



**Association for  
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in Texas**

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## Table of Contents

<b>Welcome .....</b>	<b>i</b>
<b>A Preliminary Report on TNMS: TCU's Network Management System</b> C. Thomas Nute and L. Donnell Payne .....	<b>1</b>
<b>Developing a MIS Major and Support Facilities: A Unified Project</b> Gary Fisher.....	<b>5</b>
<b>Message-Passing as an Introduction to Distributed Processing In the Undergraduate Curriculum</b> Timothy McGuire .....	<b>10</b>
<b>E-Commerce Contracts Enforceability</b> Keith Jenkins.....	<b>15</b>
<b>The Role of Technologies in a Modern Urban Higher Educational Institution</b> Steve A. Reames .....	<b>20</b>
<b>ADA and Website Compliance</b> Charles R. B. Stowe .....	<b>22</b>
<b>ACET Author's Guidelines.....</b>	<b>27</b>

# Welcome to the ACET Journal of Computer Education and Research!

## The Value of Computer Education

The Association for Computer Educators in Texas is a non-profit, tax-exempt corporation formed for the purpose of promoting the exchanging and sharing of ideas, techniques, materials and procedures related to computer education. This publication extends that purpose to a journal format for the purpose of making available research to the broad community of computer educators.

Our mission as computer educators from elementary through doctoral programs has enormous implications for society. What Latin was for past generations of scholars as the *lingua franca* has now been replaced by computer education. Computer science and technology encompasses programming, use of applications software, web design, networks both hardware and software, computer based communications systems, computer architecture, systems architecture and a myriad of technology that has literally changed every single academic discipline. Computer-based technology has permeated all aspects of our lives from eating genetically modified foods to making phone calls to using the internet. Computer education is not strictly for the technically inclined but is a necessary component of all education at all levels.

There is no discipline that has not been seriously impacted by computer technology. Music is created on computers and exchanged through the internet. Digital art pervades all aspects of our society from animated movies to multimedia entertainment to commercial advertisements. Medical research has reached new levels of sophistication with the mapping of the human genome as but one example of what would not be possible without the complex algorithms and extraordinary super computing power. Even our personal security and perhaps our privacy are affected by the application of computer technology to all aspects of travel from reservation systems to detection systems both active and passive.

## The Mission of this Journal

The role of this journal is to share research findings among computer educators and scholars. The format of this journal recognizes that the field of computer science is changing even faster than Congress can change tax regulations! Therefore, we have adopted a unique set of requirements for this peer-reviewed journal. Rather than extremely long and meticulously documented discussions of methodology, this Journal requires that our contributors quickly introduce their topic and its significance and immediately reveal major findings all in less than five pages. As email addresses are

provided for each researcher/author, further inquiry is welcomed and invited. We will publish as frequently as we can justify an edition but most certainly once a year.

You will notice our acknowledgement of the sponsors of our annual conferences – a collection of textbook and trade book publishers, vendors of computer software and hardware, and other commercial enterprises. We appreciate their support and we ask you that when you are making purchasing decisions if you would kindly give them an audience and your thoughtful consideration.

Guidelines for authors are very simple. They are published as the last two pages of our journal. Our reviewers are charged with simply determining if the research has potential value to our readership. As computer technology has permeated all disciplines, we welcome contributions regardless of discipline so long as the findings have relevance for computer educators. And we solicit your feedback on improving this journal. Please send your comments to me at [fin\\_crs@shsu.edu](mailto:fin_crs@shsu.edu).

Finally, we extend a thank you to our reviewers who have agreed to assist the Journal in selecting a fine collection of worthy articles and to you, our readers for caring enough about your students to continue your professional growth. Please consider sharing your research with us. We accept manuscripts at any time and will publish when we have enough to justify an edition. We also encourage you to attend our annual conferences. Information on our meetings is posted on our web site at [www.texasacet.org](http://www.texasacet.org). We are in a very exciting field that provides the tools for mankind to create wonderful art and entertainment, to improve communication among diverse peoples, to hopefully be kinder to our environment, to pioneer new frontiers of knowledge, and to foster a greater appreciation of life!

Enjoy!

Charles R. B. Stowe MBA, JD, Ph.D  
Professor and Editor-in-Chief  
May 24, 2003

## **Reviewers**

Steve A. Reames Ph.D  
San Angelo State University

L. Donnell Payne Ph.D  
Texas Christian University

Timothy McGuire Ph.D  
Sam Houston State University

James Zipperer MBA  
Montgomery College

## **A Preliminary Report on TNMS: TCU's Network Management System**

C. Thomas Nute<sup>1</sup>

L. Donnell Payne<sup>2</sup>

Students obtaining an undergraduate degree in computer science at Texas Christian University (TCU) are required to take a two-semester, project-oriented, capstone course. This paper provides an overview of a network management tool being developed by one of the student teams in the course. The project involves three computer science majors, two faculty advisors, and a member of the University's Information Services (IS) technical staff. The latter acts as both an advisor to the project as well as the ultimate customer. When completed, this tool will be used by system and network administrators in IS to monitor the "health" of the TCU network. In the discussion that follows we will describe the overall architecture of the monitoring tool, some of the issues that have been addressed in developing a prototype of the tool; and offer a critique of the project to date.

### Requirements of a Network Management Tool

Numerous network management tools exist; however, none have been found that run on a Windows 2000 platform, provide a web interface, and support monitoring of nodes, links, and services in a heterogeneous network. In addition to these user specific requirements, a full function network management tool should also be able to:

- Collect information about the current state of network nodes (routers, gateways, bridges, servers, workstations, etc.), links and services offered by the network.
- Support multiple views of the network's state with varying levels of detail.
- Identify problems and potential problem areas within the network.
- Maintain a history of the above items.
- Facilitate analysis of the network's current and historical data.
- Provide extensibility of items monitored, attributes monitored, and general program functions.
- Provide a means of making changes to the network parameters.

With the exception of the last bullet item, this project includes aspects of all of these features. (Implementing the last item in the list requires write access to the backbone components of the University's entire network; Information Services is understandably reluctant to permit such access by an undergraduate project.)

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<sup>1</sup> C. Thomas Nute, Associate Professor of Computer Science, Texas Christian University, Ft. Worth, Texas. Email is t.nute@tcu.edu.

<sup>2</sup> L. Donnell Payne, Associate Professor of Computer Science, Texas Christian University, Ft. Worth, Texas. Email is d.payne@tcu.edu.

### TCU Network and Further Requirements

The TCU network is typical of many medium sized local area networks. While it undergoes frequent changes due to expansions, upgrades, etc., its essential features are listed below:

- Approximately 300 internal nodes that are part of the communications network. This consists of a heterogeneous collection of equipment from multiple vendors including bridges, gateways, routers, repeaters, and servers from such companies as Extreme Networks, 3Com, Cisco, Compaq, HP, and Apple.
- Two major subnets and several minor subnets that are superimposed on the physical network. The two major subnets are the faculty/staff network and the student network.
- In excess of 9500 end user nodes (i.e. leaf nodes) consisting of workstations, printers, file servers, and laboratory devices. The workstations consist of Apple Macintoshes, Intel based PCs, Sun Workstations, etc. They run MS Windows, Unix, Linux, and Mac OS.
- The backbone of the University's network is implemented using the TCP/IP protocols and services. The University has access to both the Internet and Internet2 via a pair of leased T3 lines. It is available 24 hours a day, seven days a week. TCU's network is administered and maintained by a staff of full time employees augmented by part-time student workers.

