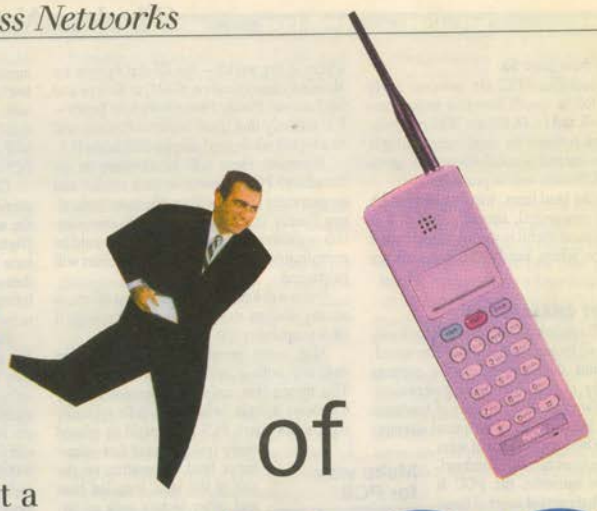
The ABCs of PCS



Different flavors of PCSs are evolving to meet user needs, but a number of political, technological and implementation issues may affect your adoption plans.

By CRAIG MATHIAS and PETER RYSAVY

Personal communications services (PCS) is perhaps the hottest topic in wireless communications today, and with good reason. The promise of PCS ascribes to it far-reaching significance — at the very least, PCS has the potential to radically alter wireless communications, unifying voice, data, facsimile and even some limited forms of multimedia communications under a single, universal, cost-effective umbrella.

But before any of you get too carried away, it should be noted that PCS is not just a single service — there are, in fact, three major flavors of PCS. Nor do standards for wide-area deployment of the technology exist. As is the case with Asynchronous Transfer Mode in the wired world, PCS will pose some potentially major ramifications.

While the ultimate value of PCS is not by any means in doubt, the time scale involved in efforts of this magnitude require careful attention even on the part of network managers who already share the wireless vision. The issue today is that PCS services have yet to make the jump from concept to reality, and there are a number of political, technological and implementation issues that come into play if you're considering PCS as part of your long-term enterprise net strategy.

That means your best bet is to use today's wireless services, isolating applications from specific networks by using mobile middleware, and then migrate to new services, including PCS, where appropriate.

WHAT IS PCS?

First and foremost, PCS is a frequency allocation, recently codified by the Federal Communications Commission. The FCC is responsible for public use of the electromagnetic airways and, after many years of thought, deliberation, hearings and politicking, the commission reallocated a considerable portion of the electromagnetic spectrum for emerging communications technologies, including PCS. That spectrum will be divided up to support three major categories of PCS service:

■ Narrowband PCS has been allocated spectrum at 900 MHz to 901 MHz, 930 MHz to 931 MHz, and 940 MHz to 941 MHz. It is envisioned that this space will be used to offer new services that extend the capabilities of current pager (or beeper) technology. Such concepts as wireless voice messaging and two-way or acknowledgment paging have been discussed by suppliers.

■ Broadband PCS is what most people think of when PCS is mentioned. This is an allocation of 120 MHz in the 1850-MHz to 1990-MHz band, and represents a considerable amount of spectrum — by comparison, the current U.S. cellular phone system, known as the Advanced Mobile Phone System occupies only 50 MHz.

This type of PCS is widely believed to be the successor to cellular and will likely be used to implement an all-digital integrated voice/data infrastructure. Also possible for this service will be advanced intelligent network functionality, such as the "one person, one number" concept pushed by carriers for some time now.

■ Outside of narrowband and broadband options, there is the unlicensed portion of PCS spectrum. Basically, a 40-MHz block of spectrum has been allocated from 1890 MHz to 1930 MHz. This service is designed to allow unlicensed operation of short-distance (and typically indoor or campus-oriented) wireless voice and data devices, including wireless LANs and wireless private branch exchanges.

These applications today are relegated to the industrial/scientific/medical bands, which are notorious for noise and interference. Unlicensed PCS should, therefore, make better use of the radio spectrum and allow for more simultaneous users and better signal quality.

Thus PCS, encompasses both voice and data over both local and wide areas, with both indoor and outdoor applications. But a big question, of course, is performance. At this point, it seems likely that unlicensed PCS will be able to offer the magic 10M bit/sec for indoor and possibly campus LAN traffic. Narrow-

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There are more than 10,000 cells in the U.S. cellular phone system today. When fully deployed, PCS networks will use more than 100,000 cells across the nation.

