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Discipline of Information Technology: History and Development

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2.1.1 Emergence of the IT Discipline

Since the introduction of computers several decades ago, there have always been those who spend some of their time solving problems with computers. This became particularly true after the advent of the personal computer, as in this new era the majority of computer users were not trained in computers, and, indeed, did not want to be. This was intensified as the World Wide Web became ubiquitous. These trends gave rise to the need for professionals with a unique skill set, which, as we will discuss later in this chapter, were not being provided by the traditional computing programs.

In response to these needs, new 4 year computing degree programs emerged at several institutions in the United States; the earliest was introduced in 1992. These programs, which were typically titled “information technology” (IT), grew out of the need to produce professionals with the skills necessary to support the use of the newly ubiquitous computing tools. In the past decade, the number of these programs has grown. In 2012, there are at least 50 such programs, of various flavors, in the United States.

The objectives of this chapter are to further chronicle the emergence of this new computing discipline of IT and its maturation, and to draw a contrast between it and the other computing disciplines.
the disciplines of computer science (CS) and (IS)). This was also mostly true of those who used computers. And if someone outside the “computing cognoscenti” wanted to use computers, it was necessary for them to immerse themselves in this knowledge domain.

This began to change with the introduction of the personal computer, and with further system software releases (particularly the graphical user interfaces of the Mac OS and Windows). Computers were soon in the hands of people who wanted to harness their capabilities, but did not want to have to learn all the details of how they worked. Thus, the need arose for a computing discipline whose responsibility was to solve computer application problems for this new computing generation. From this history grew the broad goals of IT programs:

1. Explain and apply appropriate information technologies and employ appropriate methodologies to help an individual or organization achieve its goals and objectives
2. Function as a user advocate
3. Manage the IT resources of an individual or organization
4. Anticipate the changing direction of IT and evaluate and communicate the likely utility of new technologies to an individual or organization
5. Understand and, in some cases, contribute to the scientific, mathematical, and theoretical foundations on which information technologies are built
6. Live and work as a contributing, well-rounded member of society

In 2001, several of the institutions with 4 year programs in IT met to formally define IT as a separate academic discipline. The outgrowth of this meeting and the many meetings that followed included a formally accepted model curriculum, accreditation guidelines and criteria, and a special-interest group of the ACM: SIGITE—Special Interest Group for Information Technology Education.

The IT model curriculum, the first draft of which was published in 2005 and which was formally accepted by the Education Council of the ACM in 2008, defines the academic discipline of IT as follows:

“IT, as an academic discipline, is concerned with issues related to **advocating for users** and meeting their needs within an organizational and societal context through the **selection, creation, application, integration and administration** of computing technologies.” (emphasis in original).

This same document further lists the five pillars of IT: programming, networking, human–computer interaction, databases, and web systems, with information assurance and security being a “pervasive theme,” which, with other pervasive themes, are “woven-like threads throughout the tapestry of the IT curriculum.” The other pervasive themes are as follows:

- User centeredness and advocacy
- The ability to manage complexity through abstraction and modeling, best practices, patterns, standards, and the use of appropriate tools
- Extensive capabilities for problem solving across a range of information and communication
- Technologies and their associated tools
- Adaptability
- Professionalism (lifelong learning, professional development, ethics, responsibility)
- Interpersonal skills

The IT Model Curriculum also points to another important characteristic of the IT discipline, namely, its breadth. As mentioned in the IT model curriculum: “The depth of IT lies in its breadth...,” meaning that an identifying characteristic of the IT discipline is that it is very broad—anything having to do with the applications of computers lies within the domain of IT.

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2.1.2 Unique Nature of IT

Until fairly recently, the only computing programs that had had formally defined model curricula were CS, whose first model curriculum was promulgated in 1968, and IS, whose first model curriculum was accepted in 1973. For many years, CS and IS were the only widely recognized computing programs. However, in the early part of the 2000s, the relatively well-established computing disciplines of software engineering (SWE) and computer engineering (CE) started formulating new model curricula, as did the newer computing discipline of IT. These efforts took place primarily under the auspices of the ACM, the Association for Information Systems (AIS), and The Computer Society of the Institute for Electrical and Electronic Engineers (IEEE-CS). It also soon became clear that there was a need to describe the similarities and differences among the different computing disciplines.

