Little Devices Will Think

Starting the dishwasher from your cell phone or having your refrigerator order your milk online may seem far-fetched now, but it won’t for long. By Carol Levin

Manufacturers of all sorts of home appliances are building more smarts into their wares with the help of embedded processors with names such as StrongARM and DragonBall running obscure operating systems such as pSOS and VxWorks. You won’t see multimillion dollar Super Bowl commercials promoting the processors, but these no-name chips—over 120 varieties from some 40 companies—are positioned to reinvent computing for the new millennium.

You already benefit from many of them every day. They’re hidden inside microwave ovens, washing machines, set-top boxes, and other assorted peripherals of modern life. The fastest-growing destinations for embedded chips are video games, digital cellular phones, and automobiles.

Technically, there’s not much difference between some low-cost embedded processors and pricey Intel Pentiums, except that embedded processors cost less and consume less power. “There are embedded chips that would give the Pentium II a run for its money,” says Jim Turley, senior analyst at MicroDesign Resources (MDR) and senior editor of Microprocessor Report. Technological advances may start showing up in embedded processors before they do in conventional ones. John Hennessy, dean of Stanford University’s School of Engineering and cofounder of MIPS Computer Systems, says embedded chips may be first to offer multiple processors on a single chip. And they are multiplying at a blistering pace, relegating PC chips to mere specks in the digital ecosystem.

Though sales of PC chips are measured in the millions, and although annual growth hovers around 15 percent, sales of embedded processors are counted in the billions, with annual growth at 50 percent last year and 100 percent the previous year. “Conventional processors make up roughly 0 percent of the world market,” says Turley. Last year, 250 million high-end (32-bit or 64-bit) embedded processors shipped; that’s one for every man, woman, and child in the U.S. You get the picture.

Consumers’ hunger for embedded chips has become insatiable. Just consider the success of the Palm family of hand-held devices, the latest of which run on Motorola DragonBall EZ chips. And there’s lots more to come, as hardware manufacturers eagerly show off prototypes and discuss concepts of even smaller devices that break the bounds of traditional computing.

PHONES, WATCHES, AND FRIDGES

At IBM, one of the latest prototypes to come out of the lab is the cyberphone, a combination cellular phone and computer with wireless Web access and a tiny built-in virtual display on which, thanks to a mirror, images appear as large as they would on a desktop monitor. IBM engineers are also noodling with a super-high-resolution wristwatch that can provide easy visual access to data. And wrist phones have already hit Asia, where Samsung sells a model with voice-activated dialing that should be available in the U.S. next year.

Symbian (the consortium of Ericsson, Motorola, Nokia, and Psion) has developed the EPOC operating system for running the next generation of Internet devices. Symbian has kept a low profile, but it has been striking deals left and right to get EPOC inside future devices. The Ericsson R380 GSM mobile phone, which should be available early next year, will run EPOC and include a built-in modem, PDA, touch screen, calendar, address book, e-mail, Internet connection, handwriting recognition, voice dialing, and voice answering. But Microsoft wants Windows CE to be inside your Internet devices, and the company recently demonstrated the Hermes Internet telephone, which runs Windows CE.

Smarter microprocessors are also finding their way into refrigerators. A prototype refrigerator from Frigidaire Home Products and ICL, which uses an Intel microprocessor, offers such mouthwatering items as 32MB of RAM, an Ethernet connection, a flat-panel touch screen, a bar-code scanner, and Microsoft Windows 95. Once the fridge is connected...
to a phone line for dial-up Internet access or to a home network that’s connected to the Web, you can send orders to retailers, scan and purchase goods, pay bills, watch TV, and send e-mail.

Some observers, including MDR’s Turley, are bearish about such network appliances, relegating them to technologists’ dreams. Instead, Turley sees embedded processors improving on existing technology. Your dishwasher, for example, will become quieter with the assistance of an internal computer that deadens the sound.

**COMMUNICATION IS KEY**

So how exactly will you start your dishwasher while you’re at the office? After all, neither your phone nor your PC even knows that your dishwasher exists. Both Microsoft and Sun Microsystems think they have the answer. Each company is backing its own initiative to get all these new appliances and gadgets to become aware of each other and communicate in much the same way as your telephone communicates with any other telephone in the world.

For Sun Microsystems and the many manufacturers of cellular phones, printers, and hand-holds it has recruited, the answer is Jini, a Java-based technology that deposits Java code on digital devices so they can self-organize into communities without a desktop computer to act as an intermediary. Devices that support Jini can join a network, automatically configure themselves without fuss, and start communicating. Jini doesn’t require any particular operating system or processor.

Competing directly with Jini to become the common language for all digital devices is Microsoft’s Universal Plug and Play. If everything goes as planned, it will be built into every device in your digital universe, so you’ll be able to connect your WebTV to a scanner and e-mail photographs from your television. Or perhaps you’ll need to turn off the stove from the car by using your digital phone to access the home network. No problem. And if you can’t be home to let the cable guy in, you’ll be able to tap into the video camera and let him in remotely.

Universal Plug and Play uses standard Internet protocols, so when you connect a device to the network, the device automatically acquires a TCP/IP address and, using a “discover protocol” based on HTTP, announces its availability to other devices on the network. No PC required.

But Universal Plug and Play is just one step toward Microsoft’s far more ambitious Millennium research project, which aims to turn a network of devices into one giant computer that allocates resources efficiently to accomplish each task. Whereas Universal Plug and Play provides a way for devices to communicate, Millennium “takes all those devices and makes them look like one big computer,” says Microsoft researcher Galen Hunt.

What Millennium does is comparable to talking to your friends, whether they’re standing next to you or on the other side of the planet, without even knowing a phone is involved,” says Hunt.

Motorola, a leading embedded-chip manufacturer, also has ambitious plans for smart appliances. It recently teamed up with MIT’s Media Lab to create the Motorola DigitalDNA Laboratory, where future smart and appliances are already under development. DigitalDNA refers to the possibility of linking together all sorts of smart products. Some of the concepts include a treadmill that automatically checks your pulse and adjusts the incline accordingly, clothing with labels that inform the washer what cycle to use, and doors that open for specific people or pets.

And that’s just the beginning. Whichever protocol wins out for connecting all these devices together, there’s a good chance that it won’t matter to you. Just as you don’t think about what OS your telephone runs, you won’t care what OS or chip your digital devices run. They’ll just be there, at your service.