The customer wants to monitor this network in a "user friendly" way. In particular, graphical displays are to be used where feasible. It was decided early in the project that the interface should be web-based and the user should be able to monitor the network using a standard browser such as Internet Explorer. A hierarchical set of views is required with the higher level displays showing just the major features of the network, but with the capability to "drill down" to lower levels using a mouse device to obtain additional details. Views must be implemented using a standard symbology for various classes of devices and color codes to reflect the state of a device or link between devices (e.g. "green" for fully operational, "yellow" for marginal or near capacity, and "red" for failed). The customer also wants to be able to view such parameters as the utilization of disk space, memory, and CPU usage; message packet queue lengths, throughput and delay, as well as number of lost or rejected packets.

### Developing a Prototype

The requirements of the course dictated that the students develop a rapid prototype. In order to do this the team decided on a rudimentary implementation of the data collection, historical database, and display capabilities. This prototype was successfully completed in approximately a month and has provided valuable knowledge and insight into critical issues of the project.

At the beginning of the project, the first challenge was to determine what network data was necessary and how to obtain it. Fortunately, most commercial network equipment manufactured in the past five or ten years has included support for the Simple Network Management Protocol (SNMP)<sup>i</sup>, a TCP/IP supported service. A major advantage of SNMP is the generality that it offers for identifying the values that a

particular device makes available and a relatively simple set of commands to retrieve this data. Unfortunately, the implementation of SNMP provided by the various vendors is uneven, sometimes inconsistent, and often poorly documented.

It was apparent that a flexible interface for using the monitor tool would be required to support both the changing network environment as well as the multitude of vendor implementations of SNMP. The students elected to use a configuration file to describe the network and its components as well as the monitoring data requested by the user. They choose to represent this information as an XML file. This offered a number of benefits. The file contents are in ASCII, thus allowing easy visual inspection. There are editors, viewers, and consistency checkers for creating XML files. And because XML supports the Document Object Model (DOM), there is a public domain API available that supports structured access to the file.

The configuration file is the repository for all information related to components of the network, the SNMP variables<sup>11</sup> that are to be collected, and the format of the data displays. The file's organization is hierarchical and reflects the structure of the network being monitored. When the network is modified in any way then the configuration file is edited to reflect the change. Both the historical database and the display capability of the tool track the structure of the configuration file. Furthermore, the database and displays are automatically updated as a consequence of any changes made to the configuration file. This approach helps ensure a consistent view of the network throughout the entire network monitoring system.

The configuration file entry for a network device, such as a router, would include the device's IP address and the SNMP identifiers for values that are to be collected. (Other features of the device, such as the identity of physical ports, frequency of monitoring, etc. would also be included in the device's configuration file entry.) The data collection is performed by periodically sending SNMP commands to the device. The command structure is very simple consisting of a command verb (e.g. GET), the device's IP address and a list of one or more SNMP identifiers. A successful SNMP command returns a string representation of the values being collected. The returned values are extracted from the string, any necessary transformations, such as scaling, are performed and the result is added to the database.

The display portion of the network monitoring tool is a web-based application. A Windows 2000 machine executes Perl scripts to obtain the network data and maintain the historical database. This same machine is configured as a web server. The server runs Apache Tomcat in order to support Java Server Pages (JSP). The display interface is written in JSP. When the client requests a particular network display, the request is sent to the server which in turn passes the JSP to Tomcat for execution. The embedded JSP code accesses the XML file created by the database and dynamically creates web page content that is then passed back to the client's browser for display.

### Observations and Concluding Remarks

Clearly, the configuration file is a significant element of the entire monitoring tool. It has been very gratifying to observe the progress of the students as they wrestled with the question of how to implement this file. They soon realized the benefits of having a common structure for use throughout the system, the advantages of using XML with its

flexibility and available support, and the importance of having the file structure reflect the layout of the network being modeled. They have been quick to recognize issues when they arose and addressed the questions in a mature way. As an example, when the decision was made to extract information from the database in the form of an XML document the question of available resources arose. The students developed a worst-case test scenario and came to the conclusion that there was adequate real-time available to monitor the University's network, but that there was very little reserve capacity. As a result, they are now re-examining the question of when to generate the XML files – each time the database is updated (the original approach) or “on demand” when a data display is requested. The students researched this and other issues and made any necessary decisions entirely on their own. (Note that the faculty advisors had originally assumed the configuration file would be a flat, unstructured file of records as opposed to the approach selected by the students.)

The students began work on this project at the beginning of this term approximately twelve weeks ago. They have had to learn a great deal about networks, SNMP, Perl and JSP, as well as the various document types. They were given an initial introduction to networks and SNMP in the first couple of weeks of the term, but have had very little direct faculty assistance since then. They have been required to meet deadlines for design reviews and developed a basic prototype; to date they have been ahead of schedule and made excellent progress.

In the remaining month of this term the students plan to verify that their design will “scale up” to the size of the University's entire network. One significant aspect of this is populating the configuration file with data concerning all of the network elements. This will require reviewing manufacturer's documentation to identify the SNMP identifiers. And while progress has been good to date, the analysis capabilities of the project have not yet received any serious consideration. This will be the focus on their next term's efforts.

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<sup>i</sup> Stallings, William, *SNMP, SNMPv2, and CMIP: The Practical Guide to Network-Management Standards*, Addison-Wesley, 1993.

<sup>ii</sup> Perkins, David and Evan McGinnis, *Understanding SNMP MIBS*, Prentice Hall, 1997.



## **Developing a MIS Major and Support Facilities: A Unified Project**

Gary Fisher<sup>1</sup>

Management Information Systems courses were introduced to the Angelo State University campus as of the fall semester 1996. This involved the creation of courses that were at first taught under the Management 4381 series of seminar courses. These courses were eventually cataloged as MIS courses once the MIS option to the management degree was approved in October of 1998 and became effective with spring semester 1999. It is not clear what this approach to MIS was supposed to achieve, but the four courses so cataloged were:

MIS 3303 Network Application Development. This course will define and study client/server, networks, the internet, and multimedia. The nature of hypermedia and the challenge of designing effective hyper-learning materials will be discussed. The students will be provided with a multimedia toolbox and shown how to use it to create and publish multimedia applications. Discussions will include multimedia regulation, copyright, fair use, equity, cost, and universal access.

MIS 3343 Management Information Systems. The course will provide a foundation in the theory and practical application of information systems within an organization. Managing, analyzing, designing, and implementing an MIS will be the focus of the course. Strategic value, methodologies, quality, decision making, modeling, reengineering, software, hardware, and ethics will all be included.

MIS 4336 Management and Designing of Networks. The course will provide a foundation in the theory and practical application of LAN design and implementation. How LANs can be connected to other LANs, MANs, wide-area networks (WANs), and larger mainframe computers will be presented. Students will be provided with an insight into emerging LAN/WAN technologies and their potential impact on the future of LAN/WANs. Topics covered in class will be demonstrated online using Novell NetWare, Windows NT, or another leading LAN operating system.

MIS 4344 Advanced Management Information Systems. A course intended to provide study and applications beyond the foundation course in MIS. Emphasis will be given to current technology and applications.

What is clear, from the above catalog descriptions, is that there was a heavy emphasis on instruction dealing with networking. This is significant in that it lead to the acquisition of a classroom to be developed into a network laboratory. However, little progress was made with this facility as the faculty member who introduced MIS to the campus and who authored the above course descriptions left Angelo State University in May of 1999. During the academic year of 1999 – 2000, the cataloged courses were taught by various faculty members while a search for a replacement Ph.D. in MIS was underway.

The above situation was inherited by the newly hired MIS Ph.D. in late summer of 2000. At that time, the classroom intended to become a networking lab was in a state of great disarray. The room resembled a store room that could have served as a classical

example of entropy. Furniture which had been purchased for the room was stacked in various piles about the room and a sizeable number of computers, many of obvious age and no-further technical value, were about the room in various states of disassembly. All sorts of miscellaneous hardware and much cabling covered the floor.

