# Cellular Data Communications Made Easy

*by Peter Rysavy*

Huge numbers of people are hitting the road with their cellular telephones and notebook computers, many of which have PC Card modems installed. Thanks to recent advances in modem technology and cellular services, users can easily connect those modems to their cellular phones. And they can reliably dial up connections over cellular links at rates of 9,600 bps-sometimes higher-gaining mobile access to corporate e-mail and databases, online services and the Internet. But few are taking advantage of cellular data. Why?

One reason is that most people are not aware that cellular data communications is a viable option. Others are unsure of the costs they will incur. And finally, there are some significant hurdles for the user to overcome. Although these hurdles are relatively minor for IS managers and technical users, they can defeat the average user. In this article, we'll tell you what you need to know to make cellular data work for you.

For our testing, we concentrated on the Advanced Mobile Phone Service (AMPS) network. This analog cellular network provides service throughout the United States and Canada, accounting for more than 90 percent of cellular phone use in North America today. AMPS technology is used in other countries as well.

Digital and Analog Technologies Cellular and Personal Communications Services (PCS) companies are rapidly deploying new networks based on digital technology. However, though data services for some of these digital networks are available today, they will not be broadly available until 1998 or later. For more details, see "Update on Data Over Digital Cellular and PCS," immediately following this article. Additionally, see "Digital Cellular Networks: On the Road to PCS".

Just to confuse things, Cellular Digital Packet Data (CDPD) networks also operate over the analog cellular network (see "Wireless Data Made to Order". For CDPD, you need a special modem or a new-generation smart cellular phone (such as AT&T PocketNet phone) that incorporates a CDPD modem. CDPD is a packet data technology best-suited for transmission of short messages. RAM Mobile Data and ARDIS are two other packet data networks available in the United States.

With packet data, the modem occupies the radio channel only for the time it takes to transmit that packet. Typically, users are billed for the amount of data they send. In contrast, when you use your PC Card modem to communicate over a cellular connection, you are making a circuit connection and paying for the duration of the call just as when you make a voice call. The per-minute charges are usually the same.

How does cellular circuit data work? Instead of plugging your modem into a telephone jack, you plug it into your cellular phone with what is called a "direct connect" cable. Easy so far. But cellular connections are noisier because of interference and they are more prone to errors. Additionally, the radio channel's spectral characteristics differ from those of a landline copper wire connection. The result is that conventional modem modulation and error control do not work well. Therefore, modem vendors have developed new protocols and other techniques specifically for cellular connections.

**All the Right Moves**

The key to success is to take advantage of these new cellular protocols. We assume your PC Card modem is already installed in your computer along with all the appropriate PC Card drivers, and that you can readily make landline connections.

- Use the right application Because cellular calls can cost more than landline calls, use cellular connections judiciously and with programs that give you control over how much data you download. For example, Microsoft Exchange lets you view headers before you transfer mail items. QUALCOMM's Eudora Pro lets you specify a maximum message size. Most Web browsers let you operate in a text mode (eliminating data-hogging graphics). These controls can protect you from inadvertently downloading megabytes of data that you don't need. Some applications may have to be re-architected before they are suitable for wireless use, in which case, you may want to consider a variety of wireless middleware toolkits that function not only with analog cellular, but also with other wireless networks. Before attempting cellular connections it's a good idea to make sure your application and modem work properly over landline connections. Doing so will help you isolate problems with cellular connections should they occur.

- Use the right modem Make sure your modem supports one of the leading cellular protocols, which include Enhanced Throughput Cellular (ETC), the Microcom Networking Protocol 10 (MNP10), MNP10-EC (enhanced cellular) and TXCEL. Because a protocol is like a language, it only works if the modems on both sides of the connection speak the same protocol (there's no translation involved). Hence, the fixed-end modem needs to support the same cellular protocol as the mobile modem. Unfortunately, most corporate modem pools, Internet service providers (ISPs) and online service providers do not support these protocols. The solution is to make connections through a modem pool operated by a cellular service provider.

