

By Leslie J. Nicholson  
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**T**his could turn the whole idea of a "chat room" on its head.

Imagine a new kind of Web emerging in the next 10 years. On this Web, a human's prerequisite might be a handheld computer, but the Web users would not always be people. Often, they would be machines.

Kitchen appliances could talk to each other. A new refrigerator could register itself with the manufacturer online.

The refrigerator also could gather information about what items are in short supply, add them to a computerized shopping list, and place an order with a grocer over the Internet. The same appliance could be a memo board, downloading family members' calendars from handheld computers, and then displaying the information on a monitor or sending it to a printer.

William Mark can imagine such a Web. Mark, vice president of information and computing sciences at SRI International in Menlo Park, Calif., has predicted the emergence of "agent communities" that will carry out tasks online without a single human being involved.

Over the next decade, we will move into this new era of ubiquitous computing, or pervasive computing, experts have said.

It is "anytime, anywhere" computing integrated into the most mundane of objects. It is computing that is invisible to the user, where objects are capable of retrieving information and carrying out tasks without human intervention.

"Pervasive means extending the reach of computing technologies to wherever the end user might be," said Jon Prial, director of marketing for IBM Pervasive.

Steve Shafer, senior researcher in the vision technology group at Microsoft Research in Redmond, Wash., added: "To me, it's the vision of a future in which all electronic devices function as parts of an integrated, organic whole."

In the near future, when a person speaks a command into thin air, a nearby object will take action, or even answer the person by voice. In the future, "It is going to be very quaint to think of a time when your refrigerator didn't talk to you," Mark said.

With ubiquitous computing, your clothes will monitor your heartbeat, and your bathroom will monitor your health, said Michio Kaku, author of "Visions," a book on future technology trends. "You'll enormously on your medical bill because your toilet will basically be your doctor," Kaku said.

Matsushita Electric Industrial Co. Ltd. in Japan is already working on a toilet that would perform urine analysis, and send

results to a doctor over the Internet. Kaku said he foresaw the day when such a device will be able to detect the first stages of cancer by finding certain proteins in body fluids. "Ten, 15 years, it will be better than a doctor's office," he said.

The National Institute of Standards and Technology, which just launched a pervasive-computing initiative, said computers, actuators and sensors would be embedded

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in "virtually every device, appliance and piece of equipment, and even clothing. Many of these devices will be connected to the Internet."

Four trends are coming together to make this possible, NIST said: the growing number of computers per person, advances in miniaturization technology, the explosive growth of the Internet, and continued growth of wireless communications technology.

People will experience pervasive computing in two ways. The first is through "intelligent environments." These are ordinary places — cars, homes, conference rooms — that are made smarter and more interactive by microprocessors, sensors, software, wireless networking, tiny cameras, speech recognition and other technologies.

Embedding such capabilities in ordinary objects is not new. Linking those smart items to each other and to the Internet is the challenge.

The second ingredient in pervasive computing is mobile devices that will connect people to the intelligent environments no matter where they are.

Research laboratories nationwide are delving into both sides of ubiquitous computing.

It may be time to stop snickering at the office geek with the palm computer in her purse. To hear the experts describe this world of ubiquitous computing, nearly everyone will need a handheld. It could be any device, including a cell phone, capable of providing a link between a person and smart objects around him — no matter where the person is — and also serving as a gateway to the Internet.

Whatever it is, it will be equipped to communicate with the omnipresent sensors and beacons, and it will be able to send and receive data over high-frequency, very-short-range wireless networks. These networks will connect all the smart products within a home or other small space.

This handheld device will also be able to connect to the Internet, and, in all likelihood, will use some form of speech recognition.

But the access device could also be a wearable computer, with a tiny screen that hangs on a headband. Or, it could be a wristwatch. Hewlett-Packard Laboratories and Swatch are working on a Web-surfing watch now.

The smart watch is an example of what Hewlett-Packard calls a "context-aware" Web device. That means a device that will be able to identify its user through some kind of biometric technology. Once it knows the user, it will be able to provide appropriate information. Using, say, global positioning satellites, it could pinpoint the user's location.

A context-aware device would be capable of gathering and responding to information about the surroundings. It could tell someone that a friend is in the next room because it reads a signal from the friend's palm computer.

Right now, mobile devices are like children who have not learned the rules and courtesies of society, said Bill Joy, cofounder of Sun Microsystems Inc. For example, a cell phone should be able to read your calendar, see that you are scheduled to be in a meeting, and turn its ringer off automatically, or even do so because it recognizes that the room you are in is a meeting room.

And that brings us to CoolTown. CoolTown is Hewlett-Packard Laboratories' vision of a world filled with

people, places and things that are connected to the Internet. Everything has a Web page in CoolTown. The bus stop, the restaurant, a painting at the art museum, and the person walking down the street would be equipped with some kind of beacon that could broadcast a Web address.

All you would have to do is pick up that URL with some kind of device, be it a smart watch, a handheld computer, or something else. The device would display the Web information, or become a clipboard that accepts the data and then shoots them wirelessly to the nearest printer, said John J. Barton of the Future Systems Department with H-P Labs.

Barton said that a person carrying a personal digital assistant on a bus of the future might be able to pick up URLs from businesses that the bus passes along the route. A museum visitor could download and print a Web page about a favorite painting on the spot.

Work on intelligent environments is equally intriguing.

At Microsoft Research, Shafer is involved in a project that tries to get computers to "see." Such computers would recognize people and things, and respond to human movements and gestures. He is experimenting with three-headed cameras,

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capable of depth perception, along with sensors to teach computers the layout of a house and how to recognize the people who live there.

You sit down somewhere. The computer knows where you are, and turns the wall next to you into a personalized computer screen. Such a system also would allow people to remotely monitor home electronics, and to find their lost car keys.

"One day, the system will be so clever, it will recognize the dog," Shafer said.

The Fuji Xerox Palo Alto Laboratory in California is working on smart conference rooms with everything from animated avatars to note-taking systems that capture and send presentations to the handheld computers of all meeting attendees.

The list goes on and on. Researchers at Andersen Consulting are working on the online medicine cabinet, which would use face recognition to identify the person standing before it. If it knows the person has allergies, it could deliver the day's pollen count. Using "active labels," it would even know whether the person picks up the wrong pill bottle.

Unisys Corp. is banking on the use of human speech to control these ubiquitous devices. It has software "tools" that other companies use to design and employ "natural language" applications.

Such programs go a step beyond ordinary speech recognition. They allow people to have an actual dialogue with a computer program, said Joseph Yaworski, head of the natural language understanding business initiative at the Blue Bell company.

Author Kaku predicted that pervasive computing will turn jobs "upside down and backward." He said there will be less need for "middlemen," such as car dealers and travel agents, and more demand for workers who provide services that cannot be provided by machines.

"You have the Internet in your glasses. Any human experience that can be digitized will be accessible through your glasses," Kaku said. "Somebody just lost their job."

All of this pervasive technology raises troubling privacy issues. Hewlett-Packard's Barton said the technology in the CoolTown scenario would let people choose what information would be broadcast. Some simply said privacy was a hurdle that must be overcome.

Kaku said he believes that Big Brother is not the real issue, especially with people creating computing networks in the home.

"The downside of all this will be little brother: nosy neighbors, and stalkers, and busybodies."