In 2003, the ACM invited representatives of all five of these computing disciplines to write a document that would form a guide to undergraduate degree programs in computing. With oversight from the ACM, AIS, and IEEE-CS, two representatives from each of these disciplines met on several occasions. This effort resulted in 2005 in a report entitled "Computing Curricula 2005—The Overview Report." This document became very influential in helping to define the different computing disciplines with respect to each other. It provides, for each of these computing disciplines, insights into their history, descriptions, and graphical views, a table of the comparative weights of computing and non-computing topics (Table 2.1), and a table of the relative performance capabilities of computing graduates.

The Overview Report describes IT in the following way:

"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 field that started as a grassroots 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. These systems must work properly, be secure, and upgraded, maintained, and replaced as appropriate. Employees 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 systems; and the planning and management of the technology lifecycle by which an organization’s technology is maintained, upgraded, and replaced."

As indicated in the second paragraph of this quote, the needs of the rapidly growing computing community were not being fully met by the existing computing disciplines in academia. The desire to supply these needs was the major motivating factor that gave rise to the IT programs in academia.

On page 20 of The Overview Report is a depiction of the problem space of computing, specifically depicting the space occupied by IT, as shown in Figure 2.1.

This figure shows that IT is strongly focused on the application, deployment, and configuration of computing systems, and is concerned with four of the five domains identified on the left side of the figure.
TABLE 2.1  Computing and Non-Computing Topics and Performance Capabilities Which Identify IT

<table>
<thead>
<tr>
<th>Computing Topics</th>
<th>Non-computing topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming fundamentals</td>
<td>Risk management (project, safety risk)</td>
</tr>
<tr>
<td>Integrative programming</td>
<td>Mathematical foundations</td>
</tr>
<tr>
<td>Operating systems configuration and use</td>
<td>Interpersonal communications</td>
</tr>
<tr>
<td>Net centric principles and design</td>
<td>Performance capabilities</td>
</tr>
<tr>
<td>Net centric use and configuration</td>
<td>Provide training and support for users of productivity tools</td>
</tr>
<tr>
<td>Platform technologies</td>
<td>Create a software user interface</td>
</tr>
<tr>
<td>Human–computer interaction</td>
<td>Train users to use information systems</td>
</tr>
<tr>
<td>Information management (DB) practice</td>
<td>Maintain and modify information systems</td>
</tr>
<tr>
<td>Legal/professional/ethics/society</td>
<td>Model and design a database</td>
</tr>
<tr>
<td>Analysis of technical requirements</td>
<td>Select database products</td>
</tr>
<tr>
<td>Security: implementation and management</td>
<td>Configure database products</td>
</tr>
<tr>
<td>Systems administration</td>
<td>Manage databases</td>
</tr>
<tr>
<td>Systems integration</td>
<td>Train and support database users</td>
</tr>
<tr>
<td>Digital media development</td>
<td>Develop computer resource plan</td>
</tr>
<tr>
<td>Technical support</td>
<td>Schedule/budget resource upgrades</td>
</tr>
<tr>
<td>Non-computing topics</td>
<td>Install/upgrade computers</td>
</tr>
<tr>
<td>Risk management (project, safety risk)</td>
<td>Install/upgrade computer software</td>
</tr>
<tr>
<td>Mathematical foundations</td>
<td>Design network configuration</td>
</tr>
<tr>
<td>Interpersonal communications</td>
<td>Select network components</td>
</tr>
<tr>
<td>Performance capabilities</td>
<td>Install computer network</td>
</tr>
<tr>
<td>Provide training and support for users of productivity tools</td>
<td>Manage computer networks</td>
</tr>
<tr>
<td>Create a software user interface</td>
<td>Manage communication resources</td>
</tr>
<tr>
<td>Train users to use information systems</td>
<td>Manage mobile computing resources</td>
</tr>
<tr>
<td>Maintain and modify information systems</td>
<td>Manage an organization's web presence</td>
</tr>
<tr>
<td>Model and design a database</td>
<td>Configure and integrate e-commerce software</td>
</tr>
<tr>
<td>Select database products</td>
<td>Develop multimedia solutions</td>
</tr>
<tr>
<td>Configure database products</td>
<td>Configure and integrate e-learning systems</td>
</tr>
<tr>
<td>Manage databases</td>
<td>Evaluate new forms of search engine</td>
</tr>
</tbody>
</table>
It should be noted that since this figure was created and the field has matured, IT has developed a stronger focus in the area of systems infrastructure, which would be depicted in this figure by extending to the left the area of the gray shape in that fourth domain. For example, the IT model curriculum, which was still in draft form when the Overview Volume was being formulated and which was formally accepted in 2008, contains 10 IT-specific knowledge areas, of which four (platform technologies, networking, system integration and architecture, and system administration and maintenance) are most directly concerned with the systems infrastructure and one (information assurance and security) has a direct bearing on this layer.

