



Policy Brief

Stanford Institute for Economic Policy Research

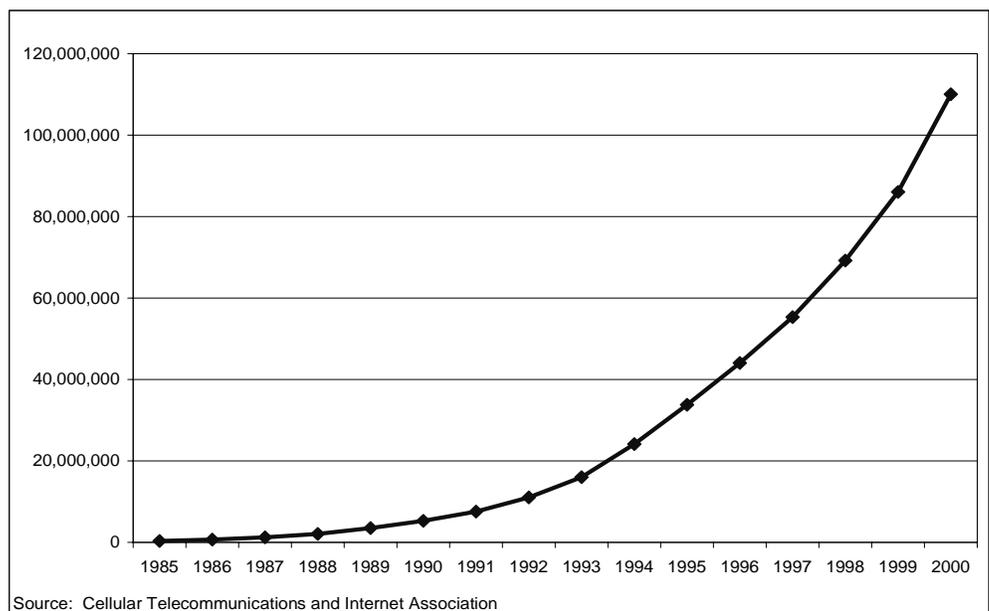
The Future of Wireless

Gregory L. Rosston

Wireless communication has grown phenomenally since the introduction of cellular telephone service in 1984. But the future growth of the wireless sector depends on advances in technology and policy to create the bandwidth necessary to support the next generation of applications.

The figure below shows the increase in wireless subscriptions; there is now nearly one cell phone for every two people in the country. Most analysts predict that cell phones are not the ultimate wireless product, but that we will have ubiquitous wireless Palm Pilots, handheld video phones, and other as yet unimaginable wireless devices.

U.S. Wireless Telephone Subscribers



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How do we get from here to there? The promise of new wireless services requires increased capacity to carry the heavier information loads – more "bandwidth." Wireless bandwidth is essentially a function of the amount of available electromagnetic spectrum, or frequencies, and the investment in capital to use that spectrum. In total, there is currently about 200 MHz of spectrum for commercial mobile wireless devices. But the problem is that demand for new services means that there is a need for more bandwidth if advanced services are to be adopted widely. There are two ways to increase wireless bandwidth: increase the amount of spectrum available or increase the capital invested to support the current spectrum.

To a certain degree, more investment in capital can substitute for spectrum. For example, a wireless communications company can "create" bandwidth by putting up more transmission towers to use spectrum more intensively. Other solutions involve the use of more advanced technology. Third-generation, or "3G," wireless technologies promise to deliver more bandwidth over the same amount of spectrum through advanced compression techniques.

Television Spectrum

Additional bandwidth through capital investment will become incrementally more expensive as service providers exploit the cheapest forms of capacity expansion first. As a result, service providers, Congress and the administration have tried to determine how to release more spectrum to the wireless industry. Usable frequencies for mobile services are generally below 2 GHz. Two groups occupy large swaths of spectrum that could be used for mobile services: broadcasters and the federal government, primarily the Defense Department (DOD). The United States has 70 over-the-air television channels, each accounting for 6 MHz of spectrum, for 420 MHz of spectrum devoted to television -- about double that allocated for mobile services. This is a large amount of spectrum considering that 80% of households have cable or satellite television service, and the typical over-the-air subscriber receives only 13 television channels. DOD also occupies a large amount

of the spectrum usable for mobile communications – on the order of several hundred MHz.

