Making The Call With Two-Way Paging

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The wireless data market is poised for dramatic growth. Although the number of subscribers still is relatively low, carriers are offering networks with excellent coverage, lower prices and more options for mobile workers to access the Internet and corporate systems such as Lotus Development Corp.'s Notes. The wireless WANs that have been deployed include cellular-based systems, such as analog, digital and cellular digital packet data (CDPD), and data-only networks, such as ARDIS and RAM Mobile Data (see "Digital Cellular: On the Road to PCS," February 15, 1996, and "Wireless Data Made to Order," March 15, 1996).

But now there is a new player: two-way paging. Two-way paging offers some significant capabilities with distinct advantages. In this article, we will explore how two-way paging works, discuss the types of applications supported and consider its limitations. We also will discuss the results of our testing with SkyTel's network to determine whether its promises live up to reality. SkyTel is the only national provider with two-way service, but other paging companies are considering two-way service.

What is two-way paging? Quite simply, it is alphanumeric paging that lets the pager send messages, either to respond to messages it receives or to originate messages.

How might you use this service? You're a network manager with a network-diagnostic program that pages you when it detects a problem, such as the file server running out of disk space. Using your pager, you could return a message indicating whether you can respond to the emergency. You could send a message indicating which backup server to engage. You could respond with predefined messages such as "on my way," "will arrive in 15 minutes" or "send number to call," for example. If your reply indicated you could not respond, the diagnostic program could then page somebody else.

Sizing Them Up The pagers will come in various shapes and sizes. Some will look almost like today's alphanumeric pagers. Others, such as Motorola's forthcoming PageWriter will add small keyboards and larger displays. Some will be PC Card devices that will operate in a notebook computer or handheld PC. SkyTel's unit, called SkyWriter, looks almost identical to today's one-way alphanumeric pagers.

What type of messages will two-way paging support? That remains to be seen, but because of the limited bandwidth, it probably won't be practical to send messages larger than 500 characters. With SkyTel's current pricing of about 25 cents per 80-character message, you will want to limit how much information you send. Message delivery times are on the order of tens of seconds to minutes (in contrast, message delivery times for wireless data networks typically

are less than five seconds). Even with these limitations, there should be many ways for users to take advantage of the service.

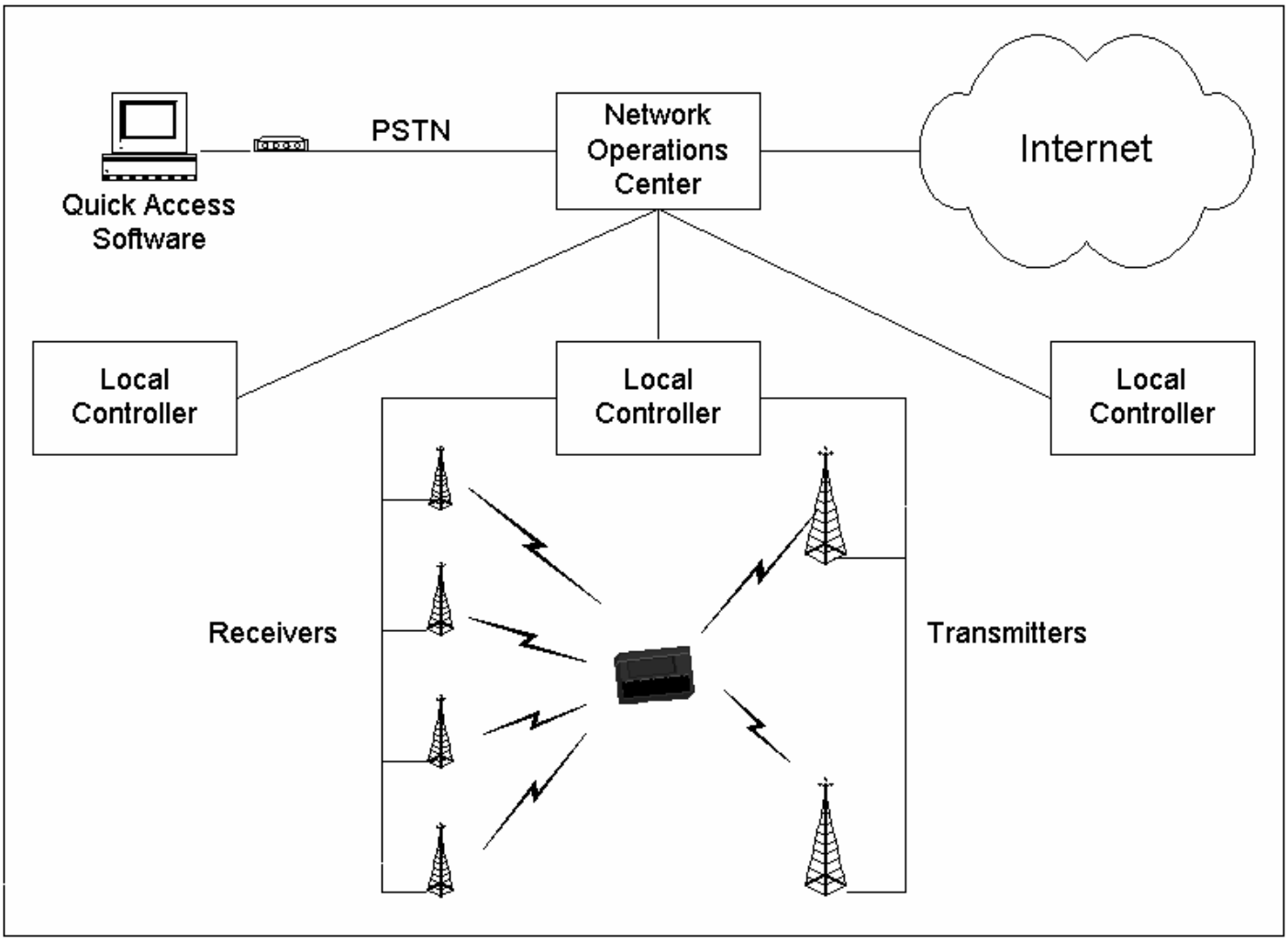
You should expect a few specific applications for two-way pagers. One would be a reliable paging model where the pager simply acknowledges that it received the page. Another would be menu response, where a message sent to the pager would contain a list of reply messages; you scroll through these and select a response. (With SkyTel's service you can send up to 10 reply messages, each of which can be up to 15 characters.)

