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AICPA InfoTech UPDATE

Practical Advice For Implementing Technology

What Makes a Database Management System Relational?

In This Issue:

By Steven W. Bare, CPA

Steve Bare is a member of the AICPA Information Technology Practices Subcommittee. In this article, he discusses the underlying theory of database management systems and some of the ways that accountants can use them.

Database management systems provide powerful tools to organize and manage data. While there are other database management models, relational theory is perhaps the most well known.

Here are three well-known uses of database management systems:

- Using a database management system, an auditor organizes and analyzes loan information as he audits a bankrupt savings and loan.
- A manufacturer uses a database system to track suppliers, delivery times, and costs for raw materials.
- At your local library, the librarians use a database management system to manage the library's inventory—books.

Database Management Systems

Whether you use database management systems in your work, or encounter them while working with clients, an introduction to the underlying theory supporting them will help you understand them. It will also help you evaluate the products and discuss them with coworkers and clients.

Database management systems are among the most widely used software tools; yet, they may also be the least understood. Accountants are familiar with the concept of electronic spreadsheets because they combine the functions of columnar pads and calculators. Word processing software is familiar because it replaces the typewriter. But what connection do database management systems have to the physical world?

Data is only useful if you can organize it and extract information from it. The database management system helps users do this by providing a structure for data and tools to help use the data. The structure and tools are an integral part of the relational database management system (RDBMS) and exist independently of applications developed by users.

A relational database management system is a DBMS that follows a set of rules developed by E. F. Codd, an IBM Fellow. For users to enjoy the benefits offered by the relational model, the DBMS must implement "truly, fully, and correctly," at least the basic features of Codd's model. (Codd's twelve basic features are presented in the sidebar on pages four and five.)

The rules are not arbitrary; they provide a solid theoretical foundation that offers real benefits. It is the power of relational theory that gives the RDBMS power, flexibility, and usefulness. Relational theory is built upon the union of first-order predicate logic and set theory.

First Order Predicate Logic

First order predicate logic provides us with the following logical form:

Proposition
Every salesperson receives commission.
Jones is a salesperson.

Inference
Therefore, Jones receives commission.
By using first-order predicate logic,

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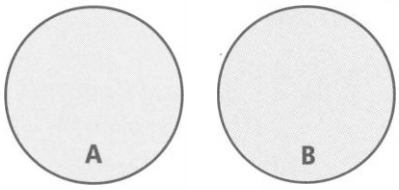
relational databases help us infer things about data from other things we know about the data.

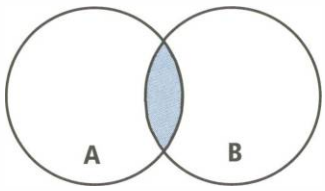
Set Theory

Set theory provides the following:

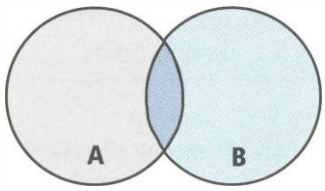
For two sets:



A intersection B yields members the sets have in common.



A union B yields all members of both sets.



Relational Tables

A relation is a special kind of set that we represent with tables. It has the following characteristics:

- Each row represents one occurrence of the relation
- The ordering of rows is immaterial
- The content of each row is unique

Data are organized in tables comprised of columns and rows. Each row represents something real: a loan, a supplier, or a book. Each column represents a separate piece of information about the item in the row. Further, each row must not only be unique, it must be atomic—unable to be subdivided. For example, a phone number and an address should not be stored in the same column.

For example, for an employee, a relation may be presented as in Table 1 on page three.

Rows are called records and columns are called fields. Hence, a record for an employee contains the fields Employee Number, Employee Name, Date Hired, and Salary.

Relational Databases

Relational databases are collections of relational tables. They are not linked to a specific application but can be used by any application that needs the data.

Relational database management systems are collections of data structures and tools. The tools operate on relational tables just as +, -, x, / operate on numbers. RDBMSs also provide tools to secure and maintain the integrity of relational databases. Even though the RDBMS provides data management functions, it is separate and independent of applications.

Records can be located in the relational database by referring to the table name, column name, and some value in the column. Looking to our Employee table, let's process the following operation:

Table=Employee
Column=Salary
List employees with salaries greater than $45,000

This operation yields the relational table in Table 2, page three.

This will only work if each row contains unique data. If duplicate rows are allowed, we will have to resort to some concept of order or "nextness" to process operations. Without indicating an order, we will not be able to express which record we are referring to. This will add complexity, impair the integrity of the database, and reduce the power of the relational model. Duplicate rows are not part of the relational model. However, many vendors do allow duplicate rows.