Cellular's slow rise

1958 Bell System issues proposal to FCC for 75 MHz in 800-MHz band.

1970 Allocation is granted.

1971 AT&T Bell Labs submits cellular proposal.

1978 Trial system in Chicago.

1981 FCC imposes dual-carrier licensing rule.

Mid-1980s PCS emerges as new wireless option.

1991 Apple proposes creation of new, unlicensed, data-only spectrum.

1992 FCC floats initial PCS proposal.

1994 U.S. users total 20 million.

SOURCE: FARPOINT GROUP, ASHLAND, MASS.; AND RYSAVY AND ASSOCIATES, SEATTLE

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band and broadband PCS are, however, likely to be limited to speeds common to modems today — 9.6K and 14.4K bit/sec. With compression — and perhaps by combining multiple channels — limited remote LAN access, nominally at ISDN rates, will be possible.

But unlike land lines, wireless bandwidth cannot be guaranteed, meaning that PCS is likely to be most useful in messaging and other applications where bandwidth demands are flexible.

CURRENT CHALLENGES

The PCS spectrum is currently occupied by a number of incumbents, mostly low-speed, point-to-point data and telemetry systems operated by utilities and local government. Consistent with the FCC's policy of spectrum refarming, whereby the government attempts to make the best possible use of what is one of the most valuable commodities in the universe, the FCC is requiring that current users of these bands relocate to other radio space, with such moves to be paid for by PCS licensees. However, moving incumbents takes time and will cost a significant amount of money, which is a major issue for both broadband and unlicensed PCS.

Make way for PCS

As many as 30,000 incumbent microwave systems must be relocated to a new spectrum in order to make way for PCS.

In the unlicensed area, the FCC has chartered the Unlicensed Transition and Management (UTAM) committee to create proposals for clearing the spectrum as soon as possible. Expent opinion is mixed, however, regarding how successful UTAM will be in meeting its charter. The requirement for significant sums of money and delicate negotiations may take a substantial period of time before the relocation issue can be sufficiently resolved.

Another major issue is a recent change in FCC policy regarding who gets spectrum allocations. Traditionally, the commission used a simple lottery, giving all comers an equal chance to get into the game.

The FCC, however, has now begun auctioning the airwaves, using techniques that are designed to maximize revenue to the government and provide for broad participation in the process.

Coupling the millions of dollars involved in bidding (the recent narrowband auction raised more than $650 million) with the expense of building out an infrastructure for new communications services results in a major business challenge — and, again, potential delays in realizing the intended service.

A final challenge is the lack of technical standards for the deployment of broadband PCS. Many customers (especially for voice service) are anticipating a single, unified, all-digital network with nationwide roaming — features lacking in current cellular phone service. While systems similar in concept to broadband PCS have been operational for some time elsewhere in the world — the Global System for Mobile Communication (GSM) in Europe and the Personal Handy Phone System in Japan — it is unlikely that these implementations will be adopted whole as a basis for PCS in the U.S.

Moreover, there will be as many as six broadband PCS licensees in each market and no guarantee that all will use the same technology. Finally, that Holy Grail of wide-area wireless — universal, seamless roaming — could be complicated since no nationwide licenses will be granted.

Users will have to rely on business alliances among vendors using common technology if such a capability is to exist in PCS.

Also, many broadband PCS systems are designed with a microcellular architecture. This means that, unlike the current cellular telephone system, which has cells typically eight miles apart, PCS cells might be placed every few thousand feet (sometimes less), depending on the size of the local installed base and other factors such as terrain.

As a result, PCS handsets can be smaller, lighter and could have an excellent battery life. The short-distance transmission characteristics of low-power systems should also allow excellent frequency reuse in a given area, providing much more capacity than current cellular systems.

On the downside, it will take some time before carriers can get the necessary permissions from local authorities to conduct a build-out of this magnitude, even though PCS base stations are much smaller and less obtrusive than current cellular systems.

WHAT TO EXPECT

There is little doubt that the integration of mobile users into corporate data networks improves the productivity of workers on the move. More than ever before, the utility of a mobile computer and the productivity of the mobile computer's user is today a function of the networks to which the computer is connected. Universal wireless data connectivity is a noble goal, and PCS will clearly play a role in expanding the value of data communications. Users and application developers can expect both circuit- and packet-switched data services, although circuit-switched services will predominate initially.

