

## PERSONAL INFORMATION MANAGEMENT SYSTEMS

A personal information management system (PIMS) is a system consisting of a set of procedures, with or without specialized hardware, to acquire or generate, store, modify, and retrieve selectively information pertinent to an individual's functioning in his or her personal or working environment. This information typically includes addresses and other contact information, appointment schedules, expense records, and notes.

A personal information manager (PIM) is any independently functional component of a PIMS. PIMs are often embodied as computer software that runs on personal computers (generic desktop or laptop computers) or on unique hardware designed specifically for this application.

The word *personal* denotes information necessary for the performance of a duty that is particular to an individual. This information can be and often is distinct from the database necessary for managing an organization. This information need not be generated or owned by the individual. For example, a list of clients or prospects who are to be contacted must be available to the person who is establishing the contact, even though that list may be owned by the company that em-

plains the person. The company that owns the list may also own other information, such as a list of stockholders, that is unimportant to the individual's duty.

*Information* is data or knowledge. In particular, it is timely or specific knowledge. *Management* refers to the strategy by which a person deals with information, and *system* applies to the collection of tools and methods used to implement this strategy.

The formal definition of a PIM is broad, so it is useful to have a more narrow but functional definition: A PIM is a device or system designed or marketed primarily to perform all or most of the eight information actions identified in the following. For example, a user could set up a PIMS using a popular word-processing package to keep lists, generate calendar printouts, and so forth. In fact many word-processing packages include programs and features useful for personal information management, but since the packages are primarily designed for document production and formatting, and not for PIM, they are excluded from the definition. Table 1 lists some common information tools that are not PIMs in themselves, but could be used as part of a personal information management system.

This article summarizes the history and need for PIMS. It then identifies the major categories of PIMs, describing their salient features, and concludes with some general observations on choosing and using PIMs.

### History

Journals and diaries have preserved personal information since ancient times. Access was not much of a problem, because the quantity of data was relatively small. The last half of the nineteenth century brought much technical and social innovation: the telegraph became widespread and the telephone and phonograph were invented. The typewriter became common, and typing became recognized as a profession. Typesetting became more automated, paper became cheaper, and the rotary press became common. The abundance of information—mostly recorded on paper—contributed to the development of mechanical aids to deal with it. The vertical file system with folders in racks appeared before 1900.

The twentieth century brought no slowdown to the information age. Paper-based information organizers and indexers (e.g., The Daily Planner, Filofax, which is currently available)

**Table 1. Devices or Systems That by Themselves Are Not PIMs**

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Alarm timers
Telephone answering machines
Pagers and reader beepers
Smart cards
Identification tags
Email programs
Word processors
Language translators
Spellers
Thesaurus
Dictionaries
Calculators
Reference and search engines
Generic compact disk-read only memory databases
Intelligent agents

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appeared by 1940, and their use increased rapidly after 1950. The Rolodex (Insilco Corporation) system filing system takes specially shaped cards and permits the user rapid access to each card individually.

The 1940s saw the creation of the first electronic computer, and the business use of computers increased rapidly after 1960. These computers were mainframes—large machines that processed information in batch mode—so most individuals did not have direct dealings with them.

The personal computer (PC) changed that. As introduced by IBM Corporation in 1981 (1), the first widely accepted PC was a desktop system with a text-based disk operating system (DOS) that required considerable learning to operate. Shortly thereafter stand-alone programs (applications) for business and personal information processing appeared. For example, Lotus 1-2-3, a spreadsheet program, and Borland's SideKick, a personal organizer program, were first marketed in 1983. In 1984, with the release of the Macintosh, Apple introduced the first popular graphical user interface (GUI). GUIs made operating the PC less threatening for many users, because the GUI represents objects as small images (icons) of familiar items such as a file folder or a Rolodex card. The business use of PCs increased rapidly thereafter. The World Wide Web brought a graphical interface to the Internet, and its use increased rapidly when graphical web browsers became widely available around 1995.

As the information age progressed, individuals became assailed by data in many formats coming from many directions. New forms typically were added to the melange and few deleted. In addition, computer and printer technology permitted the person writing a document to produce the actual document, reducing the need for secretarial personnel. This, in turn, reduced secretarial availability.

The number of ways data can arrive has increased over time. Examples of these include courier, mail (post), telegraph, telephone, radio, FAX, e-mail, and the World Wide Web. The formats in which data come are also diverse. Electronic media such as floppy disks embrace varied media, physical size, means of formatting, and means of coding the data itself. Incompatibility in any of these characteristics makes dealing with the information problematic.

A 1998 study found that workers from administrators to senior executives sent or received 190 messages on any given day (2), up from 178 in 1997 (3). Table 2 shows the breakdown of the 1998 study.

**Table 2. Information Traffic for Office Workers**

Communication Type	Number per Day
Telephone call	52
Voice mail	22
Telephone messages	10
Faxes	15
Pager	4
Cellular phone	3
Email	30
US Postal Service mail	18
Interoffice mail	18
Courier packages	4
US Postal Service Express	3
Post-it notes	11

Source: Ref. 2.

Inability to deal with this quantity of data is called information overload. Individuals become swamped, and productivity decreases. In order to relieve this situation, the PIM evolved as a tool to assist with information handling.

### The Nature of Information

Information is necessary to bring resources, including personnel together at a specific time and place in order to perform a function such as communication, generating a product, or making a decision. If the proper information is not available, then resources, particularly time, are wasted. The person responsible for a particular function needs to get the appropriate information efficiently. This fact speaks directly to the nature of personal information management.

Eight actions pertain to information management (4): receive, create, change, store, retrieve, make decisions, communicate, and discard. A useful PIM will have capabilities that assist in all these actions except, perhaps, that of decision making. Some PIMs even have some capability in this action.

Information tends to fall into three general categories: persistent, archival, and ephemeral. Persistent or enduring information is that which rarely changes and is available to anyone at small cost. Examples include the product or sum of two numbers, the spelling of a word, and the postal zip code for a given address. Standard references or retrieval processes for persistent information are generally available. On occasion, local repositories for selected persistent information are convenient because of ease of access, time saved, and reduction of look-up error.

Archival information is special because it must be retained. It is usually information related to a specific event or occasion. Examples include a contract, a photograph, a final report. Administrative and operating procedures and documentation must be kept available. External constraints often require the preservation of some types of information, such as that needed for legal, accounting, tax, or historical purposes.

Ephemeral information abounds, but it loses value quickly. Examples include messages related to establishing a meeting time, passwords, and editorial comments on document drafts. Ephemeral information can be extremely important during its life, but it also can usually be discarded after it has performed its function. The presence of vast quantities of outdated ephemeral information often interferes with access to currently needed information. Here PIMs can provide substantial assistance.

