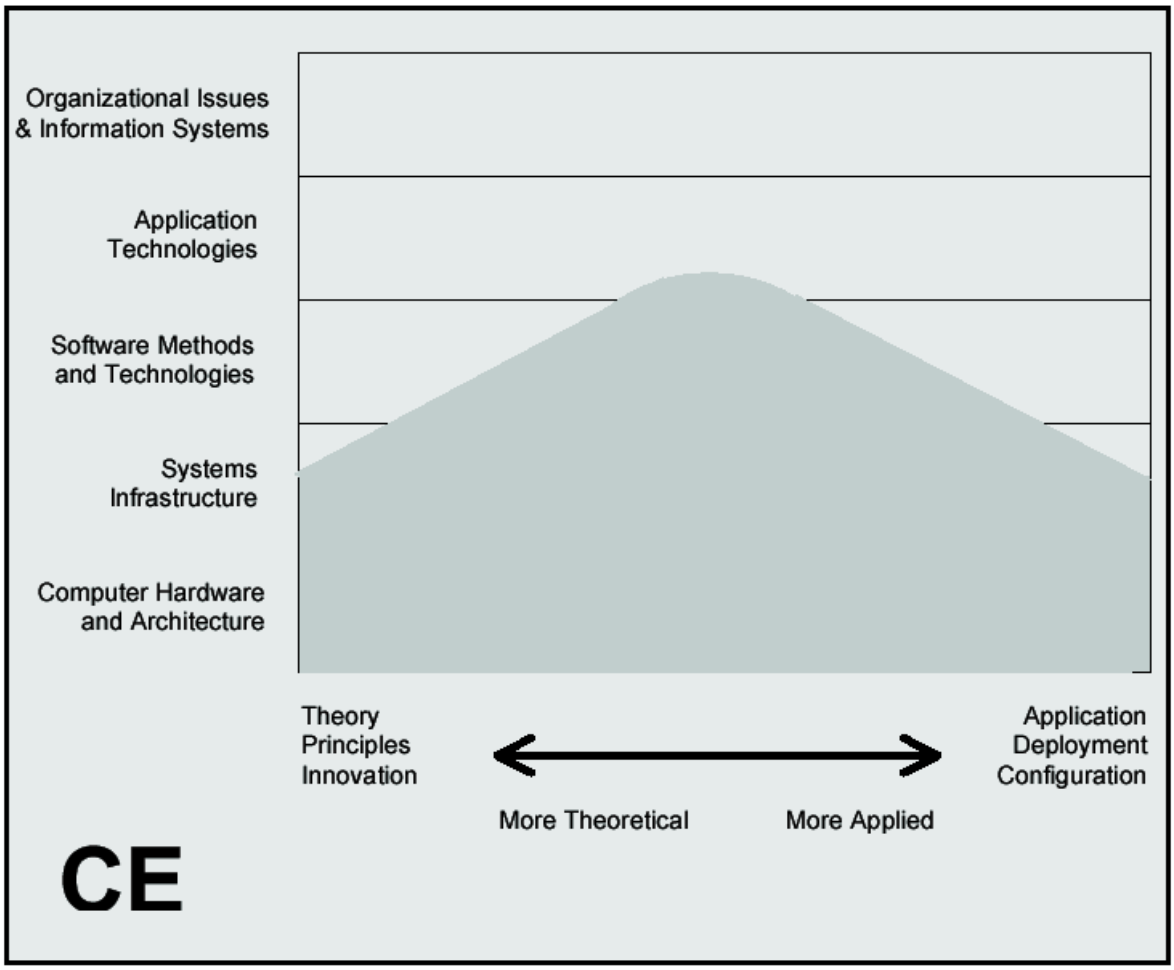
The vertical range runs from "Computer Hardware and Architecture" at the bottom, to "Organizational Issues and Information Systems" at the top. As we move higher on this axis, the focus of work is more on people, information, and the organizational workplace. As we move lower on this axis, the focus of work is more on devices and on the data shared among them. Thus, someone who likes designing and building circuits, or who is fascinated with the inner workings of computers, will care about the lower portion of the space, while someone who likes seeing how technology can work for people, or who is curious about the impact of technology and information on organizations, will care about the upper portion of the space.

We can consider the horizontal and vertical dimensions together. For example, someone who cares about making things work for people and is more interested in devices than information or organizations will be interested in the lower-right, someone who wants to develop new theories about how information affects organizations will be interested in the upper-left, and so on. In Figures 2.3 through 2.7, we use this framework to sketch out the conceptual territory occupied by each of the five computing disciplines.

Note: These illustrations show only computing topics. Both *computer engineering* and *information systems* programs devote significant attention to topics which are outside of computing and not reflected in this diagram.

