Electronic Teaching and Learning: Trends in Adapting to Hypertext, Hypermedia, and Networks in Higher Education

(Suggestions, Corrections, and Comments Welcomed)
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But the reason the new technology will prevail is that it combines the best of U.S. educational technology with the best of the famed Oxford and Cambridge one-on-one tutorials. As Sue Smith’s session at the computer demonstrates, multimedia technology allows each student to create his or her own solutions to problems by interacting with almost limitless sources of information. And it permits students to do so at their own paces and in places and at times of their own choosing. Elfin (1992, p. 110)

What I am saying is that the new technology offers, immeasurable more scope for relation-building in these domains. And ultimately the reason is that more dimensions of knowledge are present. When the technology was a technology (print, chalk, pencil) of the letterate (sic) word knowledge is reduced to one aspect: propositions that can be written down, than can be proved or refuted, perhaps debated. When the technology allows the building of a dragon, knowledge loses nothing of this vitally important aspect but also becomes dynamic, personal and interwoven with passion. Papert (1994, p. 2)

. . . the mechanisms of learning, of self-expression, and of communicating are not limited to words alone. Quite the contrary, in fact. Visual and auditory modes, for example, are also powerful and are used on a moment-by-moment basis in our everyday life . . . no longer need there be any penalty for using nontextual media in documents; no longer need there be any penalty for linking one’s documents to those of our collaborators, our peers. Transmitting documents that incorporate sound or even video to a colleague halfway around the world will be the norm as the Nintendo Generation moves into middle and high school. Soloway (1993, p. 26)

Twenty-one universities and colleges have been chosen as the flagship sites in the New Media Centers Initiative, an innovative program that teams industry and academia to foster multimedia in higher education . . . The mission of the New Media Centers program is to form model learning centers for new media technology in institutions of higher education worldwide. These centers serve as a resource for training and support to a broad range of users: faculty, staff, students, teachers, business executives, artists, film makers, and any other interest individuals within the university and the local public community. HEPC Syllabus (May/June 1994, p. 67)

The Law School at the College of William and Mary last week unveiled a state-of-the-art moot courtroom that school officials say is unrivaled in higher education. The courtroom at the Marshall-Wythe School of Law here is also more advanced than most functioning courtrooms in the United States, where videocassette recorders are often considered high-tech. Deloughry (1993a, p. A22)
This university (Penn) recognizes that technology tools must be united into coherent programs and systems if they are to truly improve the process of teaching and learning. The authors look at several specific issues being addressed at Penn: networks and communication links, including distance education and “the net”; electronic publishing with academia (“notebooks” and “disc-books); and the electronic library.

Farrington and Eleey (1994, p. 104)

Students (in Rensselaer introductory courses) give the new “studio” classes higher approval ratings than they gave traditional lectures in the past. Professors say the new methods have caused them to think more about their teaching. They are delighted to hear students ask questions that are more thoughtful than any asked in lectures.

DeLaughry (1995a, p. A19)

In 1994, an earlier version of this book became available for a $5.00 handling fee from the Center for Technology in Accounting (CETA), the University of North Texas, Denton, TX 76203-3677. Internet users may obtain a free copy of this book from Rice@Loyola.edu or Rice@Loyvax.bintnet. If there are any difficulties in connecting, contact the Pacioli Network centered in the College of Pacioli International Centre for Accounting Education using Computer and Multimedia (PIC-AECM) at Loyola College of Maryland, 4501 North Charles Street, Baltimore, MD 21210-2699 (Phone: 410-617-2478) and (Fax: 410-617-2006). The book contains technical details about why professors should start to develop hypermedia learning and research materials, how to go about hypermedia development, and who is doing what in accounting hypermedia development at the present time. The advantages of making the book available on computer disc include low cost availability, ease of updating, ability of readers to search text electronically, and ease of reader customization and note insertions. For example, readers will be able to modify and delete insertions among the thousands of products and hundreds of vendors listed in Appendix 6. Although no index is provided, readers are encouraged to conduct electronic searches of keywords of interest. A partial listing of such terms is provided in Chapter 0. The computer disk has a separate file for each chapter and appendix to make it easier for users to print individual chapters and appendices of interest. The book is written in Word for Windows and Excel, but most Windows-based word processors and spreadsheet software should be able to display and read the “.doc” and “.xls” files of the book. The separate “.doc” files may be merged into a single file to facilitate electronic keyword searches. Users having any difficulty reading or merging these files are urged to contact their computing centers if such centers are available. Unfortunately, we cannot provide further assistance in translating the book for your computer.

The spotlight of this book is on emerging technology options for educators seeking to author or otherwise modify teaching and research materials with only a modest starting investment. Although it is helpful to have authors such as Lynch (1993) catalog the “Core Skills in Multimedia Development” and “Steps in Developing a Multimedia Project,” we believe that faculty and other developers of learning materials should dive into hypermedia authoring waters even though they are lacking in some core skills and/or are lacking in some of the hardware and software items of their dreams. For most of us, hypermedia authoring is a bootstrapping, part-time effort for which we will never have ideal skills or facilities. We urge you not to sit on your thumbs waiting for the “pros” to make these materials available on a silver platter. By the time such materials are available to you, the silver will have tarnished in light of the rapid changes both in technology and in the content of what you want to make available to your students. The best teachers in modern times will be able to author their own materials, merge materials made available from others, and help students locate other sources of learning materials.
Although this book consumed huge amounts of our time and effort, we elected to make it available to the public with no financial remuneration to ourselves. Furthermore, we encourage readers to add updates and corrections on their own word processors. Our only request in return is that readers notify us of their revisions and corrections and give us permission to reproduce those changes for use by other readers. Chapters 4 and 5 along with several appendices make use of the results of a survey completed by colleges and universities in various parts of the world. We are grateful to the institutions listed in Appendix 2 who completed the long and difficult questionnaire. Chapter 2 and Appendix 1 use the results of a survey send to publishing firms. We thank those firms who took the time and trouble to respond. We also want to thank Robert Michaelson for agreeing to have CETA distribute this book for a nominal handling fee.

A book such as this must always be considered “work in process” rather than “finished goods.” Hardware, software, networking, and hypertext/hypermedia authoring are all changing so dramatically from month to month that every effort is needed in the academy to share information on current happenings as efficiently and effectively as possible. Because colleges and universities have not yet changed reward structures to encourage development of learning materials on a par equal to the development of research materials, it behooves all educators who are developing learning materials to freely share as much as possible with one another. Amid the mounting evidence of weaknesses and failures in education worldwide, it is a time for a “Johnnie Appleseed” commitment to widely plant seeds of new technology for learning around the world. Roles of educators will be changing in the following ways due to new technologies that are already operational:

1. Course instructors will play a larger role in inspiring students to want to learn more about a subject and a smaller role in explaining that subject to students.

2. Course instructors will spend more time authoring hypermedia materials that will be available at all hours on campus networks and recording compact disks for student use.

3. Course instructors will play a much greater role in selecting learning goals and helping students choose from a mind-boggling multimedia library of worldwide learning material that will expand at an exponential rate in the next century.

4. Some instructors will build international reputations for creativity in authoring and continually updating hypermedia learning materials made available on vast, worldwide education networks.

In the spirit of helping develop and search the forthcoming “mind-boggling multimedia library of worldwide learning material,” it is our plea to each reader of this book that you tell us about your own viewpoints and contributions to this library. In particular, tell us about resources and applications either overlooked or not treated fully or properly in this edition of the book. Please send your comments, revisions, summaries of applications, etc. to the following address:

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We hope this book helps to inspire you to use and adapt technology in your own teaching and research. We especially encourage you to make use of computer keyword searching capabilities of
Education is in the midst of a technological paradigm shift caused by the combined, and, as yet, chaotic impacts of broad band networks, multimedia computers/television, hypertext/hypermedia nonlinear interactive navigation, improved economies of computer speed/memory, data/image compression technology, and accelerating pace of the digitization of knowledge. *Newsweek* (September 6, 1993, p. 42) reports that “more than 12 million Americans are living ‘on line’ --- looking for love, stock tips, and therapy on computer networks.” Soon those and others will seriously be looking for networked training and education as well. Current developments are nearly a decade ahead of what was anticipated in the past decade. The TULIP project from Elsevier Science (see listing of acronyms below for more details) is an excellent example of the movement away from hard copy publishing in favor of electronic publishing and distribution. We summarize emerging alternatives in this frenzied paradigm shift. Then we explore the extent to which university accounting programs and their faculties have experimented with alternatives purportedly being tried in other parts of their campuses, particularly in science education. Although Chapters 4 and 5 are focused mainly upon a survey of accounting educators, most other parts of the book are focused on education and research in general and should be of interest to educators in other disciplines.

The pace at which industry is adapting to new technology for training appears to exceed the pace of reengineering and adaptation by academe in general. Accounting educators in most universities lag behind many of their colleagues in other departments. There are continually emerging success stories in the sciences and humanities such as the Fiero Online art education system at Princeton University. This is an online art class on Fiero del Fancesca, an Italian 15th century Renaissance artist. The system uses an Iris Silicon Graphics high-end database library with scanned images of frescoes and a three-dimensional walking tour on computer for students. Students also construct their own models. This is considered one of the most successful CAL applications in universities along with other multimedia classroom success case stories profiled in *HPEC Syllabus* (May/June 1994, pp. 28-35). There are excellent accounts of successes in applications of technologies in music by Robert Winter at UCLA and his multimedia CD-ROMs from The Voyager Company and Microsoft Corporation. These applications are discussed in greater detail in Chapter 6. Accounting applications of technology pale in comparison. In a 1991 listing of over 100 of the leading “successful” implementations of new learning technology in universities in EDUCOM Responds (1991) did not mention any accounting program “successes.” Four research papers on the impact of technologies on learning are contained in the Council of Chief State School Officers (1993). In the present book, we show the results of our attempts to identify implementations that were perhaps overlooked in the 1991 EDUCOM survey. Although accounting programs were not on the leading edge of the paradigm shift in technology for learning and communication, there are more recent assorted experiments taking place that are worthy of tracking over the next few years, some of which are mentioned in Chapter 4.

The book also reports accounting educator and publisher attitudes and insights regarding trends of the paradigm shift and its anticipated short-run and long-run impacts on education both inside and outside the classroom. It appears that the majority of accounting professors have a “wait and see” attitude that removes them from the leading edge of both research and applications of electronic learning technology. This is not reported to be a popular research area among accounting faculty. Applications in accounting programs for the most part await more widespread successes reported in other parts of the campus and in accounting firm training programs. The opinions of accounting educators regarding both reasons and excuses for these delays were obtained in our Appendix 3 survey and are discussed in Chapter 5. We also conducted the Appendix 1 publisher survey.

We see industry and private-individual training programs (e.g., see Fryer 1994), including accounting training programs, moving much faster into technology of hypermedia and networking...
than the pace at which college educators are leading their programs into this technology. The new
theme in training is called JITT which stands for **Just-In-Time Training**. In many technical and
complex areas it is not practical for employees or other persons to be knowledgeable about all details
at all times. For example, it has become impractical for auditors to have a working knowledge of
every accounting and auditing standard in the United States and other nations. Physicians and other
medical practitioners cannot have instant recall of the details of every disease and combination of
medical symptoms and treatments. JITT refers to a process (that is usually aided by computers,
compact discs, computer networks, and/or teleconferencing) in which the person receives training
“just-in-time” when it is needed for a particular purpose. The JITT process may change the entire
process of education and training, because the focus may become how to effectively access and
utilize JITT rather than how to teach students and/or employees technical details that have to be
memorized long before they are needed in practice. JITT is related to the concept of “lifetime
learning,” whose importance of which in terms of technology developments is stressed in Garland et
al. (1992).

The main purposes of this book are to help educators commence to author their own
hypermedia learning materials and to help researchers undertake research on newer technology
implications for learning. A major hurdle to cross is the bias of university reward structures (for
promotions, tenure, merit raises, sabbatical leaves, and job mobility) in regard to the research rigor,
generality, reproducibility, and stationarity of research findings. Bias that diverts educators from
developing both classroom and network learning materials also puts education technology
applications at a disadvantage. Many universities, including our own, grant sabbatical leaves for
research but not for the development of student learning materials. Doing research in technology for
learning also has unaccustomed risks and frustrations. Whereas published research traditionally has
some stationarity in terms of applicability to the future, the computer and networking technology of
the past month may be quite different from the new possibilities emerging each succeeding month.
Findings in education research last month may not hold in revised settings this month. Also findings
dealing with student learning are confounded by situational factors and intervening variables.
International reputations in accounting and most other disciplines are still not built upon education
research and education materials development other than textbook authoring.

A second major hurdle is the problem that the development of hypermedia learning materials
is a relatively expensive and long-term commitment that requires diverse teams of developers and
technicians to assist authors who are just not inclined toward all phases of new technologies and/or
do not have the necessary hardware and software to author hypermedia. Whereas governments and
corporations have resources to join diverse technologies and talents into team efforts, university
professors seldom, except occasionally in science, participate in large technological team efforts in
which technicians and other specialists are readily at hand to transform creative ideas into finished
outputs.

A third major hurdle is the lack of standardization in learning technology. Whereas educators
can make money writing books that are sold to students and libraries, as yet it is impossible to author
electronic materials in any standardized format, other than videotape, that can be sold in a mass
market. Although most students have access to videotape players, videotape is technologically
obsolete in terms of interactive learning, speed of knowledge search in giant databases, network
random access, and the quality of images suited for reading text.

A fourth major hurdle lies in overcoming the belief in some educational settings that the
Socratic method and other time-enduring approaches are “close to ideal” and that technology can
only approach but never attain the “ideal” of students at the feet of Socrates. Smallen (1993)
asserts:
The environment of liberal arts colleges like Hamilton is close to the ideal for maximizing student learning. Successful applications of technology to the learning process, at any institution, will be ones that address variances from the ideal learning environment. Technology applied in a manner oblivious to these variances will not improve teaching and learning, and will waste critical institutional resources.

This overlooks the fact that hypermedia extensions of even one-on-one tutorials in “ideal” environments demonstrate significant advancements in the teaching of art, languages, literature’s, music, medicine, and science as well as training in the military and industry. Smallen is correct in the sense that faculty teaching both large and small classes must ultimately make the decision to adopt technology only if it is cost-effective in promoting student learning in their respective environments. This is why our major conclusion in this book is that faculty will be happy with hypermedia technology only if they can author their own materials or customize acquired materials to suit their individual styles of learning.

A fifth major hurdle is that effective use of technology may require huge changes in the credit-for-contact model that is pervasive in educational systems. Such drastic changes are both difficult and risky in time-honored structures. Heterick (1993, p. 1) states:

The overwhelmingly dominant model of instruction in American university education, especially at the undergraduate level, is credit-for-contact. In this model, the student’s progress and the faculty member’s instructional contribution are measured by hours of contact in lecture hall, seminar room, or laboratory.

Effective use of technology may be optimized only when departing from the contact hour structure. For example, faculty who take on a greater role in customizing curriculum design and helping students access networked learning materials may have to spend more time “on call” to meet the needs of students and less time in formalized class, seminar, or lab settings. Most faculty and institutional structures are not yet open to the radical changes that are required to evolving learning technologies.

Our research results show signs of change in the distant horizon. Universities are becoming more conscious of the quality of teaching and learning that takes place both on and off campus. In spite of budgetary crises, colleges are somehow networking departments on campus, connecting to international networks such as those on the Internet, transforming traditional classrooms into electronic classrooms, upgrading libraries for new electronic technology, investing in some multimedia workstations to be shared jointly by faculty members, and upgrading faculty office computers. The change in structures and incentives for faculty to author hypermedia networked learning materials will be slower but may, in time, follow suit. The unwillingness of faculty to invest time and money in developing learning materials and conducting education research using new technologies probably will not change to any great extent until university and/or mass market reward structures change. However, some analysts like Moberg (1993, p. 38) are more optimistic:

Everyone who works in higher education knows that teaching and learning are evolutionary, interactive processes. Rarely do faculty members teach the same course the same way twice. New fields of inquiry and study emerge, often as “cross-disciplinary” or “multi-disciplinary” hybrids. This will continue to happen with or without the use of information technology. But the drive to make more effective use of computing and networking resources which are already in place will cause major changes whether or not this effort is planned as deliberate strategy of improvement.
The key to success in a knowledge-age economy isn’t education. It’s a high-tech, ultra-customized process that I call “hyper-learning” (HL). By making use of the enormous range of knowledge resources now available, anyone plugged into the multimedia network being born from the fusion of cable TV, personal computers, and telephones will have access to more customized instruction than any school or university can hope to match. The result, hyperlearning, is to classroom education what the M1A1 Abrams tank is to the chariot. Perelman (1993, p. 62)

Some analysts like Perelman (1993, p. 62) predict that “within 10 years, schools will be obsolete” and will be replaced by a “video dial tone” turning homes and offices into “virtual campuses.” We do not subscribe to such extreme visions of future education. In Jensen (1993), the continued need for classrooms and teachers in the presence of students is stressed. However, trainers and educators accustomed to mainly explaining technical details of their crafts will soon find that the computer can teach those technical details far better than teachers in a classroom. The classroom or networked teacher of the future will evolve into a facilitator of learning by devoting more time to inspiring students to learn and showing them where and how to access the best learning materials of the world on computer networks that link millions of databases containing materials of the world's best educators alongside simulations and “field trips” to anywhere in past, present, and future worlds. Human educators will aid in designing a custom curriculum for each student and in evaluating learning achievements. Traditional writing and grading of “term papers” will give way to student productions of multimedia “dramas” and instructor interactions in both the production and evaluation phases.

Students will do more than focus on computer screens. Classrooms themselves may be transformed. Although much of the hypermedia learning in the future will be on networks outside classrooms, it is exciting to sit back and stare into space dreaming of classrooms similar to the electronic court chamber at the College of William & Mary School of Law. Deloughry (1993a, p. A22) reports on this high tech chamber as follows:

The Law School at the College of William and Mary last week unveiled a state-of-the-art moot courtroom that school officials say is unrivaled in higher education.

The courtroom at the Marshall-Wythe School of Law here is also more advanced than most functioning courtrooms in the United States, where videocassette recorders are often considered high-tech.

The wood-paneled courtroom boasts two large television screens, a computerized transcription system, an automated videotaping system, and computers attached to the judge's bench, the witness stand, and the desks of the court clerk, the prosecutor, the defense lawyer, and each of the eight jurors.

The computers can be used to connect to legal data bases, to review a transcript as it is being typed by a court reporter, or to
view animations, graphics, or video segments that might be offered as evidence in a case.

“We think this is going to be something very, very significant in the future of the justice system,” Paul Marcus, acting dean of the law school, said at last week’s demonstration of the courtroom’s technology. “This will allow us to train lawyers for the future.”

Instead of a multimedia court chamber, the auditing applications could be simulated audit engagements; information systems applications could be simulated business firms; and accounting applications could be a simulated hearing before the FASB or SEC. Ethics conflicts could be role played in more realistic dramas, and students could play a part in simulated courtroom dramas of accounting firm litigation. The accounting electronic classroom(s) would need to be more flexible in terms of changing the “sets” of the classroom “stage.” But the electronic equipment and software could be very similar to the electronic court chamber of College of William & Mary School of Law.

For example, when debating an accounting standards issue, hypermedia video of actual testimony before the FASB coupled with hypertext random access to actual written responses to Exposure Drafts could become the focal point of student interactive learning in the simulated FASB classroom. Students could assume the role of FASB Board members forced to make decisions regarding what standards to propose and what standards to adopt. Other students could take on advocacy roles of other segments of society in the hypermedia classroom setting similar to the William and Mary electronic court chamber. Realistic simulations of audit committees and corporate board of director meeting could become part of the student learning process.

Still another scenario for classroom instruction of the future is the Center for Computer-Assisted Legal Instruction (CALI) that provides software and coordinates the distribution and use of computerized course modules in legal studies. Details of CALI are provided in Appendix 5.

Student learning laboratories will also be radically designed to accommodate multimedia technologies. Brickman and Manning (1995) discuss how language labs may be designed for multimedia learning.

The paradigm shift of technology in education is already set into motion in virtually every academic field at every level of education and training. Educators in accounting trail the pack, but there are signs of progress and interest among the respondents of the Appendices 1 and 3 surveys analyzed in this book. These responses are analyzed in Chapters 4 and 5. University applications of technology also trail applications in training programs in accounting firms. For example, to date we know of no interactive videodisc developments in academe comparable to the videodisc training programs entitled Risky Business and Account Ability developed by Price Waterhouse in England (see Appendix 1).

Network education, however, is exploding worldwide. New York University School of Continuing Education in 1991 commenced a comprehensive “Virtual College” computer network education service that will provide instruction in a wide range of courses in a comprehensive curriculum, conduct examinations, monitor course projects, and field inquiries from students virtually anywhere in the world. The coordinator of auditing instruction in the Virtual College is presently Professor Richard Vigilante. For example, an internal auditing curriculum is know available for practitioners around the world. The Virtual College has four modules termed Student (course discussions, project development, e-mail, cafe discussions, student newspaper, course evaluations), Faculty (curriculum, grading, course production, e-mail, research support, committee support), Library (course hypertexts, case study materials, reference books, journal articles, audio/visual materials, online database gateway), and Administration (student inquiries, admissions, registration, transcripts, CPE certifications, faculty records, alumni records) modules. Learning materials include Lotus Notes and databases of various types. To our knowledge, no on-line hypermedia learning materials are yet
available on either networks or CD-ROM discs. There are, however, television and teleconferencing education courses available in 85 countries. For example, a 16-credit Advanced Professional Certificate (APC) package is now available for information systems auditing.

On May 13, 1994 in London, a special issue called Synthesis: The Times Higher Education Supplement devoted the entire issue to trends, advantages, and disadvantages of multimedia for teaching and learning. Several quotations from that issue are as follows:

This (traditional school education) is the beginning of an epistemological shift that will culminate in learning by being taught. Since the children cannot follow their own interests in pursuit of knowledge, school takes responsibility and the paraphernalia of fragmentation of knowledge, linear curriculum, segregation by age and the rest follows as the .... But given an increasing difficulty of imposing the curriculum on the children it seems quite likely that school will find an escape by opening itself to what would already be obvious if the education establishment had an open mind ...

Papert (1994, p. 2)

Multimedia is different again, and more complex to understand because it is not a narrative medium. The user control it offers in the form of interaction with the information it presents changes the role of the audience. In fact, multimedia does not really have an audience; it has participants. The participants do not sit back and enjoy the story; they help to create it. That radical change in the nature of the medium means that it must take some time before we learn how best to use it.

Laurillard (1994, p. 3)

Learning will take place at the computer screen and from the book, and the computer will take as much a part in organising the learning and in computing, as it does in delivering the information. The point is that the computer is providing a stimulus for change in the system, and is recasting undergraduate materials in a manner which can help cope with the pressures faced.

Beilby (1994, p. 11)
Commonly Used Acronyms (for Electronic Chapter Searches)

The following terminology may be useful for electronic keyword searches in the chapters and appendices of this book. Users who have separate files for each chapter and appendix may want to combine the chapters and appendices into one continuous book for more efficient keyword searching of the entire book.

2-bit video adapter = (see “video adapter.”)

2-D = two dimensional graphics images and animated images. Software options for 2-D scanning and authoring are reviewed in the NewMedia 1995 Tool Guide (pp. 33-43). See also “paintbrush.”

3-D = three dimensional graphics images and animated images. Images in 3-D, especially 3-D photographs, are sometimes called “holograms.” Biedney (1994) provides a technical discussion and a comparison of alternative software options for rendering 3-D images on desktop computers. Software options for 3-D rendering are reviewed in the NewMedia 1995 Tool Guide (pp. 45-51). See “rendering.”

3DO = (see “CD-3DO.”)

4-bit computer = (see “bus.”)

4-bit video adapter = (see “video adapter.”)

16:9 TV = (see “wide-screen TV.”)

24-bit video adapter = (see “video adapter.”)

32-bit computer = (see “bus.”)

AB roll editing = the transfer of portions of two video sources into one master videotape. For example, one source may be a VCR and the other source a video camera. See “video.”
ABKY = the Atkinson, Banker, Kaplan, and Young (1994) textbook entitled Management Accounting which is noteworthy in this glossary as being the first accounting text accompanied by an Internet bulletin board. Prentice-Hall was the first publishing company, to our knowledge, to offer an interactive two-way network dialog between adopters of selected textbooks and the authors of those books, including a bulletin board of latest readings related to the text, abstracts of related literature, and classroom aids. The ABKY network was the first of the Prentice-Hall offerings to adopters and is available on listsrv@watarts.uwaterloo.ca. See also “Internet” and “Network.”

accelerator board = a hardware electronic board (containing a microprocessor) that can be added to some computers in order to speed up the processing in slow computers. The speed gains are confined to internal calculating and sorting such that no apparent gains are obtained for file management and other busing activities. See also “CPU,” “board,” and “bus.”

account boot disk = a disk used to load DOS into the computer when it is turned on.

Acrobat = (see “PDA.”)

Active Video = a video AV standard and open-video architecture that Microsoft Corporation hopes will become the popular standard to replace the Video for Windows (.avi file extension) and Quicktime (.mov file extension) video architecture. Active video attempts to overcome common complaints with its Video for Windows (e.g., limited throughput, poor A/V synchronization, and hardware/software incompatibilities. Also, Active Video will have software MPEG decoding and will cross platforms with Windows, Windows NT, and Power Macintosh. It will also have an Active Movie filter to play on the Internet via Microsoft’s Explorer browser. Whereas Video for Windows was losing out to Apple’s Quicktime in popularity, Microsoft’s Active Video makes it a closer race between Apple and Microsoft for dominance in the setting of video standards. See also “video” and “MPET.”

ADAM = Animated Dissection of Anatomy for Medicine project that resulted in high quality computer-aided learning modules for schools of medicine. The “inside story” of A.D.A.M. is briefly reviewed in PC World, November 1994, p. 96. See A.D.A.M. Software, Inc. in Appendix 6 for more details.

ADC = Analog to Digital Converter that converts analog sound to binary code form (digital information). See also “analog,” DAC,” and “modem.”

ADPCM = Adaptive Pulse Code Modulation of audio waveform sampling that records the difference between samples is recorded rather than the actual values. This increases fidelity with lower resolution than conventional PCM. See “audio” and “PCM.”

AIX = an IBM version of the Unix operating system. It will run on PCs with 386 or higher chips and on workstations and mainframes. See also “Unix.”

Alpha processor = the ultimate top-of-the line processor for PCs that uses DEC’s DECchip 21064 chip. The “Alpha-based” systems such as the DECpc from Digital Equipment Corporation claims it is the fastest system available for Windows NT.

ALT = software ALTERNATives to authoring systems that have full CMS utilities. In other words, professors who do not need full CMS features may opt for alternative authoring packages such as hypertext or hypermedia packages that do not have full CMS features. Various ALT options are compared in Chater 3. See also “CMS.”
America Online = the commercial AOL network (800-827-6364) that “remains the hottest, easiest-to-use and most interesting of the services” according to Mossberg (1994a). AOL offers Time Magazine, the Chicago Tribune, and other news and television network options. New services to educators online include an American Federation of Teachers online doctoral program from the Electronic University Network and the Forum on Technology in Education and Training (FORUM-TET). With the May 11, 1994 announcement of a merger of AOL and Rdggate Communications, AOL will take an early lead over competitors in multimedia and GUI graphics networking. See “GUI,” “Networks,” “CompuServe,” Internet,” “eWorld,” “Interchange,” and “Prodigy.”

Amiga = a video computing hardware/software desktop workstation formerly manufactured and marketed by Commodore International based on Motorola microprocessors. Amiga workstations became a widely popular option in conjunction with NewTek’s Video Toaster software for home and office videotape productions. Amiga developed its own operating system called Amiga DOS. A major drawback is that as a computer it does not communicate (i.e., its files are not readable) on more popular Apple, PC, and Unix operating systems. For example, it can neither read MS-DOS files into its operating system nor write out MS-DOS files. It is far less of a competitor for digital computers and networking than for analog video computers such as Mac Video (see Birkmaier 1993 and Torres 1993) options. The new Amiga workstations became aggressive low-priced competitors to Silicon Graphics and Sun workstations for 3D animation rendering for broadcast quality video. The future of the Amiga is clouded by the 1994 declaration of bankruptcy and subsequent liquidation of the former Commodore International Corporation. At this juncture it is uncertain whether another manufacturer will take over all Amiga technologies and patents. NewTek Inc. (800-847-6111) now sells workstations for its Video Toaster software formerly used in Amiga computers. The Amiga and NewTek workstations compete with Apple AV and SGI competitors, but these options should not be confused with the more extensive concepts of network video servers. See also “video server,” “CD32,” “Apple AV,” “SGI,” and “Mac.”

Amiga DOS = (see “Amiga.”)

analog = (see “video.”)

ANet = The International Accounting Network, Southern Cross University, New South Wales, Australia and Bond University, Queensland, Australia. The email adress is ANet@scu.edu.au. A description of services is contained in the CETA Newsletter, June, 1994. Mailing lists are also available on ANet, including CDI-ACC-AUDIT in the United Kingdom and AC-CHANGE from Maricopa College in Arizona. See also “PIC-AECM” and “International Internet Association. . See also “ANet,” “PIC-AECM,” and “RAW.”

animation = time-phased moving graphic images that give the impression of motion such as in motion picture cartoons or videographic movements of objects about the screen. Several frames show a progression of movement, and thereby simulate movement. The best-buy in animation software is Autodesk 3D Studio according to to PC Computing, December 1994, p. 204. See also “3-D,” “flc/fli,” “morphing,” and “video.”

ANSI = The American National Standards Institute basic standards like ASCII character sets and acts as the United States’ delegate to the ISO. Standards can be ordered from ASCII by writing to the ANSI Sales Department, 1430 Broadway, New York, NY 10018. See also “ASCII” and “rich-text format.”

