ITMC421
ITNT403

UbiComp Theories
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UbiComp Theory [1]

- Important Paper

The Computer for the 21st Century

Specialized elements of hardware and software, connected by wires, radio waves and infrared, will be so ubiquitous that no one will notice their presence

by Mark Weiser

تطوير التفكير في الحوسبة:
الحوسبة في كل مكان

We are therefore trying to conceive a new way of thinking about computers, one that takes into account the human world and allows the computers themselves to vanish into the background.

By: Dr. Abdussalam Baryun

الحوسبة في كل مكان ولكن مخفية !!!

Such a disappearance is a fundamental consequence not of technology but of human psychology. Whenever people learn something sufficiently well, they cease to be aware of it.

By: Dr. Abdussalam Baryun

Using technology without thinking

Technology Things that disappear

When you look at a street sign, for example, you absorb its information without consciously performing the act of reading. Computer scientist, economist and Nobelist Herbert A. Simon calls this phenomenon "compiling"; philosopher Michael Polanyi calls it the "tacit dimension"; psychologist J. J. Gibson calls it "visual invariants"; philosophers Hans Georg Gadamer and Martin Heidegger call it the "horizon" and the "ready-to-hand"; John Seely Brown of PARC calls it the "periphery." All say, in essence, that only when things disappear in this way are we freed to use them without thinking and so to focus beyond them on new goals.

By: Dr. Abdussalam Baryun

How do technologies disappear into the background? The vanishing of electric motors may serve as an instructive example. At the turn of the century, a typical workshop or factory contained a single engine that drove dozens or hundreds of different machines through a system of shafts and pulleys. Cheap, small, efficient electric motors made it possible first to give each tool its own source of motive force, then to put many motors into a single machine.

By: Dr. Abdussalam Baryun

Using Different Compute Devices

Ubiquitous computers will also come in different sizes, each suited to a particular task. My colleagues and I have built what we call tabs, pads and boards.
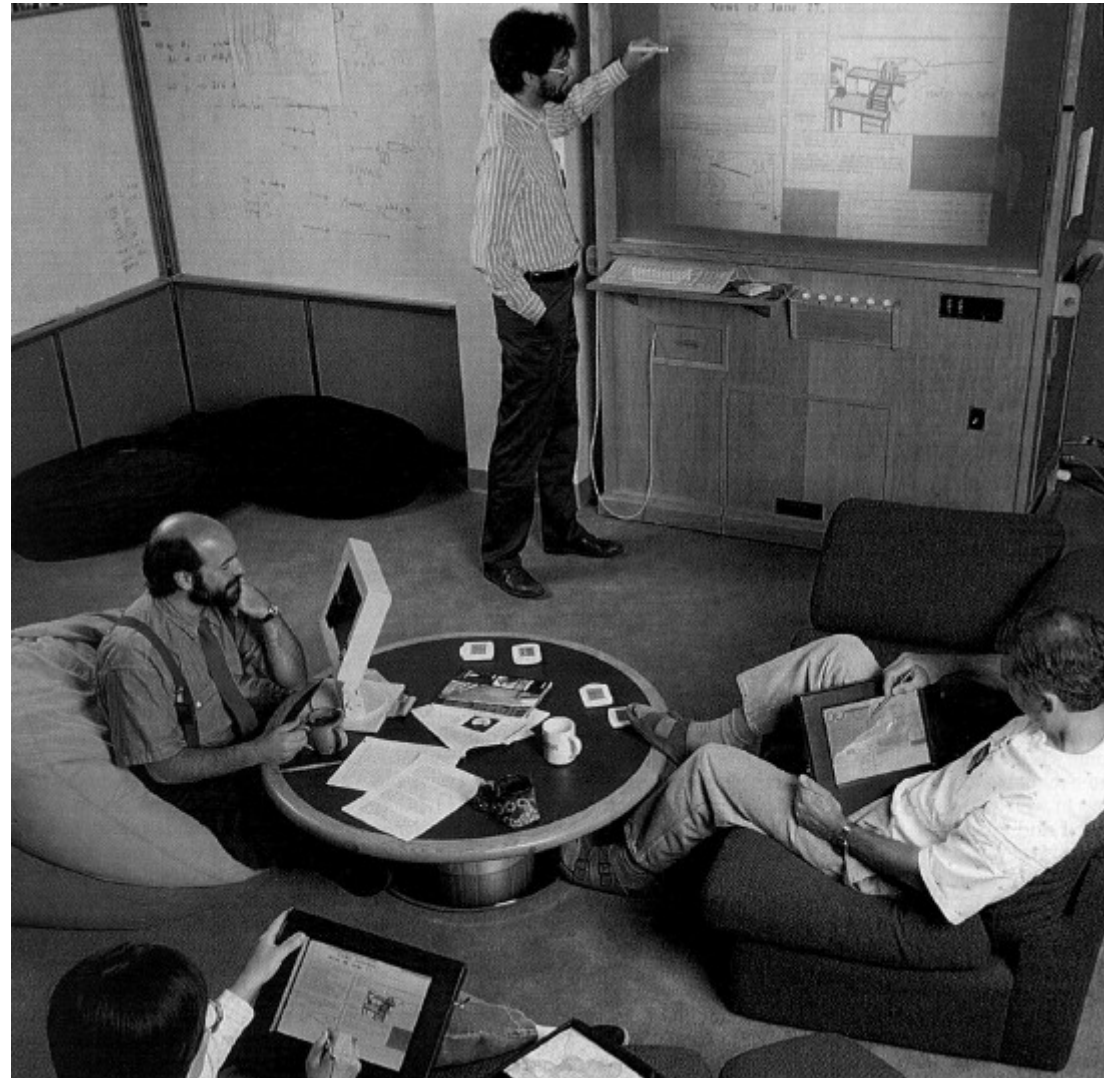
By: Dr. Abdussalam Baryun