### PAPER-BASED PIMs

Paper-based systems form the basis for the traditional personal information management systems. We review these because they have established the form, format, and symbols of electronic ones. A notebook or journal is the most traditional way to keep one's information organized and stored in one place. Most people are familiar and comfortable with paper, and most still receive large amounts of information through books, magazines, newspapers, and other printed materials. The computer revolution has given paper-based information another name: hard copy.

### General Characteristics

One of the general traits that all these paper-based systems share is that they have an interface that is typically consis-

tent from brand to brand. In addition, because they are on paper, no special implements are needed to extract the information. One can add to or modify the information by handwritten comments on the paper. Basically, what you see is what you get (WYSIWYG). One drawback is that information carried on paper is of relatively low density, so that even a moderate amount of information can exceed the available storage space.

A book offers rapid access to large amounts of information if it is arranged properly. Books are portable and require no external power sources. Printing has made bookmaking so cheap that they are often used to distribute even ephemeral information, such as flight schedules and catalogs, to large numbers of people.

Unfortunately, much information that arrives will be on paper that may vary in size, the number of pages, or other characteristics. This makes things difficult to manage. The type of information in a document presents additional problems if the documents are not organized well. The information contained within them can be difficult and expensive to find.

Although paper-based PIMs vary in technique, most share common features. They generally have

- An organizational or indexing system
- A means to add or remove records (pages)
- A means to secure the pages in order
- A means of rapid access to particular pages
- A means of marking or flagging the specific information

Disadvantages generally include

- Special media or cards may be required
- Handwork is required to transfer information to and from the media
- An entry must be inspected to determine if it applies to a specific date and time

### Index Cards and Binders

Index cards are perhaps the most generic and *ad hoc*. They usually come with no organization scheme. Tab cards with the letters of the alphabet printed on the tabs are available and are useful for rapid access by separating alphabetized sections of cards.

Index cards have a relatively small area so only data that come in small chunks will fit. Examples include addresses, phone, contact information, and recipes. The user generally must supply a container.

Index cards may also contain pointers to remote objects. The card index to a library is an example of this. A major cost is keeping the index card synchronized with the remote object, so they are generally being supplanted by computerized systems.

Index cards are a good way to sort and select information that requires judgment rather than a formula. After a sort and select, there is the cost of realphabetizing and merging them with the rest.

Binders, the three-ring type being the most familiar, serve to contain information much like index cards. The major difference is that the paper is retained more securely, and odd sizes can fit standard format binders without getting lost.

### Rolodex

Rolodex (Insilco) is a proprietary index card management system. Although it comes in a number of forms that vary in size and capability, the classic form is widely used today. This consists of a wheel on an axle with a turning mechanism. Specially shaped cards fit into the wheel rim. They generally hang so that one end of the planar surface is attached to the wheel axis. At the top a natural separation occurs so that the user can read the card contents without direct manipulation.

The maximum number of cards usable is largely determined by wheel size. Alphabetical tab cards speed user access to particular records. Cards can be added or removed easily. Companies often include pre-cut cards in their advertising literature.

### Calendars

Calendars have been the traditional way to develop and record schedules. There are many variations of calendars: yearly view, monthly view, week-by-week view, and daily view. Some of these are meant to be placed on desks, to serve as a desk pad, to form part of personal organizers, to be carried about (pocket calendar), or to be placed on the wall (wall calendar).

Users of calendars can keep track of the date by marking the days off or by flipping or tearing off pages. Wall calendars are not useful for daily appointment scheduling, but serve better for team or group planning. Planning calendars come with duplicate tear-off pages. Calendar size and amount of information space available are directly related. For people making numerous appointments, a pocket calendar might not suffice.

Calendars are good at helping to organize individual and group schedules and appointments but little else, so they are usually unsuited as a stand-alone PIM.

Popular calendars include At-A-Glance (At-A-Glance), Day Runner (Day Runner) and Day-Timer (Day-Timers, Inc.).

### Vertical File Systems

The 1890s saw the introduction of a vertical file system. These consist of racks or drawers of folders contained in special cabinets. The file folder is an open-ended container, usually made of manila or kraft card stock, that comes in standard sizes. The folder usually has a tab that protrudes for viewing. The tab carries the name of the folder or its contents. File folders usually are capable of containing up to 150 paper sheets, and they can be removed and replaced at will.

Hanging file systems extend the vertical file by providing rails that support sturdy larger folders which can contain several standard file folders. They usually have a means to apply a tab for labeling.

Most business and organization data are stored in vertical files. They can be used as a PIMS, but, other than data capacity, are no more functional than index cards. One annoying characteristic is that the file contents can get lost in a neighboring folder or by falling between folders.

Manufacturers include Steelcase, Steelworks, Hon, and Pendflex.

### Personal Organizers

Paper-based personal organizers (also called agendas, planners, and business organizers) are true PIMs lacking only an

alarm reminder function. Typically they consist of a collapsible binder with pockets or fasteners for an appointment calendar, a memo pad, an address book, and a pencil or pen.

Organizers for work groups are generally large enough for several people to view at once.

Popular products include Filofax, Day-Timer, and Day Runner (Day Runner).

### Post-It Notes

Post-it notes (3M Corporation) are adhesive-backed paper sheets sized from a few centimeters to about a half-page. The adhesive permits placement on most smooth, dry surfaces. In particular, they can be stuck on paper documents and removed later with no damage to the underlying paper. Some come with printed legends, for example, "Sign here." Classically colored a light yellow, they are available in a great range of pastel or fluorescent colors.

They are used as flags or as reminders of things that need to be done immediately and are particularly good for jotting notes on documents or marking locations in documents. They are useful for ephemeral information. Attesting to their popularity is the recent appearance of electronic Post-it notes.

## SOFTWARE-BASED PIMs AND PIMS

### General Characteristics

PIM software takes advantage of the power of the PC to provide the functions of a PIMS in an environment that permits automating many tasks. They provide output that may be visual, hard copy, or directly incorporated into a document, e-mail, or another program. In addition, PCs maintain a clock with current time and date as part of the operating system, so a PIM can automate reminder alarms, track data by date and time of entry, or log elapsed time on various tasks.

Software PIMs require the user to supply a PC with associated communications and peripherals. This generally means that they will run on a desktop PC or, in a more limited way, on a laptop PC.

The ideal PIM is one that assists the user but does not require much time setting it up, learning how to use it, and running it on a regular basis. It should also respect data security both against loss and invasion of privacy. It should interface smoothly with other application programs that may provide input to or receive output from the PIM.

Major software houses provide the most used PIMs, often bundled as a suite of individual programs that work well together. These are comprehensive PIMs because they are capable of handling a variety of tasks that assist in various aspects of information management.

In addition to comprehensive PIMs, many stand-alone PIMs and add-in and add-on programs are available. PIMs and PIM helper applications also occur as shareware or freeware that is available on the Internet or bundled with other major software packages. PIMs can be found for most operating systems.