Commenting on the information depicted in Figure 2.1, and similar figures for CE, CS, IS, and SWE, Agresti, in his 2011 paper, points out that these figures give each of the disciplines a “disciplinary theme,” and these themes are:

- CE = Hardware
- CS = Theory
- IS = Organizations
- IT = Deployment
- SE = Development

In explaining his choice of “deployment” for the IT disciplinary theme, Agresti states:

“[The figures depicting computing space] portray IT as anchored in the world of deployment, structuring and configuring computing artifacts. As new technologies appear, they need to be integrated with existing systems to have any beneficial effect for users.” (p. 260)

Thus, one of the main underlying principles of IT is that students in this discipline, compared to the other computing disciplines, should be the broadest in their knowledge of computing. They should know how to work with people of any discipline who know practically nothing about computers. They should know how to speak the language of those who do not care (or need) to know the details of how computers work or how to fix them. They should know how to get disparate computing systems to
work together. They should be very knowledgeable about each of the IT pillars of databases, human–computer interaction, networking, programming and web systems, and the pervasive themes from the IT model curriculum. The depth of this discipline is not in a single or a few knowledge areas, but in the breadth required. This goes along well with Agresti’s comment:

“Integration of technologies and interactions among them should be major focus areas of the IT discipline.”¹⁰

Another insight provided in this Overview Report is the data summarized in Table 2.1, consisting of the computing topics, non-computing topics, and relative performance capabilities of graduates of IT programs. In this table, the only topics or capabilities included are those for which IT programs were rated at a 4 or a 5 (out of 5), meaning that IT programs considered them an essential part of the identity of IT.¹¹

### 2.1.3 Accreditation

In 2003, SIGITE produced the criteria by which IT programs could be accredited by the Computing Accreditation Commission (CAC) of ABET. These criteria were accepted by CSAB Inc. and ABET in 2004, and in 2005 ABET began accrediting IT programs, along with programs in other major computing disciplines which ABET had already been accrediting.

At the time the IT criteria were created, the IT discipline was the only one of the three disciplines accredited by ABET CAC that had adopted an outcome-based approach to accreditation criteria.