Another application is general messaging, where you initiate messages from the pager. With SkyTel's SkyWriter, you compose messages by moving a cursor over a displayed alphabet, selecting one letter at a time. This works fine for short messages (20 characters or so). Additionally, computer connectivity with the SkyWriter is accomplished via a serial cable and through the use of a connectivity package available from SkyTel. In the future, pagers will be available in a PC Card format, making it easy to use the keyboard on a notebook or personal digital assistant (PDA) to compose messages.

Building Pager Networks Two-way paging networks use spectrum in the 900-MHz band auctioned in 1995 by the FCC for what is called narrowband personal communications service (PCS). Licenses, which are local, regional or nationwide, consist of blocks of up to 50 KHz for transmission in every direction. Compared with the tens of megahertz auctioned for broadband PCS, this is a small amount of spectrum, and it limits message size and message volume.

A nationwide narrowband PCS license can be a huge advantage for carriers. Unlike cellular licenses where nationwide coverage can be achieved only through cooperation among carriers, one paging carrier can serve the entire nation.

Although the glamour of two-way paging is two-way messaging, the technology also lets carriers provide traditional one-way paging nationwide at a much lower cost to the carrier. Since the pager can register itself with the network, the network has to broadcast only in the area where the pager is located rather than across the entire coverage area. Compared to battery life with other wireless network devices, the pager's battery life is good. With typical use, you can expect about two weeks of use from one AA battery, far longer than the typical one day of use with cellular phones and wireless modems.



SkyTel Network Architecture

SkyTel's network is based on Motorola's ReFLEX two-way paging technology (see "SkyTel Network Architecture," above). The system requires fewer transmitters than receivers because transmitters blast out messages at hundreds of watts, and receivers have to detect much fainter signals from the pagers, which transmit at just 1 watt. SkyTel's network, using a version of ReFLEX, called ReFLEX50, transmits to pagers a 25.6-Kbps signal in a 50-KHz channel comprising four subchannels of 6.4 Kbps, and receives from pagers a 9.6-Kbps signal in a 12.5-KHz channel. Actual data throughput is lower, since these signals include forward-error correction and other communications overhead. Motorola offers another version of ReFLEX, ReFLEX25, which uses a 12.5-KHz channel for transmitting one channel of up to 6.4 Kbps.

Carriers intending to provide ReFLEX networks can purchase infrastructure elements from Motorola or Glenayre Technologies, a licensee of ReFLEX technology. Two-way pagers are available from Motorola and Wireless Access, which supplies the SkyWriter for SkyTel.

An important element in SkyTel's architecture is that all messages pass through its network operations center (NOC). A two-way paging network configured this way is not a general-purpose WAN such as CDPD, where individual IP packets can originate from a host on the Internet and reach a mobile computer. Instead, the entire message must be formatted in a specific way and submitted to the NOC for delivery to the pager. It is a store-and-forward messaging system.