### History

Rudimentary PIMs could be implemented relatively easily on PCs when even simple word-processing programs were available. Along with the computer's file system, the software PIM

achieved most of the capabilities of a paper-based system. The development of the software PIMs is exemplified by the following one.

In 1983, Borland marketed Sidekick, one of the earliest commercial PIMs for DOS. This program was a terminate and stay resident (TSR) program that was invisible, yet able to pop up at the press of a "hot key." It included a memo pad, phone dialer, calendar, appointment book, and an ASCII (American Standard Code for Information Interchange) table with both decimal and hexadecimal equivalents. It did not implement an appointment alarm, but it did help a great deal with task management.

Now a full-fledged comprehensive PIMS, SideKick 98 (Starfish Software, Inc.) has a GUI and is supported for several Windows operating systems. Its features include all the expected PIM functions as well as many additional features such as expanded data import and export capabilities, networking, HotSync® with the PalmPilot (3Com), communication with the REX™ (Franklin Electronics) (see later), and web-compatible publications (5).

### Schedulers/Calendars

Schedulers or calendars assist in organizing a person's daily activities and in keeping track of appointments. One useful feature is the ability to remind users with alarms or warnings of upcoming events or to run another program at a specific time. Common features include

- Showing a calendar or the schedule at varying levels of detail (day, week, month)
- Selecting scheduled events by topic or project
- Scheduling specific messages to pop-up on screen at particular times
- Scheduling particular programs to run at specific times
- Checking for conflicting times or events in schedule
- Ranking events to assist in scheduling
- Linking events so that a change in one event will result in a change in another one
- Allowing entry of phone messages to be returned
- Providing Gantt chart view of schedule

These features are useful for group coordination:

- Providing reports or calendars for upcoming events of a single person or several people
- Allowing interactive scheduling
- Providing private or public (work group) view of calendar
- Allowing others in network to view and access schedule for group events
- Allowing scheduling for numerous people (50 or more)
- Giving information on availability of rooms, resources, and other people for meetings to be scheduled

Popular schedulers or calendars include Now Up-to-Date (QUALCOMM), Diary (Autumn Software), Focus and Voice Calendar (Focus Software), Schedule Wizard (Overtime Software), AMF Daily Planner & PIM (AMF), ChronilistNT (Integra Computing), Visual Day Planner (inKline Global), and Visual Scheduler (Vitrix).

**Address Books or Contact Information Managers**

These are usually needed to record the typical information (name, address, phone number, fax, e-mail, and WWW address) of friends or business contacts. Software packages that perform this function not only record these basic items but also allow entry of additional detail for each of the listings. In addition, they also allow a number of other tasks to be accomplished with each of these entries. Some of the following features are available in these:

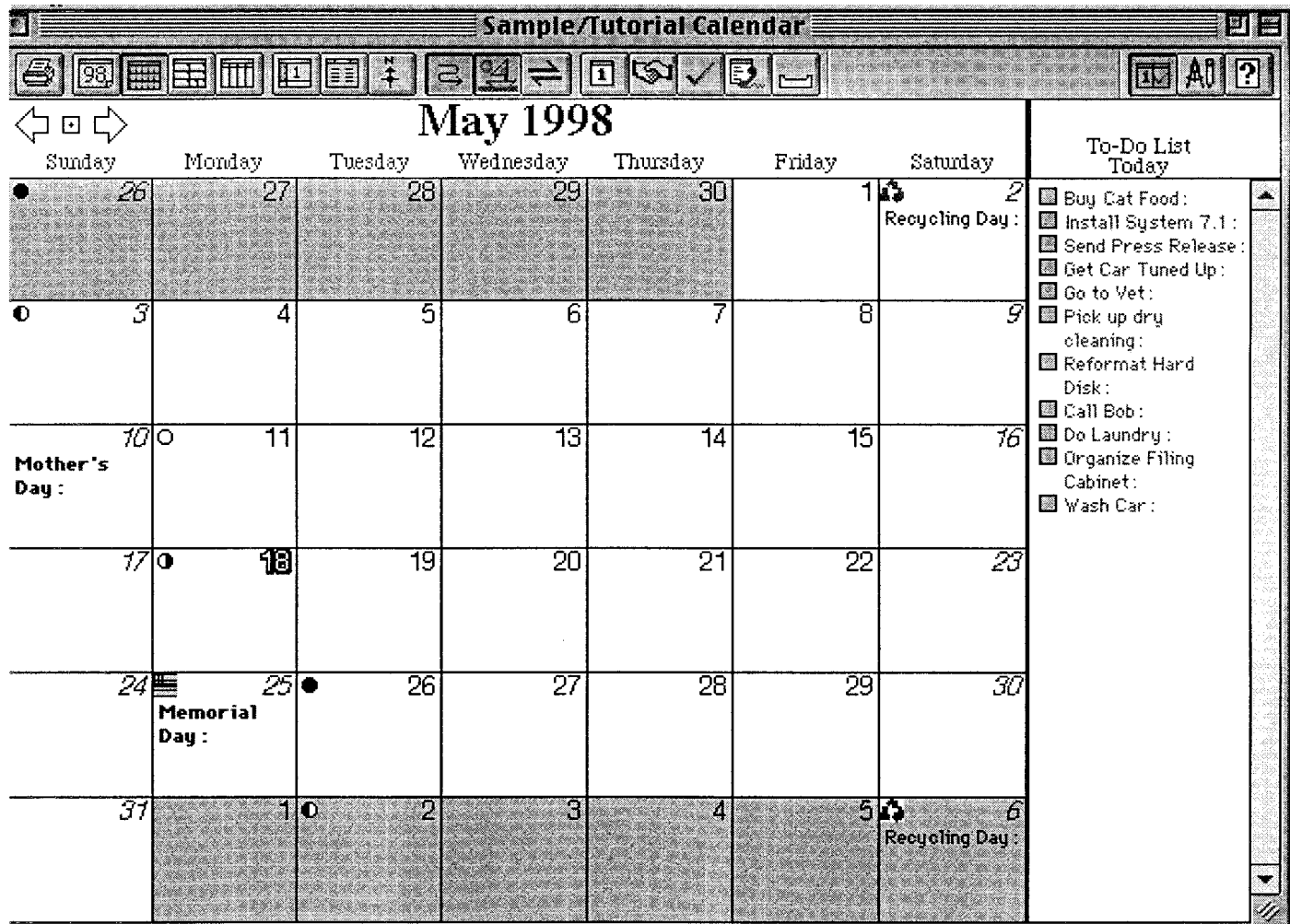
- Providing for viewing in a familiar way such as a business card holder with alphabetic tabs and allowing flipping of pages
- Allowing importing of information in other formats
- Allowing grouping of contacts by categories
- Allowing a built-in or add-on word processor to create fax documents, letters, mail labels, and mail merges from within the contact information program
- Using contact information to send e-mail or visit web sites

- Using the data to dial phone numbers and log phone calls
- Allowing network sharing of contact information for work group
- Working in conjunction with scheduling software

Popular address books or contact information managers include Now Contact (QUALCOMM), Address Master Pro (Lake Group), Address Notebook (T&T Software), Card Organizer and Adr Book (Brown Bear Software), The Complete Address Book (GreggNet Software), Contact Manager (B&P Technologies), BusinessCards/32 (Michael Dvorkin), 1st Contact (JSoft Consulting), ACE Contact Manager (Santa Fe Software), Contact Coordinator (Logic Pulse Software), Phone Book PRO 97 (Idle Software), Address Organizer (Prima Soft PC, Inc.), Smart Address (Insight Software Solutions), and Day-Timer Address Book (Day-Timers, Inc.).