Apple AV = a line of computers that was popular for low-cost analog video computing due to built video capture hardware on the motherboard, a DAV connector, and a scan converter for analog video output to television sets and videotape recorders. Spanbauer (1993b, p. 42) discusses AV strengths in analog video rendering and their weaknesses in digital video rendering. He predicts these and
other Macs will “continue its ride for at least another year” until the PowerPCs begin to spread across the market. A more detailed review of the Quadra 840AV is given by Ford (1993). Leland (1994) compares features of the Quadra 840AV with the more expensive SGI Indy and finds that the Quadra 840AV performs as well or better in most instances for a lot less money for hardware and software. A somewhat negative analysis can be found in Sherman (1994a). The Apple AV competes with Amiga, Video Toaster, and SGI competitors, but should not be confused with the more extensive concept of network video server. Francis (1994) reports that Moody's Investors Service Inc. placed Apple Corporation under review largely due to “concerns about the computer vendor's long-term operating performance and the viability of its technology strategy.” One problem has been Apple's strategy of selling its old AV architecture alongside its new Power Mac architecture. A huge area of concern has been the tapering off of demand for the new Power Mac versions of the PowerPC. Apple's share of the PC market reached 14% in 1993, but has since slipped back down to around 10%. We recommend all hypermedia authors on Mac and PowerPC systems to join the Apple Multimedia Program (408-974-4897) that offers a variety of online services and other services that, in our viewpoint, are well worth the $750 price of membership. See also “video server,” “dry camera,” “SGI,” “Mac,” “PowerPC” “Mozart,” “Copeland,” “Gershwin,” and “Amiga.”

### Apple QuickTime

Apple QuickTime = (see “QuickTime.”)

### ARPANet

ARPANet = The Advanced Research Projects Agency Network formed in 1969 to connect the Department of Defense (DOD) with institutions conducting major defense contract research. The networked linked super computers in major research universities with the DOD. This is credited as being the first academic computer network and is considered the “mother” of the Internet. In 1980s, ARPANet split into two networks called ARPANet and MILNet (for unclassified military research). An interconnection with the DOD Advanced Research Projects Agency (DARPA) led to a set of networks called DARPA Internet that later became referred to as just the Internet. See “Internet.”

### arrays

arrays = (see “jukeboxes.”)

### artificial intelligence (AI)

artificial intelligence (AI) = is a branch (usually called AI/Expert Systems) of computer science, mathematics, psychology, and systems engineering that attempts to make computer “decision making” more like human decision making and to aid or replace human decision makers with machines. Expert systems attempt to utilize the skills, knowledge, and decision evaluation processes of human experts. For example, computers now aid physicians in diagnosing diseases and computer-guided laser rockets virtually replace human guidance decisions. AI failed to live up to its early expectations when it was believed that AI computers would never fail to win at chess and language translators would soon be put out of work by computers. However, applications of AI have been taking place and computers can now play very good chess to a point where they occasionally beat even the grand masters.

### ASCII

ASCII = American Standard Code for Information Interchange computer character set (text and symbols) that enables transfer of text and data between different computing systems. For example, files from word processors such as Microsoft Word, Word Perfect, and Word Star often cannot be imported to hypertext or hypermedia software without conversion to ASCII code (most word processors will change files to ASCII “text” files). The downside is that nearly all formatting and font variations are lost in ASCII conversions such that imported ASCII text may have to be re-formatted line by line and altered for font preferences. Very few software alternatives have “filters” that import word processor files directly without having to convert to ASCII codes, although many are now adding rich-text format (RTF) utilities. In hypertext authoring, choice of a hypertext software option should include a question concerning whether “filters” are available for avoidance of ASCII text conversions. See “ANSI!” and “rich-text format.”
aspect ratio = the ratio of the horizontal to vertical size of the screen. Some monitors display rectangular pixels which can make the picture or image appear stretched. Software that allows images to be resized and changed with respect to aspect ratios greatly facilitates authoring. Otherwise images have to be transported to other software for such changes and then transported back in a cumbersome process that makes authors grateful when aspect ratios and images sizes can be modified without such difficulties. Macromedia Director is one of the very few hypermedia authoring systems that has a utility for changing the scale and aspect ratios of imported bitmap pictures as well as rotating and inverting such pictures.

assessment = the evaluation of the efficiency and effectiveness of technology on attitudes and performance. Tidd (1995) discusses various assessment scales such as the Computer Attitude Scale, the Computer Anxiety Rating Scale, and the Computer Self-Efficacy Scale. Assessment is very difficult because no matter how good the findings are in an empirical study, the relevance of those findings quickly falls away due to constantly emerging technologies that are significantly better than older technologies used in the study.

asynchronous = a method of communication that places data in discrete blocks that are surrounded by framing bits. These bits show the beginning and ending of a block of data.

AT = (see “PC.”)

ATG = (see “video server.”)


The high speed ATM networks allow transmission of video, audio, and data over local and world-wide networks. See “broadband,” “network,” and “Sonet.”

audio = voice, music, and other sounds recorded and stored in analog or digital form. See also “sound board,” “board,” “hertz,” “MIDI,” “speech recognition,” “text reading,” “video/audio networking,” and “wave files.”

audio board = (see “sound board.”)

audio card = (see “sound board.”)

audio on the Internet = (See “Internet audio and video,”)

authoring = developing (writing of text, recording of audio, importing of video, inserting graphics, etc.) hypertext and hypermedia learning, entertainment, and reference materials. In the literature such as NewMedia, the term “authoring software” refers to software for hypertext and hypermedia development and does not refer to common word processing options such as Microsoft Word, Word Perfect, and Word Star. Latest directions in hypermedia authoring are discussed by Burger (1994a) and Rosenthal (1995). Future trends are indicated by Park (1994). Rosenthal (1995) discusses trends toward crossing platforms such as between Windows, UNIX, and Mac operating systems. In Chapter 3, core and non-core attributes of both course management software (CMS) and alternate (ALT) are discussed. The term “authoring software” is often contrasted with “presentation software” designed for development of graphics, and possibly some multimedia components. Presentation software does not have full “hyper” capabilities of nonlinear navigation, runtime versions, and course control utilities. For example, the NewMedia Tool Guide for 1995 contrasts presentation software (pp. 09-12) with authoring software (pp. 17-25). Whereas 28 presentation software options are listed in that guide, 57 authoring options are listed. Later on in this book, other options overlooked in those...
listings will bring authoring options to over 60 competing vendors. This indicates the huge amount of competition that probably cannot continue to such an extent in either market. The line is also becoming less distinct between authoring and presentation software as presentation software vendors add the ability to insert nonlinear navigation buttons and authoring software vendors add more automatic scripting options. Appendix 6, we have provided a database for word searching using “authoring” versus “presentation.” Authoring software options are the focus of attention in Chapter 3. Authoring software comes in two types. The best-buy in terms of a large number of features, free runtime, and state-of-the-art authoring tools in Multimedia ToolBook from Asymetrix according to PC Computing, December 1994, p. 204. The best option for cross-platform multimedia development between Mac and Windows platforms is Macromedia’s Director according to to PC Computing, December 1994, p. 204. Options not having separate scripting languages have only “pre-scripted” options such that hiding and displaying objects, moving objects, etc. are relatively automatic using icons and menus that are already coded. Options with scripting languages type such as Asymetrix ToolBook, Quest, and Apple Media Kit have a scripting language to accompany pre-scripted icons and menus. Scripting languages allow authors more flexibility in doing a wider variety of tasks, but they also require some computer coding skills. Most scripting languages are very close to common languages such as C++, Pascal, or Basic. For example, Quest allows users to resort to powerful C coding. Courses are available on how to author hypermedia for training and education such as the course “Communications in the Professional World” at the University of California at Irvine. Various courses and training workshop opportunities are listed in Appendix 6. Especially note the Institute for Advanced Technology ToolBook training options and the Apple Corporation Apple Worldwide Multimedia Program. We recommend all hypermedia authors on Mac and PowerPC systems to join the Apple Multimedia Program (408-974-4897) that offers a variety of online services and other services that, in our viewpoint, are well worth the $750 price of membership. All professors should actively browse the IBM Kiosk for Education (see IKE below) which is provided on World Wide Web, Mosaic, Gopher, and Telnet as a free service. Career opportunities in authoring multimedia are discussed by Jerram (1994a). Courses, literature, and trade shows on learning how to author multimedia works are summarized by Lindstrom (1994). References on authoring include Apple Computer (1993a,b,c,d), ACM (1993), American Showcase Inc. (1993), Benford (1993), Blattner and Dannenberg, eds. (1992), Bunzel and Morris (1993), Burger (1992), Caffarelli and Straughan (1992), Carronade Group (1993), Cotton and Oliver (1993), Edwards and Holland (1992), Frater and Paulissen (1993), Greenberger (1993), Helgerson, (1992), Hodges and Sasnett (1992), Holsinger (1993), ICIA (1993), Jennings (1993), Jerram, Peter and Gosney (1993), Luther (1992), Marchant (1993), Maybury (1993), Microsoft Corporation (1993), Murie (1993), Ohanian (1993), Parker and Starrett (1993), Rosenberg et al., (1993), Shaddock (1992), Sherman (1993), Stone and Buckland (1993), Thalmann and Thalmann (1993), Tway (1992), Vaughan (1993), Waterworth (1992), Wodaski (1992, 1993), Yager (1993), and Yavelow (1993). Authoring in Europe is summarized by Latchen et al. (1993). Short annotations are provided in the references to this book. Biedney (1994) provides a technical discussion and a comparison of alternative software options for authoring 3-D images on desktop computers. See also “cross-platform,” “Delta Project,” “hypertext,” “core,” “non-core,” “hypermedia,” “morphing,” “presentation,” “titles,” and “rendering.”

Authorware = (see “hypermedia,” “hypertext,” and “authoring.”)

Autodesk = (see “animation” and “flc/fli.”)

A/V = Audio/Video marriage of big screen television with movie-theater-like audio in homes and classrooms.

AV = (see “Apple AV.”)
AVI = Audio Video Interleaved digitized video files (with audio tracks) that satisfy MPC standards for Video for Windows playback. The Media Player (mplayer.exe) file that is included in Windows operating systems runs AVI files. Most PC video capture boards will convert analog video into AVI files. The AVI standard from Microsoft’s Video for Windows is giving way to Microsoft’s newer Active Video architecture. See also “Active Video,” “MCI,” “MPC,” and “QuickTime.”

bandwidth = capacity of networks as expressed in cycles per second (hertz) or bits per second that determines the amount of data, audio, and video that can flow over the network. The higher the frequency, the higher the bandwidth. See also “broadband,” hertz”, “bps,” and “information highway.”

bar codes = alternate standards for marking products or other items for reading by laser beams. They are used extensively for locating items on videodiscs and CDs. The LaserBarCode was the original standard for CAV discs. This was extended to LaserBarCode2 for CLV discs. The Bar Code CD is an audio standard for CD discs. See “videodisc” and “CD.”

baseband = a network cable that has only one channel for carrying data signals.

baud = the rate of data transmission.

BBS = Bulletin Board Systems on the Internet that provide electronic bulletin board and conferencing services. See also “CWIS” and “Freenets.”

BIOS = (See “VESA.”)

bit = an abbreviation for binary digit. A bit is the smallest unit of data.

BITNET = Because It’s Time NETwork is an early network of academic and research professionals. Many of its uses have become e-mail gateways to the much larger Internet, although many professors still have BITNET addresses. See “Internet” and “network.”

BMP = bitmap graphics files that are accessible through Windows Paintbrush and most other PC graphics software. See also “compression,” “CGM,” and “JPG.”

board = a hardware component that fits into the expansion slot of a computer unit and expands the capabilities of the computer. A board can enable the computer to communicate with an external hardware device, such as a CD-ROM. Alternate terms are card, expansion card, interface card, interface board. See also “SCSI,” “sound board,” “video board,” and “PCMCIA.”

bookmark = a user-defined place mark that enables the user to return to the a particular screen or starting point after accessing related information. Bookmarks may also be used to locate sections on related topics.

bps = bits per second. This is a measure of transfer speed that is commonly used in modems. See “bandwidth.”

branch = any one of the paths an application can take after it evaluates a specific condition.

bridge = a device that connects different LANs so a node on one LAN can communicate with a node on another LAN.

broadband = network transmission capacity that greatly exceeds capacity required for voice transmission over traditional telephone cables. Broadband networks may have dedicated portions for audio, video,
and data or they may allow for capacity switching. See “bandwidth,” “information highway,” “switched network,” “network,” and “ATM.”

**browsers** = (see “web browsers.”)

**buffer underrun** = a common error where the data stream being fed from the CD-R’s cache buffer falls behind the laser doing the writing. See also “CD-R.”

**bus** = the internal pathways (data bus, address bus, and control bus) of wires connecting various parts of a computer. Common standards for buses are Industry Standard Architecture (ISA) 16-bit bus common in AT-compatible PCs, Micro Channel Architecture (MCA) 32-bit buses in IBM PS/2 computers, and Enhanced Industry Standard Architecture (EISA) a 32-bit buses that are backward compatible with ISA adapters. An “expansion bus” is an extension of the data bus and address bus that includes slots for adapter boards. It is better than ISA and EISA for hypermedia authoring to also purchase a “local bus” system in 32-bit or higher capacity with eight or more expansion slots for multimedia options. A local bus connects the CPU with peripherals directly so as to improve performance speed. The VL local busses are not as good as the Peripheral Component Interconnect (PCI) brainchild of Intel that is a better choice according to Desmond (1993). Mac computers currently use a Processor Direct Slot (PDS) local bus which does not have a consistent CPU-independent standard for add-on boards. Apple Corporation according to Spanbauer (1993b, p. 37) “intends to gradually replace NuBus with PCI in its upcoming PowerPC Macs.” Since both the VL-Bus and the PCI bus can coexist with ISA, EISA, or MCA connectors, it becomes possible to make the bus a consumer choice apart from the computer model choice in many instances. One way to improve digital video performance is to keep it off the main system bus. Apple also offers a high speed alternative called “QuickRing” that enhances its NuBus to compete with the forthcoming VESA Media Channel VM-Channel for moving video off the main system bus. The term “bus” can also apply to standards for connecting electronic components other than computer components. The term CDBus or consumer electronics bus refers to a home or office automation standard such that components connected through power lines, coaxial cable, infrared connections, and telephone lines will be mutually compatible. See also “VL-Bus” and “cache.”

**bus topology** = a physical layout of a LAN where all nodes are connected to a single cable.

**bytes** = grouping of eight bits. While a bit can assume only two states, 0 and 1, a byte can store from 0 up to 255 different states. Most of the time a character is stored in a byte. Therefore, a byte can store up to 255 different characters. The standard ASCII character set consists of 128 characters; the additional characters generally used in PC software brings the total number of characters up to 255.

**cache** = a storage area in both RAM (cache memory) and disc drives (cache controllers) that keeps frequently accessed instructions more readily accessible. See also “bus.”

**CAL** = the most generic of Computer Aided Learning or Computer Assisted Learning terms. CAL encompasses in-class lecture aids, learning materials for computer labs, electronic books, learning materials available on networks such as the Internet, and any other learning aids that are used with computers or related devices such as compact disc (CD) players connected to television sets. See also “authoring,” “hypertext,” “hypermedia,” and “networks.”

**caller ID** = caller identification of the phone number of person placing a call to another number. Some states now allow telephone owners to have visual displays of the caller ID.

**camcorder** = (see “video camera” and “video from digital (DV) camcorders”
**camera** = (see “dry camera.”)

**CAPTURE** = a NetWare utility program used to redirect output from a printer port on the workstation to a network printer.

capture = (see “screen capturing.”)

card = (see “board.”)

careers = (see “authoring.”)

**CAT** = that subset of CAL that entails Computer Aided Teaching. This subset is restricted to software designed for authoring and/or delivery of learning materials in a classroom or on line in a computer network or teleconference in which the instructor is present and using the CAT materials as an aid to his or her teaching.

**CAV** = Constant Angular Velocity playback in magnetic and laser discs where the disc rotates at a constant speed. Relative to CLV variable speeds, the CAV approach results in varying data retrieval times that depend upon where the read/write head is located relative to the disc spindle. Authors of CAV disc products try to locate commonly accessed files closer to spindle. In videodiscs, CAV discs hold only 30 minutes of video on each side of a 12-inch disc. However, CAV facilitates searching for individual frames. See “CLV.”

**CBT** = Computer-Based Training. A method usually used in corporations and academia to help nonprogrammers generate applications.

**CD** = a “small” injection-molded optical disc containing digitized information that has been recorded with a laser device and must be read on a laser device. The term “small” generally refers to a disc that is 8 cm or 12 cm (4.72 inches) in diameter as opposed to videodiscs that typically are much larger in diameter. Also, videodiscs usually are restricted to analog inputs from videotape whereas CDs rely on inputs from computer tape or other digitized platforms. Although there are several types of CDs for audio, television, and computer playback, the CD-Audio and CD-ROM discs have overwhelming shares of the market. For example, Kim (1994) discusses why CD-ROM discs are replacing floppy discs in a “ground swell.” CD-ROM discs now hold approximately 680 Mb (i.e., 680 million characters) although compression techniques make it possible to record CDs from even larger computer files. Usually CDs have slower access speeds than magnetic hard drives, but speeds are improving and playback of video is now possible on both CD-ROM and CD-I players. Although the best known CDs once were those that contain only audio recordings, there is a rapidly growing market for various types of CDs that contain computer files and/or files that can be read on special devices connected to television sets. See also “bar codes,” “CAV,” “CLV,” “Photo CD,” “videodisc,” “minidisc,” “CD-Stand Alon,” “Nintendo/SGI Cartridges,” and “laser drive.”

Dataquest (see NewMedia, February 1994, p. 26) estimates that 4.8 million CD-ROM players were sold in 1993. Developers of commercial optical disc learning and/entertainment materials should consider the platforms that dominate the market. In the July 1993 issue of NewMedia (p.22) the following sales volume and cumulative compact disc player sales are reported for “independent” (i.e., CD-Stand Alone players that play on a television or otherwise stand alone without having to be plugged into a computer) and “host-based” players (i.e., players that must be plugged into a host computer):
### Compact Annual Cumulative Disc Sales

<table>
<thead>
<tr>
<th>System</th>
<th>1992</th>
<th>1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact</td>
<td>Annual</td>
<td>Cumulative</td>
</tr>
<tr>
<td>Disc System</td>
<td>Sales</td>
<td>Sales</td>
</tr>
<tr>
<td>Sales of Independent CD Players</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sega</td>
<td>750,000</td>
<td>970,000</td>
</tr>
<tr>
<td>Photo CD</td>
<td>75,000</td>
<td>95,000</td>
</tr>
<tr>
<td>CD-I</td>
<td>35,000</td>
<td>73,000</td>
</tr>
<tr>
<td>MMCD</td>
<td>25,000</td>
<td>26,000</td>
</tr>
<tr>
<td>Data Discman</td>
<td>15,000</td>
<td>34,000</td>
</tr>
<tr>
<td>CD-VIS</td>
<td>10,000</td>
<td>11,000</td>
</tr>
<tr>
<td>CDTV</td>
<td>4,000</td>
<td>11,000</td>
</tr>
</tbody>
</table>

### Sales of Host-Based CD ROM Players

<table>
<thead>
<tr>
<th>System</th>
<th>1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows (MPC Standard)</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Macintosh</td>
<td>750,000</td>
</tr>
<tr>
<td>MS-DOS</td>
<td>700,000</td>
</tr>
<tr>
<td>Unix</td>
<td>100,000</td>
</tr>
</tbody>
</table>

The original source of the above data is cited as an Optical Publishing Association study which states that “Windows-based MPC systems are expected to dominate the computer-based CD-ROM market while Sega is expected to soar above the competition in the stand-alone CD-ROM player market in 1993.” Kim (1994) estimates over 11 million new CD-ROM players will be sold in 1994. Kaufield (1993, p. 53) predicts 50 million CD-ROM discs will be sold in 1994. The biggest new market, says Kaufield (1993, p. 54), will be in Europe where multilingual versions of entertainment, travel, education, and games will “find a surprisingly strong market.” The outlook for CD-ROM in the long haul is not so rosy. Billips (1994, p. 100) predicts the following:

As a lingering vestigial remnant of the mechanical age, the CD-ROM has no place in a fully digital communications environment and is no doubt destined to the same scrap heap as the eight-track. The new Nintendo/Silicon Graphics Inc. (SGI) media environment, for instance, uses a silicon cartridge that is two million times faster than CD-ROM.

In our viewpoint, however, the CD-ROM will remain the standard until better alternatives can be recorded as simply and as cheaply in homes and offices as CD-ROM discs can now be mastered (burned) for less than $20 per disc on desktop recorders costing less than $3,500. Each CD-ROM master can be copied for less than $2 at disc copying laboratories.

**CD32** = the 32-bit multimedia CD system that plays on Amiga Computers from Commodore Corporation. These CDs are used for CD movies, games, and educational material on Amiga Computers. The future of the CD32 is clouded by the 1994 declaration of bankruptcy by Commodore Corporation. See also “Amiga.”

**CD-3DO** = a newer type of compact disc that will compete against CD-I and CD-MM for interactive television set entertainment and, possibly, education. A promoter named Trip Hawkins put together an impressive grouping of Hollywood movie studios and other developers of interactive videos using MPEG compression. Large companies such as Panasonic, Sanyo, and others are producing playback machines for TV sets. For a review see NewMedia, August 1993, p. 21. For example, Panasonic CD-3DO Multiplayers and game discs are already available in stores. Whereas CD-I and CD-ROM discs may be recorded on CD-R blanks in home recording devices, it is less likely that CD-3DO discs will be produced outside professional studios. Users will thus be limited by what studios choose to develop and promote. It is not clear what will happen to this standard since, in 1993, competitors in Matsushita, Philips, Sony, and Victor agreed upon a competing CD-Karaoke standard. Prospects once seemed high that this will emerge a winner. In 1993 3DO stock soared in price.
Time Magazine (January 3, 1994, p. 76) ranked the Panasonic CD-3DO Multiplayer as the **Number 1** in a listing and discussion of the top ten “best” new products of 1993. (In that same listing, the Motorola PowerPC Chip ranked Number 6 and PDA products came in at Rank 7 ahead of Mattus Ice Cream at Rank 9). However, in 1994 sales of 3DO players have fallen far short of expectations (except in Japan) and the 3DO stock price fell from a high of over $45 per share to less than $15. Hawkins has had to invest millions more of his own money in the company. “This maker of multimedia game players is fighting for survival” according to Newsweek on June 13, 1994, p. 40. Actual 12 month sales are only 24% of the targeted 500,000 number of 3DO playback machines sold. Popular game developers are purportedly shying away from developing CD-3DO titles. Developers are, however, increasingly developing more popular CD-ROM titles. If CD-3DO technology ever storms the consumer market worldwide, educators hope that they will one day be able to author and record their own CD-3DO discs in a manner similar to what is today feasible for CD-R and CD-I. To date, however, it is mainly a technology for high quality interactive video games on television sets. Persons interested in becoming developers of CD-3DO titles should call 415-261-3000. Persons interested in becoming dealers or purchasing player units should telephone 817-685-1029. Details on what it takes to be a CD-3DO author/developer are given in Chapter 3. Contract forms can be obtained by contacting the 3DO Company listed in Appendix 6. Baker & Taylor Software (800-775-4100) offers software called 3DO Interactive Multiplayer. See “games,” “CD-VIS,” “CD-I,” “CD-MM,” “CD-R,” and “CD-Karaoke.”

**CD-AUDIO** = a CD that contains only audio playback. These were invented by Philips and Sony and have become extremely popular in the music recording industry. In order for these discs to be compatible with consumer playback machines, most discs are recorded according to the CD-Digital Audio “Reebok” standard.

**CD Burning** = (See “CD-R.”)

**CDBus** = (See “bus.”)

**CD-Erasable** = a new type of CD technology (see Videography, December 1993, p. 20) unveiled by Sony Corporation in 1993 that will allow for erasing and recording over CD discs. This technology brings the world of CDs closer to the world of videotapes, but the technology is too new and expensive to predict what the future holds.

**CD-I** = Compact Disc-Interactive compact disc (developed by the Philips electronics conglomerate headquartered in The Netherlands) that will play back visual as well as audio CD entertainment and learning materials in a hypermedia format on a television set. These discs require special players for CD-Karaoke that connect to a television much like a VCR machine. Players cost from $400 to $1,800, with portable players available that will fit in a brief case. Video stores are now selling and renting CD-I movie, game, encyclopedia, travel, art, and other types of discs. Realistically, authoring workstations cost around $50,000 and higher. Typically they have a remote control device or joy stick for hypermedia controls. Philips got the market jump on CD-MM from Sony and CD-3DO from Hawkins. Various CD-I games, encyclopedias, hypermedia art books, and other consumer products are available on CD-I discs in department stores and video stores. Movies on CD-I may now be purchased or rented from video stores. Unlike many of the computer game competitors such as Data Discman and Sega, it is possible to link Mac or PC desktop computers to other hardware that allow professors to author their own learning materials on CD-I discs. To be compatible with CD-I playback machines, these discs should be recorded on the CD-ROM XA (extended Architecture) “Yellowbook” standard. OptImage (515-225-7000) has new high-end MPEG Digital Video Authoring software for CD-I and CD-XA. The Education Labels Group of Philips Media (800 945-4061 or 310-444-6613) under the direction of Bernard Luskin, a pioneer in TV education materials, works with educators to develop CD-I discs for education. With the initial market shock of CD-3DO, the future of CD-I and
CD-MM is seriously in doubt, although much will hinge on the future cost of desktop authoring of CD-3DO titles. See “CD” for market share data. Reference books include Hoffos, Hoffos (1992), Miller and Miller (1992), and Phillips IMS (1992a,b,c). New software called CD-IT!ALL from OptImage(515-225-7000) allows Mac users to recorded CD-ROM discs directly from the Mac to certain types of CD-R recorders such as the Phillips or Kodak recorder with an ISO 9660 option. However, to record CD-I discs the CD-IT!ALL software will not replace the Media Mogul software and the emulator hardware required between the Mac computer and the CD-R recorder. See also “CD-VIS,” “CD-R,” “CD-Karaoke”, “CD-3DO”, “CD-MM,” “CD-TV,” “games,” and “Photo CD.”

CD-G = audio CD plus still-image graphics such as with Photo CD. Although these are commonly displayed on television screens, they are less interactive than “CD-I,” “CD-VIS,” “CD-R,” “CD-Karaoke”, “CD-3DO”, “CD-MM,” and “CD-TV.” See also “Photo CD” and “Karaoke.”

CD-Karaoke = the video CD format that JVC and Phillips initially agreed upon that eventually became the standard Video CD format agreed upon by major vendors such as Matsushita, Philips, Sony, and Victor of Japan. Initially vendors were trying to develop CDs for television sets that each had a different standard analogous to having different track gauges for different railroads. The agreed upon video standard in 1993 at last makes it possible to cross-platforms in CDs for television. The announcement is reported in Videography, September 1993, p. 10. See “CD” for market share data. See also “CD-R,” “CD-I,” “CD-3DO”, “CD-MM,” “games,” and “Photo CD.”

CDMA/TDMA = Code Division Multiple Access and Time Division Multiple Access dual-mode cellular telephones that aid in the receiving of fax and computer network data on computers and PDAs. See also “CDPD,” “networks” and “PDA.”

CD-MM = Sony CDs that compete with CD-VIS, CD-I, and CD-3DO discs that also play back visual as well has audio entertainment and learning materials in a hypermedia format on a television set. These discs require special players that connect to a television much like a VCR machine. They compete with CD-I discs but are not the same size and will not play on CD-I players. Only discs developed by Sony Corporation will run on CD-MM players. Various CD-MM games, encyclopedias, hypermedia art books, and other consumer products are available on CD-I discs in department stores and video stores. Whereas CD-I and CD-ROM discs may be recorded on CD-R blanks in home recording devices, it is less likely that CD-MM discs will ever be produced outside professional studios. Users will thus be limited by what Sony develops and promotes. In 1993, Sony agreed to a new CD-format that is more in line with other players in the market. With the initial market shock of CD-3DO, the future of CD-I and CD-MM is seriously in doubt. See also “CD-3DO,” “CD-Karaoke,” “CD-VIS,” and “CD-I.”

CD-PD = (see “Phase Change Dual.”)

CDPD = Cellular Digital Packet Data technology that facilitates more traffic on existing cellular networks. CDPD hardware is required for sending e-mail to PDAs. See also “PDA.”

CD Phase Change Dual (PD) = (see “Phase Change Dual.”)

CD-Photo = (see “Photo CD.”)

CD-R = a recordable CD blank disc also known as a CD-WORM disc. Laser recording machines typically connect to a computer's SCSI board. Some machines such as the Philips CD/521 can be installed as players and recorders. For a review of alternative hardware and software options see NewMedia, June 3, 1996, pp. 31-34. An extensive list of vendors and product attributes is provided in Appendix 6. For a review of hardware and software options, also see NewMedia Tool Guide for 1996. (The
addresses and phone numbers of NewMedia and other periodicals are contained in Appendix 4.) Other references of desktop recording of CD-ROMs include Udell (1993), Weiman (1992), and the Apple CD-ROM Handbook: A Guide to Planning, Creating and Producing a CD-ROM distributed by Apple Corporation. The movement toward desktop CD-ROM recording is analogous to desktop publishing and is reviewed by Schwerwin (1993). Prices for desktop recorders and software needed to make them run start at around $900. Note especially how the highest rated alternatives are not the highest price options. Recording CDs of any type is often referred to as "burning" or "baking." A CD recorder will not record every type of CD. Virtually all of them record CD-ROM discs. Some record CD-Karaoke with appropriate software. Some CDs such as CD-MM and CD-3DO cannot usually be recorded on home recorders. CD-ROM and other types of CDs can be reproduced for less than $2 per disc. For example, price lists are available from Disc Manufacturing, Inc. (800-433-3472 or 3475). See "CD" for market share data. Some CD recorders such as the Phase Change Dual PD recorder/player are rewritable, but the recorded discs cannot be played back on standard CD-ROM players. See also "WORM," "CD-I," "CD-3DO," "CD-MM," "Phase Change Dual (PD)", "games," and "Photo CD."