Computing into our Life:
Live Boards

UBIQUITOUS COMPUTING begins to emerge in the form of live boards that replace chalkboards as well as in other devices at the Xerox Palo Alto Research Center. Computer scientists gather around a live board for discussion. Building boards

and integrating them with other tools has helped researchers understand better the eventual shape of ubiquitous computing. In conjunction with active badges, live boards can customize the information they display.

By: Dr. Abdussalam Baryun

Making Computing into our Life:
Live Boards

By: Dr. Abdussalam Baryun

World inside the Computers: Virtual Reality

Perhaps most diametrically opposed to our vision is the notion of virtual reality, which attempts to make a world inside the computer. Users don special goggles that project an artificial scene onto their eyes; they wear gloves or even bodysuits that sense their motions and gestures so that they can move about and manipulate virtual objects. Although it may have its purpose in allowing people to explore realms otherwise inaccessible—the insides of cells, the surfaces of distant planets, the information web of data bases—virtual reality is only a map, not a territory. It excludes desks, offices, other people not wearing goggles and bodysuits, weather, trees, walks, chance encounters and, in general, the infinite richness of the universe.
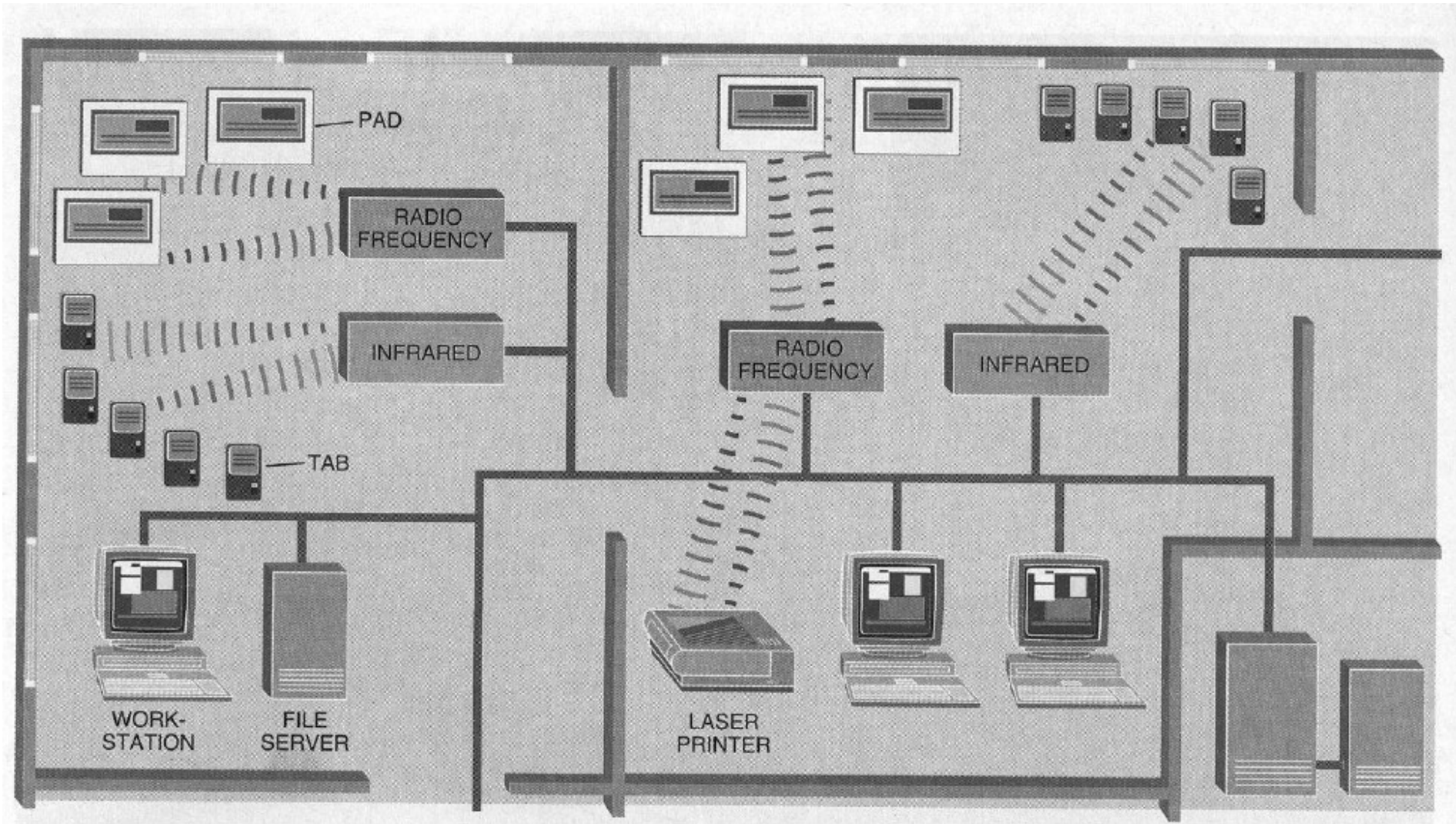
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UbiComp and Awareness