**TABLE 2.2 Program Criteria for Information Technology and Similarly Named Computing Programs**

<table>
<thead>
<tr>
<th>Student Outcomes</th>
<th>Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. An ability to apply knowledge of computing and mathematics appropriate to the discipline</td>
<td>1. Coverage of the fundamentals of</td>
</tr>
<tr>
<td>b. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution</td>
<td>a. The core information technologies of human–computer interaction, information management, programming, networking, web systems, and technologies</td>
</tr>
<tr>
<td>c. An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs</td>
<td>b. Information assurance and security</td>
</tr>
<tr>
<td>d. An ability to function effectively on teams to accomplish a common goal</td>
<td>c. System administration and maintenance</td>
</tr>
<tr>
<td>e. An understanding of professional, ethical, legal, security, and social issues and responsibilities</td>
<td>d. System integration and architecture</td>
</tr>
<tr>
<td>f. An ability to communicate effectively with a range of audiences</td>
<td>2. Advanced course work that builds on the fundamental course work to provide depth</td>
</tr>
<tr>
<td>g. An ability to analyze the local and global impact of computing on individuals, organizations, and society</td>
<td>a. The core information technologies of human–computer interaction, information management, programming, networking, web systems, and technologies</td>
</tr>
<tr>
<td>h. Recognition of the need for and an ability to engage in continuing professional development</td>
<td>b. Information assurance and security</td>
</tr>
<tr>
<td>i. An ability to use current techniques, skills, and tools necessary for computing practice</td>
<td>c. System administration and maintenance</td>
</tr>
<tr>
<td>j. *An ability to use and apply current technical concepts and practices in the core information technologies</td>
<td>d. System integration and architecture</td>
</tr>
<tr>
<td>k. *An ability to identify and analyze user needs and take them into account in the selection, creation, evaluation and administration of computer-based systems</td>
<td>2. Advanced course work that builds on the fundamental course work to provide depth</td>
</tr>
<tr>
<td>l. *An ability to effectively integrate IT-based solutions into the user environment</td>
<td>a. The core information technologies of human–computer interaction, information management, programming, networking, web systems, and technologies</td>
</tr>
<tr>
<td>m. *An understanding of best practices and standards and their application</td>
<td>b. Information assurance and security</td>
</tr>
<tr>
<td>n. *An ability to assist in the creation of an effective project plan</td>
<td>c. System administration and maintenance</td>
</tr>
</tbody>
</table>

*The outcomes preceded with an * are those which are uniquely associated with IT programs.*
In other words, IT was the first of the three computing disciplines that formulated its criteria primarily in terms of the skills and knowledge that graduates from accredited IT programs could expect to have acquired, rather than in terms of, for example, the courses students needed to complete. This was probably a direct consequence of the fact that ABET itself had moved to an outcome-based approach shortly before the IT community formulated its accreditation criteria.

However, with ABET’s greater emphasis on outcomes, CS and IS also reformulated their criteria in terms of outcomes. Moreover, since ABET CAC wanted to be able to accredit computing programs that were not necessarily named “CS,” “IT,” or “IS,” the criteria were divided into general criteria, which any program in computing must meet to be accreditable, and program-specific criteria for specific computing disciplines. As part of this effort, a distinction was made between attributes that any graduate from a computing program should possess, and those attributes that are specific to graduates from IT programs. Table 2.2 lists the attributes for IT. Today there are 18 IT programs which have been accredited by the CAC, as shown in Table 2.3.

### 2.2 Distinguishing Characteristics of the IT Discipline

Because of the emergence of the computing discipline in response to a workforce development need, it can be argued that one of the distinguishing characteristics of IT is its highly practical nature. Computing has permeated a myriad of activities and disciplines, and graduates from IT programs are expected to be able to support computing tools and their users in a variety of settings. Because of this, most IT programs have an expectation that students develop some knowledge of a particular application domains, be it geology, health care, crime investigation, archeology, entomology, etc.

A good example of this is provided by the IT program at Georgia Southern University that originally required all IT students to include a so-called second discipline in their program of study, essentially a directed minor, with the explicit aim of making sure that students developed sufficient knowledge of an application domain to be able to develop and support IT applications for that domain. As a result,
the main impact that IT has on practice lies in the application domains where it is deployed, and upon which each domain has become increasingly dependent. A few examples will help make the point.

### 2.2.1 Applications in Health Care

All health-care providers have the need to have access to accurate and current patient records. These records should be secure, convenient, thorough, and readily available wherever they or their patients may be. This is an IT issue.