But since broadband PCS is a ways off, network managers needing wireless connectivity today need to consider other alternatives, perhaps with an eye toward migrating at least some of their users to PCS as the technology and its users mature.

Currently, you have a variety of PCS alternatives. Cellular telephony remains the most popular choice, since so many mobile workers already have cellular phones. Subject to a few constraints, modems can be used with cellular phones for a traditional dial-in capability. And cellular services will behave similar to the broadband PCS offerings that will emerge.

Cellular services aside, packet data services such as those offered by ARDIS Co. and RAM Mobile Data, and Cellular Digital Packet Data (CDPD) offerings, have developed followings. These are data-only offerings well suited to the infrequent, low-volume use typical of messaging and database queries.

Finally, paging in all of its many forms can also be useful, although service is only one-way. Electronic mail-to-paging software packages are available from many mail software and network providers. Paging is extremely useful for broadcast (one-to-many) message distribution, E-mail forwarding and some dispatch applications. Narrowband PCS will most likely add two-way service, acknowledgments and, possibly, voice mail forwarding.

Perhaps of greater concern is how to migrate applications from wired to wireless, and between wireless services, with disparate application program interfaces and protocols.

A variety of approaches are available to developers. Many wireless systems support a wire-line emulation mode using extensions to the popular AT command set common to modems. Alternatively, common networking protocols, such as TCP/IP, can be supported, which is the approach taken by CDPD. Another interesting idea is the use of mobile middleware, software systems that provide a uniform network interface irrespective of the particular wireless (or wired) service being used at any given moment.

Middleware packages are available today that address the needs of both programmers (in developing applications) and end users (extending operating system or network operating system functionality). In each case, the decision about which network to use can be delayed until run-time, and software can be developed without a detailed knowledge of the interfaces provided by various networks. Net managers can therefore deploy mobile applications knowing that their choice of service provider remains flexible.

Lottery winner

The broadband PCS lottery could raise more than $10 billion for the government.

Many vendors, including AIRONET Wireless Communications (with FieldNet) and Oracle Corp. (with its recently announced Oracle in Motion package) are offering middleware systems. The right middleware package could provide an easy migration path to PCS when service becomes available.

The many uses of PCS

Narrowband PCS

- Higher capacity paging networks
- Acknowledgement paging
- 2-way messaging
- Digital voice message delivery

Broadband PCS

- Next-generation cellular networks, voice and data services (cells are similar in size to current AMPS cellular systems)
- Pedestrian-oriented microcellular networks, voice and data services (high-density usage like in downtown areas, shopping malls and airports)
- Local-loop replacement (wire line look-alike)

Unlicensed PCS

- Wireless LANs
- Wireless PBXs for voice services only
- Wireless PBXs for voice and data services
- In-building, and campus-area microcellular voice and data networks

OK — SO WHEN?

It may not make potential customers feel any better, but the history of wireless communications has been one of slow, steady progress. By comparison to cellular, which took years to become established, PCS may be on a relatively fast track. Nonetheless, given the inherent difficulties of wireless, especially involving data communications, potential customers should not be surprised if PCS service is not exactly around the corner.

Annette Bouta, executive director for wireless products at US WEST Communications, Inc. believes "it will be about two years after the broadband auctions are completed before service is commercially available." Rick Baugh, a consultant with C.R. Baugh and Associates, Inc., a PCS consultant actively involved with PCS standardization efforts, says that though excellent progress is being made in establishing broadband PCS standards, "final standards will not be available until mid-1995." And broadband spectrum auctions begin this winter and may not be completed before May or June, meaning it could be the summer of 1997 before the first broadband users take to the airwaves.

In the meantime, a variety of both local- and wide-area wireless products and services are available for both experimentation and deployment — even in mission-critical applications. And if nothing else, the high level of interest — and investment — in PCS should result in some interesting alternatives for network managers as the decade comes to a close.

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Major anticipated milestones for PCS
(Based on a best case scenario)

Late 1994	Dec. 1994	Early 1995	Mid-1995	Late 1995	Early 1996	1997	1998-1999
Drafts of standards (based on CDMA, TDMA and GSM)	Spectrum auctions begin	Field trials of broadband PCS networks	Broadband PCS licenses granted Broadband PCS standards finalized Unlicensed PCS standards finalized	Unlicensed PCS products available Initial deployment of narrowband PCS networks	Initial deployment of broadband PCS networks	Availability in major metropolitan areas	Broad availability of PCS systems