ubiquitous comput-
ers must know where they are. (Today's
computers, in contrast, have no idea
of their location and surroundings.) If a
computer knows merely what room it
is in, it can adapt its behavior in sig-
nificant ways without requiring even a
hint of artificial intelligence.

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UbiComp need hundreds of computers per Room

Hundreds of computers in a room could seem intimidating at first, just as hundreds of volts coursing through wires in the walls once did. But like the wires in the walls, these hundreds of computers will come to be invisible to common awareness. People will simply use them unconsciously to accomplish everyday tasks.

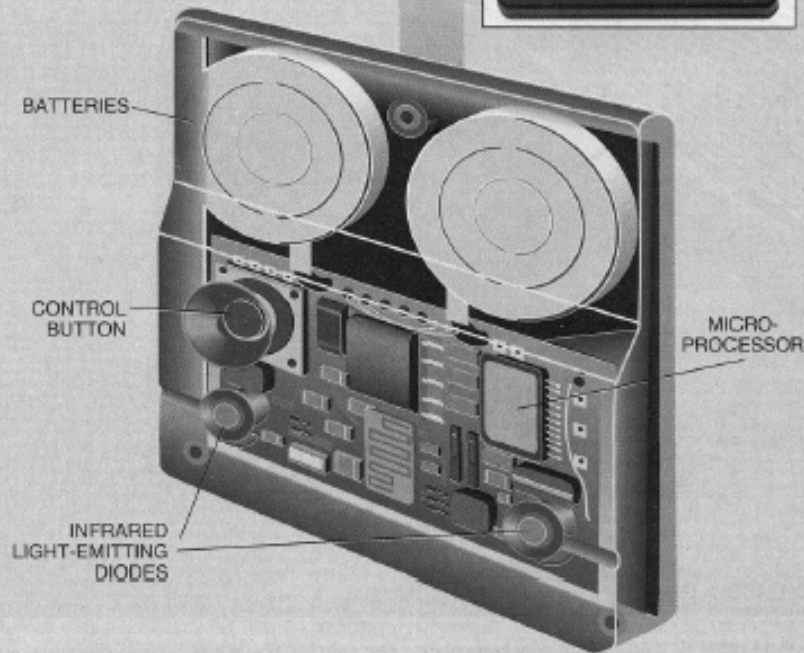By: Dr. Abdussalam Baryun

Ubi-Networks

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Ubi-Networks