**To-Do Lists**

A to-do or task list manager is useful in helping people organize their seemingly endless list of activities. These programs offer users features such as



**Figure 1.** Calendar view of Now Up-to-Date (QUALCOMM). Shown is the monthly view. Note the to-do list on the right. Other views available are the daily, weekly, and yearly. Now Up-to-Date and Now Contact are trademarks of QUALCOMM Incorporated.

- Integrating a to-do list with scheduler options
- Ranking of task importance
- Allowing the program to select the next task to accomplish randomly
- Providing the user with an alarm as a reminder of tasks to be performed
- Including a yes/no decision maker
- Providing the user with a random number generator and/or lottery number generator
- Providing a notepad to list reminders

Popular to-do list packages include List Pad (Taylor Design), and To Do Manager (Net Impact, Inc.).

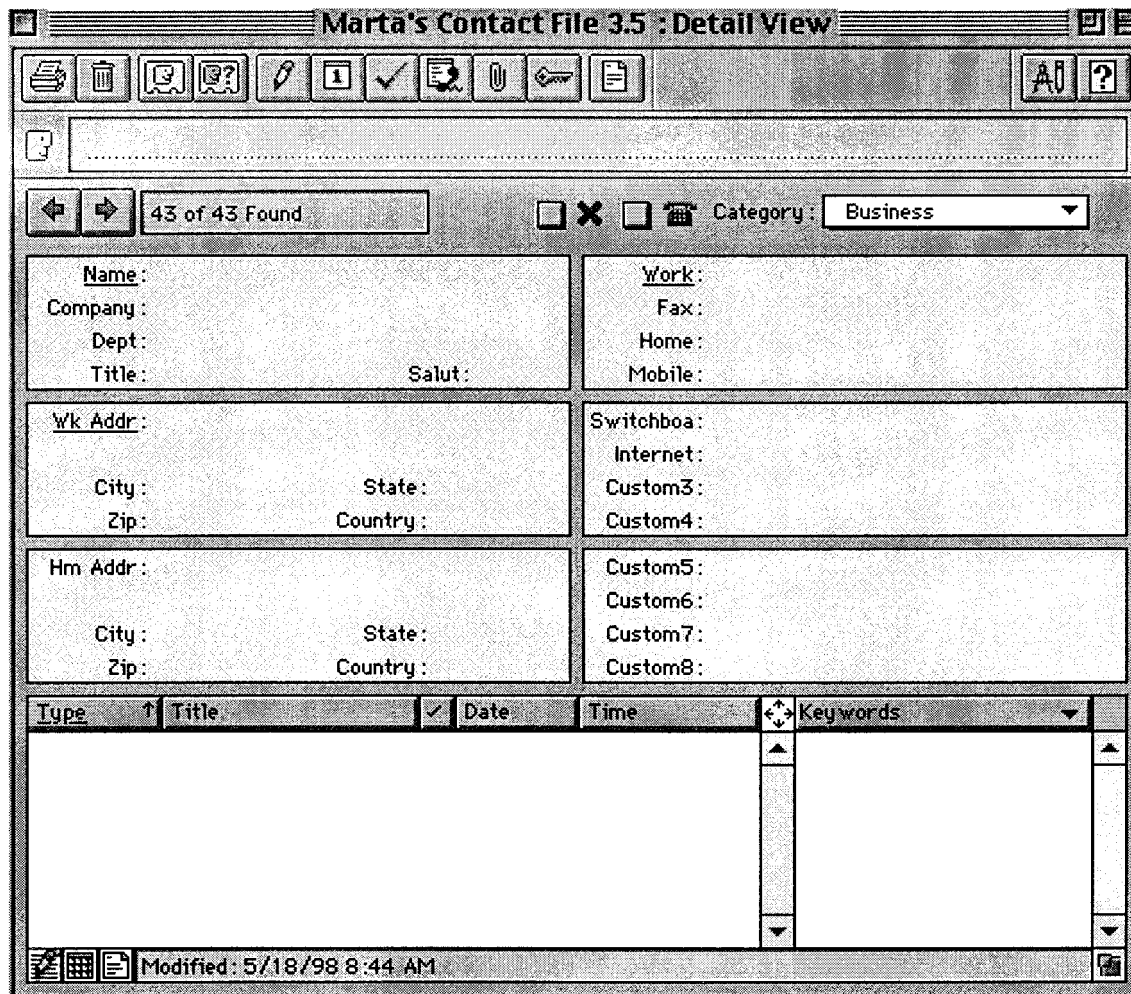
**Comprehensive PIMs**

These are software packages (sometimes a few bundled together) that include as a minimum a scheduler (calendar), an address book (or contact information manager), a to-do list, a