- Use the right phone and cable Although the RJ-11 connector is standard, neither the physical nor the electrical connection to a cellular phone is. Each cellular-capable modem supports only certain makes and models of cellular phones. Check your modem manual. Some low-cost cellular phones don't support data at all. In addition, you need to use the right direct connect cable, which you usually can obtain from the modem vendor. In general, you will have better success matching your modem to your cellular phone with the major brand phones because modem vendors are more likely to support

these products. If you find that your modem does not support your cellular phone, check with your modem vendor to see if it has more recent modem firmware that supports additional phones. If you are using a dual-mode analog/digital cellular phone, you may have to put your phone in analog mode for data calls. How this is done depends on the model of digital cellular phone. Once you have the matching components, you will experience optimal operation with the phone antenna extended and the phone in a vertical position. For reliable data calls, you want reasonable signal strength and stationary operation.

- Enable cellular protocols For reliable communications, you must enable the modem's cellular protocols. Some modems detect a direct connection to a cellular phone and automatically enable cellular operation. With others (check your modem manual) you need to modify how the modem is initialized. Most communications applications initialize the modem using a modem initialization string. You may need to add an "AT" command to this string to enable cellular operation. This command is different for every modem. Some applications, however, do not provide access to the initialization string, in which case you will need to contact your application vendor for assistance. Even if your modem can automatically detect the cellular phone, some applications restore the modem to its factory default condition, which can turn off the cellular protocols. In Microsoft Windows95, most modem applications use Microsoft Corp.'s Telephony Application Programming Interface (TAPI), which has a provision to enable cellular operation. Select Modems in the Control Panel and go to Advanced Connection Settings.

- Connect through a modem pool Cellular carriers have installed modem pools at their mobile switching centers that translate between cellular protocols and conventional modem protocols. Modem pools consist of pairs of back-to-back modems. When connecting through a modem pool, you create two separate modem links: the link between the mobile and the switch uses cellular protocols while the link between the switch and the fixed-end modem (a corporate remote-access facility, for instance) uses conventional modem protocols (see "Cellular Carrier Modem Pools" diagram below). To route your call through a modem pool, simply add a prefix of "*3282" (which spells out "data" on your keypad) to the phone number in your application. You need to follow *3282 with a "1" then area code then the number for some data carriers, and just the area code and number for other carriers. A data phone number in Seattle, for example, would have the following format: "*3282-1-206-555-1212." (The modem ignores the hyphens.)
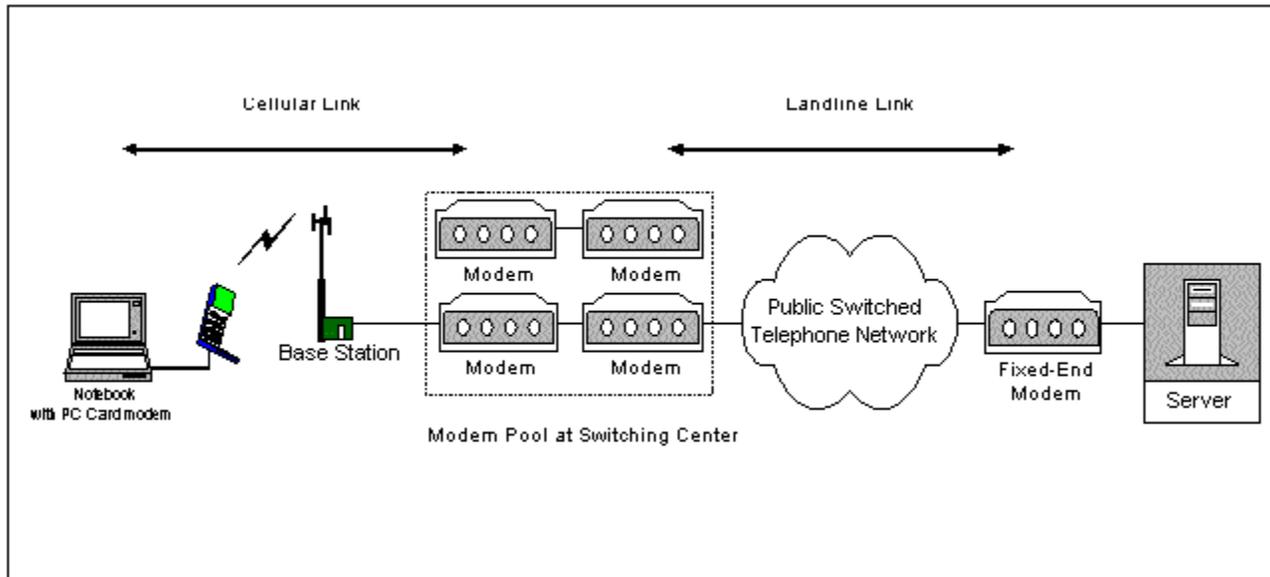
*Cellular Carrier Modem Pools*

Calling through a modem pool does not add much to the call setup time. Modem pools make all the difference for cellular data, but how they operate varies, and they are not available in all areas. Some cellular carriers require that your account be configured for access to their modem pools. Check with your provider for details. If service is not available, you can install a fixed-end modem that supports cellular protocols.

