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The PalmPilot and the handheld revolution

Have you thought that perhaps the computer belongs in your hand rather than on your desk? With many failed and still-failing efforts, handheld computation has been taking a long time to arrive. However, the unquestionable success of 3Com's PalmPilot heralds the start of a revolution in computation.

Contrary to many past and present devices, the Pilot proves that portable computers don't have to mimic desktops to be useful and successful. As a result, handheld computers are incorporating new technologies, and the market is rapidly changing. Soon, many of us will spend more time interacting with our handheld devices than with our desktop computers.

The many guises of portable computers

Portable computers come in many forms and under many names. At one extreme are laptops, which are basically desktop PCs that have been reduced enough to be lugged around. At the other extreme are Personal Digital Assistants (PDAs), which use a stylus or a few buttons, rather than a keyboard, for navigation and input. In between, suffering something of an identity crisis, are the handheld PCs (HPCs) and palmtop devices, sporting tiny fold-up keyboards and running a pared-down version of Windows 95 called Windows CE.

So far, the PC has been the most successful form of computation. As a result, when branching out to produce portable computing devices, most companies simply aim to mimic the PC. However, such a

model is inappropriate for space-starved portable devices. The now-failed Go Corporation was the first company to break tradition and introduce interaction using only a stylus. Apple continued the endeavor, leading to the present MessagePad 2100, but stylus-based PDA's have caught on only gradually. Now, the Pilot has taken the lead at an exceptional pace. According to PC Data, the Pilot accounts for 70% of US retail PDA sales. According to DataQuest, in 1996, the Pilot accounted for 51% of the 1.6 million handheld devices sold worldwide. These figures are amazing, given that

the Pilot first appeared on the market in early 1996. In retrospect, the Pilot will be seen as a turning point in the migration of computation from desktop machines to handheld devices.

Behind Pilot's success

The Pilot comes with numerous built-in applications to manage personal information—for example, calendar, to-do lists, memo pad, and address book. The touch-sensitive monochrome LCD display is used for navigation, and a simplified and easy-to-learn alphabet called Graffiti is used for input. The touch of a button synchronizes the Pilot with a desktop PC, using 3Com's HotSync technology, which also backs up data and installs new applications.

The key to the Pilot's success is its simplicity. The design is achievable rather than overly ambitious. For example, requiring the user to learn a simplified alphabet allows for accurate and predictable letter recognition. The simple design translates into affordability: the PalmPilot Personal costs \$249, compared to \$1,000 for Apple's MessagePad 2100. It also leads to wonderful portability. The Pilot weighs under six ounces, including batteries, and is a little larger than a wallet. Finally, its open architecture and available software-development systems—for example, CodeWarrior, by Metrowerks—have allowed developers and companies to offer many useful third-party applications. By simplifying the design, 3Com achieved a realistic, inexpensive, and practical device.

The Pilot clearly shows that a handheld device driven only with a stylus can be successful. Naturally, other companies are



eager to get in the market. Sharp just released the SE-500 Mobile Organizer, which looks like the Pilot but lacks handwriting recognition and runs with a proprietary OS. Franklin Electronic Publishers created the Rex PC Companion, a stripped-down device with no input, which lets you browse information downloaded from a PC.

It's all about information

Why are these devices so successful in the first place? The answer is clear: people need to keep track of all sorts of personal information. We have always had this need, and our lives are becoming even busier and more connected. We need to schedule our day, look up phone numbers, remember the names of people to whom we were introduced, keep track of birthdays, read the latest news, trade our favorite stocks, and remember what to do, including when and where. There's a name for all these things: *Personal Information Management*.

The PIM market for desktop PCs is already well-established, including products such as Microsoft Outlook, Lotus Organizer, and Now Up-To-Date. A strong market also exists for paper-based organizers. The Pilot makes carrying all this information with us practical, so that we can access it anywhere and anytime. It's the same crucial information with which we've always been working; the Pilot is just a better means of getting to it and maintaining it.

In the pipeline

We're at the beginning of a long race in which many will eagerly contend. Although the Pilot might or might not retain its lead, we consumers will continue to win. Competition will bring prices down while improving functionality. Most important, three enabling technologies loom on the horizon: wireless networking, the Global Positioning System, and cryptography.

Wireless networking. PDAs will soon come with built-in access to a ubiquitous wireless network. This will render HotSync a thing of the past; your PDA will transpar-



In due time, your PDA will absorb the other things you now feel compelled to carry in your pockets. Keys, now rendered as metal, plastic, or a magnetic strip, will instead be stored as bits in your PDA. All forms of currency will have digital correlates, letting you buy groceries without worrying about visiting the ATM first. Likewise, forms of identification—for example, your driver's license and Social Security card—will be digital. People will no longer be able to lie about their age and identity.

Global Positioning System.

Using satellites and land towers, a GPS device, soon to be one chip plus an antenna, can locate its position on the Earth's surface within three meters. PDAs will incorporate GPS. You will consult your PDA to navigate in a foreign city or to find the nearest ATM or gas station, or a good place to eat. Over the network, your PDA will monitor traffic congestion, the weather, and construction conditions, altering its recommended route as needed. You will be able to locate your children or track the entire family in the mall or on the ski slope.