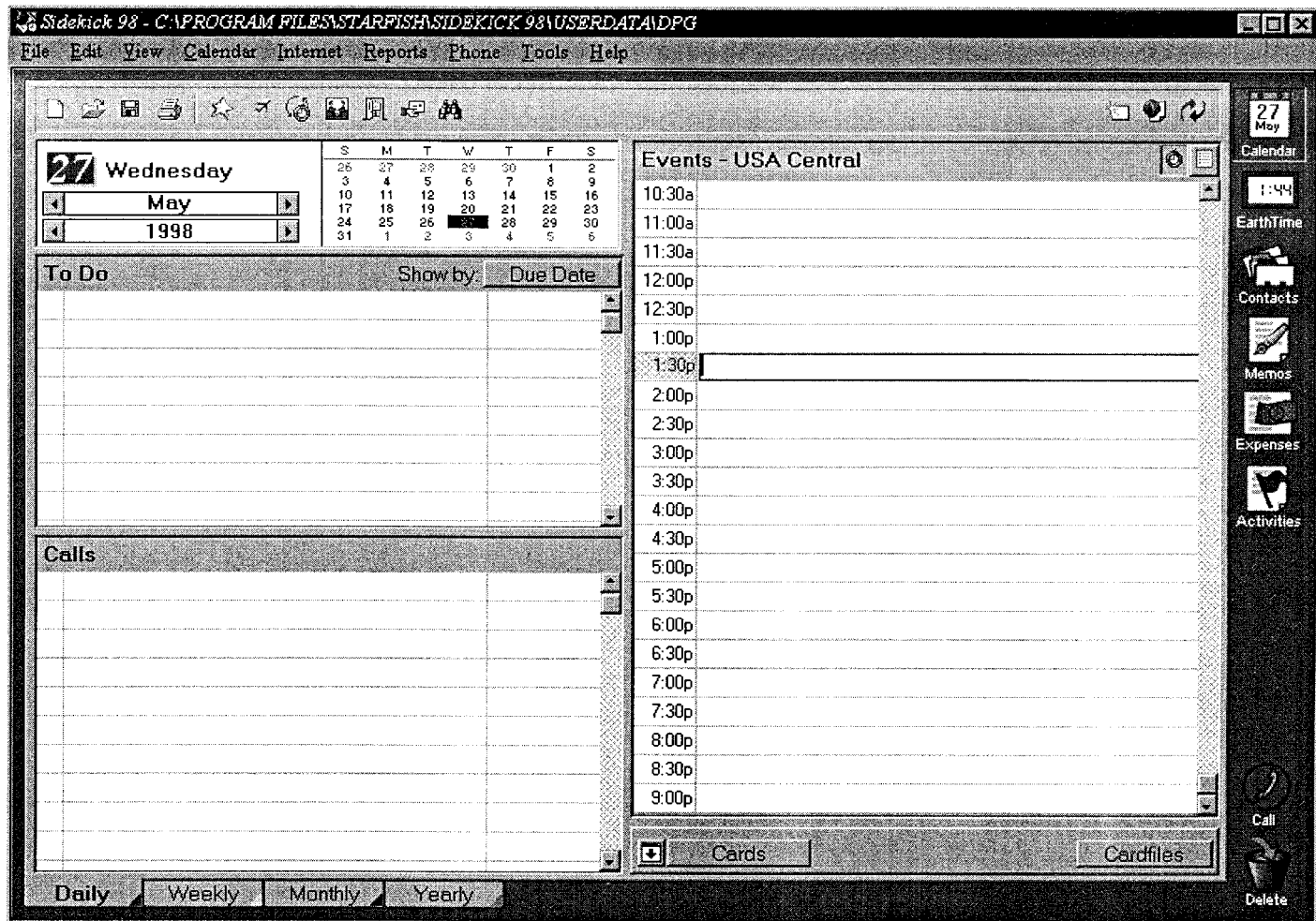
memo pad or other editor, phone dialing and communication capabilities, and networking with other PIMs.

These packages are meant to provide users with the organization capabilities needed to manage and access all of their information. These packages are usually called personal information managers (PIMs).

An example of a comprehensive PIM software package is the bundled combination of Now Contact and Now Up-to-Date™ (QUALCOMM). Now Up-to-Date provides an easy way to manage and share a schedule (Fig. 1). It allows scheduling of meetings, reminds one of upcoming events (alarms), manages to-do lists and items, and keeps a workgroup up to date. In addition, it permits attachment of WWW links and other documents to calendar events. Now Contact keeps track of your personal and business contacts (Fig. 2). Thus, the two packages work together to provide users with a complete suite for personal information management. One of the features of this package is that it allows sharing of contacts and appointments over a network. This permits users to schedule meetings on each participant's calendar simultaneously after it



**Figure 2.** Contact entry form for Now Contact (Now Software). This is a blank form for entry of all the information pertinent to a particular contact. The contact can be placed in a business, personal, general, or a specially defined category. Now Up-to-Date and Now Contact are trademarks of QUALCOMM Incorporated.



**Figure 3.** Calendar view of SideKick 98 (Starfish Software). Note the tabs at the bottom to choose between daily, weekly, monthly and yearly views. Sidekick is a registered trademark of Starfish Inc.

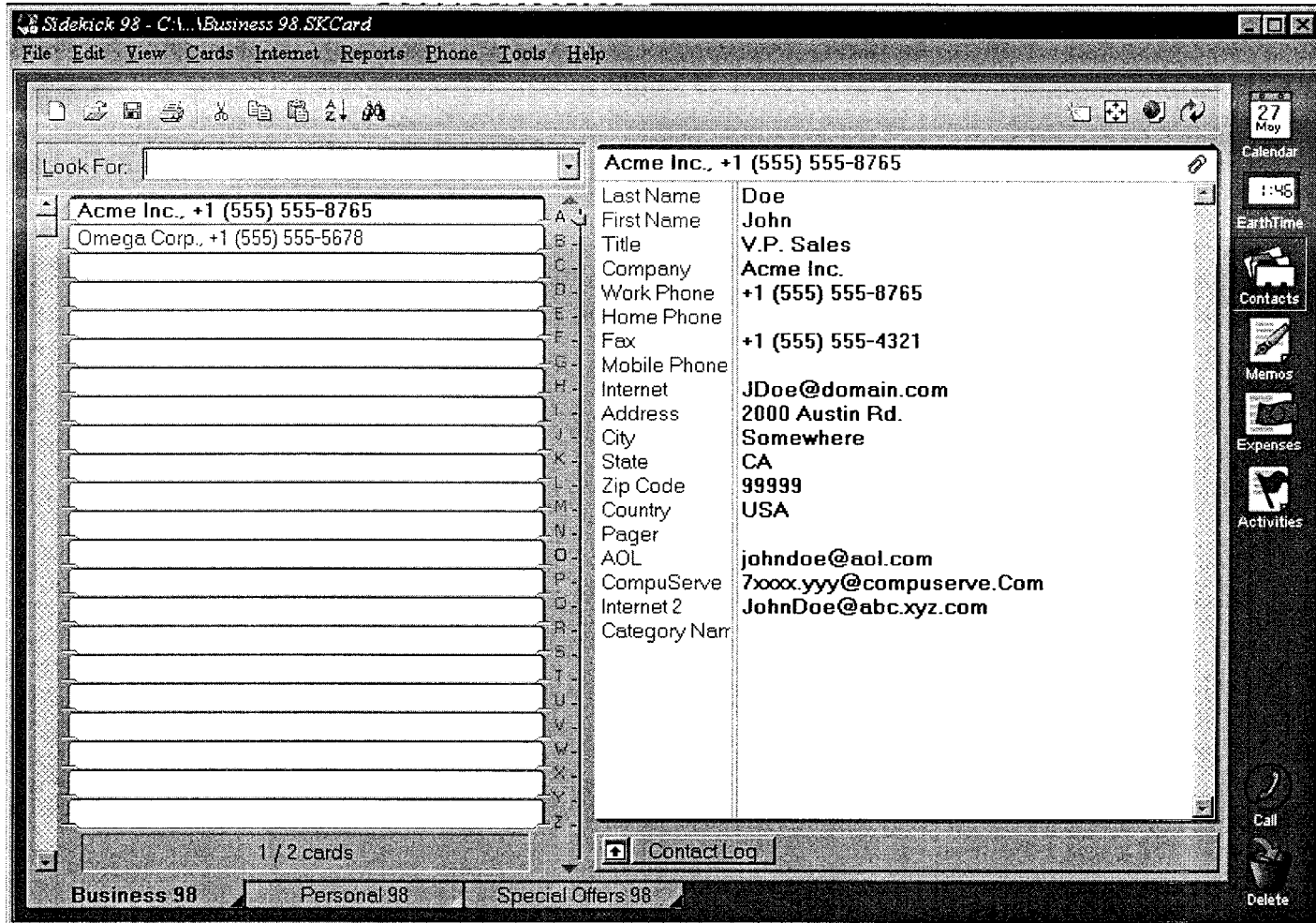
has searched for the best time available for everyone. Another useful feature is that it can maintain a list of important telephone numbers on the menu bar. It also includes a word processor that permits the user to draft letters and faxes without having to access a separate word processor. However, if needed, it also allows mail merging with documents from WordPerfect (Corel Corporation) or Microsoft Word. The correspondence is automatically logged with the date, time, and document title in the specific contact file. It can also be used to keep track of time spent on tasks on a client-by-client basis. Another significant feature is that it can synchronize data with either the PalmPilot (3Com) or the Newton Message Pad (Apple) palmtop computers. In this way, users have access to important customers and appointments whether they are in the office or on the road. It can also provide printouts in formats that fit the popular paper organizers such as DayTimer, DayRunner, and Franklin. In addition, it integrates e-mail with popular Internet communication packages such as Eudora, America Online, etc. It also allows location of street maps, phone numbers, e-mail addresses, and Zip+4 code