Keys

Given the requirement of uniqueness of data in each row, we must have some way of guaranteeing that at least one column, or some combination of columns, will have unique values. In the Employee table, the Employee Number must be unique. It serves as the primary key. The RDBMS must enforce the following rules:

- Each primary key must be unique.
- Each record in the Employee table must have a value in the Employee Number field.
- Each table will have exactly one primary key.
- The primary key may be a single column or a combination of columns.

The primary key is not a pointer or a link. It points to nothing and links the table to nothing. Its function is that it uniquely identifies each row of the table.

Throughout the database, whenever you refer to an employee, you can use the Employee Number from the Employee table. Consider the relational table contained in Table 3 on page three.

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Table 1: Employee

Employee Number	Employee Name	Date Hired	Salary($)
10	Bob Smith	08/10/73	47,000
20	Janet Drubek	09/11/93	36,000
30	Cynthia Nicole	03/01/75	53,000
40	Craig Johnson	02/17/85	29,000
50	Sally Turboc	06/15/89	43,000

Table 2: Employees with salaries greater than $45,000

Employee Number	Employee Name	Date Hired	Salary
10	Bob Smith	08/10/73	47,000
30	Cynthia Nicole	03/01/75	53,000

Table 3: Projects

Project Number	Project Name	Project Type	Project Manager	Budget Hours	Actual Hours
100	Creative AdWorks	Audit	50	65	57
150	Smith Mfg.	Tax returns	30	30	28
200	RD Solutions	Consulting	30	90	76

Table 4: Projects by Employee

Employee Number	Employee Name	Project Number	Budget Hours	Actual Hours
30	Cynthia Nicole	150	30	28
30	Cynthia Nicole	200	90	76
50	Sally Turboc	100	65	57

Project Number is the primary key for the Projects table. Project Manager uses Employee Number from the Employee table. Notice that even though we use a different name (Project Manager instead of Employee Number) it represents the same data. That is, the values are drawn from a common domain. So even though the names of the columns are different, they represent the same meaning, a number that uniquely identifies an employee in the Employee table. Codd calls the concept of domain "the glue that holds a relational database together."

In the Projects table, Project Manager is a foreign key: It refers to a primary key of another table. This is an example of how the foreign key, because it is drawn from a common domain, joins the data in the two tables.

This relational table was derived by joining elements of the Employee and Project tables. Its primary key is a composite of Employee Number and Project Number. Employee Number and Project Number are both also foreign keys referring to the primary key of their respective base table.

Note that no pointers or links have been established in the traditional data processing sense. The two tables are joined because they share a field (with common values) drawn from a common domain.

Relational Operators

However, we need to do more than compare values in relational tables. We need tools to manipulate the data. Just as we use mathematical operators to manipulate numbers, we use relational operators to manipulate data in relational tables. Consider the following:

((12-3)/(14+8)) x 893

Mathematics is a powerful tool in part because mathematical operations can be nested. This is so because of the principal of closure. Set theory uses the closure principal too. Each operation on a set produces another set. A set (let's call it S1) contains the numbers 1 through 20. Consider the following operation:

Give us all the numbers from S1 that are less than 10

S1 yields another set (S2), which contains the numbers 1 through 9. We can then perform further operations on set S2. In the same way, each operation performed on a relational table produces another logical relational table.

Relational operations are also closed. Each operation yields a relational table that can be acted upon by another relational operation. Like mathematical operators, relational operators provide us immense power. This results in part from the shared properties of closure and nesting, and

continued on page 4

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because both mathematics and RDBMSs are built on solid theoretical foundations.

It is beyond our scope to deal with all the relational operators. We will examine only the basic operators which, when combined, yield other more powerful operators.

Restriction
Allows users to select certain rows from a relational table.

Projection
Creates a new relational table with some of the columns from one or more tables.

Union
Merges rows from two tables into one.

Difference
Excludes the rows common to each table.

Assignment
Assigns the results of some operation to a relational table.

Basic operators can be nested to produce derived operators. They include:

- Join
- Intersection
- Division

Views and Reports

Views provide a way for us to see the results of our relational operations. Views are windows through which we can see a base table, part of a base table, or part of multiple base tables. Instead of saving the result of the relational operations that created the view, the actual operations themselves are saved. When a user wants to see this view again, the operations are re-executed against the underlying table(s).

As a result, views:

- Automatically reflect changes to the underlying data.