It was obvious that money had been spent and that no one currently at Angelo State had any idea what the intent of these purchases or activity in the room was supposed to achieve. The saving grace was that the monies so spent had not been spent in a room-specific fashion. This allowed the project to be moved to a more suitable location and provided the argument to develop a classroom specifically for instruction of MIS courses.

The original room seated 16 students, two each at eight tables of attractive quality and seated in high-back executive chairs. The new location, would seat 34 students in the same fashion. This did require, however, that matching furniture be purchased to accommodate the expanded capacity. An additional matching table and chair for the instructor's work station was included.

With the physical facility effort renewed, attention turned to developing the course of study for a major in Management Information Systems and the removal of MIS as an option to the management degree. The university administration endorsed this objective and willingly underwrote the project financially.

### **The MIS Major**

The academic discipline of Management Information Systems is sufficiently mature to suggest that all one must do to establish a course of study with a major in MIS is to simply find a curriculum model and place it in the university's catalog. However, such would suggest that all necessary resources to support such a model are readily available. Few universities would find those resources to be obtainable, especially considering the very limited supply of personnel available at the time of this project. Therefore, the catalog of courses must satisfy both the student's need to be educated so as to be marketable, and the faculty's ability to support the program. At Angelo State, the faculty consisted of the newly hired Ph.D. in MIS, a second position for an additional MIS Ph.D. that would soon become approved, and one or two other faculty who were qualified to teach selected MIS courses.

The approved major, which becomes effective with fall semester 2003, consists of four new courses in MIS, some reworking of the existing four courses in MIS, and four other courses tailored to the needs of the major by the Computer Science Department. The relationship between the MIS faculty, who are members of the Management and Marketing Department, and Computer Science is facilitated by both departments being in the same college of the university. Each faculty has their own department chair to whom they report, but the two chairs report to the same dean. Computer Science was found to be very supportive of the new major and is cooperating in the development of their courses.

The four courses being developed by Computer Science are included in the suggested course of study, on a year by year basis, shown below:

Year 1			Year 2	
Term 1	Hours		Term 1	Hours
ENG 1301	3		BA 2331	3
HIST 1301	3		ENG (Soph. Lit.)	3
MATH 1311	3		ACC 2301	3
Science with lab	4		PSY	3
BA 1301	3		GOVT 2301	3
PA	1		ECO 2301	3
Term 2			Term 2	
ENG 1302	3		ACC 2302	3
HIST 1302	3		ECO 2302	3
MATH 1312	3		GOVT 2302	3
Science with lab	4		CS visual basic	3
Art, music, drama	3		COMM 2301	3
<b>Total Hours per year</b>	<b>33</b>			<b>33</b>

Year 3			Year 4	
Term 1	Hours		Term 1	Hours
MKT 3321	3		MIS 4343 A and D	3
ACC 3301	3		MIS 4336 Data Comm	3
MGT 3301	3		CS dot-net	3
CS java	3		BA 4319	3
MIS 3343	3		Free elective	3
BA 2345	3			
Term 2			Term 2	
CS jsp or php	3		MIS 4344 Database	3
MIS 3303 Web Dev	3		MIS 4351 E-Business	3
FIN 3361	3		MIS 4361 MIS Seminar	3
MGT 3305	3		MIS 4401 Practicum	4
ENG 3352 Bus Comm	3		BA 4303	3
	<b>33</b>			<b>31</b>

The total of 130 hours of study is the requirement for a Bachelor of Business Administration degree from Angelo State. The catalog descriptions for the four new courses are shown below:

MIS 4343 System Analysis and Design. Provides an understanding of the system development and modification process. Emphasizes the factors for effective communication and integration with users and user systems. Encourages interpersonal skill development with clients, users, team members, and others associated with development, operation, and maintenance of the management information system. Use of data modeling and analysis tools.

MIS 4351 Electronic-Business. Survey of managerial and technical practices in electronic-business. Explores how doing business via the World Wide Web differs from all previous business paradigms. Examines the linkage of organizational strategy and electronic methods of delivering products, services, and exchanges in interorganizational, national, and global environments.

MIS 4361 Seminar in Management Information Systems. Designed to acquaint the student with current literature and to evaluate new technological developments in the field of management information systems.

MIS 4401 Practicum in Management Information Systems. Instruction providing detailed education, training, and work-based experience in the design and administration of management information systems, generally at a work or organizational site. The practicum is an unpaid learning experience involving actual information systems under the supervision of a faculty member. Student teams will evaluate the design and implementation of a significant information system or will develop such a system where none exists. Project management, management of the information systems function, and systems integration will be components of the project experience.

A feature of MIS 3303, the web development course, is a dedicated web server. Students taking the course are given 50 megabytes of disk space to build their web sites. These sites are retained until the disk space is needed for a future class, which could be a decade or more. Students have access to the server after graduation so as to keep their sites up to date. This server is administered by the MIS faculty. ([www.mis.angelo.edu](http://www.mis.angelo.edu))

The balancing of courses and resources will produce a graduate who is exposed to training that will allow them to:

1. Determine the information systems needs for an organization through systems analysis and design.
2. Design and build those systems.
3. Design and create data storage systems under a database management system.
4. Build a web site.
5. Interface other systems to a web page.

Considering the extent of resources available to the program, this list of credentials should make our graduates attractive to employers.

### **The MIS Classroom** ***The physical support facility***

The room chosen for the MIS classroom is thirty by forty feet and is located very close to the Information Technology Department's network equipment room. This facilitates the running of network cabling. The only drawback to the location is its proximity to outside entrances to the building, one of which is a loading dock. One of the two doors to the room opens onto a loading dock which is not normally occupied. The other door to the room opens onto an inside hallway on the ground floor of the building which is very near an outside entrance.

The security of the room is dealt with through an alarm system and locked doors. Each instructor using the room is responsible for the room while his class is present. Each department with classes scheduled in the room is issued their own alarm code. Therefore, if the alarm code issued to a given department is compromised, that code can

be changed without having to advise all others holding an alarm code. There is also a guest code that can be changed after each instance of being issued to someone for a visit to the room. The alarm system is monitored remotely by an off-campus service.

Raceways were installed in the floor of the room when it was constructed some twenty years ago. This permitted installing all cabling, both power and network, under the floor. This was considered to be an essential feature of the room as the line of sight between student and instructor must not be obstructed. Air conditioning and lighting were both altered. The air conditioning was increased so as to accommodate the added load of 35 computers. The lighting was altered by replacing all fixtures, which are equipped with computer-room diffusers.

The diffused light eliminates reflections of overhead fixtures from computer screens and also the effect of 120 Hz flicker that is characteristic of fluorescent fixtures. This flicker is particularly annoying because of the fixture being located above the people in the room. The light from above enters the pupil of the eye at such an angle that it strikes the edge of the retina which is most sensitive to flickering light. The specially designed diffusers eliminate this spectacular light and the associated eye strain and fatigue.

Eye strain is further reduced by choice of colors for the room. The tables are built by Texas Prison Industries and come in the appropriate two-tone gray scheme. The carpet is of a bluish-cast tweed-type pattern which should not show dirt easily. The blue-gray color of the walls complements and connects the gray of the tables and the bluish color of the carpet. The high-back executive chairs are of a dark-blue color which serves as an accent color.