numbers on the web by automatically launching a web browser and accessing the information needed, even to the location of a contact's office. One of the limitations is that it only works on Macintosh systems.

SideKick 98 (Starfish Software) is another popular PIM that works with Windows or NT operating systems. Its main objective is to assist in managing and mobilizing all kinds of personal information. It includes features for scheduling (Fig. 3) as well as capabilities to record contact information (Fig. 4). Unlimited calls, appointments, and to-do items can be scheduled, and this is enhanced by allowing scheduling of anything with anyone at anytime by using its Internet scheduling feature. It also has capabilities to handle complete expense reports. In addition it includes Caller ID, mail merge, and specialized printing features. It even allows synchronization of data with hand-held devices such as the PalmPilot (3Com) and REX™ (Franklin Electronics).

Popular personal information managers include Now Contact and Now Up-to-Date (QUALCOMM), Act (Symantec), Lotus Organizer (Lotus Development Corp.), Multiactive Max-





**Figure 4.** View of contacts of SideKick 98 (Starfish Software). Note all the categories available for data entry for each contact. Also available are Business, Personal and Special Offers categories to divide the contacts. Sidekick is a registered trademark of Starfish Inc.

imizer (Maximizer Technologies, Inc.), Day-Timer Organizer Deluxe (Day-Timer, Inc.), DigiDayReminder (Vision X Software), Simona Planner (Carlos Maya), Almanac (Impact Software), Desk Top Set (Okna Corp.), and Seize The Day (Summit).

**Business and Marketing PIMs**

To increase the efficiency of the office environment numerous software packages have been created. Capabilities include assisting in project, client, referral, and employee management. Using networked machines permits sharing the information among coworkers, thus increasing joint productivity.

**Project-Management PIMs.** Project-management software can serve as a decision organizer when the user must rank the importance of several projects and tasks within a project. It can provide a means to show the current status of projects, including entries by multiple contributors to the project. Other features of these PIMs are

- Easy report generation on project status
- Accounting of time spent on project and on tasks within project
- Providing both an overview and a detailed display

Popular project-management software includes Microsoft Project (Microsoft), Digital Diary (GTA Data Services), ActivityLog (Mathew Dredge), and Time Line (Tom Snyder Productions).

**Client-Management PIMs.** Client-management software assists businesses in tracking certain clients and is more efficient when it is integrated with a scheduling software that records activities with these particular clients. It can also provide businesses with tracking of events, services, and income expenses related to the clients. Along the same line of client management software is referral tracking software that can be useful to keep track where business is coming from. When this software is integrated with an address book it becomes even more functional.



Popular client-management software includes MinuetFetch (Minuet), Client Tracks NT (Integra Computing), and Time Win (Thunder Creek Software).

**Employee-Management PIMs.** Employee management software can increase business productivity. Network software exists that can serve as a sign-out board so that office colleagues know when someone has left, when they are returning, and how to reach each person. It can also serve as a centralized message center (Integra Computing).

Popular employee-management software includes Sign-Out (Integra Computing).

### Special-Purpose PIMs

PIMs that are capable of dealing with specialized information abound. They make dealing with a particular data type or situation easier. The following sections discuss several types.

**Financial PIMs.** Information managers for financial data are designed for bookkeeping of financial information such as accounting, income and disbursement records, check writing, tax records, and filing of taxes. They can also be used for inventory purposes and debt management. Financial software helps to organize personal or business finances efficiently. The main objective of these packages is to provide the means of organizing financial data through a familiar interface, such as a checkbook view. This can increase productivity in a business setting and provide an overall view of the financial status for a personal user. The main features provided by these kind of packages are as follows:

- Tracking of accounts, payments, and debts all in one location
- Tracking of time spent on professional matters related to accounts, receipts, disbursements, and amount owed by clients (particularly useful for people who bill clients on an hourly rate)
- Providing reports and graphs to show money flux
- Assisting in planning for tax time by keeping track of relevant expenses
- Assisting in achieving goals for home purchase, college spending, and retirement

Some programs can communicate with banks, brokers, etc., and can print checks or reports.

Popular financial packages include Quicken (Intuit), MYOB Accounting (Best Ware), 7Office (Morley Chalmers), and Peachtree Complete Accounting (Peachtree).

**Inventory Tracking.** Software packages that are set up for inventory management assist in tracking, organizing, and cataloging home and/or office possessions. These help establish a value (by various methods) for the collection or subset thereof. This is useful in cases of loss, litigation, warranty, and taxation. It also provides a method of keeping track of location and identification information.

Popular inventory packages include SmartTracker Inventory 95, SmartTracker Videos 95, and SmartTracker Books 95 (Insight Software Solutions), and Everything I Own (Blue Collar Software).

**Debt Organization.** These software packages focus on assisting organizing user debts. Some of the features this kind of software offers are as follows:

- Providing schedules for debt reduction, timed elimination, or consolidation of debts
- Providing schedules for payments
- Providing with graphical reports of daily and/or monthly activities

Popular debt organizers include Debt Analyzer (Insight Software Solutions).

**Family.** Family management packages assist users in handling typical family events by keeping track of the schedules of all family members (activities) and categorizing joint or separate recurring events. The main goal is to help everyone know what others are doing and what they should remember to do together. It also provides features to remind family members of important family dates (birthdays, anniversaries, etc.).