**CD Recording** = (See "CD-R")

**CD-ROM** = **C**ompact **D**isc-**R**ead **O**nly **M**emory compact discs. These discs can be both recorded and played back from computers connected to proper recording and/or playback drives. The CD-ROM drives become like hard drives or floppy disc drives in that CD-ROM discs may store files that can be executed in software packages such as word processors, spreadsheet software, ToolBook books, and HyperCard stacks. Some users want them to serve as auxiliary storage devices for computer text, audio, and video files. For example, Kim (1994) discusses why CD-ROM discs are replacing floppy discs in a "ground swell." CD-ROM discs now hold approximately 680 Mb (i.e., 680 million characters) although compression techniques make it possible to record CDs from even larger computer files. A single CD-ROM disc costing under $20 holds over 16,000 full-size pages of text and pictures per disc. With newer compression techniques such as PKZIP, JPEG, and MPEG, the amount of capacity can be increased to the equivalents of over 100,000 pages. Usually CDs have slower access speeds than magnetic hard drives, but speeds are improving and playback of video is now possible on both CD-ROM and CD-I players. Vendors sometimes prefer to issue games, books, and software on these optical discs because of the amount of storage space and the number of users in the world who can now play these discs. So that CD-ROMs will play back on standard devices, most CD-ROM discs are recorded on the CD-ROM standard known as the “Yellowbook” standard. Unfortunately, since CD-ROM players must be attached to host computers, the files recorded on such discs are platform dependent. This means, for example, that Mac CD-ROM discs will usually not play on PC CD-ROM players and vice versa. Only in selected instances where appropriate SCSI common interfaces allow for playback of both Mac and PC CD-ROMs, and even then, the playback may be restricted to text and other data not having graphics and audio features. A major drawback of CD-ROM technology, is that PC computers require PC CD-ROMS, Mac computers require Mac CD-ROMS, Sun computers require Sun CD-ROMS, etc. Several publications for tracking CD-ROM technology are listed in Appendix 4. Popular software used in the past by CD-ROM developers is reviewed in Victor (1993a). Kim (1994) estimates 11 million new CD-ROM players will be sold in 1994. Kaufield (1993, p. 53) predicts 50 million CD-ROM discs will be sold in 1994. The biggest new market, says Kaufield (1993, p. 54), will be in Europe where multilingual versions of entertainment, travel, education, and games will “find a surprisingly strong market.” Jerram (1994b) reports on the “explosion” of CD-ROM titles (e.g., electronic books and games) in 1993 and 1994. Chase [1993] reports how Newsweek is the first to deliver multimedia news on CD-ROM and computer networks. What makes **PC Magazine** especially unique among computer magazines is the $49.95 annual subscription rate for the quarterly CD ROM version of the magazine. Burks (1994) summarizes many of the magazines now available on CD-ROM discs. The key advantages in CD ROM versions of magazines and books are opportunities to conduct electronic word searches and ease of storing back issues. Tropia and Rothermel (1994, p. 85) complain about storage limitations of CD-ROM discs for
audio and video files. They propose that plug and play hard discs become more of a standard in education. See “CD” for market share data. First time buyers of CD-ROM players may want to read Nicholls (1993). Rega (1993) provides a catalog of titles. Other titles are contained in Appendix 6. Also listed in Appendix 6 are vendors of CD-ROM towers that house multiple CD-ROM players, thereby, adding huge storage capacities to computers. For reviews of CD-ROM titles on the market, we recommend CD-ROM Today (see Appendix 4). See also “CD-R,” “CD-I,” “CD-3DO”, “CD-MM,” “games,” “titles,” and “Photo CD.” The outlook for CD-ROM in the long haul is not so rosy. Billips (1994, p. 100) predicts the following:

As a lingering vestigial remnant of the mechanical age, the CD-ROM has no place in a fully digital communications environment and is no doubt destined to the same scrap heap as the eight-track. The new Nintendo/Silicon Graphics Inc. (SGI) media environment, for instance, uses a silicon cartridge that is two million times faster than CD-ROM.

In our viewpoint, however, the CD-ROM will remain the standard until better alternatives can be recorded as simply and as cheaply in homes and offices as CD-ROM discs can now be mastered (burned) for less than $20 per disc on desktop recorders costing less than $3,000. Newer “jukeboxes” like the CD-ROM Six-Shooter DRM-602X from Pioneer hold multiple discs that can be selected individually in less than ten seconds. The most important happening that will keep CD-ROM technology alive into the next century are the forthcoming developments that will increase data storage capacities per disc five to ten times the present 640 Mb standard capacity. Shorter laser wave lengths and new angle reading and silver coating technologies greatly enhance the future of CD-ROM playback and CD-R recording technologies. This technology and other forecasts for the future are discussed in by Brownstein (1994). Present SCSI connections to computers will be replaced by IDE interfacing. CD-ROMs can be used on network servers using new hardware described in PC Computing, December 1994, p. 144.

CD-ROM titles = books and games available on CD-ROM discs. Comparisons are difficult, because there are thousands in hundreds of markets. For example, see ADAM for one of the top medical and science titles that has done very well in a narrow market. The top titles in the general market according to PC Computing, December 1994, p. 206 are Microsoft Bookshelf (206-882-8080), Myst (415-382-4400), and Normandy (302-986-0444). PC World, December 1994 in a cover feature rates a larger number of titles by topic areas: One especially noteworthy CD-ROM title that has been popular in the consumer market is David Macaulay's The Way Things Work from Dorling Kindersley Publishing (800-225-3362). The number of CD-ROM titles has been nearly doubling each year for the past several years. It appears this will be the most popular electronic publishing medium for the rest of this decade. See also “ADAM.”

CD-ROM XA = see “CD-ROM.”

CD-TV = Commodore Dynamic Total Vision player manufactured by Commodore Corporation to compete with CD-I, CD-MM, CD-VIS, and CD-3DO CD players for television sets. CD-TV discs are viewed in television sets from a CD-TV player or on Amiga video computers. They may not, however, be played on CD-ROM players. See “CD” for market share data. The market share of CD-TV is so small that its future is quite uncertain. The future of the CD-TV is clouded by the 1994 declaration of bankruptcy by Commodore Corporation. See also “CD-I”, “CD-3DO”, “CD-MM,” “CD-VIS,” “games,” and “Photo CD.”

CD-VIS = the Memorex MD-2500 Visual Information System CD player marketed by Radio Shack that competes with CD-MM, CD-I, and CD-3DO discs that also play back visual as well as audio interactive entertainment on television sets. The Memorex MD-2500 requires no host computer to perform interactive operations from a remote control. Compton's Multimedia Encyclopedia disc and some other discs are available, but the market share of CD-VIS never became great enough to
attract widespread authorship of VIS discs. At present there are very few titles and interest in CD-VIS relative to CD-I and CD-3DO is waning.

**CD-Stand Alone** = reference to audio/video players that stand alone in the sense of not needing a computer. The term generally refers to set-top video boxes for network television or to CD players such as CD-3DO, CD-I, CD-MM, CD-TV, CD-VIS, etc. See also “set-top box” and “CD.”

**CD-WORM** = (see “CD-R.”)

**CETA** = **C**enter for **E**ducational **T**echnology in **A**ccounting (817-565-3090) at The University of North Texas, P.O. Box 13677, College of Business Administration, The University of North Texas, Denton, TX 76203-3677. CETA serves as a clearinghouse of information on use of technology in accounting education and research. It publishes a quarterly **CETA Newsletter** that attempts to track happenings around the world in applications of technology in accounting, auditing, and tax education. It also seeks to help accounting instructors find development funds and training opportunities for authoring hypertext/hypermedia accounting materials.

**CGA** = (See “graphics adapter.”)

**CGM** = **C**omputer **G**raphics **M**etafile international standard for 16-bit color graphics. CGM files cross platforms between PCs and Macs and can be generated in most graphics, paintbrush, and draw software. See also “graphics” and “cross-platform.”

**channel** = transmission line that can carry the sound of a separate MIDI instrument. Each MIDI port allows up to 16 separate channels for sending or receiving data. Each channel can function as a separate instrument in an ensemble, each using its own patch and responding independently to continuous controllers. See also “MIDI.”

**CISC** = **C**omplex **I**nstruction **S**et **C**omputing chipsets such as the Intel family of popular 386,486, and Pentium competitors and the Motorola 680x0 family in Mac computers. These were the most popular processors until the RISC alternatives entered the market. The future of CISC versus RISC is now up in the air. See “Pentium” and “RISC.”

**clipboard** = a holding device that contains the most recently copied or cut text or image such that contents of the clipboard can be pasted one or more times into other parts of the document at hand or other documents. It is usually possible to cross between different software options such as between Windows programs.

**clock speed** = the speed of the processor is measured with the clock frequency. The processor consistently works internally at the same clock frequency. The IBM PC has a clock frequency of 4.77 MHz (Megahertz). Compatables sometimes use higher frequencies, but higher speeds may create compatibility problems.

**CLV** = **C**onstant **L**inear **V**elocity playback in magnetic and laser discs where the disc rotates at varying speeds. Relative to CAV constant speeds, the CAV approach results in constant data retrieval times that do not depend upon where the read/write head is located relative to the disc spindle. CLV videodiscs hold up to 60 minutes of video per side of a 12-inch disc. However, CLV discs cannot be searched for individual frames as effectively as CAV discs. See “CAV.”

**CMS** = that subset of CAL that entails **C**ourse **M**anagement **S**ystems. This software is defined by the “core” attributes listed in Chapter 3. Chief among these attributes are utilities that allow instructors to keep student records, call up examination templates and questions, administer examinations, track
student learning in course modules, and randomly access lecture and case materials. CMS software options compared in Chapter 3 are Quest, TourGuide, LessonBuilder, Tencore, Course Builder, HyperGraphics, Authorware, and Peak. Present leaders CMS leaders are Quest for Windows and DOS and Macromedia Authorware for Mac operating systems. It is common to build custom CMS features into hypertext/hypermedia developments. For example, the Arizona State University accounting lab simulation package marketed by McGraw-Hill has core CMS attributes that were scripted into that package by the author even though ToolBook is not a full-featured CMS package. McGraw-Hill can sell the package without paying a royalty fee since ToolBook has no runtime usage fee. There are some CMS packages such as Quest, LessonBuilder, CourseBuilder, and Peak that have no runtime/royalty fees. But CMS options have drawbacks in spite of their utilities for educators. Except for Quest and Tencore, the other CMS packages do not have full-featured scripting options of such major hypermedia competitors as Multimedia ToolBook, Apple Media Kit, HyperWriter, Icon Author, etc. CMS options do not cross platforms to run on multiple platforms as well as hypermedia GainMomentum, ScriptX and Icon Author. See “runtime,” “hypertext” and “hypermedia.”

coaXial cable = a cable consisting of a single metal wire surrounded by insulation, which is itself surrounded by a braided or foil outer conductor.

Compact Disc = (see “CD.”)

companding = (See “dbx.”)

compression = has several meanings. In one context, it refers to algorithms for shrinking the storage space required for files stored on discs. In those instances, nothing is usually sacrificed in the compression, although files may have to be decompressed before they can be utilized later on. In another context, compression refers to the storage of graphics or video files in such a way that they can be stored and/or processed more efficiently on computers. In the latter case, something (e.g., color depth, resolution, image sharpness, etc.) is usually lost in the process. See “GIF,” “JPEG,” “Indeo,” and “MPEG.”

CompuServe = a commercial network that has some of the “richest offerings available, but it has been the slowest to change and can be much costlier than the other two services, especially if you make heavy use of some of its best features” according to Mossberg (1994a). It has a wide choice of bulletin boards, U.S. News and World Reports magazine, and Navigator to the Internet. News services are relatively cheap, but modem line costs are somewhat expensive. See also “networks,” “Internet,” “SLIP,” “America Online,” “eWorld,” “Interchange,” and “Prodigy.”

computer = an electronic system that can store and process information under program control.

console = the file server.

control code = special nonprinting codes that cause electronic equipment to perform specific actions.

conventional memory = (see “RAM.”)
Copeland = the name given to Apple’s operating system 8.0 for Mac and PowerPC computers. New features include OpenDoc object programming support, advanced security, and TCP/IP support, and IPX support. Although it was expected to be released in 1996, Copeland was once again delayed for purposes of adding competitive features, especially networking utilities. Latest information on Copeland and other operating systems can be obtained at <http://techweb.cmp.com/iw/center/default.html>. Details are provided in Information Week, April 29, 1996, p. 15. See also “Mac,” “PowerPC,” “operating system,” “Mozart,” and “Gershwin.”

coprocessor = electronic component that relieves the microprocessor of some important tasks. Increased performance can often be achieved through the use of coprocessors. For example, a math coprocessor performs many of the math operations outside the microprocessor. A coprocessor may also speed graphics computations.

copying = (see “VCR,” “CD-R,” “W-VHS,” and “SCMS.”)

CORE = the Chapter 3 “core” attributes that distinguish CMS software/systems from other CAL options. See also “CMS.”

CPU = Central Processing Unit that encompasses a computer’s RAM, processing, and control circuitry, including the arithmetic-logic (ALU) unit. Both the ALU and the control units are wholly contained on the microprocessing chip whereas the primary storage is on the motherboard or the expansion bus. For test comparisons of Intel Pentium, PowerPC, and Mips R4X00, and DEC Alpha, see Montgomery (1994). Montgomery ranks Pentium and Mips highest in terms of file servers. He ranks Pentium higher on most graphics and business applications criteria except for price since PowerPC is a cheaper alternative. There are, of course, other considerations. The PowerPC currently performs better than Pentium in terms of temperature, speed, and price, but all these advantages are expected to disappear when Intel introduces its upgrade versions of the Pentium. The PowerPC, however, will not perform as well using DOS and Windows operating systems. See also “Alpha processor,” Pentium,” Mips,” PowerPC,” “CISC,” “RISC,” “operating system,” and “motherboard.”

cross-platform = the ability of a software package or an electronic “book” to run in more than one operating system such as Icon Author and TIE crossings between Windows, Unix, and DOS operating systems. Rosenthal (1995) compares hypermedia authoring software having cross-platform capabilities. Some will only will only playback on cross-platforms but cannot be used to author in the platform of choice. Apple Media Kit and ScriptX authoring will run in DOS, Mac, Unix, and other operating systems, but neither option can be used for authoring in DOS or Windows. Insight into Multimedia and TIE can be used to playback in UNIX but authoring can only be undertaken in Windows. Hardware that crosses platforms in emulation (such as playing back Windows software in emulation on a Mac computer) frequently does not work well with complex authoring systems such as CBT ToolBook or Quest options that only perform well in Windows. Often very expensive options are priced for cross-platform capabilities that are limited in terms of authoring features present in software that will not cross platforms. GainMomentum authoring package from Sybase crosses platforms between UNIX, Windows, and Windows NT. However, in spite of its very high price this package does not contain many of the wonderful authoring features found in Windows-only CBT ToolBook that is less than 10% of the cost of GainMomentum. Only a small proportion (less than 20%) of the hypermedia authoring options have cross-platform capabilities, but it is becoming a priority of many vendors to upgrade their products with cross-platform capabilities. Beware that some products like Apple Media Kit, Icon Author, TIE, Macromedia Authorware, Macromedia Director, Cast, Course Builder, Insight Into Multimedia, Oracle Media Objects, PowerMedia, Test, GainMomentum, and ScriptX may claim cross-platform capabilities, but it is not possible, for example, to translate complex hypermedia animations and high resolution graphics from
a Mac to a Windows operating system and vice versa. See CGM for computer graphics metafiles that cross platforms between PC and Mac computers. Adobe Acrobat software is designed for cross-platform applications of many types of files, but it has limited or no ability to cross multimedia platforms. The term “cross-platform” can also apply to hardware options such as computers that will run under more than one operating system. However, this is not technically crossing a platform since it is merely equivalent to having two independent computers in one housing. Some, but not all, lessons authored in DOS and Windows may run on a Mac or PowerPC computer, but those that do run may run painfully slow due to being run in emulation rather than direct form. Conversion software is available for converting Mac HyperCard Stacks into Multimedia ToolBook Windows books. Although this software works well for simple books (e.g., books having no complex animations and high-resolution graphics) that aren’t in color, the converted books don’t look well for complex books with greater color depth of high resolution graphics and complex animations. The same problem arises in most conversion software (e.g., that of Macromedia’s Authorware and Director). Even ToolBooks created in 24 bit color PCs may not be suited for PC displays having lower color depths. Mac computers attempt to dither 24 bit color images into acceptable images for lower color-depth Mac computers, but PCs do not dither these images automatically. As books become more complex, a point is reached where authors must rewrite books for Mac and Windows operating systems. Someday in the next century, operating systems will render bridges and multiple authorings no longer necessary, but in the remainder of the Twentieth Century, authors will have to be bothered by such troublesome differences in operating systems. See also “authoring,” “native,” “operating system,” “PDA,” and “CGM.”

CWIS = Campus Wide Information System bulletin board services that can be accessed on the Internet. These are available on most college campuses and provide bulletin board information on campus calendars, e-mail directories on the campus, employment opportunities, campus events, course catalogs, etc.

cyberspace = a term coined by William Gibson in his fantasy novel Neuromancer to describe the “world” of computers, and the society that gathers around them.

DAB/DAR = Digital Audio Broadcast and Digital Audio Radio broadcasting in digital formats via satellites and fiber optic cable. See also “networks.” See also “DCC.”

DAC = Digital Analog Conversion hardware that converts digital signals into analog form. See also “analog,” “ADC,” “scan converter,” and “modem.”

DAT = Digital Audio Tape used for recording computer disc files onto a cheap backup and storage medium. DAT tapes are contained in small cartridges that are the cheapest means of storing vast amounts of data. For example, a cartridge smaller than the palm of an adult hand can hold two or more gigabytes of data. Popular manufacturers of DAT backup tape drives include Sony and Hewlett-Packard.

Data Discman = (See “games.”)

database = a computer file or system of data organized in records and fields for fast retrieval and ease of updating. Multimedia databases are reviewed in the NewMedia 1995 Tool Guide (pp.31). See Chapter 3 for a summary of many database options. Also see “GainMomentum” and “relational database management.”

DAV = Digital Audio Video connectors such as those found on the Apple AV that allow the flow of digitized video to bypass the computer’s main bus. See “bus.”
\textbf{dbx} = the “companding” compression and expansion of audio signals to reduce noise distortions of stereo television broadcasts. See “MTS/SAP.”

\textbf{DCC} = \textbf{D}igital \textbf{C}ompact \textbf{C}assette format that improves sound quality relative to traditional analog formats of audio cassettes. Analog cassettes can be played on DCC tape decks such that the purchase of a DCC tape deck does not preclude listening to analog tapes.

\textbf{debugging} = executing a program, one statement at a time, to identify and fix errors.

\textbf{DEC Alpha} = (see Alpha processor.”)

\textbf{Delta Project} = a European Economic Community (EEC) funded project of the Commission of European Communities. With a budget of over $100 million, this is probably the world’s largest attempt to apply modern technologies to distance training and education. Partners in the project include major universities, telecommunications companies, and business firms of all sizes across the EEC. Collis and de Vries (1994) report on 27 major projects with over 300 sub-projects in network education and multimedia development.

\textbf{device driver} = software that controls the communications between a computer program and various hardware devices such as the sound card, the video card, the CD-ROM player, the MIDI, disk drives, etc.

\textbf{digital video (DV) camcorder} = (see “video camera” and “video from digital (DV) camcorders”)

\textbf{DIP switch} = \textbf{D}ual \textbf{I}n-line \textbf{P}ackage case on a computer board that contains small switches for configuring hardware components. A given board can be configured in a way that is compatible with the entire system of other peripheral hardware. See “board.”

\textbf{DirectTV} = (See “DSS”)

\textbf{disabilities products} = a variety of hardware and software options for users having certain types of disabilities. The Trace R&D Center (608-263-2309) at the University of Wisconsin-Madison produces both a Trace Resource Book and a CD-ROM that describes computer products for persons with disabilities. An evaluation service is available from the National Information System (800-922-9234, Ext. 301), Center for Developmental Disabilities, Benson Building, University of South Carolina, Columbia, SC 29208. See also “speech recognition,” and “text recognition.”

\textbf{disk-at-once recording} = single-session recording mode, where all the data to be included on a disk is written in one pass. You must write in this mode to have your CD mass-produced by a stamping house. See also “CD-R.”

\textbf{docking station} = a platform that can be attached to portable computers giving them a variety of added options such as stereo speakers, a CD-ROM player, a SCSI port, and bays for additional components such as data tape drives and floppy disc drives. The numbers and types of options vary among vendors. Some docking stations are small and portable. Others are large and relatively heavy, especially those docking stations that provide notebook computers with added expansion slots for boards such as video capture boards. Some docking stations are reviewed in \textit{PC Computing}, January 1995, p. 128. See also “notebook computers.”
Dolby-NR = Dolby-Noise Reduction system invented by Ray Dolby. There are various levels of quality which in rank order from lowest to highest quality include Dolby B (good), Dolby C (better), Dolby S (best), and Dolby SR (professional). DSB Dolby surround digital systems are even higher quality systems used in movie soundtracks and videodiscs. HDTV will also include DSD. A sound enforcement system first used in the movie TXH 1138 by George Lucas is now known as the THX system. The THX-licensed speakers use a professional Dolby process for commercial and home theater systems. See also “HX-Pro.”

DOS = MS DOS Microsoft Disk Operating System introduced by Microsoft Corporation in 1981. It became the operating system standard for PCs around the world and still serves as the foundation of the popular Microsoft Windows extended operating system. The ability to operate from DOS on low-capacity PCs having only 640K of random access memory (RAM) has become the limitation in modern times for DOS to remain a standard for higher speed and higher RAM computers. DOS has not been upgraded for newer 32 bit processors and will eventually fade as the newer 32 bit, 64 bit, and higher capacity PCs spread across world markets. See also “operating system,” “Windows,” “Windows Chicago,” “Windows NT,” and “OS/2.”

driver = a memory resident program usually used to control a hardware device.

dry camera = a camera that records images directly to a disk or other medium that can be read directly into computers without having to develop imaging film with “wet” developer chemicals. Canon has a relatively inexpensive dry camera whereas Kodak, Logitech, and Dycam have superior and very expensive cameras that have much higher imaging quality. Apple Corporation later offered its Apple QuickTake camera at a relatively low price of $700 for features found in much higher price competitor cameras. Mossberg (1995a) reviews the $249 EasyPhoto package from Storm Software and concludes that is is a good buy for the relatively low price. Photographs can be scanned in a Photo Reader that plugs into the back of the PC. See also “video camera,” “video from digital (DV) camcorders” and “Photo CD.”

DSD = (see “Dolby-NR.”)

DSP = Digital Signal Processing chips that are common in cards (boards) added to expansion slots in computers, especially for adding multimedia to computers. In the future, DSPs and video hardware will probably be more common on motherboards instead of add-on boards. All major sound systems for PCs in the future will probably be upgraded to DSP-based audio chips, many of them right on the motherboard. See also “sound board.” See also “Multimedia Video Processor.”

DSS = Digital Satellite Systems such as those introduced by Hughes Communications and USSB United States Satellite Broadcasting, Inc. The term for commercial satellite dishes used for this system is DirectTv which will compete actively with full-service cable TV. Since 120 channel capacity is expected on small 18-inch home satellite dishes, it becomes much more feasible to bring remote education into homes, schools, and offices. For a review of DSS, see Barcroft (1993). See also “teleconferencing.”

DVI = Digital Video Interactive video compression hardware and standard developed by the Moving Pictures Experts Group (MPEG) before MPEG video boards hit the market. DVI is a form of compressed full-motion video for computer file storage. Full-motion video at over 30 frames per second takes up so much digitized storage that video must be compressed to make it more useful in hypermedia. DVI was an early compression option that required special and somewhat expensive DVI hardware installation inside the computer of both authors and users (readers) of hypermedia
materials. New technology allows for video compression without such expensive hardware. MPEG hardware for video codec compression and decompression seems to be taking over the recent market share lead over DVI largely due to quality of the MPEG and options emerging after DVI. At present, it is not clear whether MPEG or DVI/Indeo will emerge as the international standard with greatest market acceptance. Many analysts are betting on MPEG at the moment. See also “Video for Windows,” “QuickTime,” “compression,” “video,” “Indeo,” “MCI,” “Ultimedia Video,” and “MPEG.”

ECCH = European Case Clearing House, Cranfield Institute of Technology, Beds, MK43 0AL, United Kingdom (also at Babson College in Babson Park, Wellesley, MA 02157). The ECCH now offers an on line network server for international cases. Although none of the cases are, as yet, in hypertext or hypermedia format, it is a useful feature to have cases available for file transfer on the Internet. See also “HBSP.”

education grants = see “funding.”

EDUCOM = a group of cooperating colleges and universities dedicated to advancing computer and network communications technology in education. EDUCOM coordinates newsletters and other publishing efforts along with conferences and related activities. For free publication subscriptions, contact EDUCOM, 1112 16th St. NW, Suite 600, Washington DC, 20036 (202-872-4200).

EduQuest = a revitalized system of multimedia hardware and software package form IBM Corporation. The system primarily targets the K-12 education system in the United States. The new system is designed to be more powerful with networked PCs and a variety of Plug and Play adapters for auxiliary components.

EISA = see “bus.”

electronic classroom = a large or small classroom filled with multimedia devices. The usual context is that of a lecture hall where the instructor has fingertip control of multimedia aids such as computer images, video tape images, videodisc images, audio, CD-ROM players, Internet connections, cameras that transfer images to large screens, etc. Some electronic classrooms have student response hardware such as response pads or even computer terminals. Usually, however, the electronic classroom is not viewed in the same context as a computer/multimedia lab or a language lab. In a lab setting the student usually works alone or in small teams in front of computers. In an electronic classroom, the instructor is usually focusing the attention of the entire class upon the same learning media. However, labs can be equipped with central screens so that combinations of instructor-focused materials can be combined with individual learning. Large lecture halls can also be equipped with students who combine large lectures with “studio classroom learning.” See Deloughrhy(’95a). See also “studio classrooms.”

e-mail = electronic mail transmitted between millions of users connected on networks worldwide. Messages are exchanged instantaneously, usually at zero marginal cost to users, thereby saving greatly on national or international telephone and express mail fees. Messages may be stored in computer files and processed at a user's convenience. The Whois Gateway provides a listing of email addresses for Internet users. It is increasingly common for educators to communicate with students via e-mail, but few take it as far as University of the South Professor Gerald Smith according to an article in the San Antonio Express News on May 8, 1994. In Smith's class there are no longer test papers, hand outs, text books, or term papers. Everything, including class discussion, is conducted on network. See "Internet," “Mosaic,” “SLIP,” and “USENet.”

emulation = (see “native.”)
EPG = Electronic Program Guide that display scheduled shows on screen such as TV Guide On Screen.

ERIC = Educational Resources Information Center documents database that contains a variety of resources to educators, especially teachers in K-12 schools. See “Telnet.”

ESH = Electronic Super Highway. See “information highway.”

ethernet = a widely used interface data processing scheme for managing data transfers on network. An ethernet board (card) must be put into the computer for network connections. It can network a wide variety of computers, it is not proprietary, and components are widely available from many commercial sources.

evaluation = (See “assessment.”)

event handler = a special type of function that executes automatically when a particular user-enabled, system-enabled, or code-generated event occurs.

eWorld = a commercial world-wide network launched by Apple Corporation to compete with Interchange, CompuServe, Prodigy, and America Online. Key features of eWorld include its ease of use and graphical interface. The major limitation is that its use is restricted to Mac operating systems. A second drawback according to Mossberg (1994c) is that eWorld uses older technology revised from America Online. See “Networks,” “CompuServe,” Internet,” “Prodigy,” “Interchange,” and “America Online.”

execution flow = the section of code that the application executes, depending on branching decisions.

expanded memory = (see “RAM.”)

expansion board/slot = (see “board.”)

expert systems = (see “artificial intelligence.”)

explorer = (see “Internet browsers.”)

Express Author = a front end to Asymetrix Multimedia ToolBook that performs automatic scripting to both speed authoring and aid ToolBook novices. The software was developed at the IAT. This front end is mainly an aid to beginning authors who do not plan to become ToolBook experts. See “authoring” and “IAT.”

extended memory = (see “RAM.”)

fax = devices for transmitting and receiving photocopies over telephone lines. Text and graphics may be printed on paper or stored in computer files. Text is received as a graphic and must be translated by specialized software to be stored as text files for word processors. See also “PDA.”

fiber optic = cable that carries light pulses instead of electrical current. A cable comprised of a multitude of fine glass fibers has much more capacity than the previously popular copper cable. See “information highway,” “network,” and “Sonet.”
**Fiero Online** = the Princeton University online art class on Fiero del Fancesca, an Italian 15th century Renaissance artist. This is an Iris Silicon Graphics high-end database library with scanned images of frescoes and a three-dimensional walking tour on computer for students. Students also construct their own models. This is considered one of the most successful CAL applications in universities.

**file attributes** = access rights attached to each file.

**file server** = a computer running a network operating system that enables other computers to access its files.

**file transfer** = the ability to transfer text, graphics, software, spreadsheets, audio files, and video files over vast distances on computer networks such as the Internet. For example, the entire works of Shakespeare can be downloaded from Dartmouth College and government documents may be transferred from the Library of Congress. See “FTP” “Internet,” and “SLIP.”

**Finger Gateway** = a source listing of graphics images that have been placed around the world on the Internet. See “Mosaic.”

**flash memory** = an erasable memory used as an alternative to hard disk and laser disc storage. The term is used most often in conjunction with PCMCIA cards. See also “hard drive,” “RAM” and “PCMCIA.”