The seating arrangement is of a pyramid shape. This is to assure that every student has a good view of the large screen at the front of the room. The front row consists of three tables, seating six students, which are centered on the axis of the screen. The second row consists of four tables, seating eight students, which are also centered on the screen axis. Both of the third and fourth rows consist of five tables, seating ten students in each row, and those rows are also centered on the screen's axis. Thus the seating pattern forms a pyramid that is centered in the room and seats 34 students. This leaves aisles on each side of the room of about four feet. The distance from the front edge of tables in a given row to the front edge of tables in the row behind is six feet.

The instructor's table features a video-tape recorder (VCR) capable of playing both VHS and S-VHS tapes. An audio amplifier with AM-FM tuner drives speakers mounted in the ceiling. The instructor's computer is equipped with a DVD player so that almost any video material can be exhibited in the room. A cable-TV drop to the VCR allows for the viewing of TV programs on the large screen at the front of the room. A document camera permits printed material, such as pages from textbooks, and small solid objects to be projected on the large screen at the front of the room.

The opportunity to build the classroom at the same time that the courses to be taught therein was unique. It allowed an integrated view of courses and the room in which they would be taught. Physical support facility needs could be considered along with course content in that the faculty member designing both could write a course description and then immediately include needs to support that course in the physical facility.

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<sup>1</sup>Gary Fisher, Assistant Professor of MIS, Angelo State University, San Angelo, Texas.  
Email is [gary.fisher@angelo.edu](mailto:gary.fisher@angelo.edu)

## **Message-Passing as an Introduction to Distributed Processing In the Undergraduate Curriculum**

Timothy McGuire\*

### **Introduction**

The paper shares recent experience using message-passing as an introduction to distributed processing in lower-level CS courses. These experiences come mainly from using MPI in the CS I course, and comparing the experience with a similar assignment in an upper-level (operating systems) course.

Distributed processing is not yet included in the standard computer science curriculum. When it is introduced, it is usually done in an advanced course. Nonetheless, distributed processing is being used extensively in industry, and hence it is an important topic.

There has been a great deal of interest in the construction of Beowulf clusters, and many institutions have constructed these from inexpensive or even surplus machines. The programming of these machines, however, is often difficult. Various means of programming include: PVM, MPI, and Java RMI. Each of these environments has its own idiosyncrasies when it comes to programming in it.

The majority of programming activities in the CS curriculum are done using traditional languages such as C++ or Java. It can be argued that Java is an effective means of teaching distributed processing, but multi-threaded programming does not seem to be touched in most introductory texts. Other traditional languages have no direct support for distributed processing.

There are reasons that an instructor would not want to expose introductory students to distributed processing. These could include: a lack of time in the semester to introduce the distributed paradigm; the potential confusion that would result from exposing beginning students to a second paradigm and function library; the lack of familiarity of the instructor with distributed processing; or the cost of services to support distributed processing. Nevertheless, students should be exposed to this material, and in fact, need the experience.

Which distributed paradigm, then, is most appropriate as a first exposure? Several views can be offered, but our experience seems to indicate that the message-passing paradigm is sufficiently basic, and yet flexible enough to be worthy of consideration.

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\* Timothy McGuire Ph.D, Department of Computer Science, Sam Houston State University, Huntsville, Texas. [cic\\_tjm@shsu.edu](mailto:cic_tjm@shsu.edu)

The major message-passing software systems are PVM (Parallel Virtual Machine) and MPI (Message Passing Interface.) Both PVM and MPI provide a set of user-level libraries for message passing with normal programming languages (C, C++, and FORTRAN.)

In message-passing, user-level libraries are used to:

1. create separate processes for execution on different computers, and
2. send and receive messages between the various processes.

MPI was chosen for this work, since it is a standard for message passing libraries, and has adequate features for most parallel applications. It is the author's opinion that it is simpler than PVM to install, use, and explain. Most MPI programs utilize the SPMD (Single-Program, Multiple-Data) model for distributed processes [4]. In this model, different processes are merged into one program, and within that program, control statement select different parts for each process to execute. All the executables may be started together at the beginning, saving the complexity of implementing (and explaining) dynamic process creation.

### Message-Passing in CSI

Students are first introduced to MPI by using a variant of the infamous "Hello, World!" program of Kernighan and Ritchie. This variant [3] makes some use of multiple processes to have each process send a greeting to another process, as shown in Figure 1.

```
/* From Peter Pacheco, University of San Francisco */
#include <stdio.h>
#include "mpi.h"
int main(int argc, char *argv[])
{
    int myrank;           /* rank of process          */
    int p;                /* number of processes   */
    int source;           /* rank of sender        */
    int dest;             /* rank of receiver      */
    int tag = 0;          /* tag for messages      */
    char message[100];    /* storage for message   */
    MPI_STATUS status;    /* receive               */

    /* Start up MPI */
    MPI_Init(&argc, &argv);
    /* Find out process rank */
    MPI_Comm_rank(MPI_COMM_WORLD, &my_rank);
    /* Find out number of processes */
    MPI_Comm_size(MPI_COMM_WORLD, &p);
    if (my_rank != 0) {
        /* Create message */
        sprintf(message, "Greetings from process %d!", my_rank);
        dest = 0;
        /* Use strlen+1 so that '\0' gets transmitted */
    }
}
```

```

        MPI_Send(message, strlen(message)+1, MPI_CHAR, dest,
                 tag, MPI_COMM_WORLD);
    }
    else { /* my_rank == 0 */
        for (source = 1; source < p; source++) {
            MPI_Recv(message, 100, MPI_CHAR, source, tag,
                    MPI_COMM_WORLD, &status);
            printf("%s\n", message);
        } /* end for */
    } /* end if */
    /* Shut down MPI */
    MPI_Finalize();
} /* main */

```

**Figure 1**

If this program is compiled and run with four processes, the students will see the output as:

```

Greetings from process 1!
Greetings from process 2!
Greetings from process 3!

```

This (relatively) simple program uses only six (of the over 120) MPI functions from the MPI library: `MPI_Init()`, `MPI_Comm_size()`, `MPI_Comm_rank()`, `MPI_Send()`, `MPI_Recv()`, and `MPI_Finalize()`. Experience with CS I students shows that if they are sufficiently motivated and mentored, they can readily grasp what these functions do, and solve a wide variety of problems. All the problems described in this paper may be solved using only these six functions (although some solutions could be made more efficient by using other functions such as `MPI_Bcast()` or `MPI_Reduce()`. [2])

After being exposed to the basics of message-passing, an interesting application is introduced. The typical applications for parallel and distributed processing (large matrix operations, etc.) are not very accessible to the general undergraduate. After some thought and experimentation a simple yet interesting application, making use of synchronous computations was selected: cellular automata.

With cellular automata:

- The problem space is divided into cells.
- Each cell can be in one of a finite number of states.
- Cells affected by their neighbors according to certain rules, and all cells are affected simultaneously in a “generation.”
- Rules re-applied in subsequent generations so that cells evolve, or change state, from generation to generation.

A simple example of this is the 2-D heat distribution problem, in which the boundaries of an area are held at known temperatures, and the problem is to find the temperature within the area. Even though this is often modeled with a partial differential equation, in this simple form, the temperature at an inside point can be computed by taking the average of the temperatures at each of the four neighboring points, and iterating until the difference between iterations is less than some small amount.



Not only does this technique (which is equivalent to solving a forward-difference equation) not require any sophisticated mathematics, by distributing it with one point per process, there is no need for using a 2-D array to store the points.

This makes for a good example. For a student project, the famous cellular automata problem, “the Game of Life” devised by John Conway [1] was chosen. In this board game there is a theoretically infinite two-dimensional array of cells. Each cell can hold one “organism” and has eight neighboring cells, including those diagonally adjacent. Conway derived the following rules “after a long period of experimentation:”

1. Every organism with two or three neighboring organisms survives for the next generation.
2. Every organism with four or more neighbors dies from overpopulation.
3. Every organism with one neighbor or none dies from isolation.
4. Each empty cell adjacent to exactly three occupied neighbors will give birth to an organism.