**Our Findings**

By following these steps, our testing found cellular data to be convenient and reliable. However, there are some additional points to keep in mind. Protocols like ETC limit the initial connection speed to 9,600 bps. If radio conditions improve, the protocol can bump itself up to 14,400 bps, even if your initial connect speed is only 4,800 bps. Because you don't have any indication that conditions have improved or worsened, you may want to pay attention to how your application is actually performing during each call. Additionally, modem pools support only calls initiated by the mobile user. This works fine for many applications, but makes it harder to support vertical market applications, such as dispatch. These applications are better served by packet radio technologies.

Our testing with faxing over cellular connections showed mixed results. We used Symantec Corp.'s WinFax PRO to send and receive faxes. Unfortunately, modem pools do not support faxing, so we had to connect directly to the destination fax machine. We found that sending faxes was most successful when we decreased the transmission rate to 4,800 bps, though this required a direct change to the WinFax PRO configuration file. Receiving faxes is more problematic because it can be difficult to configure the modem and phone for auto answer. Our recommendation is that if faxing over cellular is your primary application, consider a specialized cellular fax machine.

The future promises a number of improvements. In addition to digital services, protocols like ETC are being upgraded. ETC2 races along at rates as high as 21,600 bps and needs only one second to connect, though modems are not yet available with this new protocol. Although the number of wireless data networks keeps increasing, circuit data over the venerable analog cellular network is a solution that offers broad coverage and good reliability at a reasonable price today. Best yet, you may already own all the pieces you need.

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## Update On Data Over Digital Cellular And PCS

Carriers worldwide are making announcements about data services for digital cellular and Personal Communications Services (PCS). You may already be thinking of subscribing to PCS service. But should you look into these new data services? It depends on your location and time frame.

First, let's clarify some terms. Digital cellular and PCS technologies are essentially the same: Digital cellular refers to digital operation in the existing cellular bands (800 MHz), and PCS refers to the same digital technologies used in the 1.8- or 1.9-GHz bands.

There are three major competing digital technologies: Global System for Mobile Communications (GSM), IS-136 Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA). The debates over these technologies border on those of a religious war (see techweb.cmp.com/nc/frezza/frezza.html). All eventually will offer robust data services with initial circuit data at rates of 9,600 bps or 14,400 bps and eventually higher speeds as well as packet data.

Up front, you must be aware that while the latest wireless technologies promise many exciting features, they also raise a whole new set of compatibility issues. For example, you will need a different kind of cellular phone for each digital service. Your GSM card won't work with your CDMA phone and your PC modem card won't necessarily plug into your GSM phone, and so on. The specific data features you can expect are as follows.

Because GSM is the oldest and most broadly deployed digital cellular technology, it also offers the most mature data service. GSM is available throughout Europe and offers circuit data service at 9,600 bps and fax capability in many areas, with a rapidly expanding number of PC Cards that support various GSM cellular phones. Unfortunately, you need a PC Card for the GSM data function, though modem vendors are beginning to include this function in some of their PC Card modems. Certain PCS operators in the United States also deploy GSM in PCS bands, and some offer circuit data service in select U.S. cities. GSM operators also promote their Short Message Service (SMS) as another data option for smaller messages.

IS-136 TDMA, also known as Digital AMPS or D-AMPS, is the most broadly deployed digital cellular network in the United States but it offers no data services. A circuit data and fax function at 9,600 bps is fully specified and will probably start to be deployed within the next year or so. A higher-speed packet data service based on CDPD protocols also will be available in the future. Unlike GSM, the connection to the phone will be a simple cable from the computer's serial port.

CDMA (also known as IS-95A) is being aggressively rolled out in the United States and has been chosen as the digital technology for Japan. Like TDMA, no data services are available, but circuit data and packet data at up to 14,400 bps are in the works.