**flatbed** = (see “scanner.”)

**flc/fli** = file extensions for animations conforming to Autodesk formats. With appropriate changes in the win.ini file, most PC computers will play back these animations without having Autodesk software installed. See also “animation.”

**FM synthesis** = the least-expensive method for producing synthesized sound. FM synthesis uses one sine wave to control the frequency of another. Most synthesizers built into PC audio boards and sound modules use more sophisticated synthesis techniques for greater accuracy in reproducing the sounds of different instruments.

**FMV** = Full Motion Video depicting video at 30 or more fps. See “video.”

**fps** = frames per second in video. Typical “full-motion” video in television and movies is 30 fps, but in digitized video such high fps rates are not yet common. Apple’s QuickTime and Microsoft’s Video for Windows typically run at 12 to 18 fps. See also “video.”

**Freenets** = bulletin board services that are funded by individuals and organizations dedicated to making information freely available on networks. They operate much like public libraries through the National Public Telecommunication Network (NPTN.). Users can connect through modems or through Internet terminals. An example of a freenet is the “campus look-alike” Cleveland Freenet operated by Case Western Reserve University. See also “CWIS” and “BBS.”

**FTP** = File Transfer Protocol used for downloading files on the Internet. Listings of ftp sites are available from Mosaic. See “file transfer,” “remote login,” “Mosaic,” and “Protocol.”

**full-duplex** = in full duplex communication, the terminal transmits and receives data simultaneously.
function = an instruction to the application that performs operations or returns a value, or both.

funding = the raising of funds for hardware, software, and development. Grants are available from a variety of sources as noted in Chapter 3. Funding grants are available from a variety of sources tracked in the newsletters listed in Appendix 4. A directory of some of funding sources is given by Eckstein (1991). Summaries of grants and assistance in writing grant proposals can be found in Columns, Spring 1994, p. 3. The CETA Newsletter tracks funding sources for accounting educators. Summer fellowships are also available from Teletraining Institute (405-744-7510). Apple Corporation offers a variety of funding sources for Mac and PowerPC users. See also “Delta Project.”

GainMomentum = the high-end $10,000 hypertext and hypermedia authoring software package from Sybase (800-879-2273). Features of this amazing, albeit expensive, software are reviewed in Morph’s Outpost, September 1994 (p. 1 ff) and in NewMedia 1995 Tool Guide (p. 25). Sybase is the first leading-edge vendor to offer serious database networking utilities for hypermedia and cross-platform utilities between UNIX, Windows, and Windows NT. The main competitor at the high-end level will be ScriptX, although at this juncture it is not certain that ScriptX will match GainMomentum if database, networking, and Windows NT capabilities. See also “cross-platform,” “authoring,” and “ScriptX.”

games = interactive entertainment programs that can be played back on computers or special playing machines connected to television sets. Some games are sold on compact discs that can either be played in CD-ROM drives connected to computers or CD players that are proprietary. For example, Sega games play on Sega players, Data Discman games play on Data Discman players, CD-I games play on CD-I players, etc. Games are generally authored by game vendors and cannot be modified or updated for education uses by users. Educators who think that their students are spending many hours in computer labs for academic purposes may discover that a large portion of computer lab time is taken up with game playing. More research needs to be conducted on the fascination of games so that educators can make better use of building these motivational factors into more serious learning materials. According to Pereira (1994), CD-ROM games are overtaking market leaders such as Sega and Nintendo that captured the early game markets with players that were not compatible with PC, Mac, or other desktop computers. Games are popular and addictive, in part, due to the release of endorphins in the brain, especially among women according to Carlton (1994a). See also “MUDs.”

gateways = are connectors between two or more dissimilar networks that facilitate communication in such instances. Gateways have their own processors to perform both protocol and bandwidth conversions. Gateways between the Outernet and the Internet that translate different protocols such as e-mail protocols of different networks into Internet protocols. See “Internet,” “InterNIC InfoSource,” “Finger Gateway,” “Whois Gateway,” and “Outernet.”

GDI = Graphics Device Interfaces link graphics hardware devices with the CPU. Much of the power of graphics processing depends upon whether the system has 8-bit, 16-bit, 32-bit, or 64-bit graphics power. Limitations of customer hardware often detracts from the ability to develop operating systems to take full advantage of graphics power. For example, when developing Windows Chicago for 32-bit processors, Microsoft Corporation had to leave 16-bit GDI capacity on its 32-bit operating system.

Gershwin = the name given to Apple’s operating system 9.0 for Mac and PowerPC computers. New features include advanced speed recognition, interfacing that adapts to individual users, and new microkernal architecture. See also “Mac,” “PowerPC, “operating system,” “Copeland,” and “Gershwin.”
**GIF** = a graphics compression standard for PCs. This is an extremely popular standard because it is so widely read in graphics software alternatives and is commonly used as the “GIF” file extensions of images carried on bulletin boards and transported across networks. A major drawback is the loss of color depth in GIF compression. See also “JPEG.”

**GINA** = a graphical interface (formerly known as GUIDE) for the Internet. This is a low-cost option for graphically interfacing with e-mail, bulletin boards, databases, library catalogs, news services, and conferencing. Contact California Technology Project, P.O. Box 3842, Dept. PRG, Seal Beach, CA 90740-7842 (310-985-9631). The e-mail address is kvogt@eis.calstate.edu.

**Gopher** = a menu-driven and user-friendly system of Internet sites that facilitate searching and browsing of documents and files around the world. Gopher has been largely overtaken by more modern web browsers (see “web browsers”). Gopher was the first system that communicated easily between different types of operating systems and computer installations. The term “Gopher” arises from the fact that the system originated with graduate students at the site of the “Golden Gophers” at the University of Minnesota. The Gopher is one of the most popular of various menu-driven systems such as WAIS and World Wide Web. NOTIS Systems (708-866-0150) developed a Windows' front end to Gopher that is described in THE Journal, March 1994, p. 39. A graphical interface called WinGopher is available from NOTIS Systems Inc., 1007 Church Street, Evanston, IL 60201-3665 (800-556-6847). Gopher became very popular on the Internet, but it is now being replaced by a similar and more graphics-oriented system called Mosaic that has Gopher services available. See “web browsers,” “GINA,” “Mosaic,” “Internet,” and “SLIP.”

**GPS** = Global Positioning System hardware that facilitates navigation via satellites. There are now versions for automobiles that have LCD screens to show maps and present vehicle location.

**grants** = see “funding.”

**graphics** = computer images that contain pictures, drawings, and other forms of imagery other than text. Popular file extensions for graphics files are **bmp, pcx, tif, and cgm**. See cgm for a discussion of graphics that will cross platforms between Mac and PC computers. The best-buy graphics software options are ranked in to PC Computing, December 1994, p. 205. See also “2-D,” “3-D,” and “paintbrush.”

**graphics adapter** = the hardware inside a computer that enables the computer to display graphics on the screen. In contrast to Mac computers, PCs have a larger variety of graphics adapters that complicate compatibility between different PCs. In the early days, the PC standard was the Color Graphics Adapter (CGA) that, by today's standards, is low resolution and low in color combinations. This was replaced by EGA Enhanced Graphics Adapter and then VGA Video Graphics Array having a standard 480 lines vertical and 640 pixels horizontal resolution. Today Super VGA extensions (to at least 600 lines vertical and 800 pixels horizontal) is the choice among most PC users for whom graphics displays are important. Be aware, however, that there are different Super VGA resolutions and monitor options that can affect the compatibility of graphics images among different PCs. Also be aware that LCD panels are not able to handle the higher resolutions of cathode ray monitors; therefore, images may not look as good during class delivery as they did on a monitor during the authoring process. The top-rated graphics adapters at the end of 1994 are Impression Plus (Rank 1) with 4Mb of video RAM from Matrox (514-685-2630), Imagine-128 (Rank 2) with 4Mb of video RAM from Number Nine (800-438-6463), and Graphics Pro Turbo (Rank 3) with 4Mb of video RAM from ATI (905-882-2600) according to PC Computing, December 1994, p. 140. See also “LCD.”

**group** = a collection of users.
**group rights** = rights given to a collection of users.

**GUI** = **G**raphical **U**ser **I**nterface that historically gave rise to the icon-based operating system of Apple Corporation computers. The GUI concept actually had its origins in Xerox Corporation's Palo Alto Research Center (PARC) in the early 1970s. However, it was Apple Corporation who eventually exploited the technology that is now the fundamental basis of Mac, Windows, and other GUI operating systems that perform commands based upon bit-mapped graphics icons. This paved the way for object-oriented systems of the 1990s. See also “Mac” and “Windows.” A decade of the revolution in GUI and hypermedia Mac computing is celebrated in a book by Levy (1994) that is given an extensive review in *Time Magazine*, January 31, 1994, pp. 93-94. See “America Online.”

**half duplex** = in half duplex communication, the terminal transmits and receives data in separate, consecutive operations.

**handshaking** = a set of commands recognized by the sending and receiving stations that control the flow of data transmission.

**hard drive** = a “hard disc” file storage disc (usually a magnetic disc) on a computer that has higher storage capacity and faster access time (e.g., under 20 ms) than slower devices such as floppy disc drives and optical disc (e.g., CD-ROM) drives. This is not the same as memory or random access memory (RAM). Usually the term “hard drive” refers to rigid discs coated with magnetic material. Fast hard idsks are compared and reviewed in *NewMedia*, November 1994, p. 103. See also “RAM,” “flash memory,” “RAID,” and “CD.”

**HBSP** = **H**arvard **B**usiness **S**chool **P**ublishing, Boston MA 02163 (800-545-7685). Although most noted for its hard copy publishing of cases and journals, HBSP has gone somewhat high tech with CD-ROM cases and catalogs listed on the Internet. Most CD-ROM options, unfortunately, do not include hypertext or hypermedia animations, audio, and video segments. A noted exception is the hypermedia video disc entitled Managing International Business by Harvard's Christopher Bartlett and INSEAD's Sumatra Ghoshal that is marketed by Course Technology (800-648-7450). A review is given in *Harvard Business School Teaching Publications*, Spring 1994, pp 1-3. Details of CD-ROM by Bartlett and Ghoshal are provided in Appendix 1. The Gopher address of HBSP is CATALOG@HBSCAT.HARVARD.EDU and the Telnet address is HBSCAT.HARVARD.EDU. E-mail may be addressed to HBSCAT@CCHBSPUB.HARVARD.EDU. The catalog is also available on floppy disc. See also “ECCH.”

**HDTV** = **H**igh-**D**efinition **T**V in digitized formats that will eventually replace present analog formats in 16:9 wide-screen TV. The Japanese version of HDTV is not truly the fully-digitized version broadcast system intended for the United States by the end Year 2,000. See “IDTV,” “wide-screen TV,” “W-VHS.” “video,” and “videodisc-digital.”

**hertz** = unit of measure that equals a frequency of one cycle per second. See “bandwidth,” “bps,” “kilohertz,” and “megahertz.”

**Hi-8** = a professional-quality format for high-end video cameras. Whereas the standard consumer resolution 8mm camera records 250 lines, the Hi-8 versions record 400 lines or more so as to produce more detail in video images.

**HL** = **H**yper-**L**earning using hypertext, hypermedia, and computer networks. Authors like Perelman (1993) tend to use the term in the context of learning from servers on an information highway such as the Internet after multimedia transmissions become more common. See “JITT” and “hypermedia.”
hologram = (see “3-D.”)

hot spots = buttons or other programmable objects that can activate objects or linked events.

HP/UX = Hewlett-Packard UNix operating system. Hewlett-Packard also uses other operating systems such as its own proprietary MPE and NeXtSTEP. See “operating system” and “Unix.”

HyperCard = (see “hypermedia,” “hypertext,” and “authoring.”)

hyperfacts = hypertext and/or hypermedia versions of fact books. The best known of these are encyclopedia CD-ROMs such as the Compton and Grolier options. But there are many other widely selling hyperfact books such as The Way Things Work by David Macauley, a CD-ROM book that has sold over 3 million copies to readers interested in guides and graphics of important inventions. This and several other innovative CD-ROM fact books ranging from sign language to art collections are referenced by Rigler (1994). See “hyperfiction,” “hypertext,” “hypermedia,” and “authoring.”

hyperfiction = hypertext and/or hypermedia versions of fiction, usually versions on CD-ROM discs. The main feature of hyperfiction is that alternative navigations through the plot are possible. In some cases the reader creatively determines certain outcomes. For a review of some of the popular alternatives see Svoboda (1994). Rigler (1994) reports that electronic book offerings at the American Booksellers Association annual meetings seem to be doubling in size annually. She discusses some of the more popular options such as Stowaway by Stephen Biesty. See “hyperfacts,” “hypertext,” “hypermedia,” and “authoring.”

hypermedia = hypertext with added features for audio and video features. Hypermedia may also entail touchscreen or remote control capabilities such that users can navigate by touching the computer screen or remote control devices. Eventually hypermedia will entail other senses such as smell. The key to hypermedia is random access that allows lightning-fast non linear navigation based upon reader choice or other reader actions such as responses to questions. The term “multimedia” is not totally synonymous with “hypermedia,” because multimedia may not entail hypertext authoring. See also “hypertext,” “multimedia,” and “timeline presentation.” A good starting reference in Marchioni (1991). Training workshops are offered by the IAT Institute for Advanced Technology (919-405-1900) and the University of Delaware (302-831-8162). Career opportunities in authoring multimedia are discussed by Jerram (1994a). The IAT also broadcasts training courses via satellite KU and C bands and distributes tapes of those broadcasts for persons unable to view record them live. Courses and literature on learning how to author multimedia works are summarized by Lindstrom (1994). An extensive listing of training programs is provided in Appendix 6. For an introduction to hypermedia, see Jensen (1993). Among the hypermedia software options listed below for PCs, PC Computing in July 1994 on Page 90 claims that Asymetrix Multimedia ToolBook “surpasses most competitors in features and functions while retaining its price advantage and royalty-free runtime arrangement.” Further details on ToolBook and other authoring options are given in Chapter 3. Also see “dry camera,” “CD,” “hyperfiction,” “hypertext,” “authoring,” “RAID,” and “CMS.”

hypertext = pages of computer text that are authored in software allowing for non linear navigation based upon button controls, hotwords, or other controls that make sequencing of pages virtually irrelevant. Hypertext authoring packages typically differ from word processing packages that are intended primarily for preparing text for hard copy printing. Hypertext software may have options to print particular pages, but the intent is for computer use rather than printing. The key to hypertext is random access that allows lightning-fast non linear navigation based upon reader choice or other reader actions such as responses to questions. See also “Hypermedia.” and “Timeline Presentation.” Popular software terminology for hypertext includes HyperCard “stacks,” LinkWay “folders,” and ToolBook “books.” A good starting reference in Marchioni (1991). Training workshops are offered by
the Institute for Advanced Technology (919-405-1900) and the University of Delaware (302-831-8162). The early history and a bibliography is given in Knee and Atkinson (1990). Career opportunities in authoring multimedia are discussed by Jerram (1994a). Courses, trade shows, and literature on learning how to author multimedia works are summarized by Lindstrom (1994). The IAT broadcast training courses via satellite KU and C bands and distributes tapes of those broadcasts for persons unable to view record them live. Courses and literature on learning how to author multimedia works are summarized by Lindstrom (1994). An extensive listing of training programs is provided in Appendix 6. For an introduction to hypermedia, see Jensen (1993). Also see “hypermedia,” “authoring,” “Mosaic,” and “CMS.” The best-buy in terms of a large number of features, free runtime, and state-of-the-art authoring tools in Multimedia ToolBook from Asymetrix according to PC Computing, December 1994, p. 204. The best option for cross-platform multimedia development between Mac and Windows platforms is Macromedia’s Director according to PC Computing, December 1994, p. 204. The hypertext and/or hypermedia authoring software options listed below are discussed in greater detail in Chapter 3.

<table>
<thead>
<tr>
<th>Royalty/ Fee</th>
<th>System Platforms</th>
<th>Operating</th>
<th>Runtime Vendor and Software Name (Phone Number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/Yes</td>
<td>Windows</td>
<td>No</td>
<td>Advanced Media’s Media Master (800-292-4264)</td>
</tr>
<tr>
<td>Yes/Yes</td>
<td>Mac</td>
<td>No</td>
<td>Adventure’s Click D Mouse (205-592-4900)</td>
</tr>
<tr>
<td>No/Yes</td>
<td>Windows/OS/2</td>
<td>Yes</td>
<td>Aim Tech’s Icon Author (800-289-2884)</td>
</tr>
<tr>
<td>Yes/Yes</td>
<td>Unix/Motif</td>
<td>Yes</td>
<td>Allegiant Technologies’ SuperCard (619-587-0500)</td>
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<tr>
<td>No/Yes</td>
<td>DOS</td>
<td>No</td>
<td>Allen Communication’s Quest (800-325-7850)</td>
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<tr>
<td>Yes/Yes</td>
<td>Windows</td>
<td>No</td>
<td>American Training Intl’s TourGuide (800-955-5284)</td>
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<tr>
<td>Yes/Yes</td>
<td>Mac</td>
<td>Yes</td>
<td>Apple Corp.’s HyperCard (408-996-1010)</td>
</tr>
<tr>
<td>Yes/Yes</td>
<td>Mac,Windows</td>
<td>Yes</td>
<td>Apple Corp.’s Apple Media Kit (408-996-1010)</td>
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<tr>
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<td>DOS</td>
<td>Opt’nl</td>
<td>Ask Me’s Ask Me Multimedia (612-531-0603)</td>
</tr>
<tr>
<td>Yes/Yes</td>
<td>Windows</td>
<td>Opt’nl</td>
<td>Ask Me’s Super Show (612-531-0603)</td>
</tr>
<tr>
<td>Yes/Yes</td>
<td>Windows</td>
<td>No</td>
<td>Asymetrix’s ToolBook (800-448-6543)</td>
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<tr>
<td>Yes/Yes</td>
<td>Windows</td>
<td>Yes</td>
<td>ATI’s TourGuide (800-955-5284)</td>
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<tr>
<td>No/Yes</td>
<td>Mac</td>
<td>No</td>
<td>AVCA’s Media Squares (512-346-1919)</td>
</tr>
<tr>
<td>No/Yes</td>
<td>Mac</td>
<td>Yes</td>
<td>Bliss Interactive Tech’s Resource Navigator (512-444-2949)</td>
</tr>
<tr>
<td>Yes/Yes</td>
<td>Windows,OS/2</td>
<td>No</td>
<td>Brightbill-Roberts’ HyperPAD (800-444-3490)</td>
</tr>
<tr>
<td>Yes/No</td>
<td>DOS/DOS</td>
<td>No</td>
<td>CAL’s LessonBuilder (312-906-5307)</td>
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<tr>
<td>No/Yes</td>
<td>Windows</td>
<td>No</td>
<td>Challenger! Deskop’s Desktop Training System (800-484-9752)</td>
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<td>No/Yes</td>
<td>DOS</td>
<td>No</td>
<td>Cincom System’s Multimedia Workbench (800-543-3010)</td>
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<tr>
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<td>Ztek's VideoJuggler (800-247-1603)</td>
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*Runtime or royalty fees are charged by some software vendors in contracts with authors for runtime (delivery, viewing) versions of the software that allows users (students, readers, customers) to run the authored versions without having to purchase full authoring licenses. Sometimes, however, runtime versions will not run every aspect of authored learning materials. Runtime and royalty fees are discussed in Chapter 3.*

**HX-Pro** = an audio tape monitoring system marketed by Dolby that facilitates recording of analog audio tapes at higher decibel levels to reduce tape hiss. This is a feature available on high-end tape decks. See also “Dolby-NR.”

**Hz** = (see “hertz.”)

**IAT** = Institute for Advanced Technology, University of North Carolina, P.O. Box 12017, RTP, North Carolina 27709 (919-405-1942). This is an IBM-funded support center for PC hypertext/hypermedia developers in higher education that was funded primarily through a grant from IBM Corporation. The IAT serves as a clearinghouse for technology developments, develops some Multimedia ToolBook hypermedia education materials (especially in language education), provides demonstrations on hypermedia. The IAT offers workshops for developers. The IAT Briefings Newsletter and other publications are free (see the listings in Appendix 4). The IAT also broadcasts training courses via satellite KU and C bands and distributes tapes of those broadcasts for persons unable to view record them live. See also “IKE.”

**IBM** = International Business Machines Corporation, a giant present and historic leader in mainframe and PC computing. Having survived an enormous downturn of bad fortunes in the past decade, IBM has struggled back with new products and joint ventures. See also “EduQuest,” “IAT,” and “IKE.”
**icon** = graphical representation of an object (file, directory, picture, text field, etc.) as a tiny symbol that can be arranged with other icons and clicked on using a mouse pointer.

**IDE** = Intelligent Drive Electronics interface hard drive disc controller standard for PCs that enables the controller to reside on the motherboard and, thereby, not require the use of an expansion slot. This enhances ease of installation and allows for the elimination of SCSI controllers for accessing auxiliary hard drives, CD-ROM drives, CD-R drives, etc.

**IDTV** = Improved Definitional TV that uses a computerized line doubling technique to simulate HDTV at higher resolutions. See also “video” and “HDTV.”

**IKE** = IBM Kiosk for Education (see also “IAT”). One thing that stood out, or rather did not stand out, at the 1994 EDUCOM Conference was a booth in the most obscure part of the vendor exhibit area. IBM made a grant to the University of Washington to develop the IKE-IBM Kiosk for Education. Whereas IBM and other major vendor sales teams were busily greeting potential customers at the front in the EDUCOM exhibit area, Professor Craig D. Yamashita (the Systems Programming Manager on the IKE project) was almost hidden in the back. This was most unfortunate since what he was “selling” is free to the general public --- and it is an exciting free service. Even though a large portion of the IKE server at the University of Washington is dedicated toward providing information about IBM products, the server also contains software reviews, software downloading, links to other Internet services, on-line publications, and course/curriculum materials in ToolBook. Professors who are willing to share their authored materials can put it on the IKE server at no cost. Educators can download these materials at no cost. Presently, there are over 20,000 educators connected to the IKE server and more are joining daily. The phone number for IKE is 206-534-3761 or 206-543-5604. Other links to IKE are as follows:

- World Wide Web: http://ike.engr.washington.edu/ike.htm1
- Mosaic: ftp.ncsa.uiuc.edu
- Gopher: boombox.micro.unm.edu in the/pub/gopher directory
- Telnet: 128.95.32.61

**incremental packet writing** = like multisession Photo CD, this process lets you add data to a disk in multiple sessions and create a single table of contents when the disk is full. Unlike Photo CD disks, though, a disk written in this way is readable by other CD drives only when the disk is finalized, not before. See also “CD-R.”

**Indeo** = video compression hardware manufactured by Intel for PC computers. The i750 chipset will capture 32-by-240 pixel windows at 15 fps and 160-by-120 pixel windows at 30 fps. Creative Labs (that markets the popular Sound Blaster and Video Blaster hardware/software) will now market the Indeo boards according to NewMedia, January 1994, p. 36. The main competitor for Indeo will be MPEG compression boards that are anticipated by analysts to be the major standard of the future. Hood (1994) is cautious about MPEG and leans toward the Intel Indeo option. He concludes: “Indeo’s most compelling argument, however, is in the numbers. Machines capable of playing Indeo video (486 or Pentium) are selling at a rate of 1 million a month, whereas fewer than 200,000 MPEG boards have sold.” See also “Video for Windows,” “QuickTime,” “video,” DVI,” “compression,” “MCI,” “Ultimedia Video,” and “MPEG.”

**Indy** = (see “SGI.”)

**information highway** = a world wide combination of fiber optic cable and satellite receivers in a a future time when homes and offices around the world will be linked by highways of electronic information that can be traversed interactively both to and from a connected user. Technologies are
coming to a head and plans are being laid to bring the digital information highways to Main Street USA and elsewhere in the world. In homes and offices, a single piece of interactive TV digital television equipment (let's call it the PCTV computer/television superhighways terminal) will combine what are now television sets, telephones, stereos, videotape players, videodisc players, compact disc players, and computers. The PCTV will be networked to hundreds of millions of “servers” ranging from the computer files of individuals to the systems of computer files that contain virtually all the movies ever made, all the contents of daily newspapers, all the “television” shows ever recorded, all the cataloged products and services available from vendors, all public documents of governments, all the contents of libraries, all instructional and training courses on most anything known in the world, and so on to limits beyond our present imaginations. Even before the information superhighways come to town via digital satellites (Barcroft [1993]), telephone fiber optics, and cable digital TV, technology (see Victor [1993b]) is presently in place to make vast amounts of digitized financial information publicly available in hypermedia structures. The hardware for a fiber optic superhighway across the United States made great progress when AT&T Corporation announced that “Sonet” service is operational initially between 200 cities. In 1994, Macromedia teamed up with Microware Systems Corporation in Des Moines, Iowa to extend the Director software into PC and Mac utilities for authoring interactive network television titles. See also “video server,” “PPV,” “set-top box,” “Sonet,” “Internet,” and “SLIP.”

**integrated information system** = networked systems that allow centrally located multimedia sources to communicate with remote centers such as classrooms. For example, over 5,000 classrooms are purportedly linked to the Dynacom (800-782-7230) integrated information system that utilizes video servers, satellite receivers, and classroom hand-held control devices.

**Interactive TV** = (see “information highway”.)

**Interchange** = a commercial network service introduced by a computer book publishing firm called Ziff-Davis. Although designed to compete with CompuServe and other commercial network services, Interchange tries to provide more services for technology monitoring of computer users. See “Networks,” “CompuServe,” “Internet,” “eWorld,” “Prodigy,” and “America Online.”

**interface** = the connection between a computer and its auxiliary equipment such as hard drives, CD-ROM drives, videodisc players, printers, scanners, etc.

**interleaving** = a process that allows separate channels for data, audio, and video files to be played back simultaneously on a compact disc. Interleaving also allows the reader to chose from one of several audio channels while a video channel is playing. In playback, interleaved audio and video sequences are alternately played back such that on slow systems there may be choppy interrupts when video and audio are played simultaneously.

**International Internet Association** = an Internet service that may be accessed for a fee under instructions given at phone number 813-923-4093. The IIA taps over 20,000 databases worldwide, including databases from government, business firms, news services, and universities. American Accounting Association members may access a free AAA bulletin board by phoning 813-923-4093. See also “ANet,” “PIC-AECM,” and “International Internet Association.”

**Internet** = an international grouping of computer networks. The Internet started as a relatively tiny United States Department of Defense (DOD) Advanced Research Project Agency (ARPA) project in 1969. It commenced with the networking of four computers. A free course on how to use the Internet is available online via an email message to listserv@ua1vm.ua.edu that includes the email request to subscribe to ROADMAP with your first and last name in the message. Each lesson takes about 15 minutes a day, and users can stop short of completing each lesson. Major advances in user
friendliness for the transmittal of text, graphics, video, and audio arose with the development of
Netscape and Mosaic (see web browsers). The World Wide Web provides an index of servers
classified by subject and service. Stefanac (1994) provides both a brief history of the Internet and an
excellent review (including Internet addresses of World Wide Web sites with their Uniform Resource
Locator Addresses) of newer options for transmitting graphics, audio, and video over Internet
networks. He also compares set-top boxes with monitor bottoms. The Finger Gateway provides a
listing of graphics images available world wide on the Internet. Alternatives for connecting to the
Internet and top tools for using the Internet are reviewed by Abernathy (1995). Computer users with
modems may connect by calling the Internet Association at 202-387-5445 or fax at 202-387-5446.
They may also FTP File PDIAL014.txt from Peter Kaminski on the Internet. Access options for the
Internet are summarized in depth by Peal (1994). With the rapid development of computer
technology, we are better able to meet the demands of our information society, and Internet is on the
leading edge of this computer technology. It consists of a vast network of computers spanning the
globe. Internet is a loose amalgamation of different networks and various computers from personal
workstations to huge super computers, with no centralized governing body. Thus, the user has a
bewildering amount of information at his or her fingertips. Every machine on the Internet has a
unique address called a “dotted quad” IP address. All local machines on a given campus, for
example, have a subnet number to the IP address. Various governments support parts of the
Internet. There are sets of protocols for Internet that were established by ARPA (Advanced
Research Projects) originating in the U.S. Department of Defense. The Internet began as a network
of super computers used in research. Since then it has expanded to networks of libraries and
individuals around the world. Regional networks such as NearNet, PrepNet, SuraNet, etc. are
included in the Internet. International and national networks such as NSFnet, Milnet, and many
others are included. The Internet carries traffic for some networks such as Usenet newsgroups that
also send traffic outside the Internet. The Internet will eventually evolve into the National Research
and Education Network (NREN). In December 1991, the U.S. Congress passed the High
Performance Computing and Communications Program. This will expand international networking to
thousands of times its present capacities and uses. Although intended primarily for research and
education, the NREN will carry commercial traffic in research and education in addition to the types of
noncommercial traffic carried presently on the Internet. Problems of security on the Internet are
commercial connections and usage of the Internet. As reported in Syllabus HEPC, July/August 1994,
p. 22, Cornell University is using an NSF grant to develop Mac and PC software for video
conferencing over the Internet. Students can set up free homepages at <http://www.tripod.com/>.
Virtual Servers Inc., for a monthly fee, will provide web server space to business firms and other
parties wanting to set up network application servers. The Virtual Server home page is
<http://vservers.com/>. For web browsers see “web browsers,” “GINA,” “Gopher,” “Mosaic,”
“Internet,” and “SLIP.” For accounting educator Internet networks see “ANet,” “International Internet
Association,” PIC-AECM,” and “RAW.” See also “ABKY,” “IKE,” “International Internet Association,”
Web,” InterNIC InfoSource,” “Finger Gateway,” “Whois Gateway,” “UUCP,” “NSFNet,” “NYSERNet,”
“Gateways,” “Outernet,” “Macmillan Information SuperLibrary,” “remote login,” “SLIP,” “TCP/IP,” and
“USENets.”