With sufficient guidance, first-year students are able to translate these rules and into appropriate code. More advanced students may attempt graphical output, but that is not strictly a message-passing issue.

Similar cellular automata problems could also be attempted, such as: “Foxes and Rabbits,” where rabbits move around randomly (reproducing) on a 2-D board, and foxes eat any rabbits they come across; or, “Sharks and Fishes,” where the ocean is modeled as a 3-D array of cells [4].

### **Message Passing in Higher-Level Courses**

The operating systems course is traditionally where the concept of cooperating processes is introduced in the CS curriculum. Here there are a variety of techniques which may be used: multi-threading, semaphores, and monitors, to name a few in addition to message-passing. After using message-passing to solve the bounded-buffer problem, the Game of Life problem was posed as an optional assignment. No in-class exposition was attempted for this problem, only a brief handout explaining how to use the MPI system on the department’s Beowulf cluster was distributed, along with pointers to online documentation and simple examples. The students responded enthusiastically to this assignment, and other extensions were suggested (Foxes and Rabbits, and real-world applications such as beach erosion.)

### **Conclusions**

The experience of introducing message-passing in the undergraduate curriculum has been positive enough for us to continue its use. Lower-level students will need substantial mentoring while being introduced to the concepts. Upper-level students learn to use message-passing quite readily, with little exposition.

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## **E-Commerce Contracts Enforceability**

Keith Jenkins\*

### **Abstract**

With the increased use of the World Wide Web for commercial and consumer transactions and with the passage of the Electronic Signatures in Global and National Commerce Act, more and more sites offer >click to agree= contracts. This paper raises the issue of whether such contracts may be defeated by the argument that they are truly adhesion contracts and that their terms should not be enforced because of a lack of effective consent. Those who contemplate making purchases or signing agreements over the World Wide Web will find this paper useful in understanding why >point and click= type contracts though fitting the description of adhesion contracts may nonetheless be deemed enforceable.

### **Introduction**

In an era where an acknowledged 40 percent of homes have a personal computer and most of them are connected to the internet, electronic commerce is the fastest growing segment of delivery of products to purchasers. While the opportunity to interact with each customer can lead to quicker communication and one might think greater diversity of contracts, the opposite appears to be true. It is apparent that the trend to use standard forms, that began as instant communications first allowed direct interaction over great distance, has led to less diversity and greater similarity of content. In fact many transactions are automated computer contacts offering the consumer a take it or leave it basis. The Seller has a set of choices that the buyer simply points to and clicks a response. The result is an agreement on a set of terms as set forth in the language and containing the terms that the seller has chosen. There is no, Anegotiation,@ the give and take of a bargained for exchange has not occurred. Sellers set the terms and impose an adhesion contract. Terms are becoming universally used by everyone in the industry leaving the consumer with no real choice. One reason sellers hold a superior bargaining position is due to the sellers increased access to buyers. Sellers prior to the internet and electronic communication dealt with a smaller universe of buyers. The seller was required to rely on repeat customers as the basis for their viability. Customer dependence required a more even give and take in the reaching of agreements. The agreement was a result of the parties discussing the various aspects of the sale, and buyers and sellers each gave in to demands of the other party. Today the universe of buyers expands to anyone connected to the internet. A seller may never have another transaction with any given customer. This independence from individual customers allows the seller to disregard the individual, provided the seller operates within the norms of the industry.

It was arguable in prior time that if the buyer objected to a provision in an agreement he could choose to do business with another supplier. In the electronic world that choice quickly disappears. Competitors recognize the value of the limitations, restrictions, and duties imposed in an agreement and quickly incorporate them into their agreements. One example today is the rapidity of arbitration clauses being incorporated

in all type of contracts. This limiting of the rights of the other part to use the courts as a resolution of disputes seems to favor businesses as they are universally adopting it.

### **Contracts**

A contract is an agreement between two or more parties that a court will enforce... Standard form contracts became prevalent after telecommunications made possible the direct interaction of buyers and sellers over great distances. These contracts led to The Uniform Commercial Code (UCC) that has been adopted in all 50 states. Contracts under the U.C.C. were defined to include agreements that are not truly bargained for in the historical sense, but only as to certain terms such as price, quantity or other buyer requirements. Since some of the contract is found in the documents the parties exchanged it is possible that a party may have terms in his agreement that he never realized were present. Some of these contracts began to be complained of as contracts of adhesion. A contract has been described as a contract of adhesion when it arise in a situation where one party has superior bargaining power and the other party is placed in a take-it or leave it situation. The fact that a contract is labeled an adhesion contract is not determinative of its enforceability.

### **E-commerce Contracts**

The internet has brought the contract more diversity and complexity. The contract formed has raised questions relating to the signature required by some statutes for enforceability, to terms that one of the parties had no knowledge of at the time of contracting. Some of the early disputes arose from the purchase over the internet of copyrighted works including the purchase of software and books. In making these purchases, the buyer is instructed to agree to a >point and click= contract which defines the license and restriction of use of the copyrighted material. It seems clear that these purchases without viewing the entire terms are analogous to the shrinkwrap products containing terms inside a sealed package.

In a controversial case the Seventh Circuit found that shrinkwrap license agreements are enforceable. The case involved a purchase of a database software package by a buyer who added data and made the package available through the internet in violation of the shrinkwrap agreement which prohibited commercial distribution of the software by the buyer.<sup>iii</sup> The purchaser of the ProCD package purchased a shrink wrapped box containing a software program and the licensing agreement. The buyer did not have opportunity to read the entire agreement prior to its purchase and claimed it was an adhesion contract. The Court did not rely on copyright law to preempt state UCC law. On the contrary, the Court held that the UCC would be applied to the dispute. The Court ruled that both common law and the UCC supported the enforceability of a money-now-terms-later transaction without dealing with the adhesion issue. Several months later, the Seventh Circuit dealt with a phone mail order for a computer which contained part of the license agreement inside the box with the equipment. The court held the terms enforceable because all the terms inside the box were incorporated into the parties=contract and there was an opportunity for the buyer to return the computer after reading those terms.<sup>iv</sup>

### **Adhesion Contracts**

The adhesion contract is appealing as a method to defeat the enforcement of a contract that upon receipt of the goods the buyer discovers some terms that are unacceptable or reduces the worth of the product to him. This approach is possible but must be viewed in light of the existing law that had developed prior to the internet contracts. The adhesion contract is generally enforceable unless the courts find a reason present that under the legal rules act to render it otherwise.<sup>v</sup>

The courts have analyzed the issue of enforceability under a variety of theories. In some jurisdictions the courts have approached the issue as an issue of whether there was true assent to terms in the Aboilerplate@ upon which there was no negotiation. In some of those the question arises as to the duty of the party to read the entire agreement. The common law rules place a high value on the writing as the complete agreement of the parties and presume it to be the agreement of both parties. What the courts have done is to graft into the normal rule that a party has a duty to read the agreement before signing, an exception where the terms are unfair under the circumstances.<sup>vi</sup> The courts in addition have used public policy, and the concept of unconscionable from the Uniform Commercial Code, as the basis to refuse to enforce standard form adhesion contracts.