WIRED AND WIRELESS NETWORKS link computers and allow their users to share programs and data. The computers pictured here include conventional terminals and file servers, pocket-size machines known as tabs and page-size ones
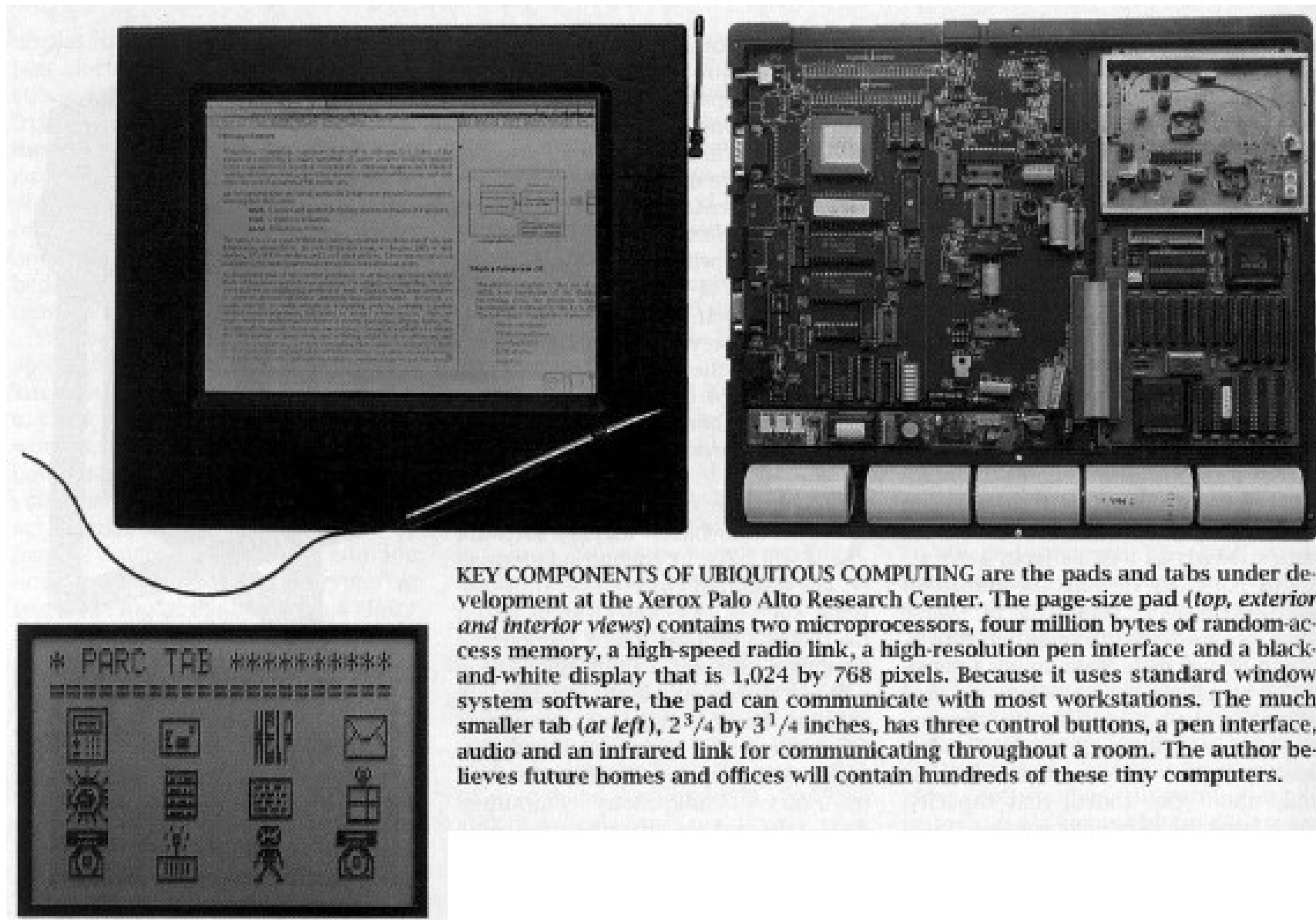
known as pads. Future networks must be capable of supporting hundreds of devices in a single room and must also cope with devices—ranging from tabs to laser printers or large-screen displays—that move from one place to another.

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The Active Badge

This harbinger of inch-scale computers contains a small microprocessor and an infrared transmitter. The badge broadcasts the identity of its wearer and so can trigger automatic doors, automatic telephone forwarding and computer displays customized to each person reading them. The active badge and other networked tiny computers are called tabs.