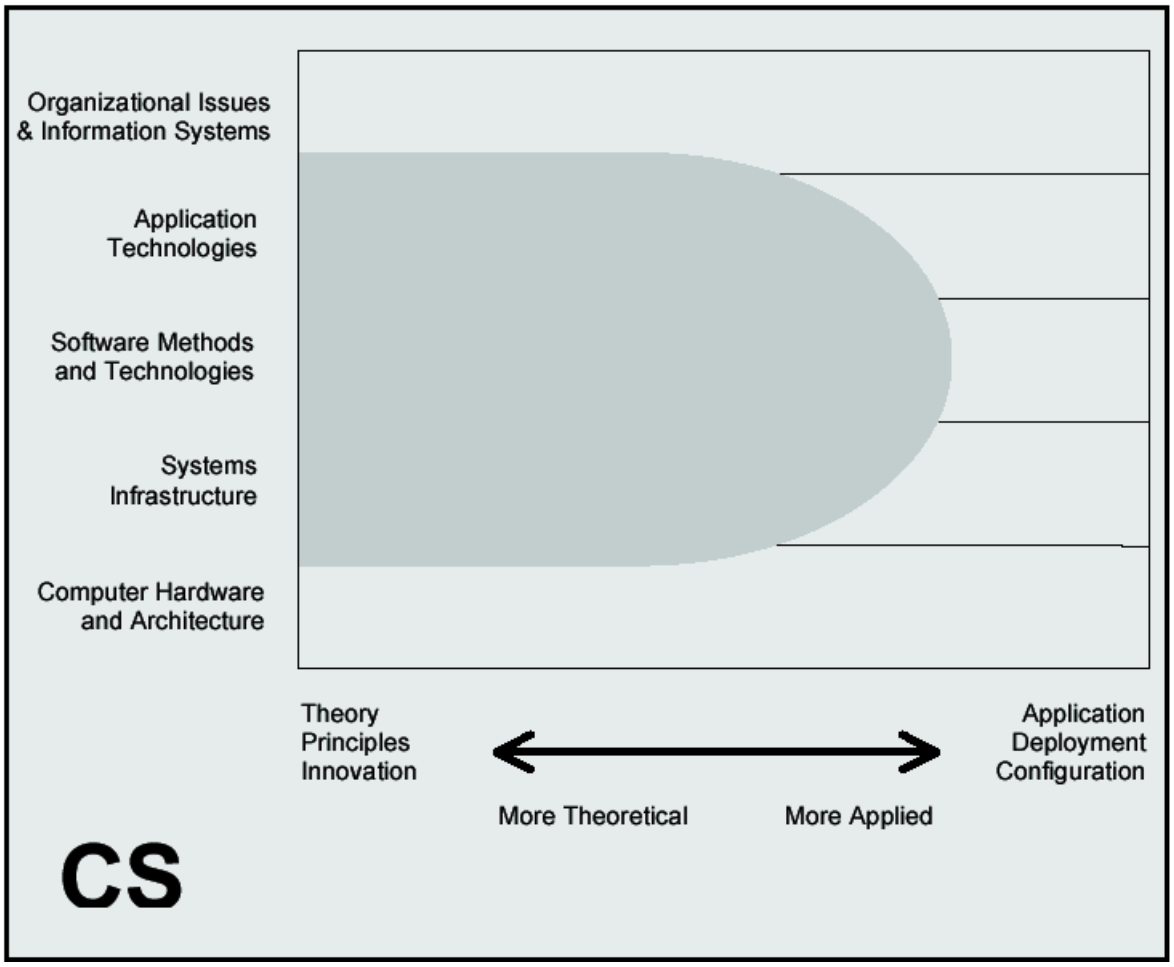
2.4.1. Computer Engineering

The shaded portion in figure below represents the *computer engineering* discipline. It is broad across the bottom because computer engineering covers the range from theory and principles to practical application of designing and implementing products using hardware and software. It narrows towards the center as we move upwards because computer engineers' interests narrow as we move away from the hardware. By the time we get up to the level of software development, we see that computer engineers' interest has narrowed to the horizontal center because they care about software only inasmuch as they need it to develop integrated devices.