Drugs for health care must constantly be under inventory control, to keep supplies adequate for needs and to monitor for theft or abuse. The supply chain for these drugs must be documented to assure their authenticity and purity. Much of this is an IT issue.

Over the past few decades, billions of patient health-care records have been kept on computers. Such records often include data such as the demographics of the patient, the symptoms they experienced, the treatments provided, and the results of the treatments. This information, if fully searchable, constitutes a vast database which could yield dramatic insights into health-care treatments and their effectiveness. Making such a database readily available across all platforms (the Internet, desktops, laptops, tablets, and smart phones) is another research area with a large IT component.

### 2.2.2 Applications in Law Enforcement

Perpetrators usually have a characteristic method of operation (MO), which can often be used to recognize a group of crimes which may have all been committed by the same person. If there were a readily accessible and secure database which could be easily searched by law-enforcement workers, it would greatly enhance their ability to solve crimes. There has been a lot of progress in this area, and this progress is sufficient to convince practically anyone that further effort in this direction will yield great improvements. Such a database would be even more valuable if it were worldwide and available across all platforms. Since the Internet is nearly ubiquitous, it is probably only a matter of time and effort before this can be accomplished. Much of the wide deployment of this crime database is an IT issue.

Each person who has a criminal record has specific conditions of their position, whether incarcerated, on parole, in a half-way house, or free. Law-enforcement officers are greatly aided when they are quickly able to determine what these conditions are for each individual. Much of this is an IT problem.

Crime-scene investigators are greatly aided by rapid analysis of forensic evidence. And today, much of that evidence is digital, including cell-phone records and contents, laptop and pad-type computers, and GPS records. Accessing this evidence and amalgamating it with all the other crime-scene evidence is largely an IT issue.

### 2.2.3 Applications in Manufacturing

Manufacturing of a typical integrated circuit (IC) involves approximately 500 steps, each of which must be precisely controlled in the materials used, the temperature, the pressure, the time, and other parameters, which together are the “recipe” for each step and for each type of IC being produced. If any of these ingredients or conditions in any step of the recipe is not exactly controlled, or if any of the 500 steps is performed in the wrong order, hundreds or even thousands of ICs will be faulty and would have to be scrapped. Solutions in this domain always involve people from varied backgrounds, needing to access multiple data sources and integrate multiple applications. Thus, a very significant need is to have professionals able to work in nearly all areas of computing. These are IT professionals.

For most products today, each step in the manufacturing process is carefully monitored and data are gathered. These data, as with health-care and law-enforcement databases, become a rich store of data which can be mined to find ways to improve the manufacturing process. Much of this is an IT problem.
2.2.4 Applications in Education

Only a few decades ago, students registered for college classes with pen-and-paper forms which they took around to classes and had their professors sign. Problems and conflicts were many, especially in classes for which the demand was particularly high. Today, students at most institutions of higher education can register based on their class standing (with graduate students getting first pick, then seniors, juniors, etc.). They can see how many openings there are in every class they wish to register for. And they can do it all from their mobile platform of choice or a fixed computer. This dramatic improvement in the registration process has been primarily an IT solution because it has involved the integration of databases, hardware, networks, human–computer interfaces, web systems, security, storage, applications, and integrative programming.

College professors today have access to a very wide array of materials, including video clips, audio clips, photos, simulations, questionnaires, forms, equations, and applications. Many of these are available on the Internet. But there are concerns with copyrights, licenses, controlling access, and availability. At many institutions of higher education, such materials are made available through “courseware,” which is basically software that pulls together solutions for appropriate delivery of all such materials. This has greatly enriched the educational experience for all teachers and students with such access. Applying such courseware across an institution and all its varied courses is primarily an IT issue for the same reason as mentioned in the previous paragraph—because it involves the integration of so many computing areas and is deeply technical.