Codd's Basic Rules

While no vendor has yet truly, fully, and correctly implemented Codd's basic rules, they are presented here to help you understand relational theory and to provide a benchmark against which to evaluate relational database products.

Foundation Rule
Any system that is advertised as, or is claimed to be, a relational DBMS must manage databases entirely through its relational capabilities as specified in the relational model.

1. Information Rule
All information in a relational database must be presented explicitly, at the logical level, in exactly one way: by values in relational tables.

2. Guaranteed Logical Access Rule
Each and every atomic value in a relational database is guaranteed to be logically accessible because it resorts to a combination of relational table name, column name, and primary key value.

3. Missing Information Rule
Indicators (distinct from the empty character string or a string of blank characters, and distinct from zero or any other number) should be supported by a fully relational DBMS to represent at the logical level and in a systematic way independent of data type the fact that information is missing for at least two distinct reasons: It is unknown, or it is inapplicable. Besides logical representation, the DBMS must support manipulative functions for these indicators, also independent of data type.

4. Dynamic Online Relational Catalog Rule
The database description is represented at the logical level just like ordinary data, so that authorized users and application programs can apply the same relational language to its interrogation as they apply to regular data.

5. Comprehensive Data Language Rule
No matter how many languages and modes of interaction are supported, the DBMS must support at least one language, expressible as character strings per some well-defined syntax, that is comprehensive in supporting:

1. Data definition
2. Integrity rules definition
3. Data manipulation (interactive and by program)
4. View definition (including updatability)
5. Authorization rules definition
6. Transaction boundaries

6. View Update Rule
For each view, the DBMS must implement a proper algorithm to determine, at view definition time, whether the view can be used to insert or delete rows, and which of its columns are updatable. The result should then be recorded in the system catalog.

7. Set Level Operation Rule
The capability of operating on the whole base or derived tables applies not only to retrieval but also to insertion, modification, and deletion of data.

8. Physical Independence Rule
Interactive operations and application programs should remain logically unimpaired whenever any changes are made in either internal storage representations or access methods.

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9. Logical Independence Rule
Interactive operations and application programs should remain logically unimpaired whenever information-preserving changes of any kind that theoretically permit unimpairment are made to the base tables.

10. Integrity Independence Rule
Interactive operations and application programs should not have to be modified whenever changes to integrity rules (definable with the data language and storable in the system catalog) are made to the database.

11. Distribution Independence Rule
Interactive operations and application programs should remain logically unimpaired when data is first distributed or redistributed.

12. Non-subversion Rule
If a relational database has a low-level (one-row-at-a-time) language, it should not be allowed to subvert or bypass the rules expressed in the high level (set-at-a-time) relational language and stored in the system catalog.

Codd's rules as presented here are taken directly from the work by Fabian Pascal which is referenced in the author's note.

- Simplify data access. It is easier for users to use the view than execute the operations it contains.
- Can be used to implement some level of security by allowing users to see only data they are authorized to access.
- Allow users to perceive the relational database in the ways it is used by their applications. Other users may use the data in different ways.

Reports present the contents of a relational table, or a combination of several relational tables, on the screen or as a printed report.

Vendor Databases

For users to enjoy the benefits of the relational model, vendors must adhere to its fundamentals. Vendors fail to implement the fundamentals in several ways. Here are some of the most common:

- Each table is not required to have exactly one primary key.
- Closure is not enforced. You can create tables that are not relational tables.
- Duplicate records are allowed.

When vendors violate relational integrity, they weaken the database management system and make it more difficult to use.

Even though vendors do not fully implement the relational model, this overview of relational theory should help you understand the basics of relational database technology, enable you to discuss it with clients, and evaluate relational database products.

Author's Note: For further reading on the subject, please see:

The Relational Model for Database Management Version 2, by E. F. Codd, Addison-Wesley, 1990, ISBN 0-201-14192-2.

Understanding Relational Databases with examples in SQL-92, by Fabian Pascal, John Wiley and Sons, 1993, ISBN 0-471-58538-6. **IT**

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Latest IT Publications

The following publications have recently been mailed to IT Section members:

- Client/Server Computing and Cooperative Processing
- Information Security

Video Conferencing Technology, Applications, and Risks

By Karen McClung Feuerborn

Karen Feuerborn is manager of Communications Technologies & Strategies in Dallas, TX for JCPenney. It is her responsibility to evaluate new communications technologies for JCPenney's voice, data, and video networks, and to develop strategies regarding the use of these new technologies in JCPenney's communications systems. In this article, she discusses several aspects of video conferencing beginning with a description of the technology and followed by a discussion of video conferencing applications in various industries and at JCPenney. She also addresses the security risks imposed by use of the technology.