**Internet audio and video** = the transport of audio and video such that users can hear sounds and
watch video while reading text and graphics on the Internet. It is no longer necessary to download
these media files and install them on a local computer or a local server. These files can be played
live on the Internet. Ozer (1996) reviews audio and video hardware and software for the Internet.
Popular QuickTime (MOV) and Windows Video (AVI) standards will soon have to compete with the
newer Microsoft (AV) standard. Various playback utilities, including the always popular QuickTime
playback software, can be downloaded free from <http://www.texas.net/>. See “Active Video (AV),”
“Windows Video,” “AVI,” and “QuickTime.”
**Internet phones and videoconferencing** = emerging telephony on the Internet coupled with the extension to video telephony. Technology in this area is reviewed in PC Magazine, March 26, 1996, pp. 143-145.

**Internetwork Packet Exchange (IPX)** = one of the data transmission protocols used by NetWare.

**InterNIC InfoSource** = an information server about the Internet. See “Mosaic.”

**ISA** = (see “bus.”)

**ISDN** = Integrated Services Digital Network means of connecting to digital networks, including the Internet, via a common (digital) telephone line. For a review of ISDN in accounting, see Harding (1996). It is the fastest way for many individuals to connect to digital networks via a modem. However, at the present capacity of 128,000 bps, it is very slow relative to cable TV modems that can do over 1 million bps and exponentially faster direct connections that do not use modems at all. See “modem.”

**ISO 9660** = the data-format and file-naming conventions that ensure CD-based data can be accessed across multiple computer platforms. See also “CD-R.”

**ITAD** = Integrated Telephone Answering Device that avoid tape recording by using direct digital recorders for telephones.

**JITT** = Just-In-Time Training. In many technical and complex areas it is not practical for employees or other persons to be knowledgeable about all details at all times. For example, it has become impractical for auditors to have a working knowledge of every accounting and auditing standard in the United States and other nations. Physicians and other medical practitioners cannot have instant recall of details of every disease and combination of medical symptoms and treatments. JITT refers to a process (that is usually aided by computers, compact discs, computer networks, and/or teleconferencing) in which the person receives training “just-in-time” when it is needed for a particular purpose. The JITT process may change the entire process of education and training, because the focus may become how to effectively access and utilize JITT rather than how to teach students and/or employees technical details that have to be memorized long before they are needed in practice. See “kiosk.”

**joy stick** = a remote control device that can be used in place of a keyboard or a mouse to allow for interactions between a computer and its user. Joy sticks are commonly used for computer games and usually connect through a serial port.

**JPEG** = Joint Photographic Expert Group standards for image compression that is an increasingly popular compressed graphics image file, the extension for which is usually **jpg**. Because large and high resolution graphics images with considerable color depth require massive amounts of storage (e.g., over 30 Mb) for each image, compression routines that create images almost as good at substantially less storage requirements are highly desirable. Doyle (1994b) calls several options “awesome,” including the $940 Fast Electronic’s Movie Machine Pro (415-802-0772) with M-JPEG and Avi file capturing options. Similarly, he calls the $570 Intel Smart Video Recorder (800-538-3373) and the $890 Micro Computer microVIDEO DC1 tv (800-249-6476) awesome. JPEG images are generally of sufficient quality that it is not necessary to utilize more storage space for uncompressed files. JPEG compression of graphics images requires no special playback boards. When using any compression utility such as JPEG, it pays to study the limitations. For example, JPEG compression does not work especially well with hard edges and lines in graphics images. Black and white images should never be compressed into JPEG images. Also conversions from GIF to JPEG may be disappointing since
GIF images are usually color reduced before becoming GIF images. Also math coprocessors will not speed up JPEG graphics since JPEG algorithms use only integer arithmetic. JPEG can be used with motion video cards such as the RasterOps MoviePak2 video compression daughter card for Mac computers. See also “video board,” “compression,” “GIF,” and “MPEG.”

\texttt{jpg} = (see “JPEG.”)

\texttt{jukeboxes} = hardware devices for stacking discs, especially compact discs such as CD-ROM discs for a computer. Two hardware options for moving from one active CD to another are called jukeboxes and arrays. Jukeboxes typically take up only one SCSI device spot but they can be slow to access while the robot finds, extracts, moves, and inserts each disc. Arrays are linked CD devices that are both faster and cheaper than jukeboxes. See Glatzer (1994) for a discussion of details and comparisons of alternatives.

\texttt{Kaleida} = Kaleida Labs, Inc. in Mountain View, CA (415-966-0400). This is a software/hardware development company (along with the PowerPC and another company called Taligent) funded in a joint venture by Apple Corporation and IBM. The first noteworthy product is the long-delayed ScriptX hypermedia package designed to cross multiple platforms. Kaleida announced a 20% reduction in work force on May 10, 1994 and is headed for “a stormy adolescence” according to Information Week, May 23, 1994, p. 16. Apple and IBM have given about $10 million annually since 1992 and have never had a return on the investment from any Kaleida products. Kaleida is suffering somewhat from changed in leadership and strategy in both Apple and IBM. The disenchantment of its parent companies regarding the long term development projects in set-top boxes for network television and the Malibu graphics chip. See also “Taligent,” “PowerPC,” and “ScriptX.”

\texttt{KE Shell} = Knowledge Executive Shell software from Arthur Andersen Worldwide Organization, Center for Professional Education, St Charles, IL. The software called Knowledge Executive Shell (KE Shell) provides facilities for integrating multimedia components of text, video, audio, and graphics. Details of the system are provided by Garland (1995).

\texttt{KHz} = (see “kilohertz.”)

\texttt{kilohertz} = unit of measure that equals a frequency of 1 thousand cycles per second. See “hertz.” and “megahertz.” Also, a center of standalone interactive information or content.

\texttt{kiosk} = a multimedia display system such as those used in marketing displays at conferences and in stores. Kiosks are typically used for demonstrations and may be self-contained hardware units having computer, video, and audio capabilities. For example, Computer and Control Solutions (800-998-3525) offers one such self-contained Kiosk machine. See “JITT.” Also, a center of standalone interactive information or content.

\texttt{KISS} = Keep It Simple Stupid refers mainly to the authoring of electronic books and/or development of software in which success often depends upon keeping the learning and usage mindlessly simple. See “authoring.”

\texttt{lab} = (see “studio classroom.”)

\texttt{LAN} = a Local Area Network that depicts any computer network technology that operates at high speed over short distances (up to a few thousand meters). A LAN may refer to a network in a given department or within a given firm or campus. It differs from computer networks that cross wider geographic spaces such as those networks on the Internet. See also “Internet.”
**laserdisc** = (see “videodisc” and “videodisc-digital.”)

**LCD** = Liquid **C**rystal **D**evice computer/video panel and projector displays. Miniature television sets, laptop computers, and notebook computers generally use some type of LCD display due to difficulties in manufacturing portable cathode ray tube monitors. LCD displays may come in black and white, gray scale, and various degrees of color depth. The panels that can be laid on top of overhead projectors for displaying computer images on walls and large screens are called “LCD panels.” LCD panels differ as to whether they can display full-motion video as well as computer images. For a review of some of the leading vendors and their panels, see *NewMedia* (September, p. 89) and *NewMedia* (February 1994, p. 85). One of the top new generation projectors is the Sharp XG-E850U that is so bright it is “bringing the obsolescence of CRT-based projectors one step closer” according to a quotation from *Videography*, October 1994, p. 112. See also “three-beam projector.”

**LD** = Videodisc. See “videodisc.”

**linear presentation** = (see “hypermedia” and “timeline presentation.”)

**local bus** = (see “bus.”)

**loop** = a set of statements in a program executed repeatedly, either a fixed number of times or until a specified condition is true or false.

**Mac** = an abbreviation of the popular Macintosh computers manufactured and sold by Apple Corporation. These computers contain what is called the Macintosh Operating System (e.g., System 7) that will only run software written for that processor. A decade of the revolution in GUI and hypermedia Mac computing is celebrated in a book by Levy (1994) that is given an extensive review in *Time Magazine*, January 31, 1994, pp. 93-94. Although software can be added so that Mac computers will run (in emulation form) many DOS and Windows programs (slowly), the PC computers cannot as a rule run Mac programs. Differences between Mac and PC operating systems have led to constant frustrations for authors since there is no single standard for authoring materials that can be used across the computer market. This is especially frustrating for authors of CD-ROM learning and entertainment materials. Mac computers took an early lead in graphics computing and menu-driven operating systems emulated later in Windows and OS/2 operating systems. A drawback for hypermedia developers, however, has been market share. Apple Corporation has less than 15% of the worldwide desktop computer market and has lost much of its competitive lead in graphics and hypermedia computing. Apple also trailed PC manufacturers of laptop and notebook computers, especially color versions of such portable computers. Many applications (e.g., *Multimedia Beethoven* from Voyager and Microsoft Corporations) developed on the Mac must later be redeveloped in Windows in order to have wider sales. Mac computers have had difficulty keeping up with PC technology in low cost and high speed computing. This problem was a major reason Apple teamed up with IBM to produce the relatively fast and inexpensive PowerPC. In 1994, Apples disturbing declines in market share even after PowerMacs were introduced, led Apple Corporation to the first-time licensing of its operating system to other hardware manufacturers, notable IBM which will undertake a new joint venture to produce a new computer running forthcoming versions of the Mac operating system. Analysts, however, are skeptical that Apple’s licensing agreements may be too little too late to stop the market share momentum of Windows 95 and Windows NT. Apple also has videotape rendering workstations known as AV or Mac Video Computers. These compete directly with the now defunct Amiga computers for desktop, office, and professional rendering of video. Video options from Apple Corporation are reviewed in Birkmaier (1993), Torres (1993), and Tuckerman (1993). Spanbauer (1993b, p. 42) predicts that, for multimedia developers, Mac will “continue its ride for at least another year” until the PowerPCs begin to spread across the market. For 10 years, Apple Corporation would not license its proprietary Mac operating system to other
manufacturers. However, in 1994 Apple announced that it would license its System 7 operating system to other vendors on PowerPC computers. This may help to overcome the problem that Apple Corporation in the past has never been able to hold more than 10% of the desktop computing market and an even smaller percentage of the laptop/notebook computer market. The new licensing agreement is designed to cut into the huge market share of Windows operating systems from Microsoft Corporation. We recommend all hypermedia authors on Mac and PowerPC systems to join the Apple Multimedia Program (408-974-4897) that offers a variety of online services and other services that, in our viewpoint, are well worth the $750 price of membership. Books for Mac users are available from a number of publishers including Ventana Press (800-743-5369). See also “dry camera,” “bus,” “Amiga,” “Mac,” “Mozart,” “Copeland,” “Gershwin,” “SGI,” “SUN,” “PC,” “PowerPC,” “GUI,” “operating system,” and “Apple AV.”

Mac AV = (see “Apple AV.”)

Macmillan Information SuperLibrary = is an online World Wide Web database (at mcp.com) to contents of computer books from Que, Sams Publishers, Hayden Press, Que College, NRP, Grady, and Adobe Press. Discounts prices are also available to WWW users. There are other features such as a free online newsletter sent to your email address. The Macmillan USA Information SuperLibrary Newsletter is intended for your own personal use. Feel free to copy this newsletter and distribute it freely, as long as it is not for any business or commercial use, and is not altered, modified, or edited in any way. For further information about these terms send email to “info@mcp.com”, or write Brian Mansfield, Marketing Manager-Online Services, Macmillan Digital USA, 201 W. 103rd Street, Indianapolis, IN, 46290. 317-581-4941

Mac TV = (see “Apple AV.”)

Malibu Graphics Chip = (see “Kaleida.”)

MAPLE = mathematics computing software also known as Waterloo Maple, because it was developed by at the University of Waterloo in Canada. This is a very popular software for both research and teaching of mathematics. New enhancements include a spreadsheet interface and interfacing with mathematics text processors. There are also interactive graphics and symbolic computing utilities. MAPLE runs on DOS, Windows, UNIX, and Macintosh platforms at present. See also “MATLAB” and “MATHMATICA.”

MATHMATICA = mathematics computing software from Wolfram Research Inc. in Champaign, Illinois. This is a widely popular software package used by many major universities. It is capable of two- and three-dimensional animated graphics. There are both Mac and Windows versions that allow users to choose between direct interaction with the kernel and interaction through a front end that supports a GUI. The front end allows users to create Mathematica Notebooks that incorporate text, graphics, animation, and audio. Many universities supplement or replace traditional curriculum materials with Mathematica curricula. See also “MAPLE” and “MATLAB.”

MATLAB = mathematical computing software from The Math Works, 24 Prime Park Way, Natllick, MA 01760-1500 (508-653-1415). Two important features of MATLAB software are the integration of MATLAB with Microsoft’s Word for Windows and the Symbolic Math Toolbox for advanced visualizations of mathematical functions. See also “MAPLE” and “MATHMATICA.”

MCA = see “bus.”
**MCI** = Media Control Interface established by Microsoft Corporation that has become a popular standard for Windows authors and users. MCI menus drop down to let users select input sources such as CD-Audio inputs, videodisc inputs, MIDI sequencers, and auxiliary sources such as inputs from a stereo set or a videotape player. These standards also mean that certain types of files should play on MCI systems (e.g., WAV files should play audio and AVI files should play video on MCI systems). It is recommended that any hardware/software purchased for the PC go beyond MCI standards and be “Sound Blaster compatible.” This does not mean that you must buy multimedia upgrades from Creative Labs. It only means that your system is compatible with the popular standard established by Sound Blaster. See also “PCMCIA” and “MPC.” Also, a standard control interface for multimedia devices and media files, including a command-message interface and a command-string interface.

**MD** = (see “minidisc.”)

**MD-Data** = (see “minidisc.”)

**megahertz** = unit of measure that equals a frequency of 1 million cycles per second. See “hertz.” and “kilohertz.”

**memory** = (See “RAM.”)

**mff** = (see “MIDI.”)

**MHz** = (See “megahertz.”)

**Microsoft Tiger Video** = (see “video server.”)

**Microsoft Video for Windows** = (see “Video for Windows”.)

**mid** = (see “MIDI.”)

**MIDI** = Musical Instrument Digital Interface audio standardized hardware parameters set under MPC standards for MIDI interfaces that connect electronic keyboards, synthesizers, and related devices to computers. Musicians may record music into computer (MIDI) files that require much less storage space than WAV files that contain complete files of digitized sounds. A MIDI file does not contain digitized sound. Instead, such a file contains the information needed to play such sounds from a MIDI-compatible device. Music files may be played back (somewhat analogous to the old player pianos) on the MIDI. MIDI sound files are generally of higher quality than their WAV audio files that play on computers without MIDI interfaces. The MIDI is extremely popular among composers and arrangers of music who want to utilize computer aids in their tasks. The mff and mid MIDI file formats are popular file extensions for MIDI files that will run on most PC computers. See also “channel” and “MPC.”

**Mimosa** = (see “video server.”)

**minidisc** = is used in a variety of contexts to depict miniature “MD” optical discs and/or magnetic discs smaller than the standard 4.72 inch CD. Some MD alternatives such as the Sony MD Data 2.5 inch disk are smaller than floppy discs but hold nearly as much as a CD-ROM. The Sony version holds up to 74 minutes of CD quality audio or 140 Mb of data storage. The most typical MD size is the 2.5 inches audio disc. The term MD-Data refers to a minidisc used to record computer files and hypermedia presentations. MD options are reviewed by Miastkowski (1994).
MIPS = Million Instructions Per Second benchmark for rating computer processor CPU speed. Comparisons of MIPS ratings, however, can be misleading since the speed of access to peripheral equipment has become so important in overall computing performance.

modem = process of converting digitized data into analog form for a carrier wave. Demodulation transforms data transmitted in analog form back into digital form for computer storage and/or processing. Modems modulate and demodulate computer data for transmission on telephone lines. Fax modems have the added capability of importing facsimiles received over phone lines directly into computer files. Cable TV modems offer transmitting speeds of over five times those of ISDN modems. See also “ISDN” and “ADC.”

morphing = process of special effects video and/or computer animation that distorts images in motion. What started out in the movies as perverse distortions and unreal “morphed” images has gained respectability in science as a means of visualizing data and dynamic changes in data. Originally, morphing was only something professionals could do on very expensive workstations. Now morphing software and hardware requirements are much more modest. See Burger (1994b) for an easy-to-read description of the morphing process. See also “animation.”

Mosaic = a menu-driven and user-friendly hypertext system (also called NCSA Mosaic) of Internet sites that facilitate searching and browsing of documents and files around the world. Mosaic has largely been overtake by more modern web browsers (see “web browsers.”) For users not connected to the Internet, Mosaic can also be used with SLIP. Mosaic provided combines various former Internet servers such as Gopher Servers, World Wide Web, InterNIC InforSource, ftp Sites, Finger Gateway, Whois Gateway, and Home Pages. Stefanac (1994) provides both a brief history of the Internet and an excellent review (including Internet addresses of World Wide Web sites with their Uniform Resource Locator Addresses) of newer options for transmitting graphics, audio, and video over Mosaic networks. Rivera, Singh, and McAllister (1994) term Mosaic as an “educator’s best friend.” Key features in include world wide free networking by graphical interfacing to text, pictures, digitized video, and audio. Clicking on a highlighted Mosaic hotword or phrase (indicating a hyperlinked term) will complete a connection to the appropriate server to display documents, graphics, audio, or other multimedia files. Mosaic's is becoming even more popular than Gopher largely due to the graphics-orientation of Mosaic and commercial developers of Mosaic interfaces. Internet users interested in Mosaic should contact the Software Development Group, National Center for Supercomputing Applications, 605 E. Springfield, Champaign, IL 61820 (217-244-0072). The e-mail address is mosaic@ncsa.uiuc.edu. Newsweek on October 31, 1994 (page 60) asserts that NCSA Mosaic “free software works widely but not well.” Enhanced NCSA from Spyglass Inc. and Netscape from Mosaic Communications Corporation have improved Mosaic code. James Clark, former CEO of Silicon Graphics Corporation, on May 16, 1994 announced the opening of Mosaic Communications Corporation in Mountain View, CA (415-254-1900) to develop software that interfaces business firms with direct Internet access. This interfacing development company has tough competitors such as Spry Inc. in Seattle, WA (206-447-0300) and others according to Information Week, May 23, 1994, p. 20. Spry Inc. specializes in connectivity tools for Microsoft Windows and has a new Mosaic interface ready for shipment. According to PC Computing, July 1994, Page 113:

Mosaic does the seemingly impossible: And its free! Mosaic provides easy net navigation by using hypertext links, and it lets you view graphics and embedded sounds while you're online.

For web browsers see “web browsers,” “GINA,” “Gopher,” “Mosaic,” “Internet,” and “SLIP.”
**motherboard** = a circuit board or "logic board" inside the computer that contains the central processing unit (CPU), microprocessor support chips, RAM, and slots for adding expansion boards such as audio, scanner, SCSI, and video boards. Multimedia chips such as DSP audio and video chips will increasingly be put on the motherboard rather than on expansion boards.

**mov** = (see “QuickTime.”)

**Mozart** = the name given to Apple's operating system 7.5 for Mac and PowerPC computers. New features include multitasking, improved networking, better multimedia support, and DOS/Windows capabilities. See also “Mac,” “PowerPC,” “operating system,” “Copeland,” and “Gershwin.”

**MPC** = a Multimedia PC refers to combinations of PC hardware that meet multimedia hardware-combination (e.g., audio and video boards for computers) standards set by the Multimedia Marketing Council to make multimedia hardware products of vendors more compatible. The MPC1 Level 1 standard requires a 386 PC with a minimum of 2 Mb of RAM. The MPC2 Level 2 standard requires a 486SX or greater PC with 4 Mb of RAM. A variety of PC manufacturers use the MPC trademark. Consumers can then be assured that MPC hardware from one vendor will be compatible with hardware of another vendor. Also, software written for MPC hardware should run on any MPC equipment. The term is generally used in conjunction with CD-ROM multimedia hardware. A CD-ROM player, for example, should run on a computer with a MPC trademark provided the player is MPC compatible. It is probably best not to invest in multimedia PC hardware that is not compatible with MPC standards. In the future, MPC standards will dwindle in importance as more and more vendors build audio and video hardware on the motherboard rather than as boards to place into expansion slots. However, Spanbauer (1993b, p. 42) observes that MPCs will “hang on” into the near future due to the number of computer manufacturers that find them to be lower cost and lower price alternatives. Brown and Lombardi (1994) review the new Level 2 MPC upgrade kits and provide consumer ratings of the vendor alternatives. See also “MIDI” and “MCI.”

**MPC upgrade** = (see “multimedia upgrade.”)

**MPEG** = Moving Pictures Experts Group systems boards and standards (e.g., MPEG-2 and MPEG-1) for the most popular emerging form of compressed full-motion video standard for computer file storage. MPEG compression requires MPEG playback boards and/or MPEG authoring boards such as the Optibase MPG-1000 digital video codec (compression/decompression) board (800-451-5101). Although MPEG-2 is superior to MPEG-1, MPEG-2 requires at least quad speed CD-ROMs that, thereby, limits the use of MPEG-2 in the commercial market. However, even MPEG-1 is considered a better video compression alternative than its competitors. Doyle (1994b) calls several hardware playback options “awesome,” including the $940 Fast Electronic’s Movie Machine Pro (415-802-0772) with M-JPEG and Avi file capturing options. Other alternatives are listed in Appendix 6. You should read Doyle (1994b) before purchasing or installing a Windows MPEG capture board. MPEG hardware options are discussed by Sauer (1996) as the dawn of the Microsoft AV standard rises on the horizon. Full-motion video at over 30 frames per second takes up so much digitized storage that video must be compressed to make it more useful in hypermedia. Guglielmo (1993) predicts “hardware-based compression will be spelled M-P-E-G” and beat out most of the competition in the future. Multimedia World, March 1994, p. 97 asserts that: “If you don't want to end up with the digital equivalent of Betamax, it's probably time to include MPEG in you planning.” However, until there are millions of computer users with enough computer hardware capacity to run MPEG digitized video, Microsoft Video for Windows and Apple QuickTime will probably remain more common in CD-ROM authoring of education materials. MPEG video files have an mpg file extension and will not run on computers that do not have special MPEG playback hardware/software installed. See also “Active Video,” “compression,” “DVI,” “Indeo,” “video,” “Video for Windows,” “QuickTime,” “MCI,” “Ultimedia Video,” and “JPEG.” Also, a digital video standard developed by the Motion Pictures Experts Group.
mpg = (see “MPEG.”)

MS-DOS = (see “DOS.”)

MS-Windows = (see “Windows.”)

MTS/SAP = Multichannel Television Sound and Second Audio Program dbx system for compressing stereo audio in a technical fashion too complicated to explain here. See also “dbx.”

MUDs = Multi-User Dungeons are extensions of Dungeons and Dragons that are seducing “adolescents” into a network world of imaginary places. For an overview of MUDs see Germain (1993). The addictive powers of MUDS and the fantasy world of LambdaMOO are discussed by Hafner (1994). See also “games.”

multimedia = the ability to combine audio, visual, and possibly other types of hardware into a presentation. For example, a “multimedia” classroom will typically have projection hardware and switching controls that make it easy for teachers to switch back and forth between computer projections, videotape projections, audio CDs, 35mm slides, videodiscs, CD-I players, etc. Although hypermedia presentations may require multimedia facilities, the two terms are not synonymous. Hardware and software options are discussed in considerable detail in Chapter 3. Career opportunities in authoring multimedia are discussed by Jerram (1994a). Courses, trade shows, and literature on learning how to author multimedia works are summarized by Lindstrom (1994). At the moment, multimedia hardware technology is in a greater state of change. We would not advise anyone to make a major hardware purchase without carefully reading Spanbauer (1993b) for a comparison of advantages and weaknesses of both current and anticipated options. Stefanac (1994) provides both a brief history of the Internet and an excellent review (including Internet addresses of World Wide Web sites with their Uniform Resource Locator Addresses) of newer options for transmitting graphics, audio, and video over Internet networks. Brickman and Manning (1995) discuss how student laboratories might be designed for multimedia technologies. See also “video/audio networking” and “hypermedia.”

multimedia database = (see “database.”)

multimedia upgrade = hardware additions (usually insert boards or plug-and-play devices) to computers that make some aspect of multimedia operational. The lowest form of upgrade is an audio upgrade kit. This is usually followed by a digital video upgrade kit. Other upgrades may include CD-ROM players, videodisc players, video scan converters, mixers, speakers, video editing systems, etc. Common upgrades meet MPC standards. See “MPC” and “multimedia.”

Multimedia Video Processor = a DSP multimedia processing chip from Texas Instruments that is claimed to be 20 to 50 times more powerful than Intel's Pentium according to Information Week, March 14, 1994, p. 10. The MVP processor combines parallel-processing, DSP, and RISC technology.

multisession recording = creating a disk in several stages rather than all at once. See also “single-session” and “CD-R.”
**multitasking** = execution of programs simultaneously on a single computer. In newer operating systems, two or more programs may be running “in the background” while the user is concentrating on another program running “in the foreground.” Limits on how many programs can be run at the same time depend more upon hardware capacities, especially RAM amounts. Most operating systems now have multitasking capabilities. Multitasking differs from multiloading in which RAM contains multiple programs that can only be run one at a time. See “operating system.”

**native** = the availability of a software package written directly for an operating system as opposed to running in emulation under some type of translation process. Emulation usually runs slower and possibly less effectively than native versions. For example, Word Perfect and Microsoft Word have native versions for both Power Mac and Windows Chicago operating systems. Most Windows and DOS programs must be run in emulation on PowerPCs such that the speed advantages of the PowerPC are virtually lost due to not being able to run in native form. Francis (1994) reports that the main drawback that is holding down sales of Apple Corporation’s Power Mac is that “no one is building mainstream (native) productivity applications for the Power Mac.” Whether or not Windows Chicago is truly better than the IBM and Apple competition operating systems may be a moot point if there are over 40 million Windows users that have installed or soon will install Windows Chicago. Market share determines the number of native software applications being developed for operating systems. Mac, UNIX, and other operating systems are losing the native software development war to Windows Chicago and Windows NT. Windows Chicago is almost certain to become the PC operating system standard of choice until its upgrade called Windows Cairo rolls off the line and/or Windows NT with upgraded object-oriented programming features become the operating systems of choice among users having newer hardware speed and memory components. See “operating system.”

**navigation** = the navigation of a reader or user through learning and entertainment materials such as electronic books, courseware, and networks. See “hypertext” and “hypermedia.”

**NCSA** = National Center for Supercomputing Applications, 605 E. Springfield, Champaign, IL 61820 (217-244-0072). This University of Illinois center produces high-end video imaging of art and scientific data. The NCSA also develops software for multimedia education and research. See “Mosaic.”

**NetBIOS** = a network communication protocol that NetWare can emulate.

**NetWare** = a network operating system produced by Novell Incorporated.

**network address** = a hexadecimal number used to identify a network cabling system.

**networks** = linkages between computers allowing data and other digitized information to be transmitted between computers. Networks may be local, regional, national, or international. Commercial vendors such as Prodigy, America Online, CompuServe, and World of Boston provide relatively user friendly instructions about how to use networks. Internet users may have to acquire greater expertise in Unix coding for FTP and Telnet usage. Travis (1993) reports that, faced with the prospect of fierce competition from Windows NT, Novell is trying to widen its market niche with Netware Video to “store, manage, edit, and play back digital video and synchronized audio over Netware networks. See Mossberg (1994a and 1994c) for a comparison of America Online, CompuServe, eWorld, Interchange, and Prodigy. Apple Computer now offers a service called eWorld. AT&T and Microsoft also have new services in the works. References on multimedia networks include D’Alleyrand (1991) and Herrtwich, (1993). In is increasingly common for educators to communicate with students via e-mail, but few take it as far as University of the South Professor Gerald Smith according to an article in the San Antonio Express News on May 8, 1994. In Smith’s class there are no longer test papers, hand outs, text books, or term papers. Everything, including class discussion, is conducted on
network. A similar paperless approach is taken in accounting education by Professor Rubik Atamian at the University of Texas - Pan American. Alternatives such as email, BBS services, and Groupware for networked PC instruction are compared at Texas A&M University by Klemm and Snell (1994). They conclude that desktop conferencing is the best alternative and compare alternative vendor products for such purposes. For accounting educator Internet networks see also “ANet,” “International Internet Association,” PIC-AECM,” and “RAW.” Prentice-Hall was the first publishing company, to our knowledge, that offers an interactive two-way network dialog between adopters of selected textbooks and the authors of those books, including a bulletin board of latest readings related to the text, abstracts of related literature, and classroom aids (see ABKY for an illustration). CD-ROMs can be used on network servers using new hardware described in PC Computing, December 1994, p. 144. See also “America Online,” “DAB/DAR,” “Delta Project,” “CompuServe,” “eWorld,” “Interchange,” “Prodigy,” “LAN,” “video/audio networking,” “video server,” “Internet,” and “SLIP.”

*Next* = Next Generation microprocessor RISC chip from Alaris (a venture company formed with seed money from Compaq, Olivetti, Paine Webber, and others) that was independently designed from Intel chips but is aimed at being equal to or better than the best Pentium alternatives from Intel. Alaris may be contacted at Phone 510-770-5770 or Fax 510-770-5769. Major manufacturers such as IBM and Compaq are offering NexGen alternatives to Pentium. Advantages and disadvantages are compared by Knorr (1994). At present, NexGen can deliver most performance efficiencies of the best Pentium alternatives at significantly lower prices. See also “RISC” and “Pentium.”

**NEXTStep** = an operating system developed by Steve Jobs, co-founder of Apple Computer. For a comparative analysis with other current operating systems see PC/Computing Special Report (1994). NEXTStep is a leader in GUI interfaces and has some native applications software such as Word Perfect and Mathematica up and running. The major drawback is lack of market share and radical departures from DOS and Windows that most users are not accustomed to at this point in time. See “operating system.”

**NIC** = the Network Interface Card is a circuit board that is installed in the file server and workstations that make up the network. It allows the hardware in the network to send and receive data.