The concept of unconscionability became the focus of most courts in holding the adhesion contract unenforceable. In *C & J Fertilizer INC Vs Allied Mutual Insurance Company* 227 N.W.2nd 169 Supreme court of Iowa 1975, the court faced an issue of a term that was defined in it=s Astandard form@ contract in a non typical way. C & J had purchased a policy from Allied for burglary and robbery coverage of it=s chemical plant. The policy had defined a burglary to require@ Visible marks made by tools, explosives, electricity, or chemicals upon, or physical damage to, the exterior of the premises at the place of ...entry.= This definition was not in accordance with the ordinary meaning as most persons understand it or the legal requirements of the State of Iowa. The Company denied the claim on the basis of the definition that the loss was not covered since it did not fit the policy definition of a burglary. The trial court upheld the policy and the appeal to the Iowa Supreme Court in part focused on the issue of the enforceability of the term burglary as defined in the standard form policy. The court noted several relevant factors to the controversy. First, that probably 99% of all contracts are now standard form which have little in common with the historical contracts that the parties participated in choosing the language of the agreement. Second, the buyer of the insurance has a zero chance of negotiating with the company for any change he is in a Atake it or leave it=s situation. Third, the buyer will not read the detailed Standard form or understand it if he does.

In light of these factors the court found that the buyer would have reasonably expected the exclusion of Ainside job@, but the definition making the obligation to pay dependent on the burglars skill was not a reasonable expectation of the buyer. The court found that the exclusion of coverage should not be enforced due to the definition being unconscionable. The Texas courts have made a very clear statement as to the requirements for a person claiming unconscionability. The Court has required that the party show both procedural and substantive unconscionability.<sup>vii</sup> The question, of the procedural aspect of unconscionability is concerned with assent and focuses on the facts surrounding the bargaining process.<sup>viii</sup> The procedural aspect focuses on the question of whether the parties actually bargained over the terms of the contract claimed to be

unconscionable? The substantive aspect of unconscionability, is concerned with the fairness of the resulting agreement.<sup>ix</sup> The issue is whether the result of the agreement is unfairly burdensome when discovered by the complaining party?

### **Procedural and Substantive Unconscionability**

The New York Courts have defined the concept that to prevent enforcement of the contract due to unconscionability the part must show both procedural and substantive unconscionability. Contrary to many arbitration cases, the New York court in *Brennan v Bally Total Fitness* found that the arbitration clause was unenforceable<sup>x</sup>. In this matter Brennan a former employee brought a suit under title VII and the ADA. Bally moved to dismiss and compel arbitration.

Brennan was employed by Bally for some two years prior to filing a complaint for sexual harassment by her manager with the company officer responsible for such complaints. Employees were required to watch a video on harassment, as soon as the video ended they were given a 16 page document that he described as containing procedures for bringing discrimination claims. The employees were told to review, sign, and return the document which allowed the company to use arbitration to resolve disputes. They were given about 5 minutes. . Brennan signed believing that her failure to sign would lead to her termination. The officer checked each employee=s form to see it was signed and gave them no chance to turn it in later after reviewing it personally or with an attorney. Brennan quit her job and filed this cause related to the sexual complaint and her pregnancy. The court found that in order to decide to compel arbitration they first had to determine if there was an arbitration agreement.<sup>xi</sup> The court then reviewed the agreement in light of the law relating to the enforceability of the arbitration agreement as unconscionable. The court stated that the test for procedural inadequacy in forming the contract is whether in light of all the facts the party lacked Aa meaningful choice@ in deciding whether to sign the contract.<sup>xii</sup> The court also found that not only must there be procedural unconscionability but substantive unconscionability. A contract the court said is substantively unconscionable where its terms are unreasonably favorable to the party against whom unconscionability is claimed.<sup>xiii</sup> The court found that this agreement was procedurally unconscionable due to the circumstances of the making denied Brennan the time or opportunity to understand it and coerced her agreement to its terms. The court further held that the agreement was substantively unconscionable because of the unreasonable favoring of Bally. The Court recognized that arbitration clauses can be reasonable even if they favor the stronger party. It did find however that Bally retaining the right to unilaterally modify the agreement, and denying Brennan the right to proceed in court in a pending claim against the company was unreasonable. The court therefore found the agreement unconscionable and unenforceable.

### **Clickwrap/Shrinkwrap, Contracts of Adhesion and Enforceability**

While click-wrap and shrink-wrap type contracts or license agreements may meet the definition of adhesion contracts, those contracts may still be enforced. Successfully preventing the enforcement of those contracts entails establishing that the terms are >unconscionable.= To prove that such terms are unconscionable requires procedural and substantive evidence. The reality is that commercial and consumer transactions are based on contracts in which the seller essentially offers a >take it or leave it= approach.

There is effectively little bargaining power to the consumer other than to shop elsewhere. Adhesion contracts are a reality. However, those drafting and implementing click and agree or shrink-wrap contracts should be aware that if they cross the boundary of >unconscionability, = their agreements may be unenforceable.

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<sup>iii</sup> ProCD v. Zeidenberg, 86 F.3d 1447 (Seventh Cir. 1996) and Goodman, Batya ANote: Honey, I Shrink-Wrapped the Consumer: The Shrink-Warp Agreement as an Adhesion Contract@, 21 Cardozo. L. Rev. 319, October 1999.

<sup>iv</sup> Hill v. Gateway200, inc. 105 F.ed 1147, 1149 (7<sup>th</sup> Cir. 1997), cert denied, 118 S.Ct. 47 (1997) as cited in Goodman, Batya ANote: Honey, I Shrink-Wrapped the Consumer: The Shrink-Warp Agreement as an Adhesion Contract@, 21 Cardozo. L. Rev. 319, October 1999.

<sup>v</sup> 62B Am. Jur 2<sup>nd</sup> Private Franchise Contracts ' 344(1990)

<sup>vi</sup> Contracts John J. Calamari and Joseph M. Perillo West Publishing St. Paul Minn. 3rd edition, 1987, ' 9-44.

<sup>vii</sup> Arkwright -Boston Mfrs. mut ins.co. V Westinghouse Elec. Corp. 844 F.2d 1174, 1184 ( 5<sup>th</sup> Cir.1988)

<sup>viii</sup> Pony Express courier Corp V Morris, 921 S.W.2d 817( Tex. App-San Antonio 1996 no writ)

<sup>ix</sup> Ibid.

<sup>x</sup> Brennan v. Bally Total Fitness (2002) --- F.Supp.2d ----, 2002 WL 10434, 88 Fair Empl.Prac.Cas. (BNA) 335, 22 NDLR P 134 S.D.N.Y.

<sup>xi</sup> Ibid

<sup>xii</sup> Ibid

<sup>xiii</sup> Ibid

## **The Role of Technologies in a Modern Urban Higher Educational Institution**

Steve A. Reames<sup>3</sup>

Our culture of urgency is splitting space into time. Although residences and work places have drifted physically closer over the last thirty years, travel time between residence and work has been increasing. Urban sprawl has thinned the human population to a level where interesting activities associated with diversity don't spontaneously appear, and has created conditions where automobiles can no longer travel space in reasonable lengths of time. In these circumstances, individuals are faced with a choice: (1) they can endure further degeneration of their time-space circumstance, (2) They can re-group at the city center and attempt to regenerate the diversity within the bounds of the city, or (3) they can turn and run. Not surprisingly, telecommunications technology, rather than the telephone, remains at the center of this choice.

The paradox of urgency and time permeates the academy of learning. It is becoming increasingly difficult for time-constrained students to travel to campus or students who must live with multiple responsibilities (work, family, school) to live on campus, a place primarily dedicated to a single responsibility. Just as our cities are confronted with the need to reduce the friction of distance while maintaining the vitality of the community, so are our colleges and universities.