An Introduction to Video Conferencing

Video conferencing is a technology which allows people at different locations to have face-to-face meetings. Video conferencing systems consist of computer hardware and software packages that use telecommunications networks to send and receive audio and video information. They operate just like a telephone call with the addition of a video image of the participants—thereby making it a "video call." The physical aspect of human interaction is vital, with more than 40% of the information exchanged between individuals being conducted in a visual context. Business people spend an inordinate amount of time either on the telephone or in meetings to which some or all of the participants must travel. In the case of telephone calls, the addition of video often results in a more effective communication. In the case of meetings, video conferencing enables meetings to occur more spontaneously and allows attendees to be more easily included at the last minute since they don't have to travel to the meeting location. Video conferencing provides new opportunities for collaboration, teaming, and the building of personal relationships. For many businesses, the net result of video conferencing is greater effectiveness of human resources and increased productivity.

What is Video Conferencing?

A video conferencing system is comprised of several major components: input/output devices, a CODEC, and the telecommunications network. Input and output devices like video cameras, microphones, TV display monitors, and speakers "capture" the audio and video information at one site and "recreate" it on the other site. In Figure 1 on page 7, the video camera and microphone at Site A capture the movement and conversation of the people at that location. The video and audio information is then fed into a CODEC, a computer which converts the information into a format more suitable for transmission over telecommunications networks. The information conversion entails converting the analog video and audio signals into digital signals and applying mathematical algorithms to compress the amount of information from about 90 million bits of information per second to about 112 thousand bits of information per second. Digitization and compression are necessary to reduce the amount of information so that it can be cost effectively transmitted over a telecommunications network. At Site B, the information is decompressed and converted back into analog video and audio signals which are recreated through a TV screen and a speaker system. Other types of input and output devices may be used such as a document camera, which captures images of overhead transparencies, a VCR to input audio and video information previously recorded on tape, or a giant projection screen to display the video for a very large audience.

Types of Video Conferencing Systems

Many different types of video conferencing products are available today. Most products fall into one of three categories: boardroom systems, group systems, or desktop systems.

Boardroom systems are designed for business boardrooms and are typically more expensive as they often utilize more sophisticated accessories and tend to be higher-quality overall systems. Group systems or room systems are used in regular conference or meeting rooms to provide video conferencing for groups of people. Group systems comprise the vast majority of the installed base today. Last of all is the desktop category. Desktop systems are designed for use on an individual's desktop and the video conferencing components are added to the existing personal computer (PC). With desktop video conferencing, the PC monitor becomes the display device, a small video camera and microphone are placed on top of the PC, and the CODEC is on a card that is installed in the PC. Desktop video conferencing is still in the embryonic stage as there are several barriers preventing its widescale use. These include high cost, product incompatibility, and the inability of most existing LANs to support the video traffic.

A Background to Video Conferencing Applications

Video conferencing systems began to emerge in the 1980s. Many people thought the potential applications were limited because video conferencing falls short of in-person or actual face-to-

face meetings. In 1876, when the telephone was patented, many people thought it would only have a limited application because it didn't create a written record of the correspondence, as did the telegraph. Another similarity between video conferencing and the telephone is that in both, early systems were extremely expensive, which inhibited the speed of their widespread adoption. The first video conferencing systems cost around $500,000, with network charges of $900 per hour. In 1920, a long distance telephone call from coast to coast cost $30 per hour, the equivalent of $20,000 per hour in today's dollars. In 1994, video conferencing is still relatively expensive with average room system prices around $40,000, and network costs of $30–$80 per hour. Like the telephone, however, video conferencing is a generic communications tool, and as such has the potential to become a prevailing method of communication. Many people familiar with video conferencing believe that its widespread use is mostly a matter of prices coming down. Until video conferencing prices are further reduced, applications will remain in areas where either the cost of human resources is high, or there is an opportunity for substantial reduction in travel costs. The following section describes some of the interesting video conferencing applications in use today in various industries, professions, and at JCPenney.

Video Conferencing Applications in Various Industries

Video conferencing is being used in a variety of different industries, with 55% of Fortune 500 companies using the technology. In the education industry, video conferencing supports "distance learning" applications which allow students to attend classes taught by other schools. Training is a similar application used by many businesses.

Businesses use video conferencing to communicate with employees, customers, and other companies. Work at home is a business's application of video conferencing with employees. One example of a customer application is a company using video conferencing to add sales support engineers to meetings in which non-technical sales representatives are visiting with customers. Businesses also use video conferencing to conduct campus interviews—which enables the companies to consider applicants from a wider variety of universities.