**Nintendo/SGI Media Cartridges** refer to data storage cartridges that are much faster than present CD-ROM alternatives for storing computer games, audio, and video files. The outlook for CD-ROM in the long haul is not so rosy. Billips (1994, p. 100) predicts the following:

> As a lingering vestigial remnant of the mechanical age, the CD-ROM has no place in a fully digital communications environment and is no doubt destined to the same scrap heap as the eight-track. The new Nintendo/Silicon Graphics Inc. (SGI) media environment, for instance, uses a silicon cartridge that is two million times faster than CD-ROM. The storage capacity of this new environment has doubled in the last two months and the price unit has dropped more than half. By the time it hits the market it will set a new standard overnight.

In our viewpoint, however, the CD-ROM will remain the standard until better alternatives can be recorded as simply and as cheaply in homes and offices as CD-ROM discs can now be mastered (burned) for less than $20 per disc on desktop recorders costing less than $3,000. See “Games.”

**node** = a workstation, file server, bridge, or other device that has an address on a network.

**non-core** = those Chapter 3 attributes commonly found in course authoring systems that are not part of the core attributes of course management systems (CMS). See also “authoring” and “core.”
**nonlinear presentation** = see “hypermedia” and “timeline presentation.”

**notebook computer** = a portable computer about the size of a standard ring binder notebook. Original laptop computers were about the size of a briefcase. Notebook computers later emerged that could be carried inside a briefcase. Next sub-notebook computers were introduced that could be carried inside a suit pocket, although the most popular models presently are notebook size portables. Multimedia versions are even larger and heavier. Present and next-generation multimedia portable options are reviewed in PC Computing, January 1995, pp. 124-144. See also “docking station,” “PDA,” and “PCMCIA.”

**Novell** = a company based in Provo, Utah, that produces the NetWare network operating system.

**NPTN** = **National Public Telecommunication Network** in Cleveland that is dedicated to making communication, bulletin boards, and networking services freely available through linkages of privately funding sources. See “Freenets.”

**NREN** = **National Research and Education Network** (NREN). In December 1991, the U.S. Congress passed the High Performance Computing and Communications Program. This will expand international networking to thousands of times its present capacities and uses. Although intended primarily for research and education, the NREN will carry commercial traffic in research and education in addition to the types of noncommercial traffic carried presently on the Internet. The NSFNet is now referred to as the “Interim NREN.” See “Internet.”

**NSFNet** = **National Science Foundation Network** connecting research universities and other research centers in the United States. See also “NREN.”

**NTSC** = **National Television Standards Committee** standards adopted in the 1960s by most nations in the Western Hemisphere, Japan, and other parts of Asia. These standards differ from PAL and SECAM standards in other parts of the world. For example, videotapes recorded under NTSC standards will play on videotape players sold in the United States and Canada. NTSC videotapes will not, however, play in European countries which have not adopted the NTSC standards. See also “PAL” and “SECAM.”

**NYSERNet** = an Internet network that links rural libraries with a high speed communications network. This network is a nonprofit, equal-access network that has strong backing from major computer vendors and publishing firms. For details see EDUCOM Update, July/August 1993, pp. 3-4.

**object linking and embedding** = (see “OLE.”)

**OCR** = **Optical Character Recognition** software and hardware used to interpret scanned symbols into characters of text or numbers recognized as something other than mere graphics images. The term is commonly used in such software as OmniPage Pro (800-535-7226) to indicate options of translating scanned words and numbers into computer text files that can be read by word processing and spreadsheet software. For a review of options, see Molinari (1995). See “scanner.”

**ODBC** = **Open Database Connectivity** support. Access to the database programming interface from Microsoft Corp. ODBC provides a common language for Windows applications to interact with various databases, locally and on a network.

**OLE** = **Object Linking and Embedding** standards established by Microsoft Corporation for Mac and Windows operating systems. These standards allow the creation of links between documents and
the embedding of documents in multiple applications. The OLE standards are designed to be
"dynamic" in that as changes are made in an object in one document, the changes are
simultaneously made automatically in all linked documents. For example, in pasting from the
clipboard, authors choose the Paste Link or Paste Special command rather than the Paste command
in the Edit menu. Pasting in this way creates a dynamic link between the source document and the
destination document. OLE also supports embedding which embeds the source document (or a
portion of the document) into the destination file such that the two documents become a "compound"
file. Embedding is often used where a server file (creating embedded items) and client files
(receiving embedded files) are in the system. In contrast to OLE linkages, OLE embedding edits in
client files will not alter server files. This is not the case with OLE linkages, where any changes in a
linked file will change all other linked files. Most word processor and spreadsheet software options
have OLE capabilities. Most hypertext and hypermedia software options do not have OLE, but there
are exceptions such as Multimedia ToolBook from Asymetrix. The latest OLE operating systems are
Windows Chicago and Windows Cairo discussed at other points in this glossary. For a review, see
Bott (1994).

Online = (see “networks”).

on-the-fly recording = sending data from your hard disk directly to the CD-R burner, without creating
a physical image file first. See also “CD-R.”

operating system = the master control software system that serves as a foundation for applications
software. Latest information on Copeland and other operating systems can be obtained at
<http://techweb.cmp.com/iw/center/default.html>. Details are provided in Information Week, April 29,
1996, p. 15. Examples of present and forthcoming operating systems include MS-DOS, Amiga DOS,
Windows, Windows NT, Windows Chicago, Windows Cairo, OS/2, Workplace OS, Apple/Mac
Systems 7 and 8, Taligent (Pink), PowerOpen, NeXTSTEP, Unix, SCO, AIX, HP/UX, HP/MPE, SCO
Open Desktop, Solaris, and UnixWARE (Novell). A second class of operating systems is known as
real time processing. These are used more for on-the-fly control systems such as aviation control
systems and military applications. Examples include the Intel Multibus and iRMX operating systems.
For a comparative analysis of the 32-bit options, see PC/Computing Special Report (1994) where it is
concluded that there are advantages and drawbacks of each option and no clear optimal choice at
this juncture in time. For 10 years, Apple Corporation would not license its proprietary Mac operating
system to other manufacturers. However, in 1994 Apple announced that it would license its System
7 operating system to other vendors on PowerPC computers. It will probably do the same for its
Mozart, Copeland, and Gershwin upgrades. This may help to overcome the problem that Apple
Corporation in the past has never been able to hold more than 10% of the desktop computing market
and an even smaller percentage of the laptop/notebook computer market. The new licensing
agreement is designed to cut into the huge market share of Windows operating systems from
Microsoft Corporation. However, Microsoft Windows still remains the market share choice. In an
article comparing Windows Chicago with the other leading 32-bit systems, Bott (1994) calls it the
“most promising software system in years” that will capture even greater market share than the
earliest Windows version as a “sure thing.” Whether or not it is truly better than the IBM and Apple
competition operating systems may be a moot point if there are over 50 million users of Windows
Chicago. Windows Chicago is almost certain to become the PC operating system standard of choice
until its upgrade called Windows Cairo rolls off the line. See also “cross-platform,” “Amiga,”
“Mozart,” “Copeland,” “Gershwin,” “native,” and “OS/2.”

optical character recognition = (see “OCR.”)
**optical drive** = any medium or device using a laser beam for accessing data stored on an optical disc. Typical optical drives are CD drives and videodisc drives. However, there are many types of optical drives including those that can be written on and re-written on much like floppy discs or computer tape. To date, most optical drives have slower access time than magnetic drives. See “CD” and “videodisc.”

**optical scanner** = (see “OCR.”)

**OS/2** = Operating System 2 introduced by IBM Corporation in 1992 and upgraded to OS/2 Warp in 1994. This is the first 32 bit processing system designed for PCs. It beat its rival Microsoft Windows NT to the market by almost two years. In early 1994, neither Windows NT nor OS/2 have made a huge dent in the DOS and Windows market. For example, there were only four million OS/2 adopters and 250,000 Windows NT adopters at the end of 1993 in comparison with over 40 million Microsoft Windows adopters. As older PCs are replaced by higher speed PCs with more memory, 32 bit processors will become more popular. OS/2 gets some high praises when compared with current 32-bit alternatives in PC/Computing Special Report (1994). At issue is whether OS/2 or Windows NT or Pink or some other operating system will saturate the market (after DOS, Windows, Apple/Mac, and Windows Chicago stubbornly fade from the scene). OS/2 is a very reliable operating system that requires less PC capacity than Windows NT. However, Windows NT has more networking utilities that may give it the competitive edge in the future. Until software vendors offer a wider array of options for either OS/2 or Windows NT, the operating systems most widely used worldwide will continue to be DOS, Windows, and Windows Chicago. An alternate IBM operating system called Workplace OS combines the object-oriented Workplace with the OS/2 operating environment. Since OS/2 Warp has such a small market share, developers are not generating significant native software applications that run more efficiently in OS/2 vis-a-vis Windows. In CD-ROM Today, February 1995, pp 40-51, OS/2 Warp performance is evaluated and a forecast is made that IBM will abandon OS/2. Although OS/2 Warp runs DOS applications better than MS-DOS itself, it is very slow when trying to run Windows applications. Neither Apple Corporation nor IBM Corporation have been able to significantly gain market share against Microsoft Windows. See “Ullitmedia Video,” “operating system,” “DOS,” “Windows,” “Windows Chicago,” and “Windows NT.”

**outernets** = systems of computer networks that are not bundled on the Internet but nevertheless can be accessed to the Internet through gateways that translate outernet protocols into Internet protocols. The worldwide system of gateways is called the “Matrix” or “the Net.” See “Internet.”

**packet** = a discrete unit of data bits transmitted over a network.

**paintbrush software** = software used to create new or modify imported graphics images and photographs. Options and prices vary widely. Important features to look for are the variety of filters that enable importing a wide variety of types of graphics images, the ability to resize and change aspect ratios of pictures, and the layering of objects in an image such that images behind layers can be recovered (this is a feature of Adobe Photoshop that is not available in most other software options). Alternative software features and options are reviewed in the annual NewMedia Tool Guide from NewMedia magazine. In the 1995 edition, 2-D graphics software options are listed pp. 40-43. See also “animation” and “texture.”

**PAL** = Phase Alternation Line television standard for most western European nations. For example, videotapes recorded under PAL standards will not play on the NTSC tape players found in the Western Hemisphere and Asia. See also “NTSC” and “SECAM.”

**palette** = a table of available simultaneous colors that paints pixels on the screen.
panning = positionings of sounds to the left or right in a stereo sound field, creating the effect of different instruments playing in different parts of the room. You must be able to control panning in order to take advantage of the stereo capabilities of high-end synthesizers and some MPC boards.

Paradox = a relational database PC system from Borland International. See “relational database management.”

parallel processing = (see multitasking.)

password = a secret word used to identify a user.

patch = a set of tone-generating parameters that determine the instrument imitation (flute, violin, etc.) of a synthesizer.

PC = a Personal Computer that is compatible with the IBM desktop computers. PCs that are not manufactured by IBM Corporation are typically referred to as “clones.” Generally, programs written on any PC will play on another PC. Most PC users now run under Microsoft DOS or Microsoft Windows operating systems. Newer and more advanced processors include OS/2 from IBM and Windows NT from Microsoft Corporation. Programs written on a Mac operating system will not usually run on a PC. Differences between Mac and PC computers have led to constant frustrations for authors since there is no single standard for authoring materials that can be used across the computer market. This is especially frustrating for authors of CD-ROM learning and entertainment materials. PC computers using the early Intel 8088 processor were called XT models. The XT’s gave way to the AT models containing the 80286 or higher level Intel processors. Now the model names usually contain the processor specifications such as Intel 386, 486, and Pentium designations. The top-rated PCs at the end of 1994 are Dell Dimension (Rank 1), Micron PCI (Rank 2), Gateway P% (Rank 3), and IBM ValuPoint (Rank 4) according to PC Computing, December 1994, p. 126. Two pages later, that same magazine ranks the best-buys in portables as TravelMate 4000M from Texas Instruments (Rank 1), Latitude XP from Dell (Rank 2), and ThinkPad755C form IBM (Rank 3).

pcd = (see “PhotoCD.”)

PCI = (see “bus”.)

PCM = Pulse Code Modulation of audio waveform sampling that records actual values rather than the ADPVM difference between samples. This decreases fidelity with higher resolution than ADPCM. See “audio” and “ADPCM.”

PCMCIA = Personal Computer Memory Card International Association defined standards for memory card external slots (ports) to peripheral devices such as fax modems. PCMCIA slots are common in printers, and notebook/laptop computers, but these “slots” have been troubled technologies from the start. Before buying a computer with PCMCIA slots, readers are advised to read Doe (1994) and Smarte (1994) regarding the problems and hopes for improvements in the future. Doe (1994, p. 172) states that: “User outrage about this incompatibility has scared many people away from PCMCIA.” The Type I slots are 3.3 mm thick and serve mainly as memory cards. The Type II slots are more input/output compatible with fax modems and LAN adapters. The Type III slots are 10.5 mm thick and can be used for porting to some auxiliary storage devices such as external hard drives. One problem is than some vendors who claim to have Type III slots are really manufacturing with only Type II slots stacked on top of each other giving rise to a .5 mm incompatibility difference. There is also some doubt whether PCMCIA technology can be expanded to 32 bit and 64 bit processors of the
future. Smarte (1994, pp. 204-205) compares performances of leading PC models on various PCMCIA attributes and functions. Readers might especially want to note how many of the computer models “fail” with respect to SCSI performance using PCMCIA slots. Smarte (1994, p. 208) also provides a small glossary of PCMCIA terms. For example, “CIS” depicts Card Information Structure of formatting and data organization on the card. “Plug and play” is a feature that allows changing of cards without having to reboot the system. Smarte (1994, p. 215) also provides a listing of new PCMCIA technologies and their vendors.

**PCTV** = (see “information highway”.)

**pcx** = (see “graphics.”)

**PDA** = **P**ersonal **D**igital **A**ssistant pocket-sized devices for recording of typed or handwritten messages that can later be ported to computers. Given the poor performance record of the PDA alternatives, some analysts contend PDA means Pretty Damn Awful. However, after the first generation PDA frustrations, the newer upgrades are much more serious products, especially those that link with the Internet. Apple has significantly improved its Newton Device (especially in handwriting capabilities and connections to the Windows operating system) and the Pilot from U.S. Robotics (see *PC Magazine*, May 14, 1996, p. 42) provides a lot of punch for a much lower price than the higher-featured Newton Device from Apple and the HP OmniGo. Examples include the Newton Device from Apple Corp. and similar PDA products such as AT&T’s EO, Tandy’s Z-PDA, Sharp Expert Pad, Psion Series, Sony, Amstrad PDA 600, and Casio’s Z-7000. Such devices may include notepads, address books, clocks, calculators, personal finance utilities, language translators, dictionaries, games, modems, etc. For a review of options, see Kantrowitz (1993). For a summary of first-generation flaws, see Pepper (1993). Over 20 developers that are announcing PDA products are discussed in Gellerman (1993). In January 1994, AT&T introduced its PersonaLink Service with combines wired and wireless networking of PDAs to computers. General Magic Corporation offers software called Telescript for customizing tasks and message routes on PDAs. The general feeling is that PDAs are not yet suited to the capacity and convenience needs of customers, but a time will come when newer PDAs will become as common place as cellular telephones. In fact, cellular telephones, subnotebook computers, and PDAs will probably become one small piece of hardware.

**PDF** = **P**ortable **D**ocument **A**ssistant PostScript formatting technology that attempts to provide a viable way of exchanging documents across operating systems and different types of software. Two of the best known PDA options are the Acrobat tools from Adobe Corporation and the World Wide Web on the Internet. Acrobat also provides other utilities such as the Distiller tool that translates PostScript files into a PDF format, the Exchange tool that facilitates insertion of hypertext linkages, the PDF Writer containing printer drivers, and other utilities. For a review of Acrobat, see Wiggins (1995). See also “cross-platform.”

**Pentium** = a CISC high speed processor that followed the 486 processors of Intel. The Pentium runs much faster than the 486 in most instances and, thereby, is a better alternative for graphics, audio, and video processing. It is also better suited to newer operating systems such as Windows Chicago and Windows NT. Early versions tended to overheat and had an unknown life and reliability. Later versions of Pentium processors such the P54C overcame all doubts about Intel's ability to produce a cool running CISC processor at speeds up to 100 MHz and plans produce even faster Pentiums. These newer versions dispel all doubts about “Intel’s aim to crunch the PowerPC” according to *Information Week*, February 21, 1994, p. 60. The comparative advantages, and they are serious advantages in the market, are the ability to run DOS and Windows applications in direct rather than emulation form in Pentium processors. This is not the case with PowerPC alternatives. Also, some users prefer CISC to RISC. For a comparison of Pentium versus 486DX2-66 (the highest speed 486 processors), see Farrance (1993). Such comparisons, however, were based upon the older Pentium
versions which were much less efficient than P54C versions. Newer low-voltage Pentiums make it possible to manufacture Pentium laptop computers. Texas Instruments announced a new Multimedia Video Processor that is claimed to be 20 to 50 times more powerful than the Pentium. Pentium computers are rated by Gralla (1994). See PC/Computing (January 1994, pp. 36-37) for a commentary entitled “First PCI Pentiums: AST, Dell, and IBM.” See also “Multimedia Video Processor,” “NexGen,” “RISC,” and “CISC.”

**Peripheral Component Interconnect** = (see “bus.”)

**PersonaLink Service** = (see “PDA.”)

**Phase Change Dual (PD)** = a technology for recording rewritable compact discs that was developed by Matsushita Electric Industrial Co. of Osaka, Japan. The PD phase change on tiny disc crystals is achieved with a laser beam burning that makes them more or less reflective. The PD rewritable discs, however, cannot be read on standard CD-ROM players. This limits the market for developers. However, the rewritable feature has many useful attributes. The capacity of a PD disc is currently 650 MB and the player/recorder sells for less than $1,000. See “Compact Disc.”

**Photo CD** = a CD that contains up to 100 high quality photographs developed by Kodak from 35 mm film directly onto a CD-ROM or a CD-I disc. PhotoCD files generally have a pcd extension and can be played back on Kodak software. New Photo CD Portfolio and Create-It software from Kodak (800-CD-KODAK) facilitate presentations such as classroom lectures and outside presentations to be pressed to Photo CDs. However, the Photo CD disc only stores graphics images (including text stored as a graphic) and will not store files that can be executed in computer software such as playing back a ToolBook book or HyperCard stack or storing a Lotus or Excel spreadsheet file. (In contrast, a CD-ROM disc will store computer files that can be read into execution files.) Reading of such discs requires special software. Also, CD-ROM drives have to be sufficiently fast (e.g., double or triple speed) to playback Photo CD discs. CD-I and related machines that play on television sets rather than computers will also play Photo CD discs. For a guide to Photo CD usage see Brannon (1993). For the Photo Factory software package see Multimedia Store in Appendix 6. A production guide is provided by Larish (1993). See also “dry camera” and “video from digital (DV) camcorders.”

photography = (see “dry camera.”)

**physical-image file** = a complete, bit-for-bit mirror image of all the files to be burned to a CD-R disk in a recording session, stored on a hard disk. See also “CD-R.”

**PIC-AECM** = Pacioli International Centre for Accounting Education using Computers and Multimedia, Loyola College in Maryland, 4501 North Chales Street, Baltimore, MD 21210-2699 Phone: (410-617-2478). Fax: (410-617-2006) email: pacioli@Loyola.edu. The AECM-L mailing list is also available. A description of services is contained in the CETA Newsletter, June, 1994. See also “ANet” and “International Internet Association.” See also “ANet,” “International Internet Association,” and “RAW.”

**Pink** = a forthcoming Taligent multi-platform operating system jointly backed by Apple Corporation and IBM as the next generation of operating systems. The “multi-platform” feature will permit running DOS, Windows, OS/2, Apple/Mac systems, Unix, and PowerOpen. See “operating system.”

**PIP** = Picture-In-Picture that can simultaneously display two TV images on the same screen, including images from two separate TV tuners or a TV tuner and VCR tape deck. See “POP” and “video.”
**pitch bend** = gradual change in a tone’s frequency (highness or lowness). For example, this can be used to create effects like vibrato or to produce more natural note attacks on some instruments.

**pixel** = the rectangular “dots” that comprise the smallest units of screen color variations. The more pixels that the computer can display per square inch of screen, the higher the resolution of graphics images on the screen. Older CGA resolutions had such large pixels that outlines of individual pixels could be seen in the graphics images. Higher resolutions such as those in Super VGA make it harder to detect pixels without zooming enlargements of parts of the screen. Larger numbers of pixels make graphics modification tasks more tedious.

**platform** = (see “operating system.”)

**plug and play** = a phase that can have a variety of meaning in different contexts. In the most general sense, it means ease of setup and operation such as when a device can simply be plugged into power and run with ease. In the area of PCMCIA cards, the term means that cards can be removed and replaced with other cards without having to reboot the system. Details of plug and play are given in White (1994). See “PCMCIA.”

**POP** = Picture-On-Picture that entails wide-screen viewing of up to three TV images simultaneously on 16:9 wide-screen TV. See “wide-screen TV,” “PIP,” and “video.”

**Power Macintosh** = (see “PowerPC.”)

**PowerOpen** = (see “operating system” and “PowerPC.”)

**PowerPC** = a revolutionary new desktop RISC computer emerging from a joint venture between Apple Corporation, Motorola, and IBM. Rupley (1994, p. 129) writes that: “PowerPC will remake the computer industry at its foundations.” What is revolutionary is the ability of the PowerPC to run under Apple, OS/2, DOS, Windows, and Unix operating systems. This is a remarkably fast and cheap CPU using RISC chip technology. IBM was the first company to introduce the PowerPC notebook computer. For a time it looked like the PowerPC would indeed capture enormous chunks of market share from Intel, but then Intel introduced its 90-MHz and 100-MHz O54C CISC processors. With the new CISC Pentiums and RISC NexGen alternatives selling at a much faster clip than Mac and IBM PowerPC processors, it appears that PowerPC will have a tough time selling to other users who want faster processors for the Apple operating systems. Later versions of Pentium processors such as the P54C overcame all doubts about Intel's ability to produce a cool running CISC processor at speeds up to 100 MHz and plans produce even faster Pentiums. These newer versions dispel all doubts about “Intel's aim to crunch the PowerPC” according to Information Week, February 21, 1994, p. 60. The comparative advantages of the Intel processors, and they are serious short-term advantages in the market, are the abilities of Intel processors to run DOS and Windows applications in direct rather than the emulation form used in PowerPCs and Macs. The main drawback of the PowerPC is that PowerPC users can only run DOS and Windows applications in emulation form such that all speed advantages of the PowerPC are lost. For this reason, the “PC” part of the tradename “PowerPC” is somewhat misleading since most PC users run under DOS and/or Windows operating systems. Certainly users who prefer to stay in a DOS and/or Windows operating systems are advised to stick with the 486, Pentium, or other some other CPU alternative that does not require emulation. When applications vendors bring applications to market in PowerOpen, Pink, and planned PowerPC native software, Intel and NexGen may lose market share to PowerPC, but this probably will not happen to a major extent in this century largely due to the fact that PowerPC requires replacement of existing computers with new PowerPC computers. Worldwide, this will not happen for years due to tight budgets in business and government. It will be years before software developers offer PowerPC native software anywhere.
close to the present Windows product lines. Francis (1994) reports that the main drawback that is holding down sales of Apple Corporation's Power Mac is that “no one is building mainstream (native) productivity applications for the Power Mac.” IBM is also working with Apple to develop the PowerOpen operating system for the PowerPC. Taligent is developing the Pink operating system for the PowerPC. At the time of this writing the planned full line of PowerPCs is not available. It will only be a short time before portable (e.g., Tadpoles and PowerBooks) and multimedia PowerPC lines are produced, although demand for these portable versions lead to long delivery delays. Another drawback of the PowerPC is that the alliance between IBM and Apple was weakened somewhat by delays in developing a PowerPC that will switch back and forth between Mac and IBM operating systems (e.g., between Mac and OS/2 or Mac and Windows). Users still have to make that big choice between one operating system or another. Good news includes the current availability of some popular software packages designed specifically for the PowerPC such as WordPerfect native Power Macintosh. Bad news included the decision of Lotus Corporation not to produce native PowerPC versions at the present time. Even more discouraging for PowerPC hopefuls are analyst forecasts of the pent up demand for Windows 95 and Windows NT that will probably lead consumers toward Intel and NexGen processors. At the moment, its still a horse race between Intel and PowerPC with PowerPC far behind and waning hopes for a burst of speed. Francis (1994) reports that Moody's Investors Service Inc. placed Apple Corporation under review largely due to “concerns about the computer vendor's long-term operating performance and the viability of its technology strategy.” A huge area of concern has been the tapering off of demand for the new Power Mac versions of the PowerPC. Apple's share of the PC market reached 14% in 1993, but has since slipped back down to around 10%. Whether or not Windows 95 and Windows NT is truly better than the IBM and Apple competition operating systems may be a moot point if there are over 40 million Windows users that have installed of soon will install Windows Chicago. Market share determines the number of native software applications being developed for operating systems. Mac, UNIX, and other operating systems are losing the native software development war to Windows Chicago and Windows NT. Windows Chicago is almost certain to become the PC operating system standard of choice until its upgrade called Windows Cairo rolls off the line and/or Windows NT with upgraded object-oriented programming features become the operating systems of choice among users having newer hardware speed and memory components. But for users who stand by their Power Macs, we recommend joining the Apple Multimedia Program (408-974-4897) that offers a variety of online services and other services that, in our viewpoint, are well worth the $750 price of membership. See also “native,” “CPU,” “Pentium,” “CISC,” “RISC,” “Taligent,” “operating system,” “Mozart,” “Copeland,” “Gershwin,” and “Mac.”

PPV = Pay-Per-View commercial selling of live-event TV such as PPV boxing events. PPV will probably become a much more lucrative business when the information highway comes to town. See “information highway.”

premastering/mastering software = the software layer that readies files for recording. This involves converting file structures to adhere to the ISO 9660 conventions, simulating the image on the hard disk as a CD-ROM, and sending the image to the CD-R drive. See also “CD-R.”

presentation = presentation electronic “slide show” options such as SPC's Harvard Graphics, Gold Disk's Astound, Asymetrix's Compel, Microsoft's PowerPoint, Macromedia's Action, Micrografx's Charisma, Just-Ask-Me, On-The-Air, Lotus Corporation's Freelance, Word Perfect's Presentations, Special Delivery, Q/Media, Zuma Group's Curtain Call, and others mentioned in Chapter 3 and listed in greater detail in Appendix 6. These, in conjunction with spreadsheet software (Lotus, Excel, Quatro Pro, etc.), are the most widely employed aids currently employed by accounting professors according to survey results reported in Chapter 4. An extensive list of presentation software vendors and product attributes is provided in Appendix 6. Green and Green (1994) discuss how presentation software is becoming closer to authoring software. Jerome and Lee (1995) rate and compare presentation software alternatives with particular focus on multimedia features. Hardware options are
reviewed in the NewMedia Tool Guide for 1995 (pp. 105-112). For a review of presentation software options also see NewMedia Tool Guide for 1995 (pp. 11-16), McCraken (1994) and Green and Green (1994). (The addresses and phone numbers of NewMedia, Multimedia World, and other periodicals are contained in Appendix 4.) The top rated options according to PC Computing, December 1994, p. 178 are PowerPoint from Microsoft Corporation (800-426-9400), Harvard Spotlight (Rank 2) from Software Publishing (800-336-8360), and Freelance Graphics (Rank 3) from Lotus Development (800-343-5414). Paintshow and photoshow options such as Micrographix PhotoMagic, MacPaint, Corel Draw, Publisher's Paintbrush, and Adobe Photoshop may be used for pictures but are cumbersome for group presentations but are often used for images imported into presentation, hypermedia, and CMS courseware. Robinson and Lee (1994) discuss the fine line between “authoring” and “presentation” software. Many presentation software vendors such as Gold Disk (Astound) are adding audio, video, and button navigation utilities. They also discuss options for crossing platforms between operating systems such as between Windows and Mac operating systems. See also “projection” and “authoring.”

**print devices** = definition files for different types of printers to be used on a print server.

**print forms** = definitions of different types of paper size to be used on a print server.

**print job configurations** = complete descriptions of how a file is to be printed on the network.

**print queues** = definitions of the order in which and where a file is to be printed on the network.

**print server** = a computer running a program that allows it to accept files to be printed from other workstations.

**processor** = (see “CPU.”)

**Prodigy** = a commercial network service that is a joint venture between Sears Roebuck and IBM. This service has improved some of its technical problems but it is also expensive according to Mossberg (1994a). NewMedia, January 1994, p. 31 has a brief summary of new features such as color-coded menus, digitized photos, Internet mail, TV listings, and travel services. See “Networks,” “CompuServe,” “Internet,” “eWorld,” “Interchange,” and “America Online.”

**projection** = display of computer and video images on monitors and screens. A “Multimedia Projectors Buyers’ Guide” is provided in Multimedia World, June 1994, pp. 77-79. Also see “LCD” and “three-beam-projector.”

**protocol** = any formal description of message formats and the rules two computers must follow to exchange those messages. Protocols can describe low-level details of machine-to-machine interfaces (e.g., the order in which bits and bytes are sent across a wire) or high-level exchanges between allocation programs (e.g., the way in which two programs transfer a file across the Internet). Files on the Internet are transferred via what is known as FTP File Transfer Protocol. See “FTP” and “file transfer.”

**QuickRing** = (see “bus.”)

**QuickTake** = (see “dry camera.”)

**QuickTime** = animation and video files that originally were designed for Mac computers. Various playback utilities, including the always popular QuickTime playback software, can be downloaded free from
QuickTime files may also be authored and played back on Windows systems in addition to Mac systems. Quicktime is clearly the standard in the lead. But Microsoft’s replacement of Video for Windows with its newer Active Video software makes it a closer race for dominance in video software. See also “Active Video,” “DVI,” “Video for Windows,” “Indeo,” “MPEG,” “DVI,” “video,” “MCI,” “Ultimedia Video,” “Internet audio and video,” and “AVI.”