Universities are responding to the culture of urgency using various technological strategies to allow people to be in two places at the same time. One strategy centers on improving on-line access to a university's libraries, Internet point-of-presence, and individual class resources (faculty-student e-mail, bulletin board's, web pages, typically using modem pools and client-server technologies). A second strategy focuses on managing time; specifically time students must be in a particular place at a given time. Faculties are videotaping lectures so that individual students can attend lectures during their available time either in their own homes or at a central media laboratory. A third strategy promotes academic groupware, to allow students and faculty to be members of groups that meet from independent places either synchronously or asynchronously.

However, these innovations could be considered as parallel to efforts to accommodate the time/space crunch of individuals in other work environments. But innovations developed in the academic workspace, in my opinion, will be elevated to a contest for institutional survival. You see, technology weakens the "natural monopoly" of educational institutions once afforded by physical presence. Predictably, and one day, a battle will persist in the purview of accreditation.

In conclusion, my belief is in technological collaboration between two or more universities (campuses). This collaboration can be understood as founded on the model of distance education in which one locale delivers its expertise to a collaborating institution. This approach can be structured to avoid competition for students and the

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<sup>3</sup> Steve A. Reames, Assistant Professor of Management Information Systems, Angelo State University, San Angelo, Texas, Email is [steve.reames@angelo.edu](mailto:steve.reames@angelo.edu)



state and federal resources based on enrollments. A carefully planned and tested technological collaboration will meet the student/consumer's implied need for co-location of physical and electronic space.

## **The ADA and Website Compliance**

Charles R. B. Stowe<sup>\*</sup>

### Introduction

This research was undertaken to consider the following question: whether the Americans with Disabilities Act (ADA) applies to websites, and if so, what sort or compliance is required and for what types of sites? While there are no Supreme Court pronouncements on the specifics of the applicability of ADA to websites, there is a body of case law and regulatory standards. Assuming that the ADA does apply to websites, this article introduces the technologies and sources of information on how to design a website that might be considered ADA compliant.

### Brief Legal History

The first major federal legislation concerning individuals with disabilities was Section 504 of the Rehabilitation Act of 1973 which prohibited discrimination against persons with certain disabilities by recipients of federal financial assistance, including federal agencies. This Act applied only to the federal government or to private organizations that had contracts with the federal government.<sup>xiv</sup> In 1998, Congress amended the Rehabilitation Act to require Federal agencies to make their electronic and information technology accessible to people with disabilities. The law applies to all Federal agencies when they develop, procure, maintain, or use electronic and information technology. Under Section 508 (29 U.S.C. Section 794 d), agencies must give disabled employees and members of the public access to information that is comparable to the access available to others.<sup>xv</sup> The Access Board is an independent government agency that has issued standards to govern the implementation of Section 508. They offer a full website explaining their standards and providing technical information on compliance.<sup>xvi</sup> While the information is oriented to federal government agencies, it is a useful source of technical information for commercial website compliance with ADA.

The Americans with Disabilities Act was enacted by Congress in 1990 and signed into law by President George Bush for the purpose of removing barriers that block the nation's disabled from public facilities and employment opportunities.<sup>xvii</sup> The ADA simply took the language of the Rehabilitation Act of 1973 and extended it to persons with disabilities in the private sector employment (Title I), to those who use public services (Title II), to enable access to public accommodations (Title III), and to telecommunications (Title IV).<sup>xviii</sup>

## ADA and Websites

Some legal commentators suggest that Title III of the ADA provides the best legal platform for arguing that websites are covered under the Act.<sup>xix</sup> If a website is considered the equivalent of a public accommodation, then the ADA clearly applies. There is no specific language in the Act equating a website with a public accommodation, but legal scholars argue that the legislative history, meaning the texts of supporters of the legislation, demonstrate that supporters intended to remove barriers faced by disabled when using public accommodations, seeking employment or merely trying to access physical commercial establishments. There should be no dispute that in 2003, the World Wide Web is a major source for recruiting and employment opportunities, for selling goods and services, for information, and for educational opportunities. The simple logic of excluding disabled from this massive resource is a compelling argument that the ADA does apply to websites. Title III defines private entities as public accommodations “if the operations of such entities affect commerce.”<sup>xx</sup> There are several circuit court of appeals cases that offer judicial interpretations of the Act supporting the position that accommodations under the ADA are not limited to physical facilities.<sup>xxi</sup> There are other circuit courts that have ruled that a place of public accommodation must involve a physical facility.<sup>xxii</sup>

Title III defines a “public accommodation” as an entity whose functions fall into any one of twelve categories. The categories include the following:

- a. place of lodging: inns, hotels, motels;
- b. establishments serving food: restaurants;
- c. place of exhibition or entertainment: movie theatres, concert halls, stadiums;
- d. place of public gathering: convention centers, lecture halls;
- e. sales or rental establishments: bakery, grocery stores;
- f. service establishments: dry-cleaners, bank, barber shops;
- g. public transportation terminals;
- h. place of public display or collection: museum, libraries;
- i. place of recreation: parks, zoos;
- j. place of education: nursery, elementary, secondary, undergraduate and graduate;
- k. social service establishments: day care center, senior citizen center, food banks;
- l. place of exercise or recreation: gyms, health spas, golf courses.<sup>xxiii</sup>

The Department of Justice and the Department of Education regard the ADA as applying to websites which receive federal funding. In 1997, Senator Tom Harkin, one of the original sponsors of the Act, wrote a letter to the United States Department of Justice seeking clarification of the government’s position on whether websites fall under the jurisdiction of the Act. He received an answer from Deval L. Patrick, Assistant Attorney General, Civil Rights Division. The response was “The Americans with Disabilities Act (ADA) requires State and local governments and places of public accommodation to furnish appropriate auxiliary aids and services where necessary to ensure effective communication with individuals with disabilities, unless doing so would result in a fundamental alteration to the program or service or in an undue burden. 28 C.F.R. Sec. 36.303; 28 C.F.R. Sec. 35.160.”<sup>xxiv</sup>

Although the Rehabilitation Act applies only to federal agencies, Section 508 does apply to states through grants distributed by the Department of Education. Both the Technology-Related Assistance for Individuals with Disabilities Act of 1998 and the Assistive Technology Act of 1998 require agencies receiving grant funds to comply with Section 508.<sup>xxv</sup> As related to educational opportunities and services, the Americans with Disabilities Act specifically requires all examinations and courses for 'licensing, certification, or credentialing must be offered in an accessible format. This has resulted in the Department of Justice requiring private, commercial bar exam, CPA exam and college entrance exam preparatory organizations to provide auxiliary aids such as qualified sign language interpreters, assistive listening devices, and materials in Braille.<sup>xxvi</sup> One can make the argument that web-based courses should be designed to be accessible or at least the sponsoring institution should offer some alternative access for those who require it.

Perhaps the strongest argument in favor of applying the Americans with Disabilities Act never went to trial or to appellate review. In 1999, the National Federation for the Blind threatened litigation against AOL. Their lawsuit charged that AOL's service, the nation's largest internet provider at that time, was not compatible with the software required to translate computer signals into Braille or synthesized speech. The suit cited the ADA Title III's provision that "no individual shall be discriminated against on the basis of disability in the full and equal enjoyment of the goods, services, facilities, privileges, advantages, or accommodations of any place of public accommodation by a person who owns, leases (or leases to), or operates a place of public accommodation."<sup>xxvii</sup> There were other aspects to AOL's interface with potential clients such as requiring them to fill out a form that was not available in a format that the blind could respond to. In July 2000, an out-of-court settlement was reached in which AOL agreed to recode their software and make other operational changes to facilitate access by the blind to their services.<sup>xxviii</sup> Evidently, AOL's attorneys and management felt it was less expensive and less risky to reach a settlement than to face the negative publicity and possibility of losing than to change their software.