Video Conferencing Applications Used by Professionals

Law firms use video to conduct depositions. In a major US city, video conferencing was implemented to expedite the booking process of arrested individuals. The benefits included less law enforcement officials having to work overtime to complete the booking process and less arrested people being released due to not being booked within the required period of time.

Video is also used among professionals within different organizations. For example, doctors and specialists use video to consult more freely with one another.

Video Conferencing Applications at JCPenney

Although video conferencing is not a mainstream communications tool at JCPenney, it is used in place of in-person meetings and telephone calls in an effort to improve productivity and reduce costs. Video conferencing has been used to support communications to various international sites including Hong Kong, Taipei, Singapore, Canada, and Australia. Video conferencing also enables JCPenney more effective use of consulting services by eliminating the need for consultants to travel to store sites for meetings and the need to send multiple JCPenney associates to these off-site or out-of-town briefings. At JCPenney's headquarters in Dallas, Texas, four major sites in different areas of town use video conferencing to eliminate the hours of travel between locations. Another application of video conferencing at JCPenney comes through associates using video conferencing to allow them to participate more fully in professional associations. Without video conferencing, the level of participation in professional associations is often limited by the travel and time commitments required. In the executive wing, several of the top management team are testing desktop video conferencing—which they use to communicate with each other and to join meetings which they might not otherwise be able to attend. Most video conferencing applications at JCPenney support routine business activities like information systems project reviews, advertising plan sign-offs,

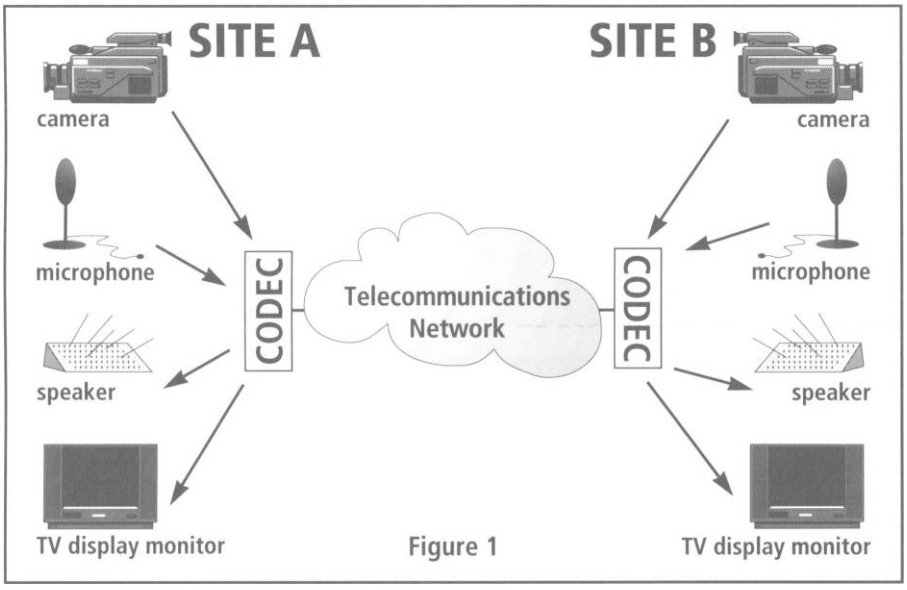

Figure 1

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communications between the accounting center and the corporate headquarters, and extending seminars held at the corporate location to outlying offices. One of the newest applications is the bridging of the video conferencing network with the business TV network. This enables regional managers, who are located in the field, to use video conferencing to access the TV broadcast center at headquarters.

The TV broadcast center uplinks the video conferencing signal and broadcasts it to any or all of the 1250 retail stores. In this manner, regional managers can address any or all of their stores on short notice without having to travel to the TV broadcast center at headquarters.

Risks Imposed by the Use of Video Conferencing

Video conferencing is for the most part a highly secure method of communications. This security is due to the complicated nature of the underlying technologies which comprise video conferencing networks. Installing a system capable of participating in a video call requires careful coordination and installation activities involving at a minimum the end-user and the network service providers (i.e., the local and long-distance phone companies). The only real risk imposed by the use of video conferencing is the ability to use a room system to call and "spy" on people in a different video conference room. Spying can only happen with systems which utilize a feature called "auto answer." Auto answer allows a video conferencing system to call another video system and be guaranteed acceptance of the call. In other words, the call is connected without requiring that a person at the receiving site physically answer it. Most video conferencing systems have options for either "manual answer mode" or "auto answer mode." Auto answer mode is a risk because any site could call another site before people enter the conference room. Then, if a group of people enter the site being watched, it may not be apparent to them that a video call is in progress (especially if the spying site is not sending video or audio signals). In this case, the spying end of the video call could eavesdrop on a non-video meeting being held at the other location. To ensure security, end-users should only purchase systems with manual answer and should configure their systems only to permit manual answer.