QuickTime VR = (see “virtual reality.”)

**RAM** = Random Access Memory portion of a computer. The term “memory” typically refers to RAM as opposed to hard disc and optical disc storage of files that cannot be randomly accessed without searching between sectors. RAM stores instructions and other files potentially needed for immediate processing of a task at hand. Memory usually can be accessed “randomly” at relatively high speeds. Files stored on computer tape, floppy discs, hard drive, optical drives, etc. are not available in RAM until they are “loaded” into RAM. Four important types of RAM in PCs running DOS are conventional memory, high (upper) memory, expanded memory, and extended memory. When DOS first was designed, 640 Kb of memory seemed like a lot, so out of the then standard 1 Mb of base memory, 640 Kb was designated as conventional memory reserved for DOS and the remaining 360 Mb was high (upper) memory available for other internal system computing functions. Later, memory managers and the Windows HIMEM.SYS file make some of the high memory available for software usage. Another gimmick entailed use of peepholes of size 64 Kb swapping of chunks of memory. However, today, the 1 Mb base memory utilized in the most efficient way is not sufficient to run most newer types of software. Memory SIMM chips can be added to raise the RAM to higher levels such as 64 Mb currently popular in multimedia authoring. Upper limits for extended memory options vary with types of PCs. Extended memory is much more important than expanded memory. Often the term extended memory applies to all RAM above the 640 Kb of conventional RAM, although from a technical standpoint it applies to RAM above the 1 Mb base. The term “RAM cache” refers to a section of RAM set aside to serve as a buffer between the central processing unit and auxiliary disc drives. At the present time it is not uncommon to pay in the neighborhood of $800 for each 16mb of RAM added to computers. See also “cache,” “SIMM,” “VRAM” and “hard drive,” “drive,” “flash memory,” and “CD.”

**RAID** = Redundant Arrays of Inexpensive Discs refers to storage products with speed and capacity for large quantities of data, especially graphics, video, and audio data for multimedia computing. There are six RAID levels starting with RAID 0 available for Mac computers. Most PC disc array systems are designed for Novell Netware software. Alternatives are compared by Weiss (1994).

random access memory = (See “RAM.”)

**RAW** = Rutgers Accounting Web informational retrieval system (funded with a grant from NCAIR) for a variety of free materials for accounting educators. The main purpose of the system is to share materials developed in connection with the Accounting Education Change Commission (AECC). Materials include lectures, cases, assignments, examinations, syllabi and course outlines, and reports of projects at various AECC sponsored sites. The World Wide Web address for the Lynx program is for text only is <http://www.rutgers.edu/Accounting/raw.htm>. Lynx only transfers text, For graphics, a Mosaic option is available. Contact Professor Alex Kogan, Accounting and Information Systems, Faculty of Management, Rutgers University, 180 University Ave., Newark, 07102-1905. Phone: 201-648-1064 and Fax 201-648-1283 and email kogan@andromeda.rutgers.edu. See also “ANet,” “International Internet Association,” and “PIC-AECM.”

real time = (see “operating system.”)
reengineering = computerized automation of a “production” system (factory, education, information, etc.) that entails radically redesigning the way work is done and the intended performance of the system.

relational database management = a database system that stores data in two-dimensional data tables at the same time such that the program can work with two tables at the same time. It is “relational” if one table defines the relation between entries in rows (data records) and columns (fields). Not all database software claiming to be relational meet the “true” relational database mathematical theory developed by Edgar Cobb in 1970. For example, dBASE and FoxPro can link two databases through a common field but are not a true relational database programs. One of the most widely selling relational database management systems is the Unix-based system from Oracle Corporation (415-598-8000). The Oracle relational database that may account for half of the Unix database market before the end of the century (see Information Week, December 1993, p. 72). See Chapter 3 for a discussion of database options. Also see “database.”

remote control = any of a variety of meanings depending upon the context. There are remote control computer devices such as remote mouse controllers and wands that generate some keyboard controls. A remote control buyers’ guide is provided by Glass (1994). See also “student response pads.”

remote login = refers to the capability of a network user to access databases and software on other computers, possibly computers linked on the Internet in remote parts of the globe. See “Telnet” and “FTP.”

remote print server = a computer running the RPRINTER program, enabling it to print output from other network workstations and operate as a normal workstation.

rendering = generally refers to graphics rendering, especially 3-D rendering. Biedney (1994) provides a technical discussion and a comparison of alternative software options for rendering 3-D images on desktop computers. See “authoring.”

rescaling = (see aspect ratios.)

response pads = (see student response pads.)

RGB = a signal that can be separated into red, green, and blue components, combinations of which then can be used to create color screens or color print. Most computers have an RGB output that differs from the composite video or S-video outputs of television sets. This is why RGB computer signals must be scan converted into composite video for television viewing.

rich-text format = a text formatting standard established by Microsoft Corporation to enable text to be transferred between a word processor and other software without losing all of its formatting properties. Many modern word processors have the option of saving documents in rich-text format (RTF). Increasingly, authoring software vendors of hypertext, hypermedia, and CMS software are adding RTF importing utilities to overcome the frustrations of importing in ASCII or ANSI forms that lose all or most formatting properties. See also “ASCII” and “ANSI.”

ring topology = a network configuration that connects all nodes in a logical ring-like structure.

RISC = Reduced Instruction Set Computing chipsets such as the MIPS R4000 and R4400 intended to outperform CISC complex instruction chipsets such as the Intel family of popular 386,486, and Pentium competitors and the Motorola 680x0 family in Mac computers. The concept of RISC evolved
from IBM laboratories where it was noted that most routine processing of consumers does not require
full use of the processor. RISC processors consume less power and generate less heat than CISC
processors powerful enough to compete at the same speed and capacity as RISC processors. They
do this by reducing the number of operations and executing multiple instructions in what is known as
“superscaler” processing. However, INTEL intends to keep its CISC lines competitive with RISC
processors. At this juncture, it is impossible to know who will win the RISC versus CISC processor
competitions of the future. The RISC-architecture is the foundation of the new PowerPCs and the
PA-RISC systems of Hewlett-Packard Corporation. The HP 32-bit PA-7100 chip, for example, runs
about 25% faster than the PowerPC RISC chips and the Pentium CISC chips. A new RISC
processor from Texas Instruments called the Multimedia Video Processor is claimed to be 20 to 50
times more powerful than Intel's Pentium. RISC chipsets may become more of a threat to CISC in
the form of NexGen alternatives to Pentium that are being manufactured by Alaris for Compaq, IBM,
and other major PC manufacturers. See Multimedia Video Processor,” “NexGen,” “PowerPC,” and
“CISC.”

**ROM** = **R**ead-Only **M**emory whose files can be accessed, executed, and possibly copied. However, ROM
files cannot be deleted or otherwise altered on the ROM device; for example a CD-ROM compact
disc that can be read only but not written upon by the user. See also “WORM.”

**RTF** = (see “rich-text format.”)

**runtime** = permissive use of a portion of a software system that allows for the “running” or “viewing” or
“delivery” or “playback” of an application in contrast to its “authoring.” An author may write an
electronic book in Asymetrix ToolBook authoring software, for example, which can then be played by
readers using ToolBook runtime software. Many types of software (e.g., word processor,
spreadsheet, and database software) have no runtime versions. Most hypertext and hypermedia
authoring packages have runtime versions. Vendors vary as to whether fees are charged for runtime
versions. Apple Media Kit from Apple Corporation and ScriptX from Kalieda Labs are examples
options that can have costly runtime fees, especially for items sold in large-scale markets. Some
options have free runtime within an organization but charge a royalty on all sales of applications
outside the organization. A professor who writes a CD-ROM textbook in some types of software
(Apple Media Kit, Icon Author, Tencore, etc.) can use the free runtime versions for discs distributed
free to students and faculty within his or her university but would have to pay a royalty to on each
CD-ROM sold for a profit. There is a strong incentive for authors to seek out hypertext and
hypermedia authoring packages that are accompanied by free runtime (reader, player, playback,
delivery) files for all customers. Many of these alternatives are discussed and compared in Chapter
3.

**sampling rate** = the frequency with which samples are taken and converted in digitizing operations.
This is measured in kilohertz (KHz). The MPC standard requires a sound card with a recording
sampling rate of at least 11 KHz and an output rate of 11 and 22 KHz.
scan converter = a hardware device for converting the digitized monitor signals of a computer into analog signals that can be played on a television set. For a detailed review of options and comparison of products see Waring (1994c). Some projection devices such as three-beam projectors for computers in class rooms have built in scan converters. See “analog” and “video.

Scanner = a device for optical character scanning hardcopy text and graphics into computer files. Scanned items may be on sheets of paper, photographs, or 35-mm slides (slide scanners usually take special hardware apart from the more common document scanners.) A scanner is either hand-held or resembles a “flatbed” desktop photocopy machine. Scanners are available for black/white, gray scale, and color scanning. Most scanners simply record pixels into graphics files. Text scanned as a graphic must be converted into computer text or computer data by means of a text conversion program such as the OmniPage Pro (800-535-7226) text conversion software. Scanners save the effort or retyping text and data as well as capturing drawings and photographs for computer processing. Scanners are widely employed in government and industry to store computer images of documents so that the documents themselves can be destroyed to save on the cost of storage, risk of loss by fire, etc. Authors who do not have access to a color scanner may obtain satisfactory results for transmitting graphics and photographs from video tape directly into the computer (assuming the computer has a video board). In this way, a video camera becomes a scanner of sorts, although images are usually not of sufficient quality for text conversions of graphic inputs. A similar alternative is the dry camera. See “dry camera,” video camera,” and “OCR.”

Scanner = both hand-held and flatbed hardware and software for coping graphics images and text into computer-files. Both color and black and white options are available. We have never had much luck with hand-held versions, but the latest flatbed scanners do a terrific job. Text scanned as graphics must be converted into computer text via specialized software such as Omni Page Pro from Caere (800-GO-CAERE). The top-rated scanners at the end of 1994 are SanJet Ilcx (Rank 1) from Hewlett-Packard (800-722-6538), Apple QuickTake 100 (Rank 2) from Apple Corporation (800-538-9696), and CanonIX-4015 (Rank 3) from Cannon (800-848-4123) according to PC Computing, December 1994, p. 152

SCMS = Serial Copy Management System circuitry in digital recorders that allows copying from a source program but blocks making copies of copies.

SCO Open Desktop = Santa Cruz Operations' GUI operating system that is compared with other 32-bit operating system alternatives in PC/Computing Special Report (1994). This is a UNIX-based system that runs on Intel and MIPS hardware. See “operating system.”

Score = a sequence, either time-based or frame-based, that determines the timing of a presentation and the synchronization of its objects.

Screen capturing = the “capturing” of images on a computer screen onto a clipboard or into a graphics file so that they can be imported into other software. Screen captures are analogous to photographs of screen images. Captured text is normally in graphics mode such that it must be run through a text converter (e.g., OmniPage text conversion software) that translates graphics text back into word processor text. In PC World, February 1994, p. 224 it is shown how Windows screen capturing can be accomplished using the Windows Recorder utility in the Program Manager. Doyle (1994a) provides useful tips for QuickTime video capturing. Screen capturing software options are reviewed in the NewMedia 1995 Tool Guide (p. 34). See “OCR.”

Scripting = (see “authoring.”)

ScriptX = a forthcoming and somewhat revolutionary authoring and scripting hypertext and hypermedia language. ScriptX from Kaleida Labs (in a joint venture with Apple and IBM corporations) will be the...
only option designed to cross between various operating systems (e.g., Unix, Windows, DOS, Apple/Mac, OS/2, and PowerOpen). ScriptX will also nicely compliment the Taligent (Pink) multi-platform operating system. As scripting languages go, ScriptX will be relatively inexpensive at $795. However, its $2,500 runtime/royalty fee for each title (book, course, etc.) produced makes it very expensive relative to competitors such as Macromedia’s Director. Bove (1993, p. 56) asserts “ScriptX has no peer in scripting language, and it will one day dominate the industry as PostScript dominated desktop publishing.” This is controversial and somewhat questionable unless it comes down in price to developers and will play back hypertext and hypermedia on relatively inexpensive PCs that are widespread throughout the world. Also we view the $10,000 GainMomentum option from Sybase as being much better than ScriptX in some features, including crossing platforms to Windows and Windows NT from UNIX. Since ScriptX has a $2,500 runtime fee/royalty, it is doubtful whether it will become as popular as Bove predicts, because there are many quite good options discussed in Chapter 3 that have no runtime fees. Since Windows 95 (Chicago) and subsequent planned Windows upgrades from Microsoft Corporation are expected to take the market by storm, the market will be limited for ScriptX unless ScriptX eventually “plays in Chicago.” According to Carlton (1994c), ScriptX may not become as popular as Macromedia Director and other competitors because it is less user-friendly. The futures of both ScriptX and Director depend upon what strides present competitors such as A Symetrix (ToolBook), Microsoft Corporation (Visual Basic), and others listed in Chapter 3 do to make their own scripting languages cross platforms. A more recent account of ScriptX is given by Bove (1994b). See “GainMomentum,” “Kaleida,” “Taligent,” “cross-platform,” and “authoring.”

**SCSI** = a **Small Computer System Interface** board that has remains the preferred hardware to add to hypermedia computers. The main use is to connect the computer to auxiliary storage drives such as CD-ROM drives, auxiliary hard drives, computer tape drives, Bernoulli drives, Syquest drives, etc. Other devices such as CD-ROM recorders can be connected to the computer through the SCSI board. Major producers include Adaptec (800-050-7274) and Corel (800-772-6735). For a review of SCSI technology, see *NewMedia*, April 1, 1996, pp. 31-34. See also “RAID.”

**SECAM** = **SEquential Couleur Avec Memoire** sequential color and memory television standard adopted by France and the USSR in 1967. This has some phase and amplitude integrity (skew-symmetry) advantages over NTSC and some line flicker (Hanover bars) disadvantages. Having France and some parts of Eastern Europe on a different standard than PAL for the rest of Europe and NTSC for North America and Japan is somewhat frustrating for manufacturers of hardware and developers of videotapes. See “NTSC” and PAL.”

**Sega** = (See “games.”)

**sequence** = a combination of events executed in a predetermined order.

**server** = a computer that shares its resources, such as printers and files, with other computers on the network. An example of this is a Network File System (NFS) server which shares its disk space with other computers.

**set-top box** = a digital device that will sit on top of or inside a television set and provide the digital processing necessary to support interactive network services (video-on-demand, network placing of purchase orders, database access, etc.) in the early phases of the information highway. Eventually PCTVs will probably replace set-top box processors. See “stand-alone” and “information highway.”

**SGI** = **Silicon Graphics, Inc.**, 2011 North Shoreline Blvd., Mountain View, CA, 94039-7311. This company manufactures high-end graphics work stations such as its Indy line for hypermedia, video, and 3-D graphics rendering. Some software vendors such as Information International write software for SGI
workstations. These are among the best of the professional options for generating videographics and virtual realities, but they come at a high price for hardware, software, and technical help to obtain and maintain a SGI workstation. Software for SGI and other Unix-based workstations costs much more, “often 10 times the price of equivalent software for high-volume platforms like MPC---and much of it is extremely vertical in nature” says Spanbauer (1993b, p. 42). SGI now has a low-end multimedia workstations starting at under $5,000. The Sun Microsystems SPARCclassic M (under $5,000) and 10SX (over $15,000) are designed to compete with the SGI Indago line for multimedia computing. Beware that buying an SGI computer such as the Indy for less than $5,000 is analogous to buying an automobile without a transmission, wheels, and other essential components. For example, the hard drive and monitor are not included at the $5,000 price. Lindy (1994) says the price of a complete Indy system rises to $27,600. He compares features of the Quadra 840AV with the more expensive and faster SGI Indy and finds that the Quadra 840AV performs as well or better in most instances for a lot less money for hardware and software. The SGI Indy competes with NewTek’s Video Toaster and Apple AV competitors, but should not be confused with the more extensive concept of network video server. See also “video server,” “Amiga,” “Apple AV,” “PowerPC,” “Sun” and “Unix.”

shell = under NetWare, the network drivers.

SIMM = Single In-line Memory Module plug in memory module containing all the chips needed to add blocks of RAM to a computer. See also “RAM.” At the present time, for example, it is not uncommon to pay in the neighborhood of $800 for each 16mb of RAM added to computers. See also “RAM.”

simulation = computer generated or enhanced emulation of real world happenings. In the early days of computing simulation was largely a numerical modeling of factory operations, weather systems, planetary movements, etc. The advent of flight simulation ushered in physical reproductions of reality that gave the look and feel of being in a real world happening such as landing an aircraft at night in simulated airports around the world or simulated combat situations. Modern day multimedia computing has ushered in countless applications of visual as well as numerical modeling simulations. The high end technology for simulation today is virtual reality. See “virtual reality.”

single-session recording = the older CD-ROM standard, where all data you intend to put on a disk must be recorded in one session rather than in several different sessions over time. See also “CD-R.”

SLIP = Serial Line Internet Protocol that allows users in selected parts of the world to access the Internet via modems and phone lines if they are not directly connected to the Internet system of worldwide networks. There are specialized SLIP firms plus some of the more general firms such as Delphi and CompuServe. Unlike direct connections, however, SLIP interfacing normally have usage fees based upon timing and extent of usage. See also “Internet.”

SMITS = Self-Monitoring Intelligent Tutoring System for computer-aided instruction of accounting information systems. SMITS was developed with an NCAIR grant by Professors Glen L. Gray and L. Richard Ye at California State University at Northridge. See Gray (1994).

Solaris = (see “Unix.”)

Sonet = Synchronized Optical Network that is now operational on 155 Mb per second fiber optic cable between major cities in the United States. This forms the AT&T Corporation backbone for asynchronous transfer mode (ATM) switching and transmission of voice, video, graphics, and data. See “information highway,” “fiber optic,” and “network.”

Sound Blaster compatible = (see “MCI.”)
**sound board** = a hardware insert for computers that allows mono or stereo audio (e.g., from cassette players, microphones, and television audio tracks) to be sent to computer speakers “on the fly” and/or to be captured as computer files such as **wav** and **voc** files for PC computers. The wav file extensions run on Microsoft MCI standards and the **voc** files run on Soundblaster sound boards from Creative Labs. Hardware options are reviewed in the *NewMedia 1995 Tool Guide* (pp. 53-61); specialized sound boards are listed on p. 56. Software (audio editing) options are reviewed in the *NewMedia 1995 Tool Guide* (pp. 63-67). Sound boards and MPC upgrade kits for PCs are reviewed in Waring (1993). When available, it is often better to have audio hardware on the motherboard rather than as a board added to a computer’s expansion slot. The VESA BIOS Extension/Audio Interface (VBE/AI) is an extended standard that does not modify existing MPC hardware standards, but VBE/AI does make it possible to have VESA compatibility with less worry over patent litigations. For more details on VBE/AI see *Multimedia World* (June 1994, p. 35). See “DSP.”

**sound recording** = (See “Sound Board.”)

**Sparc** = a class of Unix-based workstations from Sun Microsystems, Inc., 2550 Garcia Ave., Mountain View, CA 94305. These are common in Unix-based networks. See Sun.

**speech recognition** = the ability of the computer to interpret speech or other audio commands along with keyboard, mouse, and joystick commands. To date, vocabulary limitations and other problems make this a less than perfect option for authoring at the moment. Alternatives for the PC are reviewed by Tynan (1995), who contends that the top alternatives really work at present and then warns that even the top packages do not yet work for conversational speech. It is doubtful that writers across the world will be content with the effectiveness and efficiency of dictating text to their computers using present software. We tried the popular Voice Pilot from Dragon systems (617-965-5200) for using menu commands in Windows, but we find it makes many mistakes in recognizing our simple verbal requests. Significant progress has been made in relatively expensive systems for persons unable to use their hands. Gellerman (1994a) reviews technology now available and calls speech recognition “the final frontier” of computer communications. The ability to talk directly with a computer was anticipated years ago in Star Trek television shows and with the supercomputer named HAL in the *popular film “2001 Space Odyssey.”* Eventually speech recognition will be commonplace when using both large and small computers. Apple intends to make advanced speech recognition a viable feature in its future Gershwin (System 9.0) operating system. Now such options such as Voice Assist from Creative Labs (800-998-1000) are available for PCs. See Thyfault (1994) for a review of applications already in place in business firms. See also “text reading.” See also “disabilities products.”

**sprite** = an independent graphic object that moves freely across the screen.

**stand-alone** = (see “CD-Stand Alone.”)

**star topology** = a network configuration where each node is connected by a single cable link to a central location, called the hub.

**still video camera** = (see “dry camera.”)

**student response pads** = hand-held wireless audience response pads which allow individual answers or group frequency responses to be immediately displayed in front of the class. The pads themselves must be separately purchased. HyperGraphics is the only CMS vendor that sells response pads with built in CMS software utilities. Barry Rice at Loyola College in Maryland performs Multimedia ToolBook authoring with student response pads for accounting applications in a Windows environment. Also see “remote control device.” See “electronic classroom.”
**studio classroom** = an application of computer technology pioneered by Jack M. Wilson at Rensselaer Polytechnical Institute for replacing large lecture courses with students working in pairs in front of computer screens where they interactively tackle problems and issues rather than listen to or passively watch lectures in front or a mass lecture section. The only lecture comes at the beginning and end of class where the instructor commences or wraps up the learning session. The “studio” is a combination lab and electronic classroom. For a summary see DeLoughry (1995a). See also “electronic classroom.”

**SUN** = Sun Microsystem computers, most of which are network workstations using Unix operating systems. The Sun Microsystems SPARCclassic M (under $5,000) and 10SX (over $15,000) are designed to compete with the SGI Indago line for multimedia computing. See also see “SGI,” “Sparc,” and “Unix.”

**S-VHS** = (see “VHS.”)

**switched network** = is the opposite of dedicated bandwidth on the information highway. It is analogous to having a bridge that opens certain lanes in one direction to accommodate traffic flows in the morning rush hours and then changes the directions to accommodate evening rush traffic. In the case of switched networks, the bandwidth dedicated to flows of data, voice, video, and audio can be changed as needed. For example, video may require a temporary widening that limits data and audio flows. See “bandwidth,” “information highway,” and “video server.”

**synchronous** = a method of communication using a time interval to distinguish between transmitted blocks of data.

**syntax** = the rules of construction and terminology of a computer programming language. These rules are analogous to rules of spelling and grammar in a language, except that syntax rules are usually less forgiving. We can read a thousand-page book that has one error in spelling or grammar. Such is not the case with a computer program because it will not usually run if there is a syntax error.

**Taligent** = a software development venture initially commenced by Apple and IBM corporations. In 1994, Hewlett-Packard announced it would take a 15% take in Taligent and provide technical support. Taligent's primary mission is to develop cross-platform object-oriented operating systems and applications software, the first release of which will be in 1995 for IBM's Unix-based system called AIX. Versions for OS/2, PowerOpen, and Hewlett-Packards HP-UX systems will follow. The future of Taligent along with a similar joint venture at Kaleida Labs is somewhat uncertain due to changing times and top management strategies in IBM and Apple according to Information Week, May 23, 1994. Key features of the Taligent applications operating system and the “People, Places, and Things” user interface are discussed in Panettieri (1994b). The key feature is the object-oriented design that will greatly reduce the time and effort needed by software developers who can make use of chunks of pre-written code. (see “Kaleida” and “Pink.”)

**TCP/IP** = Transmission Control Protocol/Internet Protocol is an internet transmission protocol that is extremely popular but has no firewalls or other protects for transmission security. This is a standard for routing and data transfer around the world. See also “Internet.”

**teleconference** = a telephone communication in which more than two people are simultaneously connected so they can exchange verbal comments as if they were in the same room having a face-to-face conference. A teleconference need not have visual communications in addition to audio communications, but modern technology now makes it possible to see conference members on monitor screens or television screens. See also “videoconferencing.”
Television = (see “video.”)

Telnet = the Internet standard protocol for remote login service that allows users on the Internet to access programs and applications on computers in remote locations. Telnet allows a user at one site to interact with a remote timesharing system at another site as if the user's terminal were connected directly to the remote computer. When using the Internet, type “Telnet” followed by a space and the address of the computer for remote login. Note that the Telnet protocol should not be confused with the Telnet public data network. See “protocol” and “remote login.”

TENet = Texas Education Network education Internet computer network connecting 15,000 school teachers and administrators in Texas. On the Internet, people from around the world can communicate with educators and access educational resources such as an online encyclopedia, the Educational Resources Information Center Documents Database (ERIC), lesson plans, study guides, current events, etc. See also “Internet.”

text conversion = (see “OCR.”)

text reading = the conversion of computer text into audio sounds. Apple Computer has a text manager in its AV models. Options such as Text Assist from Creative Labs (800-998-1000) and related hardware/software from sound board vendors are available for PCs. See also “speech recognition.”

text recognition = (see “text reading.”)

texture = texturing effects in graphics images and multimedia backgrounds. Comparisons of software options for “tantalizing textures” are compared in NewMedia, November 1994, p. 104.

three-beam projector = a computer/video projector having three color beams (guns) to project computer and/or video images on the wall or large screens. These are generally the top of the line in terms of projection quality and lowest in line in terms of portability. Most of these have scan converters to convert computer RGB into NTSC images. Early models could only scan CGA images from PC computers. Modern versions can scan almost any type of computer display, although they may require skilled technicians to adjust the display whenever a computer is first connected to the projector. These projectors are very popular as ceiling mounts in electronic classrooms. See also “projection,” “LCD” and “graphics adapter.”

THX = (see “Dolby-NR.”)

tif = (see “TIFF.”)

TIFF = Tagged Image File Format graphics file format popularized by Aldus PageMaker for recognizing graphics from different types of software. TIFF graphics files typically have a tif extension. See also “graphics.”

Tiger Video Server = (see “video server.”)

time line = a graphical representation of a span of time and the chronological relationship of events.
**timeline presentation** = a “linear” presentation where the sequence on images or tasks is predetermined and cannot be interactively altered or modified by the user. This is just the opposite of “nonlinear” hypertext and hypermedia presentations where users interactively determine or partly determine the sequencing. See also “hypertext” and “hypermedia.”

**titles** = the vast array of CD-ROM, CD-I, CD-3DO, videodisc, videotape, and other “titles” of electronic books, electronic games, etc. available on the market. Many such titles of interest to accounting educators are listed in Appendix 1. Jerram (1994b) reports on the “explosion” of CD-ROM titles in general (e.g., electronic books and games) in 1993 and 1994. Weiner (1995) describes the activities of publishing companies to expand multimedia titles and related software. Weiner features efforts by Addison-Wesley Interactive. For reviews of CD-ROM titles on the market, we recommend CD-ROM Today (see Appendix 4). See “authoring,” “games,” and “hypermedia.”

**token** = the data packet used to carry information on LANs using the ring topology.

**ToolBook** = (see “hypermedia,” “hypertext,” and “authoring.”)

**topology** = the manner in which nodes are connected on a LAN.

**touchscreen** = an overlay for a computer monitor screen that allows users to control navigation and other actions by touching the screen. Although widely used for children, touchscreens are also useful when customers enter reception areas and library users want to search holdings listings. A review of options is provided in the NewMedia 1995 Tool Guide (pp. 101-103).

**track-at-once recording** = a mode that lets you record contents to a disk in multiple sessions, a track at a time. See also “disk-at-once recording” and “CD-R.”

**training** = (see “authoring” and “multimedia.”)

**trustee rights** = rights given to users to access directories on the file server.

**TULIP** = a program from Elsevier Science (212-633-3787) to license universities to receive technical journals in electronic form, including bibliographic information. To date, over 43 Elsevier and Pergamon journals are available at major universities such as The University of Michigan, Cornell, Carnegie Mellon, Georgia Tech, University of Tennessee, University of California, University of Washington, Virginia Tech, MIT, and others. This is probably the first major attempt to by a publisher of science journals to depart from hard copy publishing in favor of electronic media. Major advantages to users include compactness for storage, rapid access and retrieval, keyword searching, and ability to add user annotations and updates.

**Ultimedia Video** = is IBM Corporation’s OS/2 equivalent of Video for Windows. Ultimedia Video IN/2 is priced at under $200 and supports video capture and editing in IBM Ultimation and Indeo compression formats. It can deliver up to 30 fps at 320 by 240 window size if the user’s hardware can handle the upper-end capabilities. See also “OS/2” and “Video for Windows.”

**uninterruptible power supply** = a device that keeps computers running after a power failure, providing power from batteries for a short period of time.
Unix = an operating system developed by Bell Laboratories for use on large workstations. Latest information on Copeland and other operating systems can be obtained at <http://techweb.cmp.com/iw/center/default.html>. Details are provided in Information Week, April 29, 1996, p. 15. Unix became one of the main operating systems for networked computers. It is especially suited for networks and is commonly used for Internet networks. The Unix System V Release 4 based operating system is called Sun's Solaris that runs of Sun Workstations and the PowerPC. IBM's Unix-based operating system is called the AIX, and the Hewlett-Packard version is called HP/UX. A discussion of whether Unix should become more of a part of operating systems in accounting practices is provided by Courtney and Hunton (1993). For a comparison of 32-bit operating systems see PC/Computing Special Report (1994). See “Solaris,” “SCO Desktop,” “network,” and “operating system.”

upgrade = (see “multimedia upgrade.”)

USENet = USEr's Network of machines that exchange information tagged with labels called “newsgroups” which are transmitted between individuals at universities, secondary schools, government agencies, home computers, etc. Databases are available on many topics, from foreign hotels to kite flying. USENet traffic can be carried on the Internet, but is not restricted to the Internet. Internet users can exchange papers and lengthy data files.

user = under NetWare, the definition of a set of access rights for an individual.

UUCP = Unix-to-Unix Copy Protocol that can be used for transferring files between Unix computers on network. See “FTP.”