Doing That Two-Way Thing SkyTel provides considerable flexibility in sending and receiving messages. There are numerous ways to send messages. You can visit SkyTel's home page (http://www.skytel.com) and enter a message by filling in a form, or you can use SkyTel's QuickAccess software that runs on Microsoft Windows. Once you have composed a message, the software dials into SkyTel's NOC and transfers messages. The software also lets you check on the status of messages sent.

Additionally, you can use the Telocator Message Entry (TME) protocol (to which SkyTel has added special extensions) to submit messages over dial-up or dedicated connections to SkyTel's NOC. SkyTel provides a developer's kit to develop applications that easily exchange messages with SkyTel's network. Every pager is assigned an e-mail address, so that you can address a pager as an Internet e-mail destination using a seven-digit ID, such as 1234567@skytel.com. It is also possible to use a cc:Mail client where the SkyTel network presents itself as a remote cc:Mail post office. Skytel also supports the Telocator Alphanumeric Protocol (TAP) to submit messages over a dial-up connection to SkyTel's NOC.

The first three options let you attach a set of reply messages through which the recipient can scroll and select one for their reply. When sending a set of reply messages, you also can specify an address where the reply message should be sent.

To originate a message from a pager, you can address the message to an Internet address, address the message to another SkyTel pager, reply to a message sent from SkyTel's QuickAccess software or reply to a message sent from SkyTel's Web site.

You can expect similar options from other service providers once they begin offering service. To a large extent, these options will determine what applications are feasible for two-way networks.

But Wait, There's More Although SkyTel has the field to itself for the moment, other carriers are evaluating ReFLEX for their networks, including major paging companies such as MobileComm and PageMart. There is another significant technology in the two-way paging market, called Personal Air Communications Technology (PACT), which features players such as AT&ampT Wireless Services, Ericsson and Pacific Communications Sciences Inc. (PCSI). Though running a year or two behind ReFLEX, PACT promises some advantages over ReFLEX, including symmetrical send and receive speeds, a more open architecture and the ability to pinpoint a user's location.

There will be other choices as well. Don't forget about short message service (SMS) in digital-cellular and PCS networks. Will people want to carry a separate pager when their digital telephones offer many of the same features? In addition, new smart phones are being introduced. One, called the PocketNet phone, includes an integrated CDPD modem and platform for messaging applications to run directly in the phone. You also can expect services and mobile devices that will look like two-way paging and operate over RAM Mobile Data and ARDIS.

Getting Down to Paging In working with SkyTel's service, we found the system to operate as advertised. SkyTel's SkyWriter pagers arrive preactivated and are ready to use. It took us only an hour to install and operate SkyTel's QuickAccess software, to learn how to use the pagers, and to send messages to and from the Internet. Configuring the service is comparable in difficulty to installing and using a typical e-mail client; it is something a computer-literate person will have little problem understanding, but inexperienced users might require some assistance.

As far as message integrity, SkyTel has taken an interesting approach. With wireless-data networks such as CDPD, the network corrects transmission errors in real time, both at the link layer over the wireless portion and on an end-to-end basis using network transport protocols such as TCP. As a result, users and applications always work with correct data. But since paging networks can have delays of a minute or more, a pager could receive a message with errors, but may not have the ability to immediately correct the error. In fact, since two-way paging networks transmit to the pager with much greater power than they receive, users easily can be in a coverage area where they can receive pages but cannot send them.

SkyTel has designed its system so that if the pager receives a message in error, the message is shown with the error. As soon as the pager can notify the system that it has a checksum error, the system retransmits the message. The idea is that getting some message is more important than getting no message at all. We tested this and found that while we were in a coverage area where the pager could be heard by the network, within seconds, or in some cases tens of seconds, the garbled messages were replaced by a correct version. Anybody using two-way paging networks for mission-critical applications will have to take this approach into account.

We also simulated being out of coverage by sending messages to our test pagers when they were turned off. After turning them on we found that, in most instances, the pager would receive the message within five to 10 minutes. This delay occurs because the pager must first register itself with the network when it is turned on or when it re-enters a coverage area. This is a tremendous improvement over today's networks, where being out of coverage means you never receive the message.

Electronic Paging When sending lengthy messages such as long e-mail from the Internet, the system automatically truncated the messages to 500 characters. This is probably acceptable since the pricing plan encourages smaller messages. In fact, to dissuade users from saturating the network, SkyTel charges users more per message if they exceed 5,000 messages in a month.

We measured message delivery times in the tens of seconds (occasionally delays exceeded a minute). Since the number of subscribers is relatively low, our tests were done on a lightly loaded network. In the future, two-way paging service providers operating heavily loaded networks may offer different pricing plans with prices varying by priority.

Overall, we are impressed by the capabilities of the network and with its ease of use. The good news for users is SkyTel's network appears ready for use. Comparable services will be offered soon from other paging networks as well as from other kinds of networks, bringing competition for SkyTel. But for now SkyTel is clearly in the lead.