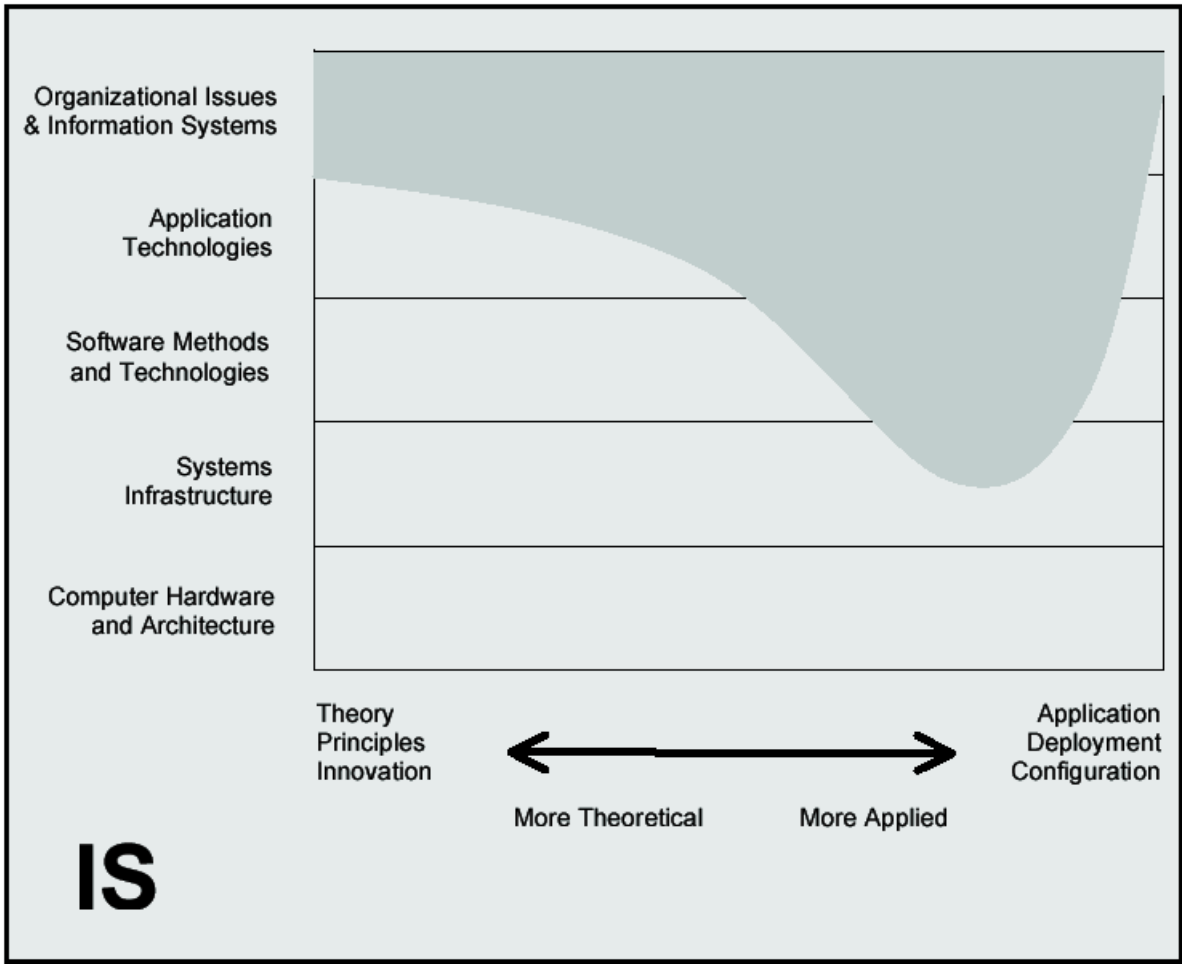
2.4.2. Computer Science

The shaded portion in the figure below represents *computer science*. Computer science covers most of the vertical space between the extreme top and extreme bottom because computer scientists generally do not deal with "just the hardware" that runs software, or about "just the organization" that make use of the information that computing can provide. As a group, computer scientists care about almost everything in between those areas (down as far as the software that enables devices to work; up as far as the information systems that help organizations operate). They design and develop all types of software, from systems infrastructure (operating systems, communications programs, etc.) to application technologies (web browsers, databases, search engines, etc.) Computer scientists create these capabilities, but they do not manage the deployment of them. Therefore, the shaded area for computer science narrows and then stops as we move to the right. This is because computer scientists do not help people to select computing products, nor tailor products to organizational needs, nor learn to use such products.