2.2.5 Summary: Impact on Practice

The preceding examples are illustrative only; many more examples could be provided in dozens of application domains. Graduates from computing disciplines such as CS and SE have done much to produce software for these applications. Graduates from CE have done much to provide hardware specific for these domains. And graduates from IS have done much to define how the software and hardware must perform in their specific organization and how information is processed to benefit the organization. And when the software and hardware are both deployed, there are always some changes that need to be made to make the system more effective in specific applications—that is the part most often played by the IT professionals. They must be able to see the entire situation as a system, consisting of multiple entities, each of which must be understood, and their interactions also known and designed for. In each of the scenarios described previously, the unique contribution provided by IT professionals is their view of the system as a whole. Thus IT professionals must be broad, able to deal with problems in the infrastructure, the software, the hardware, the networking, the web, the database, the human–computer interaction, the security, or any other part of the computing system.

2.3 IT Literature

The more practice-oriented nature of IT is also reflected in its relationship to the so-called practitioner literature, including white papers and case studies (some published by consulting firms), and the articles that appear in more practice-oriented publications, such as *Educause Review* and *CIO Magazine*. This material often reflects valuable insights from practice, but lacks the scientific rigor that is typically demanded by academic researchers. At the same time, the practitioner literature tends to have a greater influence on practice than the academic literature and since IT programs strongly prepare their students for practice, the discipline has to pay greater attention to this literature than some of the other computing disciplines do.

A good example that illustrates this is the emergence of the IT Infrastructure Library (ITIL), a set of best practices for IT service delivery. While there is relatively little academic literature on ITIL, the practitioner literature is replete with examples of implementations of ITIL and claims about its ability to improve the quality of IT service delivery. IT service organizations are starting to widely adopt the ITIL framework. As a reaction to this trend, IT programs are therefore starting to include coverage of ITIL.12

As Reichgelt et al. (Chapter 4 in this volume) argue, the fact that the practitioner literature lacks the rigor demanded by academia opens up a viable stream of possible research topics for the academic IT
community, namely, projects to find solid evidence for the claims made by practitioners using the traditional methods used in the various computing disciplines.

2.4 Research Issues

This volume contains a chapter on the topic of research in IT (see Chapter 4); the reader is advised to study that chapter for further depth in this area.

The academic discipline of IT is centered on the scholarship of application and the scholarship of integration, as defined in Boyer. This means that research in IT is most likely to be concerned with applications of IT in solving problems in many fields of endeavor. A bottom-up study of IT research embodied in IT masters theses shows that of the 70 theses studied, they could be classified into 5 categories:

1. Development projects (case studies)
2. Education and IT for the education domain
3. Information assurance, security, and forensics
4. Project management and IT for the project management domain
5. Technology evaluation and modeling

Subsequent research has reinforced these categories. Taken together, these categories demonstrate the point that IT is focused on application and integration. It is important to recall that the third category embraces the most central of the IT pervasive themes, which further emphasizes the point that the domain of IT is best defined by application and integration.

2.5 Future of Information Technology

There are two trends that are likely to influence the further evolution of the discipline of IT.

The first is that we are likely to see further growth in IT programs around the world. For example, the shift toward cloud computing in the way information services are delivered will result in a growing number of data centers, a trend that is likely to be exacerbated by the continued growth in the use of computing to support organizations and individuals. There will therefore be a growing need for graduates with the type of skills instilled by IT programs.

The growth of IT is likely to manifest itself in three ways. First, it is likely that there will be more programs calling themselves “IT” emerging at more institutions. However, there is also a second, more subtle, way in which IT is likely to become more widespread, in that programs will emerge that may not call themselves “IT” but that cover a large part of the IT model curriculum. Examples might include programs in information security or network technologies. Third, there is likely to be a shift in existing computing programs toward a greater coverage of aspects of the IT model curriculum. For example, more and more CS programs are introducing courses on information security that place a much greater emphasis on the more practical way in which these topics are covered in the IT model curriculum than the more theoretical way in which related topics are covered in the CS model curriculum. For example, such courses place much less emphasis on encryption algorithms and more emphasis on the more practical aspects of hardening the IT infrastructure against attacks.