Conclusion

In summary, video conferencing is an evolving technology which allows people at distant locations to conduct face-to-face meetings. Many businesses use video conferencing today to improve the effectiveness of human resources and to reduce travel costs. As prices continue to decline, deployment of video conferencing is expected to become more widespread. The risks imposed by the use of video conferencing are minimal and should not hinder acceptance of the technology. IT

Windows on Taxes

By Joseph C. Maida, CPA, MBA

Joe Maida is a shareholder of Nicholas C. Maida, CPA, Chartered, in Trenton, New Jersey. In addition, he is a member of the AICPA Information Technology Practices Subcommittee and the Tax Computer Applications Committee. This article highlights the AICPA Tax Division Tax Computer Applications Committee's demonstration of tax office automation in a tax department. The article has been reprinted with the permission of the AICPA and appeared in its entirety in the October 1994 issue of *The Tax Adviser*.

The AICPA Tax Division Tax Computer Applications Committee presented its version of an automated tax office at a recent meeting of the Division. Using off-the-shelf systems, the committee designed and presented, in real-time, the simulated activity of a busy tax preparation office.

A typical day's events were staged to show how networked computers can be used to communicate within a firm; eliminate paper copies of documents, forms, etc., yet have the latest version of each document available at all times; as well as facilitate tax research and tax preparation.

Tax office automation

Attaching documents

An important feature of the intraoffice E-Mail is the ability to attach documents such as a tax return, spreadsheet, or research finding to an E-Mail message simply with the click of the mouse button. Both a spreadsheet program and worksheets created by staff were opened by a review partner without further loading of application software.

Reviewing documents

A tax manager responsible for review of a completed tax return was able to discuss the return with her client while updating the data for a late-arriving K-1. When complete, the return was attached to an E-Mail message routed to the review partner, announcing the return as final and ready for review.

Database research

To see the effect of a recent development in tax law, a data-base search was conducted. Then, using the tax

manager's built-in word processor, a mailing was produced in a matter of minutes to notify those clients affected.

Tax preparation

It was relatively easy to assign a staff member to research a proposed transaction and plan the client's taxes accordingly: The project was received via E-Mail, the tax research was completed on CD-ROM, and a pro forma tax return was done with planning software. Together the research and planning were then attached to the E-Mail message and sent to the assigning partner whose E-Mail reply now included the original assignment, the staff's response, and attached documents. The staff's reply was cut and pasted into the client letter reporting on the research, while all supporting work was archived under the client's ID on the network.

Windows

The demonstration illustrated the ease of use among the varied types of software products when operated under the common interface of Microsoft's Windows for Work Groups, a specialized network version of Windows. Windows is a launching pad for software programs. It provides built-in tools (such as data edit) that application developers can use (rather than having to create from scratch). By using the standard tools of Windows, most programs written for Windows will have a common look and feel.

Windows was designed to use a graphic, as opposed to a text-based, interface. Instead of typing archaic commands on a blank screen, the user makes choices by pointing and selecting from available options in a menu format. While entries may be typed in, most Windows programs rely on a pointing device (such as a mouse, track ball, or pen). The user selects from icons or small pictures representing the concept on the screen.

Windows also maintains backward compatibility, allowing the use of older DOS/text-based programs. These programs are started from the Windows desktop but run in a special DOS window. (DOS programs generally do not have access to all of the Windows features.) This arrangement allows the user to mix both Windows and DOS programs on a single system. In this configuration, Windows acts as a menu system. When the older program is released, the user can upgrade the program files without reconfiguring the entire system. Often, data files will work equally well with both the DOS and Windows versions, or the conversion will be transparent to the user.

Windows, however, places significant demands in terms of computing resources. Microsoft's minimum hardware configuration for Windows 3.1 is an 80286 processor, two megabytes (Mb) of random access memory (RAM), and at least 10 Mb of disk space for the Windows operating system. Beyond the minimum Microsoft requirements, most Windows programs require two additional Mb of RAM and 10 to 20 additional Mb of disk space each. (Windows programs generally use more disk space than their DOS counterparts.) Because Windows is a graphical presentation, the user's monitor must have at least one-half to one Mb of video RAM to handle the increased data flow. Without additional video RAM, most users will be forced to wait while Windows repaints the screen after each selection.