VAP = a Value-Added Process to the NetWare operation system provided by a third party vendor.

variable = a named container that holds values, either numeric or text.

VBE/AI = (see “sound board.”)

V-CD = (see “CD-Karoke.”)

VCR = a videotape player designed to connect to television sets or computer video capture boards. Videotapes are recorded in video format (e.g., NTSC or PAL) in half, three quarter, or one inch formats. The most common tape is the half-inch VHS tape, but for professional video materials and videodisc mastering one-inch tape is preferred. See also “VHS,” “Video,” and “Videodisc.”

VESAl = Video Electronics Standards Association that set such standards as the 1992 VL-Bus standards for local buses. A highly critical discussion of the VESA/Bios Extension/Audio Interface (VBE/A1) that is not backwards compatible with the Sound Blaster standard appears in New Media, June 1994, p. 18. See also “sound board,” “bus,” and “VL-Bus.”

VESAl/BIOS = (See “VESAl.”)

VGA = (See “graphics adapter.”)

VHS = videotape having 240-325 lines of horizontal resolution. Super VHS (S-VHS) and videodiscs contain up to 425 lines of resolution. S-VHS tape decks can also play VHS formats. See also “Video.”
video = a term that was once used to refer almost exclusively to analog recordings of images on tape that can be replayed at 30 or more frames per second (fps) depicting “full motion video.” Since the age of digitization, the term now refers to analog or digital recordings (e.g., digitized video in computer files and HDTV) that can be replayed at 30 fps or a reasonably close approximation of full motion video. The term differs somewhat from “animation” in that animations are successions of still frames not necessarily intended to be “full-motion” at speeds comparable to video full motion. The highest quality video connectors are termed S-video connectors, whereas the lowest quality connector is the RF connector. Because of the tremendous bandwidth required for network transmission of video between computers, it is not yet common to watch a movie on the Internet. Travis (1993) reports that, faced with the prospect of fierce competition from Windows NT, Novell is trying to widen its market niche with Netware Video to “store, manage, edit, and play back digital video and synchronized audio over Netware networks.” For CD-ROM video in education materials, much of the authoring will continue to be done in the lower cost and lower compression Microsoft Video for Windows and Apple QuickTime having current fps rates of only 12 to 18 fps. Guglielmo (1993) predicts “hardware-based compression will be spelled M-P-E-G” and beat out most of the competition in the future. However, until there are millions of computer users with enough computer hardware capacity to run MPEG digitized video, Microsoft Video for Windows and Apple QuickTime will probably remain more common in CD-ROM authoring of education materials. Video options for the PC with particular stress upon Intel's Indeo Video and Smart Video Recorder are analyzed by Liebman (1994). Hood (1994) is cautious about MPEG and leans toward the Intel Indeo option. He concludes: “Intel's most compelling argument, however, is in the numbers. Machines capable of playing Indeo video (486 or Pentium) are selling at a rate of 1 million a month, whereas fewer than 200,000 MPEG boards have sold.” Sony Electonics (201 930-1000) has the UP-1000 series of video printers. See also “Internet audio and video,” “Active Video,” “video server,” “HDTV,” “IDTV,” “PIP,” “POP,” “videodisc/digital,” “Tiger Video Server,” “Apple AV,” “Amiga,” “Ultimedia Video,” “Video for Windows,” “fps,” “MPEG,” “VHS,” “NTSC,” “PAL,” and “SECAM.”

video adapter = the video hardware that determines the resolution and color depth of screen images. An k-bit adapter can display 2 to the kth power colors. For example, an 8-bit adapter displays up to 256 colors whereas a 24-bit adapter can display over 16 millions colors in a single screen. In hypermedia authoring, problems are created when the color depth of the authored image is higher than the color depth of the user (customer, student, reader) computer. Mac and PowerPC computers will usually dither to make the image reasonable good for users, whereas PC users may have terrible images if their video adapters are too low in color depth. The same thing can happen if the user's PC screen resolution adapter is lower than the authored PC screen. These are terribly frustrating problems for authors and users. For this reason, most of the commercial PC graphics and video CD-ROM files are authored for lower video adapters than the author's video adapter. For example, the author may be capable of presenting a graphics image in 30 million colors in a resolution of 1024 by 768. The author may elect, however to only use no more than 256 colors in standard VGA resolution in order to have better images on user computers with lower powered video adapters.

video/audio networking (streaming) = the networking of video and audio images over networks. For example, Starlight Networks offers the StarWorks digital video networking software that supports 40 simultaneous DOS, Windows, and Mac users accessing video and audio over local area networks (LANs). A state of the art video streaming installation at the University of Nebraska is described in Columns, Winter 1995, pp 1-4. Using fibre optics connected to an IBM EX/9000, users at workstations and classrooms on campus and off-campus (at secondary schools) can access interactive digital video from a massive server. See Appendix 6.

video board = a somewhat misleading term that can apply to video capture and/or video playback hardware inside a computer. Video can be played back on computers without having video capture hardware. This enables CD-ROM users to view video and animations without having to install MPC or other standard video capture boards. However, if video capture boards are installed, users can
also connect their computers to video sources (video recorders, video cameras, and television signals) in order to either view incoming video "on the fly" and/or capture segments of the video into digitized formats such as Quicktime, avi, MPEG, or JPEG video formats. Entire multimedia packaged PC options are reviewed by Bott (1993). Video board options for PCs are compared in NewMedia 1995 Tool Guide (pp. 73-78), with full-screen and full-motion MPEG boards listed on p. 74. Video editing software is reviewed in NewMedia 1995 Tool Guide (pp. 81). Comparisons of video accelerator boards are given by Spanbauer (1995a). Earlier comparisons are provided by Doyle (1994a) and (1994b). In particular, Windows users should not purchase or install a video capture board before reading Doyle (1994b). He provides excellent advice on things to do before installing a Windows video board along with comparisons of alternative hardware options. Price is not currently a good indicator of quality and features. He also provides important advice for capturing and storing video files. For example, video files should not be saved using disk compression utilities like Doublespace or Stacker. For capturing and playback of digitized video into and out of computer files, a full-motion video frame grabber (digitizer) of some type allows authors to capture selected full-motion video (camcorder, videotape, videodisc, cable TV, satellite dish, etc.) images and convert those analog frames into digital graphics files on the computer. Video boards (cards) and frame grabbers start at around $200, but prices vary a great deal with vendors and options, including options under Microsoft Windows Video MCI standards, Apple QuickTime standards, IBM M-Motion (MM) standards, MPEG standards, and Intel Indeo standards. Virtually every major computer brand on the market has multiple options for video (multimedia) devices. Many of those devices also have accompanying frame grabber software. For example, readers may consider Pioneer's LaserActive system (213-746-6337). Compression boards for PCs that come in a variety of prices and features. MPEG compression requires MPEG playback boards and/or MPEG authoring boards such as the Optibase MPG-1000 digital video code compression/decompression board (800-451-5101). Other alternatives such as Xingt from Xing Technology (800-294-6448) for video capturing software on ReelMagic MPEG playback hardware from Sigma designs (800-845-8086) are listed in Appendix 6. Full-motion video at over 30 frames per second takes up so much digitized storage that video must be compressed to make it more useful in hypermedia. Guglielmo (1993) predicts 'hardware-based compression will be spelled M-P-E-G' and will beat out most of the competition in the future. However, until there are millions of computer users with enough computer hardware capacity to run MPEG digitized video, Microsoft Video for Windows under MCI standards and Apple QuickTime will probably remain more common in CD-ROM authoring of education materials until the market sorts out its preferences for MPEG, DVI, and the Intel Indeo. Video options for the PC with particular stress upon Intel's Indeo Video and Smart Video Recorder are analyzed by Liebman (1994). Doyle (1994b) calls several options "awesome," including the $940 Fast Electronic's Movie Machine Pro (415-802-0772) with M-JPEG and Avi file capturing options. Similarly, he calls the $570 Intel Smart Vidoe Recorder (800-538-3373) and the $890 Micro Computer microVIDEO DC1 tv (800-249-6476) awesome. For PCs having the highly popular (but technologically obsolete) MCI standard boards for Windows Video and Windows QuickTime, CompuVid (305-448-0839) sells the School Board II full-motion video adapter that emulates (on AT models of PCs) IBM's M-Motion video board. Microsoft's new Active Video architecture is designed to compete head on with Apple's popular QuickTime. The term "video overlay" is used to depict a video board option to view live video "on the fly" in a monitor screen without burdening the CPU until the user elects to capture video. Not all video cards have video overlay options. Doyle (1994b) discusses advantages and disadvantages of video overlay. See "Active Video," "Quicktime," and "video capture."

**video camera** = a camcorder camera that records full-motion images and audio directly to videotape. Video cameras exist for filming tapes of varying widths. Usually the wider the tape (e.g. one inch versus half inch), the better the picture quality. However, other factors such as High 8 versus Regular 8 come into play. High 8 cameras are especially popular among hand-held cameras, because of the professional quality for the size and price of the camera. Users who, for example, purchase an 8 mm video camera can play the tape into a videotape recorder and record VHS tapes or videotapes of other widths. See "High 8, “VHS,” and “dry camera.”
**video camera** = a camera that captures video to tape or tape cassettes. These are typically called camcorders with popular models being analog camcorders in Regular8 or Hi8 quality. See also “dry camera” and “video from digital (DV) camcorders”.

**video camera still** = (see “dry camera.”)

**video capture** = a process of transforming a video (e.g., NTSC) image into a computer (digitized) image. The process entails adding hardware and software designed to transform an analog (TV) image, say from a videotape, into a digital computer image. Usually a video capture board must be installed that is compatible with the bus of the computer. For example, a PC generally has an ISA, EISA, or MCA bus that in turn requires a compatible video capture board inside the computer. Video boards also enable computer users to view videotape or television images “on-the-fly” without necessarily capturing the images into computer files. Video capture boards vary greatly in price and quality. What is best for a given computer depends a great deal upon the amount of RAM, video RAM, graphics adapter, screen resolution, color depth, and speed of the computer. More recent comparisons are provided by Doyle (1994a) and (1994b). In particular, Windows users should not purchase or install a video capture board before reading Doyle (1994b). He provides excellent advice on things to do before installing a Windows video board along with comparisons of alternative hardware options. Price is not currently a good indicator of quality and features. See also “video boards.” See “Active Video,” “Quicktime,” and “video board.”

**video card** = (see “video board.”)

**videoconferencing** = remote communication in which two-way video images are transmitted with audio. Although this can be accomplished with video cameras on special telephone connections, it is now possible to become much more sophisticated with videoconferencing using computers. A review of available systems is provided by Sherman (1885). Many colleges have videoconferencing systems in place (e.g., see T H E, Technology Horizons in Education, September 1993, pp. 38-40. Purportedly, the highest proportion of videoconferencing worldwide is for education and training. As reported in Syllabus HEPC, July/August 1994, p. 22, Cornell University is using an NSF grant to develop Mac and PC software for video conferencing over the Internet. Successful applications in education are reviewed by Rutherford and Grana (1994). See also “Internet phones and videoconferencing,” “teleconferencing” and “DSS.”

**video digital (DV) camcorders** = (see “video from digital (DV) camcorders.”)

**videodisc** = a “large” (more than 12 cm or 4.72 inches) injection-molded optical disc containing digitized information that has been recorded with a laser device and must be read on a laser device known as a videodisc player. The most common sizes are eight and 12-inch discs. A 12-inch disc will hold 54,000 video frames of super VHS quality. Full-length movies usually require more than one disc since only 30 minutes of video with audio can be stored on each side of a 12-inch CAV disc. A CLV disc can hold up to 60 minutes per side of a 12-inch disc. CLV holds more video but is more limited than CAV in terms of searching for individual frames. Two audio tracks can accompany a video track, thereby enabling educational audio to accompany entertainment audio. Although a videodisc resembles a CD-ROM in appearance, there are major differences. Relative to a CD-ROM disc, the laser disc is “large” in varying sizes of eight or more inches. Whereas a CD-ROM player can hold computer files and computer graphics images in common file extensions (e.g., GIF, BMP, PCX, TIF, JPG, etc.) and can be treated as a computer storage disc somewhat analogous to a high-capacity floppy disc, a videodisc cannot hold computer files. Videodiscs are more like videotape in that they are recorded in video formats such as NTSC or PAL or SECAM. Videodisc players are generally connected to television sets and will play on the fly in a computer only if that computer has a video board for any video source such as television inputs and VCR inputs. Videodisc and videotape
images can be “captured” and transformed into computer files only if the computer has video capture has capture hardware and software. Videodiscs are currently used in some multimedia presentations but their future in hypermedia is uncertain. Some analysts still advocate them as an affordable approach to multimedia. For example, see Lynch (1994). As compression technology improves for storing full-motion video on CD-ROM discs, videodiscs may become less popular. Videodisc players cannot be made portable as CD-ROM players. Recently options became available for desktop recording of videodiscs. For example, Panasonic (201-348-7837) offers the LQ-3031T model starting at $12,500. However, most videodiscs mastered in professional labs require inputs of professional-quality videotape (usually one-inch videotape) produced in a video workstation. A second drawback of videodiscs is that, unlike CD-ROM discs, videodiscs cannot be previewed prior to being mastered. There are two types of videodiscs known as CAV and CLV. The most common entertainment and educational videodiscs are CLV discs. There are currently four levels of interactivity for videodisc players. Level “one” is controlled with an inferred or wired remote control or bar code reader. Level “two” players have programmable memory. Level “three” is controlled by an external computer which greatly improves interactive controls with hypermedia software. Level “four” is a high speed computer interface videodisc player that accesses each side of the videodisc. Level four is more useful for using a videodisc as an external storage device for computer data. For a short discussion of levels of interactivity see Lynch (1994, p. 19). Sources of educational videodiscs are given in Appendix 6. Applications in accounting education and training are listed in Appendix 1. Alternative videodisc players are discussed by Waring (1994a). Authoring software options for videodisc control on PCs include Interactive Image Technology’s Authority, Macromedia’s Authorware Professional, Paul Mace’s Grasp, Ntergaid’s HyperWriter, AimTech’s Icon Author, Instant Replay’s Instant Replay Pro, HSC’s InterActive, EduQuest’s Linkway Live, Warren-Forthought’s LINX Test Factory, Lenel Systems’ Media Developer, Network Technology’s MEDIAScript, and Asymetrix Corporation’s Multimedia ToolBook. Mac and PowerPC users can use Macromedia’s Authorware Professional, Macromedia’s Director, Discover System’s Course Builder, Apple Corporation’s HyperCard, Warren-Forthought’s LINX Test Factory, and Sunburst/Wings for Learning’s MediaText. Video Toaster users can choose from NewTek’s Video Toaster Workstations and Scala’s MM200. Unix users can use AimTech’s Icon Author. NeXt users can control videodiscs from the Xanthus Craftman. One of the best buys for less than $1,000 is the MDP-1700R Multi Disc Player from Sony that plays different size discs and has an auto reverse feature that allows viewing and searching on both sides of the disc without having to turn the disc over in the playback machine. See also “bar codes,” “CAV,” “CLV,” “Delta Project,” “videodisc-digital,” “CD,” “titles,” and “CD-I.”

**videodisc-digital** = a videodisc in digital format. For example, the DDV-7100 8-bit, 4.5 MHz bandwidth model was unveiled in October 1993 by Optical Disc Corporation (800-350-3500). The DDV-7100 will hold four hours of compressed digital video on one side of a 12-inch videodisc. Later systems will hold up to 10 gigabytes of data or one hour of HDTV. This technology is intended for interactive television of the future and for satellite uplinks and mass storage video servers. Playback units start at under $5,000 but recording units are likely to be found only in professional videodisc recording and reproduction laboratories since the disc recorder sells for almost $100,000 and requires other workstation hardware and software.

**video from digital (DV) camcorders** = camcorders that capture video directly into digital formats that offer many advantages for multimedia computer files. The captured video can be copied indefinitely with higher resolution, digitized audio, and no loss of frames. The mini-DV cassettes are smaller and have at least double the capacity of the Regular 8 and Hi8 analog cassettes. Vendors and products are reviewed by Doyle (1996). See also “dry cameras.”

**videodisc levels** = (See “videodisc.”)

**video on the Internet** = (See “Internet audio and video,”)
video overlay = (See “videocapture.”)

video scan conversion = (See “scan converter.”)

Video for Windows = animation and video files that originally were developed by Microsoft Corporation for PCs running under Windows. This has become a widely popular option for PCs operating under MCI standards. Like QuickTime, Video for Windows is a low cost and low fps option that will be common in CD-ROM authoring of education materials until MPEG compression options and video networking become more widespread. Although Microsoft's Video for Windows and Apple's QuickTime captured early market share leads in digital video, newer and better compression alternatives such as Indeo and MPEG probably will take over this market. See also “DVI,” “QuickTime,” “Indeo,” “MPEG,” “DVI,” “video,” and “AVI,” “MCI,” and “Ultimedia Video.”

video server = the combination of hardware and software that allow for storage and transmission of continuous animation and video in real time. The core of a video server is a continuous media operating system that allows animation, audio, and real-time video to be processed and transmitted across networks or over digital television satellites. Major players are rushing to develop video servers, including the over $100 million dollar per year effort by the Advanced Technology Group (ATG) and Microsoft Corporation to develop the Tiger video server as part of the overall information highway architecture development code named Mimosa by Microsoft managers. For a review see Soat (1994). Microsoft's Tiger Video Server competes head on with rival video servers from IBM, Digital Equipment, Hewlett-Packard, Oracle, Silicon Graphics Corporation, and others. What is unique about Tiger is that it can save about 90% on costs and can network the video directly into PC computers. For comparisons of video servers, see The Wall Street Journal, February 18, 1994, p. B1. Also see “switched network” and “set-top box.”

Video Toaster = (See “Amiga.”)

virtual-image file = a set of pointers to the files on your hard disk to be sent to the CD-R drive, rather than a duplicate physical-image of those files. Usually employed for on-the-fly recording. See also “CD-R.”

virtual reality = computer and video “VR” simulations that entail wearing headgear, electronic gloves, and possibly electronic body suits such that users are immersed in a cyberspace of simulated reality that gives the sensation of being in a three-dimensional world where objects can be moved about with hand movements and sensations of walking and touching are simulated using super computing power. The origins of virtual reality are in flight simulators of the military. There are now VR game arcades and laboratories where wide varieties of applications in entertainment, training, medical research, architectural design, data research, etc. are taking place. Virtual reality programs require massive computer power. Usually, the closer authors attempt to simulate the real world, the greater the computing power needed to achieve sensations of reality. Although virtual reality most of its applications to date in training and entertainment, there are some applications in data analysis such as the use of VR to analyze international portfolio data in the TIAA/CREF Pension Funds. Winn (1994) contends VR will become a major part of university curricula. He cites evidence that VR is especially successful for learning disadvantaged and physically handicapped students. In June 1994, Apple Corporation unveiled a new desktop computing software option (with a CD-ROM recorder) called QuickTime VR that takes a collection of photographs (e.g., photographs of numerous angles of the inside of a room) and assembles them into motion scenes that resembles more expensive virtual reality generated on super computers. Viacom Inc. sells a QuickTime VR entertainment CD-ROM called “Star Trek: The Next Generation Interactive Technical Manual” that provides VR tours of the Starship USS Enterprise. For a review of some initial applications of QuickTime VR in anatomy education see Carlton (1994b). See also “simulation.”
VL-Bus = a local bus standard set by the Video Electronics Standards Association (VESA) that requires direct-to-CPU connections that limit the number of expansion slots in computers. The VL-Bus is faster than EISA and less expensive to manufacture. For a time it was the bus of choice for PCs until the newer PCI bus was introduced by Intel. See “bus.”

VM-Channel = (see “bus.”)

voc = (see “sound board.”)

voice recognition = (see “speech recognition.”)

VR = (see “virtual reality.”)

VRAM = Video Random Access Memory chips that determine the performance capacity of video adapter hardware in computers. In particular, they allow for reading and writing of graphics images to take place simultaneously. At the time of this writing, authors of hypermedia are advised to purchase a computer with at least 2Mb of VRAM. See also “RAM.”

WAN = Wide Area Network of computers spanning hundreds or thousands of miles. See also “LAN.”

WARP = (See OS/2.)

Waterloo MAPLE = (See “MAPLE.”)

wav = (see “sound board” and “wave file.”)

wave file = a wav file format used by Microsoft Windows for storing digitized audio. All information necessary to generate voice and music is stored in the file. See also “sound board” and “MIDI.”

web browsers = interfaces to the world wide web that simplify locating web pages, downloading files, playing of audio, playing of video, etc. Gopher was the first to become a great hit, but it was limited mainly to text. Mosaic followed, but it was Netscape that hit the market with enormous success. Netscape Navigator can be downloaded from <http://www.netscape.com/>. This success jolted Microsoft into expanding its network browser development from six employees to more than 600 developers. The Microsoft browser is known as Explorer (see <http://www.microsoft.com/>). Various other competitors are emerging, but it is market share browser race between Netscape Navigator and Explorer. Features to both are added almost monthly, so it is very difficult to stay up to date on the latest happenings without going directly to the vendor web pages. An earlier comparison is given in PC Computing, April 1996, pp. 79-80, but this comparison was obsolete almost as soon as it hit the presses. Most browser vendors also sell software for creating and maintaining web (home) pages. Students can set up free homepages at <http://www.tripod.com/>. Virtual Servers Inc., for a monthly fee, will provide web server space to business firms and other parties wanting to set up network application servers. The Virtual Server home page is <http://vservers.com/>. See also “web browsers,” “GINA,” “Gopher,” “Mosaic,” “Internet,” and “SLIP.”

Whois Gateway = a source listing of email addresses around the world on the Internet. See “Mosaic.”

wide area network = a network that encompasses a large geographical area.
wide-screen TV = television sets with a 16:9 movie theater aspect ratio for home theater systems. Standard broadcast aspect ratios are 4:3. The W-VHS is a wide-screen HDTV recorder and tape deck introduced by JVC in Japan that will record the Japanese version of HDTV as well as standard TV signals.

Windows = a windowing (Mac-like) extended DOS operating system from Microsoft Corporation that allows users to have more than one application running at the same time. Because Windows ran on lower-capacity 386 and 486 chips, it captured huge market shares and had over 40 million adopters by the end of 1993. This has severely clouded the future of Apple Corporation whose graphical operating system lost its uniqueness and popularity as Windows operating systems spread across the world. Windows applications can be stacked in succeeding “windows” that have menu lines and, unlike Mac processors, have an ability to “minimize” multiple operating programs. Users can then dart back and forth between windows (applications) without having to reload. Popular windows programs include those on Macintosh computers and on PCs using Microsoft Windows, Works, and Enable. Finder is another windows program. It has become common for the word “Windows” in computer lore to refer to Microsoft Windows built upon the DOS foundation. Newer OS/2 and Windows NT (New Technology) sheds the DOS foundation but require considerably greater hardware capacity than the older Microsoft Windows. See also “operating system,” “OS/2,” Windows Chicago,” and “Windows NT.”

Windows 95 = (see “Windows Chicago.”)

Windows Cairo = a planned upgrade (scheduled for 1996) of Windows NT from Microsoft Corporation that will have many of the Windows Chicago object-oriented features. Cairo was originally scheduled to ship in early 1995, but in May 1994 Microsoft Corporation announced that it would be delayed due to efforts to complete Daytona, the second release on Windows NT.

Windows Chicago = the significant Version 4.0 upgrade of Windows to Windows 95 in year 1995. Windows Chicago, Windows 95, and Windows Version 4.0 are synonyms for the first version of Windows to free itself from the constraints of Microsoft DOS. Latest information on Copeland and other operating systems can be obtained at <http://techweb.cmp.com/iw/center/default.html>. Details are provided in Information Week, April 29, 1996, p. 15. In October 1994, Syllabus on Page 23 asserts “Windows 95 is expected to become the next major operating system for the mainstream desktop and portable PC.” Between now and the time most users are using forthcoming native software designed for Windows Chicago, users may efficiently run their old 16-bit Windows applications on Chicago’s operating system. Windows Chicago is a 32-bit multi-tasking operating system that satisfies a wider array of users than either Windows 3.1 or DOS. Microsoft spent millions of dollars studying how to make Windows Chicago easier to operate than its predecessors. It is designed to be a plug and play system with enhanced features for hardware setup and multimedia device operations. It also has Internet utilities but is not the full networking operating system of Windows NT that will eventually become the most widespread operating system of the world according to many analysts. At the end of 1993, there were over 40 million Windows 3.1 users as compared with 4 million OS/2 adopters and 250,000 adopters of the new Windows NT 32 bit processors. Since Windows NT and even OS/2 are not well suited to most of the existing 386 and 486 computers in the world, Windows Chicago fills a big market niche until users replace older machines with higher speed and higher memory capacity PCs. In an article entitled “Chicago Blues” in Information Week, December 20, 1993, p. 14, however, it is reported that Microsoft will have to compromise on some of its 32 bit system promises for Chicago in order to allow the system to be squeezed into customer machines that only have 4Mb of RAM. This is the classical problem of having to compromise power of an operating system for hardware limitations of a large customer base. As a result, Windows Chicago may suffer from the same crashing problems as Windows and still be confined to 16-bit graphical device interfaces (GDI). See also “Operating System.” Bott
(1994), however, denies that Chicago will have crashing problems. In an article comparing Windows Chicago with the other leading 32-bit systems, Bott (1994) calls it the “most promising software system in years” that will capture even greater market share than the earliest Windows version as a “sure thing.” Whether or not Windows Chicago is truly better than the IBM and Apple competition operating systems may be a moot point if there are over 40 million Windows users that have installed or soon will install Windows Chicago. Market share determines the number of native software applications being developed for operating systems. Mac, UNIX, and other operating systems are losing the native software development war to Windows Chicago and Windows NT. Windows Chicago is almost certain to become the PC operating system standard of choice until its upgrade called Windows Cairo rolls off the line and/or Windows NT with upgraded object-oriented programming features become the operating systems of choice among users having newer hardware speed and memory components.

In answer to the question of whether Windows 95 (Chicago) will be a flop, Bott (1994, p. 139) contends: “You might as well put your money on Wile Coyote to finally catch Roadrunner.” See also “native,” “operating system,” “Windows,” Windows Cairo,” “OS/2” and “Windows NT.”

**Windows Daytona**  = (See “Windows NT.”)

**Windows NT** = **Windows New Technology** operating system from Microsoft Corporation that looks and feels somewhat like Microsoft Windows but is far more powerful in multitasking and computing speed of a 32-bit architecture memory access. NT has extensive networking capabilities as well as being a full 32 bit processor. Most present Windows users, however, will not be able to use NT without buying more powerful computers and becoming accustomed to its lack of object-oriented features. For a review of NT, see Baron (1993). For a good discussion of the debate on whether or not to adopt NT, see Auchid (1993). A comparative analysis of Windows NT and other alternatives for 32-bit processing is provided in PC/Computing Special Report (1994). The general conclusion is that Windows NT may become an optimal choice in the distant future, but hardware requirements and lack of native applications limit its market at the present time. This has led to stop-gap measures such as the introduction of Windows Daytona as a temporary bridge between Windows NT and the more object-oriented Windows Cairo due out in 1995. Many experts see Windows NT as the operating system of choice in future networks. McGee (1994) reports that, although Hewlett-Packard would rather stay entirely in its popular UNIX networking operating system, the company recognizes Windows NT as such a threat to UNIX that Hewlett-Packard is also expanding its operating system to include Windows NT. According the HP’s CEO, “...three or four years down the road, NT-related systems could become significant revenue generators.” (as quoted in McGee (1994, p. 22). See also “Windows Cairo,” “Windows Chicago,” “operating system,” “Alpha processor,” and “OS/2.”

**WinGopher** = (see “Gopher.”)

**wireless communications** = (see “PDA.”)

**Workplace OS** = (see “OS/2.”)

**workstation** = a networked personal computing device with more power than a traditional PC or Mac, although the term “workstation” is now used somewhat loosely to describe any site performing complex tasks such as an Amiga video workstation, a Mac AV workstation, a CD-ROM recording workstation, a videodisc recording workstation, a desktop publishing workstation, etc. Typically, a “workstation” has operating systems such as Unix, OS/2, or Windows NT that are capable of running several tasks (multi-tasking) at the same time. It has several megabytes of memory and a large, high-resolution display. Examples are sun workstations and Digital DEC stations.

**World of Boston** = (see “networks.”)
World Wide Web = an index of Internet Servers with sources of data presented by service, subject, or through a servers directory. Students can set up free homepages at <http://www.tripod.com/>. Virtual Servers Inc., for a monthly fee, will provide web server space to business firms and other parties wanting to set up network application servers. The Virtual Server home page is <http://vservers.com/>. See “Internet” and “web browsers.”

WORM = Write Once Read Many depicts a write-once-read-many memory device that allows an author to store prepared files once into memory so that other users may read but not alter those files. Alternately WORM also depicts a computer program which replicates itself. The Internet worm was perhaps the most famous; it successfully duplicated itself on many of the systems across the Internet. More commonly, however, the term refers to WORM Drives such as CD-ROM recorders that will allow authors to record computer files one time on a compact disc but will not allow revisions or other materials to be added to the disc at a later time. Of course, it is often possible to download WORM files into hard drive discs and make revisions that can then be recorded on a new compact disc. See also “CD-ROM” and “optical drive.”

WYSIWYG = What You See Is What You Get. The term is used mainly for newer types of software that display on the screen exactly what will appear after being printed. It is frustrating when what appears on screen is in code and what appears in print differs from what is on the screen. It was common in the past for word processors and spreadsheet software to be able to print graphics inserts but not to be able to display these inserts on the screen. Word processor, spreadsheet, and graphics programs have tried to overcome these frustrations by adding WYSIWYG options (e.g., the Print Preview menu in Word for Windows).

W-VHS = (see “wide-screen TV.”)

X.25 = a communication protocol used on public data networks.

XT = (see “PC.”)
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