Chris Kent
Xerox PARC

olivetti

BATTERIES

CONTROL BUTTON

MICRO-PROCESSOR
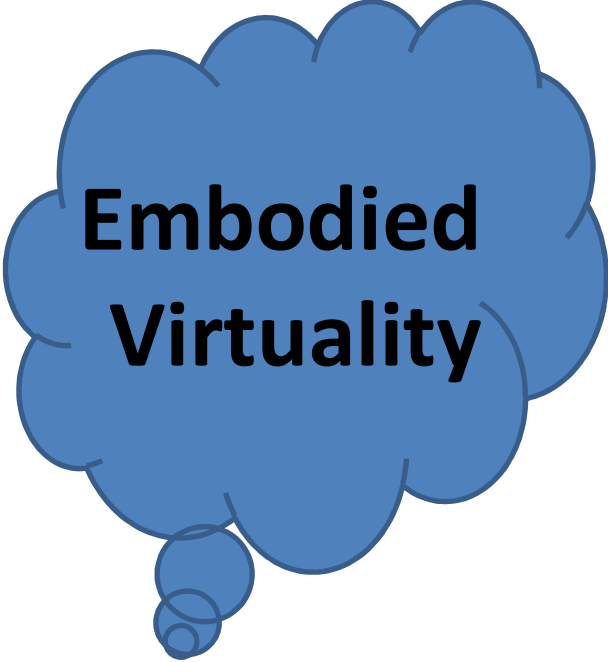
INFRARED LIGHT-EMITTING DIODES

By: Dr. Abdussalam Baryun

KEY COMPONENTS OF UBIQUITOUS COMPUTING are the pads and tabs under development at the Xerox Palo Alto Research Center. The page-size pad (*top, exterior and interior views*) contains two microprocessors, four million bytes of random-access memory, a high-speed radio link, a high-resolution pen interface and a black-and-white display that is 1,024 by 768 pixels. Because it uses standard window system software, the pad can communicate with most workstations. The much smaller tab (*at left*), $2^3/4$ by $3^1/4$ inches, has three control buttons, a pen interface, audio and an infrared link for communicating throughout a room. The author believes future homes and offices will contain hundreds of these tiny computers.

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Virtual Reality and Ubiquitous

Virtual reality focuses an enormous apparatus on simulating the world rather than on invisibly enhancing the world that already exists.

Indeed, the opposition between the notion of virtual reality and ubiquitous, invisible computing is so strong that some of us use the term "embodied virtuality" to refer to the process of drawing computers out of their electronic shells. The "virtuality" of computer-readable data—all the different ways in which they can be altered, processed and analyzed—is brought into the physical world.

Embodied Virtuality

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UbiComp Requirements

The technology required for ubiquitous computing comes in three parts: cheap, low-power computers that include equally convenient displays, software for ubiquitous applications and a network that ties them all together.

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Ubi-Operating Systems

Computer operating systems and window-based display software will have to change substantially. The design of current operating systems, such as DOS and Unix, is based on the assumption that a computer's hardware and software configuration will not change substantially while it is running. This assumption is reasonable for conventional mainframes and personal computers, but it makes no sense in terms of ubiquitous computing.

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Mobile Devices and Apps

Pads, tabs and even boards may come and go at any time in any room, and it will certainly be impossible to shut down all the computers in a room to install new software in any one of them. (Indeed, it may be impossible to find all the computers in a room.)

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Solutions for Changes to UbiComp

One solution may be "micro-kernel" operating systems such as those developed by Rick Rashid of Carnegie Mellon University and A. S. Tanenbaum of Vrije University in Amsterdam. These experimental systems contain only the barest scaffolding of fixed computer code; software modules to perform specific functions can be readily added or removed. Future operating systems based on this principle could shrink and grow automatically to fit the changing needs of ubiquitous computation.

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Solutions for Changes to UbiComp

Making pads, tabs and boards work together seamlessly will require changes in the kinds of protocols by which applications programs and their displayed windows communicate.

the problem of transparently linking wired and wireless networks resists solution. Although some stop-gap methods have been developed, engineers must develop new communications protocols that explicitly recognize the concept of machines that move in physical space.

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Solutions for Changes to UbiComp

Present technologies would require a mobile device to have three different network connections: tiny-range wireless, long-range wireless and very high speed wired. A single kind of network connection that can somehow serve all three functions has yet to be invented.

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Weiser's thoughts of the Future Directions

Most important, ubiquitous computers will help overcome the problem of information overload. There is more information available at our fingertips during a walk in the woods than in any computer system, yet people find a walk among trees relaxing and computers frustrating. Machines that fit the human environment instead of forcing humans to enter theirs will make using a computer as refreshing as taking a walk in the woods.

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References

[1] Weiser, M., The computer for 21st century, 1991.