

# Special Report

Embedded Series: PC/104 & CompactPCI



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Managing Editor

## PC/104 Eases Transition to Wireless



by Glenn S. Kubota, Micro/sys, Inc.

One of the main problems with designing embedded computer systems is the rapid advancement of technology and its effect on the features that are desired or required in a system. In some systems, adding a

new feature may require extensive redesign or it may even require starting from a clean sheet of paper. One new technology that is becoming more and more desirable is wireless communication. It has widespread applications such as data networks, point-of-sale terminals and process control, and it can be found in locations as diverse as corporate headquarters, retailers, hospitals and factories.

Designing a wireless system from scratch can be difficult because of the intricacies of radio-frequency design and FCC certification. However, designing a system with PC/104 expansion can make the transition to wireless relatively easy. Adding wireless capability becomes as easy as plugging in a card.

### The PC/104 Specification

The PC/104 bus is a mechanical and electrical specification that adapts the IBM PC/AT bus to a compact version that is optimized for embedded systems. The form-factor for a PC/104 module is 3.550" × 3.775" (90 mm × 96 mm). Additionally, PC/104 is a self-stacking bus which eliminates the need for a backplane or a card rack. Because of its many advantages, PC/104 has seen phenomenal growth over the course of its life. There are currently hundreds of companies that manufacture compatible modules.

In addition to modules that are PC/104 "compliant" (i.e., they conform to all mechanical and electrical aspects of the PC/104 specification), there are also devices that are PC/104 "bus-compatible." This refers to devices that do not have the same dimensions as specified in the PC/104 specification, but still have the PC/104 bus connector that allows other modules to be plugged in. In either case, the PC/104 expansion capability makes it easy to plug in modules that add wireless capability into the system.

Even though it was developed 10 years ago, the PC/104 bus still has the capability of embracing new technologies, both hardware and software. For example, when the PCI (Peripheral Component Interconnect) bus became popular on the desktop, the PC/104-Plus specification seamlessly added this high-speed bus to PC/104 modules. Similarly, as Linux has become more popular, PC/104 systems have allowed it to be designed into many embedded systems. As other new technologies evolve, they will doubtlessly be available in PC/104 modules.

### Wireless Technology

One technology that has recently exploded in popularity is wireless data communication. By using wireless technology, the need for extensive field wiring is greatly reduced. This means, for example, that additional nodes can be added to a company network with minimal impact.

The most popular wireless LAN (local area network) technology is currently Wi-Fi (IEEE 802.11b). Wi-Fi runs in the unlicensed 2.4 GHz range in the U.S. and has a maximum throughput of 11 Mbps over distances of less than about 100 m. It is a wireless version of the popular Ethernet standard. Wi-Fi has become very popular in the

corporate and home market, and it is making inroads into the commercial and industrial markets as well.

However, in addition to Wi-Fi, there are many other types of wireless that are available. Each standard has its own set of advantages and disadvantages. Generally speaking, there is a trade-off between high data rates and wide coverage areas. For example, Bluetooth is optimized for low cost point-to-point communication over a short distance. GSM/GPRS support allows communication through some existing cellular phone networks and thus has a wide coverage area. PC/104 shows its flexibility by making it easy to add wireless capability of almost any type to both new and existing systems.

### Adding Wireless Capability

When adding wireless capability to a PC/104 system, the method chosen may depend on whether this is a retrofit of wireless into an existing installation or a new design. If wireless is being added to an existing installation, an interface board can simply be plugged into a PC/104 expansion connector. This interface board can have the wireless circuitry on-board. However, a very flexible way of getting wireless is to plug in an interface board with a PC Card (PCMCIA) connector (Figure 1). This allows different wireless cards (Wi-Fi, Bluetooth, 802.11a, GSM/GPRS, CDMA or others) to be plugged in as required. This has proven to be a popular way of adding wireless capability

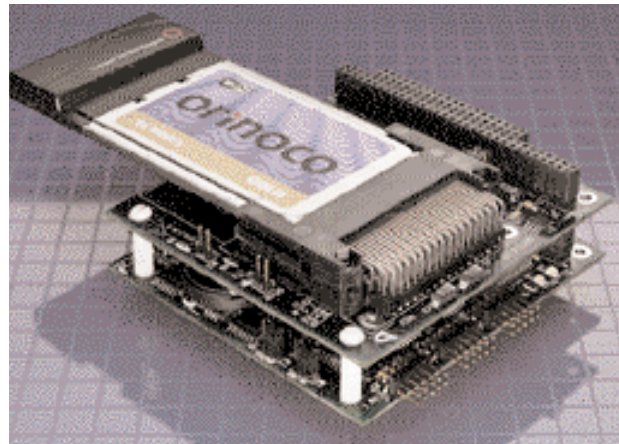


Figure 1. The Micro/sys MPC420 PC Card adapter is shown plugged into a PC/104-compliant CPU board. The Wi-Fi PC card that is plugged into the MPC420 adds wireless capability.

because it leverages off the wide availability of wireless PC cards for the laptop market.

It also has the advantage that the wireless technology employed can be changed relatively easily. If, for example, a Wi-Fi card is installed and it is found that the installation needs to have a faster data rate, the Wi-Fi card can be unplugged and an 802.11a PC card can be put in its place. If a wide coverage range is required, a GSM/GPRS card can be installed. Also, there have been many articles written about wireless security and there are going to be changes made to some of the security protocols. However, plugging in a different PC card can easily accommodate these changes in security protocols.

If a new installation is being designed, it will usually be less expensive to use a CPU board that has a PC card slot built in, as well as having PC/104 expansion capability

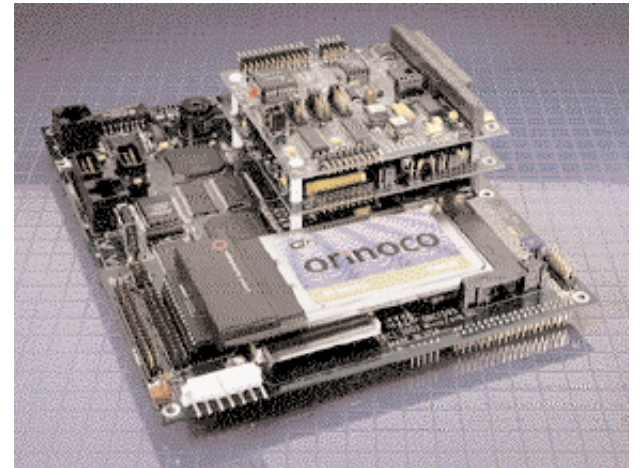


Figure 2. The Micro/sys SBC2595 is a PC/104 bus-compatible CPU board that has a PC card slot built in. Many different wireless PC cards can be plugged directly onto the CPU board.

(Figure 2). Having the PC card slot on-board means that different wireless technologies can be easily accommodated. Having the PC/104 expansion capability means that special I/O (analog, digital, video, etc.) can be added as necessary. It is even possible to add additional wireless cards to the PC/104 stack.

### The Future

As wireless technologies continue to migrate from the corporate office to other areas, the need to add wireless capability to embedded systems will become more ubiquitous. Remote monitoring, remote control, point-of-sale and many other applications will make wireless technology increase in popularity for many years to come. PC/104 expansion ensures that changes to new wireless standards can be easily accommodated.

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