As a result of its many implementations, the Tax Computer Applications Committee recommends an 80486 class microcomputer with four Mb of RAM and an 80 Mb hard disk as the minimum hardware to support a Windows workstation on a network. A stand-alone workstation will require at least 200 Mb of hard disk to contain programs and data and a minimum of 8 Mb of RAM.

Even though just about every DOS microcomputer shipped in the last four years has arrived with Windows already installed, tax preparation vendors have been slow to rewrite their software to use the graphical interface. Part of this resistance is due to the fiercely proprietary nature of tax software and its data structure. When programming for a Windows environment, most vendors will need to use the standard tools, making their data appear generic and thus allowing customers to switch easily among packages.

Also, customers have been reluctant to upgrade existing computer systems to the new hardware requirements of the Windows operating system, or, in some cases, must use slower machines that will not support Windows as part of a network environment.

1995 Outlook

Based on an industry survey in the July 25, 1994, issue of *Accounting Today*, vendors will be attempting a variety of strategies for the 1995 season. Some vendors will market a full Windows version, some a DOS version with the look and feel of Windows, and still others will include Windows-like features such as full-screen review, cut and paste, and graphical file management (drag and drop instead of copy and delete). **IT**

Upcoming AICPA Conferences

May 4-6–AICPA 1995 National Industry Conference, Palm Springs, California

Special sessions on technology include: How To Avoid Becoming Roadkill on the Information Superhighway: The Enterprise of Tomorrow—To Boldly Go Where No business Has Gone Before; and Using Graphics in Financial Presentations.

June 4-7–AICPA Microcomputer Conference & Exhibition, Phoenix, Arizona

Features three full days of computer education and product information. IT Section members are entitled to a $50 discount. Look for the full conference brochure in March.

For further information, call the AICPA Meetings & Travel Division at (201) 938-3232.

AICPA Technology Division Announces Top 15 Technologies for 1995

Electronic Data Interchange (EDI) once again placed first on the Division's list of Top Fifteen Technologies. Using the group decision support system (GDSS) at the University of Arizona, the AICPA Information Technology Research Subcommittee and Practices Subcommittee identified technologies in use today or in the near future which will affect the accounting profession and business in general.

The session, which was led by the former chair of the Research Subcommittee, Ev Johnson of Deloitte & Touche, began by reviewing the 1994 list of technologies, adding, deleting, aggregating, and disaggregating technologies to reach a final list. Using the "group matrix" portion of the GDSS software, the group then voted on the implementation stages of each of the technologies on the list. The four implementation stages are as follows:

Stage 1: New technologies in, or emerging from, research and development, but not yet in significant use commercially.

Stage 2: New technologies in the early stage of commercial use.

Stage 3: Technologies gaining in commercial use and expected to be in widespread use within a few years.

Stage 4: Technologies now in extensive use.

The GDSS software showed when consensuses among the subcommittee members on the implementation stages were reached. Once the stages of implementation were considered, the group voted on the significance of each technology according to nine new technology filters—five functional filters and four impact filters. The functional filters are Auditing & Accounting, Tax, Consulting, Financial and Operational Management–Industry, and Financial and Operational Management–Government. The impact filters are Revenue, Organizational Productivity & Effectiveness, Personal Productivity & Effectiveness, and Risks and Exposure.

This exercise ranks each of the technologies or technological concepts in order of importance for the subcommittees' work, for general AICPA membership, and for general business.

The two subcommittees consist of AICPA members from all disciplines, and their opinions represent various types of practice. The Research Subcommittee is chaired by Mark Eckman of AT&T, and the members are as follows: Ken Askelson–JCPenney; Wayne Harding– Great Plains Software; Mike Harnish–Lotus Development Corp.; Dr. Elise Jancura–Cleveland State University; Roman Kepczyk–Henry & Horne, PLC; Janis Monroe–Micro Mash; and Dr. Larry Rittenberg–University of Wisconsin. The Practices Subcommittee is chaired by Tom Diasio of Ernst & Young, and the members are as follows: Steve Bare–Savannah Software Company; Bill Creps–Rogers Seed Co.; James Curham–National Health Labs; Phil Friedlander–Ernst & Young; Joe Maida–Nicholas C. Maida, CPA; Chris Reimel–New Jersey Department of Labor; and Bill Zimmerman–French Mc Gowen & Co., P.C.

The resulting Top 15 Technologies ranked according to an average of the nine filters are listed in the box below.