Cryptography. Security is a big concern with present and future PDAs. I store all sorts of very private information on my Pilot—account numbers and passwords, PINs for my credit cards, telephone numbers—all of which I do not want to fall into the wrong hands. And as PDAs come to absorb everything on our key chains and in our wallets, it would seem that if you lose your PDA, you lose yourself.

In the short term, however, there are excellent tools that use strong cryptography to protect your information—for example, Andreas Linke's Secret 2.0 freeware. These tools require you to punch in a password every time you need to access your critical data. Although this is adequate, the danger always exists that you will forget to encrypt certain pieces of important information.

In the long term, PDAs will exploit biometric identification, using your voice, fingerprints, pulse, and other reliable aspects to transparently confirm who you are, before allowing access to your data. Because this procedure will be so simple, everything will be encrypted by default. Also, once a high-

ently back up your data, at all times. In fact, you will no longer worry about where your data actually is, because that will not matter. People will share access to the same underlying data, stored on a central server, despite being separated in space or time. An executive, while traveling, will see changes to his or her calendar as they are made in real time back in the office. All family members will be able to update the grocery list, anywhere and anytime, and whoever does the shopping will see these changes.

Using this network, your PDA will eventually subsume the functionality of the remote controls in your home. You will control and configure your home appliances through your PDA. You will set your alarm clock; read your personalized TV guide and program your VCR; turn down the stereo or select a different song or radio station; and program, from your car or the subway, your home's heater to turn on shortly before you arrive there. This network won't need to be, and probably will not be, very high performance to provide most of these new services. Rather, it will serve as a stepping stone, motivating and then financing better infrastructure.

The network relaxes where and how computation occurs. For example, applications that are too compute- or space-intensive to run directly on your PDA will run, instead, on a remote high-performance computer, but then return the output of the computation. When new versions of applications are released, your PDA will automatically update. The boundary between your PDA and the rest of the world will become blurred.



Coming Next Issue

AI in Health Care

Over the last few years, optimism has grown that the world of medicine is finally going to be truly “online.” Many believe that the answer to some of the major challenges faced by the health care community lies in computerization, and it appears that with increased networking capabilities, effective new solutions to old problems are emerging. Furthermore, both administrators as well as practitioners are becoming convinced that technology will change the face of health care, balancing improved quality of patient care with cost effective management procedures.

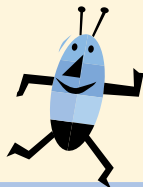
The role of AI in provoking and supporting these changes is of particular interest; despite AI's long history of research in the medical domain, relatively few AI systems are either currently in clinical practice or about to get there. Guest edited by Erika Rogers of California Polytechnic State University, this special issue considers the following questions: What is the changing face of health care? How does this affect AI research in this area? and What contributions can AI make

towards realizing these changes? Articles in this special issue are

- “Integrating a Knowledge-Based System for Parenteral Nutrition of Neonates into a Clinical Intranet”
- “Guardian: An Intelligent Autonomous Agent for Medical Monitoring and Diagnosis”
- “Neural Network Learning for Intelligent Patient Image Retrieval”
- “Knowledge Architectures for Patient Access to Breast-Cancer Information”
- “TraumaTIO: On-Line Decision Support for Trauma Management”
- “OSSIM: Voice-Enabled, Structured Medical Reporting”



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performance wireless network is in place, your sensitive data will not even be stored on the PDA but on a secure, central server, to be downloaded and decrypted on demand and then discarded. Thus, even if you lose your PDA, it will contain no sensitive data. For instance, as you hold your PDA, it will detect your pulse and measure your fingerprints, thereby confirming your identity. It will then unlock doors, let you pay bills at a hotel or restaurant, and provide your driver's license when you rent a car.

Cryptography, when properly implemented, offers tremendous security—security well beyond what we now tolerate in

the “real world.” Digitally encrypting our credit card number and storing it in a PDA is far better than stamping it on plastic and storing it in our wallets.

All this and more. Besides these revolutionary changes, evolution will ensure that these devices steadily improve. Memory capacity will increase, as will the processing power and the performance of the wireless network. Battery life will lengthen. The screen, which is rather low-resolution at present, will become color with a very high resolution.

The future commodity

The Pilot's success is just the beginning. The market frenzy that the Pilot has created will ensure that PDAs soon incorporate all these technologies, and that they will be priced reasonably. Eventually, PDAs will be a commodity item, much like calculators or digital watches are today. The PDA will just be a rather generic conduit, a standard platform, to access all your private information, securely stored on a distant, reliable server. There will be no risk if you lose your PDA; you will just buy another one, pull out a backup, or borrow your friend's for a few minutes. You will not hesitate to give your children each a PDA, just as you give them each a packed lunch box for school. Your PDA will grant you access to all your important data and devices. Soon you will need to carry little else.

Related links

Read more about the Pilot

Download Pilot software

An excellent tutorial on GPS

Secret 2.0, for encrypting Pilot data

Metrowerks CodeWarrior developer's kit

<http://www.3com.com/palm/>

<http://www.palmpilotfiles.com>

<http://www.trimble.com/gps/>

<http://www.tphys.uni-heidelberg.de/~linke/pilot/secret.html>

<http://www.metrowerks.com>

Illustrations by Sally Lee; sally@sls.lcs.mit.edu; <http://www.sls.lcs.mit.edu/sally>.