Popular family organizers include FamilyRunnerNT (Softseek).

### Database Managers

The topic of information management often includes database management. The main function of database is to store information about people, companies, or items, thus assisting in the tracking, organizing, and cataloging of this information. For example, databases can be used to catalog numerous items, such as references, videos, books, stamps, coins, music pieces, sports statistics, workout statistics, URL addresses, lists of passwords, and recipes. Most likely a database will include searching and sorting capabilities to assist the user in locating any one of its components. If it is available through a network, then others can access the information and it becomes more useful in a work group environment. (See also DATABASE LANGUAGES.)

Some databases come preformatted. Their structure is already set up and the fields to enter the information are clearly labeled to indicate exactly what to enter in each one. Nonpreformatted databases allow the user to determine the type and number of fields needed, thus enabling a lot of flexibility on the part of the user. Another basic distinction among databases is the large, complex, relational database and the simpler, smaller, flat-file type of database. The relational database allows users to create complex links and relationships between separate pieces of information from within the database. In contrast, flat-file databases only allow information to be stored in simple records, thus representing only one piece of information at a time. The latter are usually more fitting for personal use. The ability to print out reports is usually an integrated feature of many databases (4).

Popular databases (preformatted) include Lotus Organizer (Lotus), Act (Symantec), SideKick (Starfish), Bob (Microsoft), and Packrat (Polaris Software).

Popular databases (nonpreformatted) include FoxPro or Access (Microsoft), Approach (Lotus), dBase or Paradox (Borland), and Infodex Pro (Stevenson Technical Services Inc.).

Popular databases (unique items) include Golf Score Analyst (Michael Hamments), and TrainingBase (Aimbie Software Concepts).

### Bibliographic Databases

Bibliographical databases have become an essential piece for those in publishing. There are numerous features that are now available in these software packages:

- Providing the ability to search on bibliographical databases on the Internet
- Organizing references (the main function of a database!)
- Allowing multiple reference types (journals, books, etc.)
- Allowing multiple references in the database (over 30,000)
- Providing links from references to material on the WWW
- Allowing numerous term lists associated with each individual reference (journal, keyword, etc.)
- Providing sorting capabilities
- Allowing the database to be shared over the network
- Creating an automated bibliography (even from within the word processor)
- Allowing numerous styles for bibliography formatting
- Recognizing particular journal styles and converting to other specific styles
- Allowing searching capabilities within all fields of each entry

Popular bibliographical packages include EndNote (Niles Software), PAPYRUS® (Research Software Design™), Citation (Oberon Resources), ProCite (Research Information Systems), Reference Manager (Research Information Systems), Library Master (Balboa Software), Bookends Plus (Westing Software), Bibliographica (SeeCite Software)

### Recent Developments

A new kind of personal information management system has evolved that incorporates the Internet as part of its information source or as its engine to organize the information. With the advent of the World Wide Web and the vast amounts of information available on it, some use it as one of the main ways of doing research. Doing so, everyone is getting overwhelmed with the information they extract from this source and is in need of methods to be able to organize it in a cohesive manner.

One such software package available to organize information extracted from the web is Zoot (Zootsoftware) (6). This package is described as a free-form information manager and web research assistant. It allows users to collect, analyze, and organize information obtained from the web, on-line services, CD-ROM, e-mail, documents, and other electronic sources. The data are organized by predefined selection criteria. Basically, Zoot is part PIM and part text database, note editor, activity tracker, and abstract builder. It has the capability of automatically capturing all the URLs that were visited during a period of time and at the end it displays the day's work: folders, links, and notes.

Another recent development is the use of the web as a source to organize personal information. Aminda is a type of

proactive software that includes *my Aminda* (7), which functions as a free personal on-line assistant. This service will learn whatever you tell it and will be on-line to assist 24 hours a day, 7 days a week. As a personal assistant it will remember all your contacts, appointments, and to-do lists. In addition, it will also remember solutions to your problems, where to find particular information you might need, and when to automatically take action for you. Basically, it is a self-guided automated personal assistant accessible from anywhere as long as there is access to the Aminda™ web page.

## PERSONAL DIGITAL ASSISTANTS

### Definition

A PIM implemented on specialized hardware is often called a personal digital assistant or personal data assistant (PDA). These are miniaturized computers that are outfitted with PIM software. PDAs must be lightweight, compact, rugged, reliable, self-powered, and they must facilitate the input and output of information to the user in the field. These constraints impose significant limitations and tradeoffs on the types and characteristics of the hardware and often on the functionality of the device itself. PDAs require special operating systems that conserve memory and power and efficiently operate the hardware. Integration of PDAs into other consumer electronic products increasingly requires a real-time operating system (RTOS) to handle the demands of the hardware. A PDA of acceptable size may also be called a palmtop or pocket computer.

### Timer/Reminder

Timekeeping by computers is an established and relatively simple function to implement. It is therefore no problem to establish reminding functions or time-stamping of data on PDAs. PDAs usually use piezoelectric buzzers to signal the user of an event at a prespecified time. Simultaneously, the screen can awaken to display the particulars of the event.

### Console Size Consideration

In modern computers the console serves as the main input and output device for the operator. The console usually consists of a visual output screen and a keyboard for command entry. The console often includes a pointing device (mouse) and an aural beep output for signaling events such as error conditions. Minimum computer size has decreased from the full-sized desktop (approximately  $\frac{1}{2}$  m long keyboard and  $\frac{1}{2}$  m diagonal screen) to the laptop with components that fold like a clamshell for storage and transport. Computers or organizers further reduced in size, called a sub-laptop or notebook, have been released but are often too small for touch typing. An example of the genre is the Wizard by Sharp that could fit in a sportscoat pocket.

The Newton MessagePad (Apple), the first widely marketed PDA with no keyboard, pioneered handwriting input. A touch-sensitive screen served as both the input area and the display. Introduced in 1993, it suffered widespread ridicule for its poor performance in meeting public expectations for handwriting recognition (8). Initially it lacked a data port so all data had to be entered through the touch-screen interface.

Despite several improvements it was not a financial success, and manufacturer support ceased in 1997.

### Touchscreen Data Entry

A touch-sensitive screen is a useful solution to the size problem. Not only do the manual input and the visual output occur in a single area, but a stylus or pen can be used for greater pointing accuracy. Manual input with a stylus presents special problems. Although selecting items from a menu is relatively efficient, text entry by tapping on an image of a keyboard is tedious and slow. Some increase in entry speed is made possible by predictive write-ahead. Handwriting is a more natural form of input, but automated recognition of cursive script is marginal.

The PalmPilot (3Com) is the first PDA with wide consumer acceptance (9) (Fig. 5). Weighing 200 g and list-priced at \$300, it is one-fourth the volume and one-third the price of the Newton MessagePad. The PalmPilot provides for text entry using a keyboard image, but also takes handwritten input using a scheme called Graffiti. Figure 6 shows the symbols used to represent alphanumeric characters.