2.4.3. Information Systems

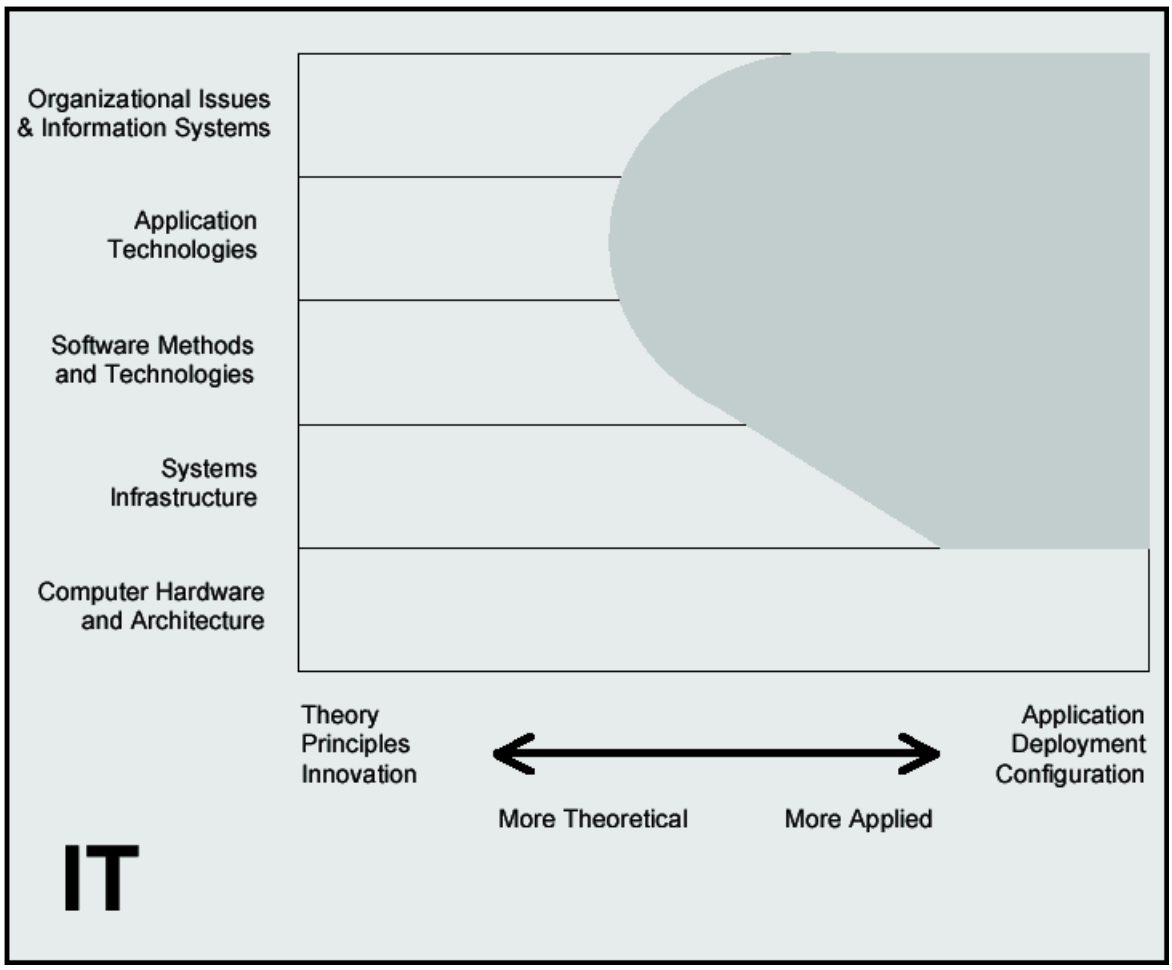
The shaded portion in the figure below represents the discipline of *information systems*. The shaded area extends across most of the top-most level because IS people are concerned with the relationship between information systems and the organizations that they serve, extending from theory and principles to application and development; many IS professionals are also involved in system deployment and configuration and training users. The area covered by IS dips downward, all the way through software development and systems infrastructure in the right half of the graph. This is because IS specialists often tailor application technologies (especially databases) to the needs of the enterprise, and they often develop systems that utilize other software products to suit their organizations' needs for information. (This figure does not reflect the attention that *information systems* programs devote to core business topics. See Chapter 3 for tables which summarize both computing and non-computing topics.)



2.4.4. Information Technology

The shaded portion in the figure below represents the *information technology* discipline. Its shaded area extends down most of the right edge, as it focuses on the application, deployment, and configuration needs of organizations and people over a wide spectrum. Across this range (from organizational information systems, to application technologies, and down to systems infrastructure), their role has some overlap with IS, but IT people have a special focus on satisfying human needs that arise from computing technology. In addition, IT's shaded area goes leftwards, from application towards theory and innovation, especially in the area of application technologies. This is because IT people often develop the web enabled digital technologies that organizations use for a broad mix of informational purposes, and this implies an appropriate conceptual foundation in relevant principles and theory.

Because IT is a very new discipline, its focus has been on developing educational programs that give students a foundation in existing concepts and skills. Many in the community of IT faculty assert that research in their field will grow to create and develop new knowledge in relevant areas. When that happens, an appropriate snapshot would feature a shaded area that extends significantly further to the left. However, this is an ambition and not yet an achievement. This figure reflects IT's current status.


Organizational Issues & Information Systems
Application Technologies
Software Methods and Technologies
Systems Infrastructure
Computer Hardware and Architecture
Theory
Principles
Innovation
Application
Deployment
Configuration
More Theoretical
More Applied
IT