The policy problem is how to transfer this spectrum from its current, presumably sub-optimal, use to something more socially beneficial. Currently, the FCC plans to auction the rights to use spectrum currently occupied by television channels 60-69. This spectrum is up for grabs because Congress granted all existing broadcasters a free second "digital" channel to replace their current analog channel. The broadcasters are to "give back" their analog channels after a transition period. Channels 60-69 were chosen for the first auction because only about 100 analog stations operate on these channels across the country, making the loss from cessation of their over-the-air broadcasts small.

The major problem with this auction is that the broadcasters do not have to vacate this spectrum until at least 2006, or later if less than 85% of households can receive digital television signals. Currently, very few of the multi-thousand-dollar digital sets have been sold, although more and more people are beginning to receive digital cable signals, which count toward the 85% goal. Even so, very few people believe that the broadcasters will relinquish their channels in 2006. As a result, for any transition to occur in the near future requires either a payment to the broadcasters to get them to vacate the spectrum or a change in legislation to force them to leave. Given the broadcasters' political power, it is unlikely that Congress will allow them to be forced off their spectrum early.

As a result, some economists, including Paul Milgrom of Stanford, have been trying to create a voluntary pre-auction to move broadcasters off channels 60-69 to clear the spectrum for other uses. The success of this plan requires that the broadcasters all feel that they will be at least as well off by participating in a voluntary bargaining solution as they would be if they held out. Since early and certain spectrum reallocation would yield a large social benefit, there is a chance that some deal can be worked out. Other possible mechanisms to clear the spectrum involve charging an increasing fee for the use of the spectrum by broadcasters. The spectrum use fee could begin in 2006 and increase to pro-

vide incentives for the broadcasters to cease operations. Finally, the major value of these stations (other than their "hold-out" value) is that an over-the-air station has the right to be carried on local cable systems, which increases their audience substantially. However, FCC rules require that a station broadcast over-the-air to gain this right. The FCC could modify its rules to eliminate the over-the-air broadcast requirement.

Federal Spectrum

Looking at spectrum occupied by the federal government, there are very few incentives for DOD to give up spectrum. DOD will receive little or nothing in return for vacating spectrum, except for the headaches of modifying systems to be more spectrum efficient and reducing future opportunities to incorporate new systems requiring more spectrum. DOD should participate in the market for their spectrum inputs just like they procure hammers, bullets and personnel. However, DOD spectrum is manna from heaven and jealously guarded because DOD cannot sell it and use the money, nor can they buy it because there is no money appropriated for that purpose. If I were in charge of DOD spectrum, I would fight efforts to take away my spectrum even if I were given the opportunity to sell it. Why? Because if an auction raised \$50 billion for DOD spectrum, the DOD budget likely would be implicitly or explicitly cut by \$50 billion in the next budget cycle, plus there would be costs to reconfigure systems. So DOD cannot win. But if the Appropriations Committees or the administration were to realize the true cost of reconfiguring systems and the true value of the spectrum, as the government budget watchdogs they might find it worthwhile to order transfers of spectrum from DOD to the public.

There is hope that we will get new wireless bandwidth through the market, through investment, and through government reallocation. But it will take time, and other countries will "win the race" for the first introduction of advanced wireless services. But losing the race is not necessarily bad. We lost the race to Japan for the first introduction of high-definition television. We also were behind Europe in the introduction of second-generation digital wireless telephone service. But winning the race does not mean maximizing consumer welfare, which should be the goal

of our spectrum policy. Delaying the introduction of new, valuable technologies because of holdouts of old, inefficient incumbents holds the prospect of harming consumer welfare; policy should be concerned with facilitating the transition of spectrum to efficient uses that will increase the ability to supply bandwidth in the future.

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About the author



Gregory L. Rosston is the Deputy Director of SIEPR. He is also a Lecturer in Economics at Stanford University. Dr. Rosston's research has focused on industrial organization, antitrust and regulation. He has written numerous articles on competition in local telecommunications, implementation of the Telecommunications Act

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