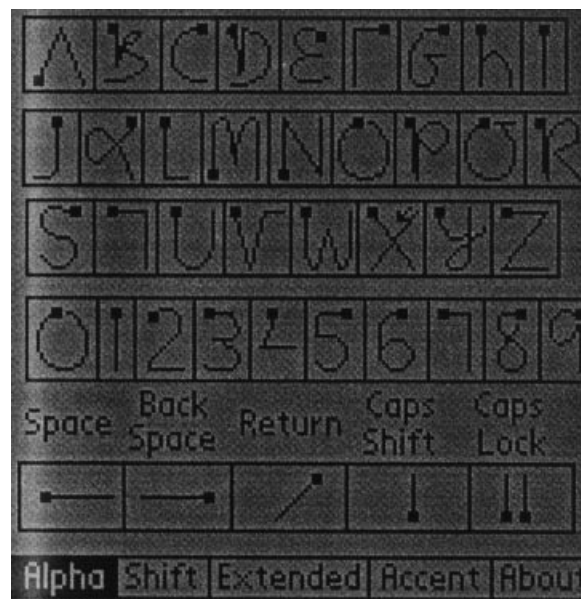
The user is able to enter letterlike symbols on a special area of the screen. This area is partitioned into numeric and text entry subareas. A game program and other aids are included to facilitate learning the symbols. With practice, the user can enter text rapidly and unambiguously, but not yet at the speed of cursive script. Add-on software exists to ease text entry with a touchscreen. For example, the T9 touchscreen (Tejic Communications) provides a telephone keypad image and uses linguistic software to determine which alphabetical character is intended on each pressed key.

### Data Storage

The need to store significant amounts of data requires a large, nonvolatile memory system. Power and ruggedness requirements militate against a fixed disk memory, so solid-state memory is commonly used. These take so little current that a capacitor can maintain the data through battery changeout.



**Figure 5.** View of the PalmPilot Professional (3Com Corporation). It weighs 200 g and the size is about 11.9 cm × 8.1 cm × 1.8 cm. It is compatible with both Windows and Macintosh systems. 3Com and the 3Com logo are registered trademarks, and PalmPilot and the PalmPilot logo are trademarks of Palm Computing, Inc., 3Com Corporation, or its subsidiaries.



**Figure 6.** The PalmPilot organizers feature an intuitive graphical interface and a highly accurate text input system called Graffiti. The writing is done with the stylus provided in the Graffiti writing area, which allows quick entry of the alphanumeric information into the system. 3Com and the 3Com logo are registered trademarks, and PalmPilot and the PalmPilot logo are trademarks of Palm Computing, Inc., 3Com Corporation or its subsidiaries.

Typical storage capacities range between 500 kbyte and 1000 kbyte.

### NonConsole Data Transfer

As memory capacity exceeds the user's ability to easily fill it solely by text entry, other means of communication with the PDA are needed. This requirement is underscored by the additional need to synchronize information in several PDAs, to back up entered data, and to forward field data for central processing. Accordingly, many PDAs feature digital data ports. By putting the PDA into a docking port or cradle or by connecting to a modem, the PDA can share data with other systems. Many PDAs are shipped with software intended to run on desktops that synchronizes data between the desktop and the PDA. On the other hand, some of the main PIM software packages offer ways to interface with PDAs. This serves the purpose of being able to enter most of the information of contacts, scheduling, and to-do lists on a desktop computer and to have the PDA updated with it and vice versa. This feature is particularly useful for those who travel frequently or are away from the office often. By being able to synchronize the information, the user's important appointments and customers are always within reach, be it in the office or on the road. Even if information is changed on the PDA while the user is on the road, the PIM software can be updated upon return to the office. This saves time by never having to enter the same information twice. Examples of packages that allow this type of synchronizing are Now-Contact, Now Up-to-Date, Claris Organizer, and SideKick.

The Newton MessagePad, in its most recent configuration, featured a detachable keyboard, a plug-in modem card, and its own web browser. It could independently serve as an e-mail

terminal and as a telephone dialer. Already announced is a pager plug-in for the PalmPilot.

Another development is the REX PC Companion. Almost credit card size (86 mm × 64 × 6 mm, 50 g), this is more than a smart card. The REX card communicates through a PC-Card slot on a host computer but functions independently in the field through five buttons and a liquid crystal display (LCD). Field data entry is limited, so it is not a true stand-alone PIM, but it may serve usefully as an adjunct or important piece of a PIMS.

### Developing Capabilities

Projected features of PDAs include voice-command drive and even speech-to-text or text-to-speech capability. Infrared communication capability will extend the communication options, including such features as exchanging electronic business cards when two PDAs establish contact. Nokia Group integrated a PDA into its smart GSM (Global Systems Mobile) cellular telephone. This permits logging of calls as well as downloading web pages during off times. Intel is promoting chip sets that permit an automotive and navigational system to be integrated into a PDA. With global positioning by satellite (GPS) units now the size of PDAs, this combination is not too far off.

It seems reasonable to assume that as the power of the PDA increases, more and more capabilities will be incorporated. As a result this article can provide only a snapshot of the temporal situation.

### LIVING WITH A PIMS

Modern office workers are at risk of becoming dysfunctional without the assistance of a PIMS. PIMS can be powerful tools, but, if not used properly, they have the potential of causing significant damage mostly due to lost data or lost time. Workers with PIMS have developed a few general considerations for the user when developing a PIMS and choosing and using a PIM.

1. Choose a strategy that makes sense. Identify the information classification scheme that covers the circumstances. Eliminate redundant categories. Remember that filing everything under "Miscellaneous" renders all of it less accessible. Know what information is not needed: archive it or get rid of it.
2. Determine the necessary physical parameters. Does the PIM need to be portable? Will it be used in the field? Must it be pocket sized? With what existing or future systems must it be compatible? What are the issues regarding data backup, synchronization, and security or privacy?
3. Choose a system that will be used. Remember that too many unused features and functions are equivalent to data clutter. A PIM with more features or power generally has a steeper learning curve, and that can be a barrier for use.
4. Use the system regularly and habitually. Lack of immediacy degrades the utility of both the system and the user.

There are many personal, physical, and psychological reasons that prevent people from getting and staying organized. Foremost among these are the inability to let go of a piece of information ("I may need that sometime."), clutter (including large number of reminding notices), and procrastination (4). Because lack of organization is such a common and persistent problem, there is a plethora of self-help books on PIMs, time management, and personal organization. There are also professional consultants and organizations available to assist individuals in setting up and using PIMs. See, for example, Refs. 10 and 11.

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**PERSONAL MANAGEMENT.** See PERSONAL INFORMATION MANAGEMENT SYSTEMS.

**PERSONNEL MANAGEMENT.** See HUMAN RESOURCE MANAGEMENT.