Ranking	Stage	Technology Description	Definition
1	3.6	EDI: Electronic Data Interchange	The automatic, electronic execution of routine business transactions between two or more business partners. It is used by large retailers to manage the supply chain process of merchandise back to raw material suppliers.
2	2.8	Image Processing	The process of converting, through scanning, paper images (e.g., source documents, mail, etc.) into electronic documents (i.e., digital images). Includes computer output on laser disc (COLD), intelligent character recognition (ICR), and optical character recognition (OCR).
3	3.8	Area Networks	Computers at different locations linked by data communications technology to share computer resources, such as local area networks (LAN), wide area networks (WAN), metropolitan area networks (MAN), and value-added network services (VANS).

Ranking	Stage	Technology Description	Definition
4	2.9	Cooperative and client/server computing	The distribution of processing functions between two or more computers. Whereas cooperative computing is the sharing of processing and resources among the servers involved, client/server computing distributes the processing functions between the workstation and server more efficiently.
5	3.1	Communications Technologies	The process of packaging and transmitting data, text, voice and/or video information among its users. Includes asynchronous transfer mode (ATM), frame relay, integrated services data services network (ISDN), fiber digital data interconnection (FDDI), T-Span, Satellite, and the Iridium Project.
6	1.9	Electronic Commerce	Means of doing business on the Internet. Includes E-cash, payment systems, and fax-on-demand.
7	2.6	Collaborative computing & Groupware	The use of technology to bring together the thoughts or ideas of multiple workers. Includes Lotus Notes, Executive Meetings, group decision support systems (GDSS), video teleconferencing, and electronic whiteboards.
8	3.0	Business Process Re-engineering	A new approach to improving business processes which fuses information technology and continuous improvement.
9	2.3	Expert Systems	Computer programs that incorporate certain amounts of expertise or knowledge derived from human sources. These programs are used by a decision maker to assist in the decision-making process. Includes fuzzy logic and rule-based and case-based reasoning.
10	2.5	Workflow Technology	Automatic routing of work or documents to the next person due to handle the information. Includes digital authorization, digital signatures, and rule-based electronic form flow.
11	3.0	Quick Response	A business strategy by management to fully utilize technology and partnering by retailers, suppliers, manufacturers, and raw material providers to better respond to changing customer demands. Technologies supporting QR include point-of-sale/SKU-level transaction processing, barcoding/scanning, electronic data interchange, automatic reorder/replenishment, automatic shipping notices/shipping carton markings, and networks.
12	1.5	Intelligent Agents	Software programs that carry out the customized instructions of their owners across multiple systems in a computer network. Agents will filter e-mail, automate ad-hoc queries, and carry out repetitive tasks, all of which is transparent to the user.
13	3.1	Security	The policies, procedures, and methods for ensuring that access to information security (IS) resources is restricted to authorized users (system confidentiality) and that IS resources will be available on an ongoing basis to support the needs of an organization (system availability). Includes viruses, encryption, data encryption standard (DES), Rivest-Shamir-Adleman (RSA) algorithm, digital signatures, Clipper chip, and biometrics.
14	3.5	Database Applications	Effective use of existing data for a competitive advantage. These uses can affect internal or external activities. Examples of internal activities include the data source for case-based reasoning, and adding dimensions to financial data that cross traditional management hierarchies. Examples of external activities include database mining, database marketing, and relational retailing.
15	2.7	EIS: Executive Information Systems	The hardware and software which summarizes and graphically displays key information for executives and other key managers. The information can include financial, operational, or external data, and can be "drilled-down" to more detailed levels of information.

The 8th Canadian Conference on Auditing and Computer Technology

The Canadian Institute of Chartered Accountants and the Institute of Internal Auditors are pleased to announce the 8th Canadian Conference on Auditing and Computer Technology, which will take place March 27–29, 1995, at the Four Seasons Inn on the Park, Toronto, Ontario, Canada.

A sampling of the topics to be presented include: Audit Enabling Technology —From Vision to Implementation, Electronic Working Papers, Auditing the AS400, Auditing in a LAN Environment, and New Competencies for IS Auditing.

Participants will receive a comprehensive conference reference binder full of checklists, instructions, diagrams, charts, forms, text, methods, specifications, systems, and case studies. There will also be a special closing address which explores the evolution towards the information highway, and the use of multimedia applications to link business, consumers, suppliers, and employees.

For further information, telephone Rita Vander Veen at (416) 204-3337, or Colette Mitton at (416) 204-3318. IT

InfoTech UPDATE

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