All of this raises the question of how an IT program is defined. Rowe et al. have developed a series of metrics based on the IT model curriculum to determine how close a program is to being an IT program, independently of how it decides to designate itself. Using this metric, over 900 BS programs in computing in the United States were evaluated and over 300 of these programs were scored using these metrics. The results of this analysis produced a list of 4 year IT programs in the United States, as well as a list of names by which these programs call themselves. The point of this is that there is a great deal of diversity in computing programs, and in programs that appear to be IT programs. It is very likely that this diversity will continue to increase, as it seems to have done over the past few decades.
A second likely development is the greater emphasis on research. There is a growing realization within the academic IT community that if IT is to thrive, it needs to gain more credibility as a serious academic discipline. This is especially important in light of the fact that high-quality IT programs typically rely on more expensive equipment than, say, CS, IS, or SWE. For example, given the growing importance of cloud computing, and given the need to allow students to develop knowledge and skills of the type of data centers that support cloud computing, IT programs may wish to build scaled-down versions of such data centers. However, even scaled-down data centers are considerably more expensive than the more traditional computing labs to support programs in the other computing disciplines, and, at a time where resources are scarce in academia, it is often to make the case for a discipline that lacks academic credibility.

As an example, SIGITE, the ACM Special Interest Group for IT Education and an organization heavily involved in the formulation of both the IT model curriculum and the ABET CAC accreditation criteria for IT, has recently expanded its annual conference to include a joint conference on Research in Information Technology (RIIT). We are also seeing a growing number of papers calling for the need for an IT research agenda (see, e.g., [13], or the chapter by Reichgelt et al. in this volume).

The greater emphasis on research is also likely to result in a greater number of graduate programs in IT. An interesting issue that is likely to arise in this context is whether the traditional PhD program, with its much greater emphasis on theory, is best for IT, or whether the more professionally focused doctoral programs, such as Ed.D (Doctorate of Education) or DBA (Doctorate of Business Administration) programs provide a more appropriate model.

### 2.6 Summary

IT is both a very broad term and a much narrower term. The broad meaning of IT is anything having to do with computers. The much narrower meaning is the academic discipline of IT, which first arose in about 1992, and which was formally defined starting in 2003 and ending in 2008. As an academic discipline in computing, it has now taken its place alongside the CS and IS veterans and the CE and SE relative newcomers.

IT is primarily focused on integration and system-type thinking in computing. Its purview includes anything in computing, but it is generally not deep in any single domain of computing. IT prepares computing generalists, whose job includes the selection, application, creation, integration, and administration of computing solutions for an organization.

IT has accreditation criteria which have been used by ABET to accredit 18 4 year IT programs in the United States. IT also has a model curriculum which is of great value to any institution looking to establish or modify an IT program. There are at least 50 4 year IT programs in the United States today, and that number appears to be growing.

### Glossary

**Forensics**: For IT, this term refers to the efforts necessary to preserve evidence found in all types of IT artifacts, including phones, computers of all kinds, flash memory, optical disks, hard-disk drives, and magnetic tape. This also includes analyzing, recovering, identifying, and presenting summary information of the evidence found.

**Information assurance and security**: This field is known by at least three terms: information assurance; security; and cybersecurity. In this document, we have chosen to use information assurance and security for this field, as is done in the IT model curriculum.

**Model curriculum**: Each of the five major computing disciplines has defined a model curriculum (see [http://www.acm.org/education/curricula-recommendations](http://www.acm.org/education/curricula-recommendations)). This formally defined and approved document represents the best thinking of professionals in IT education and describes the core of what a 4-year program in IT should include.
Further Information

Reference #1, cited several times, is definitive and should be consulted for further information. For comparing the various computing programs with formally defined model curricula, the reader should consult reference #8, which is also definitive in that regard.

References