For large commercial operators of websites and particularly for institutions of higher learning, a prudent policy is to assume that websites must comply with the Americans with Disabilities Act.

### Compliance – No Undue Burden

One of the least explained and commonly litigated provisions of the ADA is that any accommodation to the disabled should not create an undue burden.<sup>xxix</sup> The issue of whether compliance is an undue burden or imposes an 'unreasonable expense' is based on the following factors:

- (1) The nature and cost of the action needed;
- (2) The overall financial resources of the site or sites involved in the action (meaning that the larger the institution or bigger the company, the more they should be expected to spend.)
- (3) The geographic separateness and the administrative or fiscal relationship of the site or sites in question to any parent corporation or entity;

(4) If applicable, the overall financial resources of any parent corporation or entity; the overall size of the parent or corporation or entity with respect to the number of its employees; the number, type, and location of its facilities; and

(5) If applicable, the type of operation of any parent corporation or entity, including the composition, structure and functions of the workforce of the parent corporation or entity.<sup>xxx</sup>

What the above means is that a major Fortune 500 company would be expected to spend more on an accommodation than a small business. And, where there are two relatively comparable solutions such as buying a pillow for an individual with a bad back or buying a \$1,900 chair, the pillow would be considered the reasonable accommodation. In the context of governmental agencies, the Access Board provides some clarification of the term "undue burden."

"The legislative history of the ADA states that the term undue burden is derived from section 504 and the regulations there under, and is analogous to the term "undue hardship" in Title I of the ADA, which Congress defined as "an action requiring significant difficulty or expense." 42 U.S.C. 12111(10)(A). See, H. Rept. 101-485, pt. 2, at 106. In the NPRM, the Board proposed adoption of "significant difficulty or expense" as the definition for undue burden. No changes were made to that aspect of the definition in the final rule.<sup>xxxi</sup>

#### Sources of Information for Compliance

Fortunately, there are many relatively inexpensive ways of making a website ADA compliant so that for most institutions of public education, it is unlikely they would be shielded from at least offering alternatives. For example, while it might be expensive to producing a sign language version of streaming video, providing a transcript is a relatively inexpensive alternative. Tagging all photos on a web site with ASCII-text descriptions of the scenes is not prohibitively expensive which would assist blind people with reader technology to use a web site. Making photos useful for people who are color blind can be solved by commercial software that analyzes color images and changes them to be distinguishable by people who are color blind! Enabling the blind to access web sites can be solved by using commercial software designed to be compatible with screen reader technology. Offering transcripts of recorded audio solves the problem of access for people with hearing problems. By no means is the above a complete inventory of issues related to ADA compliance, but a sampling of the issues a webmaster should be aware of.

For institutions of higher education, the first place to start is the Access Board's website which provides specifics on website compliance.<sup>xxxii</sup> These regulations were published in Code of Federal Regulations.<sup>xxxiii</sup> There is the Department of Justice's website devoted to ADA compliance but this site is not limited to websites.<sup>xxxiv</sup> However, the most useful site is produced by the Trace Center at the University of Wisconsin. The Center is devoted to the issue of making websites accessible to people with disabilities.<sup>xxxv</sup> This website should be bookmarked because it contains literally hundreds of links to studies, commercial products, conferences and other sources of information on designing accessible websites.

## Conclusion

The issue of ADA compliance for websites is relevant to both designing a website and conducting a course in web-site design. While the likelihood of the loss of federal funding is fairly remote, the use of funds for litigation when sites are not compliant is unproductive. Fortunately, most of the access issues require sophisticated but readily available off-the-shelf commercial products. Awareness of these products and how they integrate with web design should be an important facet of computer education.

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\* Charles R. B. Stowe MBA, JD, Ph.D, Professor, College of Business Administration, Sam Houston State University, Huntsville, Texas.

<sup>xiv</sup> Ranen, Jeffrey Scott "Was Blind But Now I See: The Argument for ADA Applicability to the Internet" 22 B.C. Third World L.J. 398, Spring 2002. And see Stowe, Matthew A. "Note: Interpreting 'Place of Public Accommodation' Under Title III of the ADA: A Technical Determination with Potentially Broad Civil Rights Implications" 50 Duke L.J. 297, October 2000.

<sup>xv</sup> <http://lists.w3.org/Archives/Public/w3c-wai-ig/1997OctDec/0099.html>

<sup>xvi</sup> <http://www.access-board.gov/>

<sup>xvii</sup> President's Proclamation for National Disability Employment Awareness Month, 26 *Weekly Comp. Pres. Doc.* 1582 (Oct. 12, 1990).

<sup>xviii</sup> Ranen, *op.cit.* p. 393.

<sup>xix</sup> *Ibid.*

<sup>xx</sup> *Ibid.* p. 390.

<sup>xxi</sup> See *Carparts Distribution Center, Inc. v. Automotive Wholesaler's Ass'n of New England, Inc.* and 179 F.3d 557 (7<sup>th</sup> Cir. 1999) and *Doe v. Mutual of Omaha Insurance Co.*, 37 F.3d 19 (1<sup>st</sup> Cir.1994) as cited by Ranen, *op.cit.*

<sup>xxii</sup> *Parker v. Metro Life Ins. Co.* 121 F.3d 1006, 1014 (6<sup>th</sup> Cir.1997)(en banc), cert. Denied 522 U.S. 1084 (1998); *Ford*, 145 F.3d at 614 as cited in Robertson, Cassandra Burke "Providing Access to the Future: How the Americans with Disabilities Act can Remove Barriers in Cyberspace" 79 *Denv.U.L. Rev.* 199, 2001.

<sup>xxiii</sup> 42 U.S.C. Section 12182 (a) (1994).

<sup>xxiv</sup> U.S. Department of Justice Opinion posted in the *National Disability Law Reporter*, Vol. 10, Issue 6, par. 240, September 11, 1997 1053-1084/97.

<sup>xxv</sup> Robertson, Cassandra Burke "Providing Access to the Future: How the Americans with Disabilities Act can Remove Barriers in Cyberspace" 79 *Denv.U.L. Rev.* 199, 2001.

<sup>xxvi</sup> *Ibid.*

<sup>xxvii</sup> 42 U.S.C. 12182 (a) (1994) as cited by Bick, Jonathan "Americans with Disabilities Act and the Internet", 10 *Alb L.J. Sci & Tech.* 205, 2000.

<sup>xxviii</sup> Ranen, *op.cit.*

<sup>xxix</sup> 28 CFR Section 36.104 (1994).

<sup>xxx</sup> 28 CFR 36.104. as cited by Robertson, *op.cit.*

<sup>xxxi</sup> <http://www.access-board.gov/sec508/508standards.htm>.

<sup>xxxii</sup> *Ibid.*

<sup>xxxiii</sup> 36 CFR Section 1194

<sup>xxxiv</sup> <http://www.usdoj.gov/crt/ada/adahom1.htm>

<sup>xxxv</sup> <http://www.trace.wisc.edu/>

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### Advancements in Windows XP

David J. Rockefeller\*

Windows XP offers many improvements over Windows 2000. This paper explores the top five improvements. For those who remember the first Windows version, this product has come a long way.<sup>4</sup> For those who are starting to use Windows XP as their first operating system, the advancements in the software may not be as readily apparent.<sup>5</sup>

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<sup>4</sup> Gernour, David "Windows is Launched" *Journal of Computer Research*, Vol 58, No. 3, May 1998, pp 57-57.

<sup>5</sup> Ballomore, Susan "XP - A Critique" *BTU Journal of Computer Science*, Vol. 77, No. 2, summer 2002, pp. 78-90.