Spectrum Policy in Canada: A CWIRP Background Paper

Graham Longford and Matthew Wong

Introduction

In this background paper we will first briefly describe the spectrum and its operation, followed by how the spectrum is used. We will then provide an introduction to spectrum policy, including how policy is specifically handled in Canada. This will focus on the current trend towards spectrum auctions which we feel is unfairly biased towards incumbent providers. Finally, we will conclude this backgrounder by discussing the future of spectrum management and policy in Canada, in particular, the implications of auctions and "market forces"-oriented policy for community, municipal, and rural broadband.

What is the spectrum?

Electromagnetic radiation is a natural feature of the world which occurs when materials vibrate and transfer energy into their surroundings[1]. There are different kinds of energy which are classified in a *spectrum* of electromagnetic radiation. This spectrum is ordered by increasing *frequency* (vibrations per second), measured in *Hertz* (Hz). In the electromagnetic spectrum frequencies tend to be very high, so the Hertz unit observes standard metric prefixes, e.g. kilohertz (kHz, 1000 Hz), megahertz (MHz, 1 million Hz), gigahertz (GHz, 1 billion Hz). The frequency of particular waves, along with other characteristics such as its wavelength, greatly affects the properties of that wave. This phenomenon is responsible for the existence of visible light, microwaves, x-rays, and so on. The length and frequency of radio waves has a significant impact on their performance and utility for a given use or function. Signals associated with low frequencies and longer wavelengths are more desirable because they propagate farther using less power, are less susceptible to disruption and interference from natural phenomena such as rain, fog, and leaves, and have superior ability to penetrate solid objects such as walls and buildings. These characteristics make lower frequencies particularly ideal for long distance applications such as broadcasting and wireless telecommunications infrastructure for serving rural and remote communities.

How is the spectrum used?

Just as the spectrum is classified by frequency for scientific purposes, so too is it classified for management purposes as well. After all, when devices broadcast electromagnetic signals on the same frequency, *interference* can result. Interference causes errors for devices trying to process the signals into data. Too much interference can block a signal altogether. As a result of this, particularly since many frequencies are used for services or functions that affect many people (e.g. television and radio stations), the spectrum is managed by governing bodies. Different countries respective national governments also use parts of the spectrum for national security and public safety uses.

Gow & Smith (2006) describe spectrum management as a three-step process of allocation, allotment, and assignment (pg.11). In this process, the spectrum is divided up into frequency *bands* which are allocated to different kinds of services, broadly classified. Then the bands are divided up into blocks of frequencies, which are allotted based on specific kinds of services and

[1] For an excellent primer on radio basics, see Gow & Smith, 2006.
[3] See Longford, 2007, pages 9-10 for a review of Canadian spectrum auctions and policy.

technical requirements. The blocks are then assigned to a specific kind of service, usually by licensing or authorizing the block to a provider. This has also been described as the "command and control" method of spectrum management (Xavier & Ypsilanti, 2006). In Canada this is handled by Industry Canada and in the United States by the National Telecommunications and Information Administration (NTIA) for Federal use, and the Federal Communications Commission (FCC) for non-Federal use. While nations manage spectrum individually, in order to plan and maintain the interoperability of devices worldwide, the International Telecommunications Union (ITU) helps to coordinate spectrum use on the international stage.

More recently, regulators in the U.S., U.K., Europe and Canada have experimented with designating and allocating small slices of the spectrum for "open," "unlicensed," or "license-exempt" use, as part of a broader trend toward the liberalization of spectrum policy and regulation. Beginning in the 1970s and 80s, for example, some regulators began to allow unlicensed operation of radio devices in the Industrial, Scientific and Medical (ISM) band at 2.4 GHz to accommodate the proliferation of wireless consumer products such as cordless phones, garage door openers, baby monitors, and microwave ovens. In the late 90's, IEEE 802.11 standard wireless Internet began to use this spectrum as well. In 2003, member states participating in the World Administrative Radio Conference (WRC), sponsored by the ITU, approved a new allocation of open spectrum in the 5-6 GHz range.

Introduction to Spectrum Policy

The importance of spectrum management to national operations and interests means that government control over this resource must be guided by policy. In the past, policy was influenced by the fact that demands on spectrum were low and technology could make use of only limited portions of the spectrum. More recently however, with the increasing demand of numerous technologies, such as cellular phones, digital television, and wireless Internet, spectrum for broadcasting and supporting these services and technologies has become a critical commodity. Forge and Blackman (2006) predict that in the next 25 years, "the user population worldwide is set to grow significantly, leading to a massive expansion in demand for service [and] the future will also see demand for new types of services that will require much wider bandwidth to support richer content" (pg.6).

This recent shift in spectrum demand has generated a lot of concern with the existing licensing techniques. Criticisms of the command and control method include that (1) it does not ensure spectrum is used efficiently (or even used) after licenses are issued, (2) the system of granting licenses is too slow and inflexible, (3) licensees are prohibited from changing spectrum use to offer new services, (4) it limits innovative uses of new technology, and (5) it is too restrictive on the entry of new technologies (Xavier & Ypsilanti, 2006, pg.34). In the last few years, in order to address these concerns, the FCC, Industry Canada, and other national governing authorities have looked to *spectrum auctions* to deal with the growing demand for spectrum.

Spectrum Auctions

Spectrum auctions were first practiced in New Zealand in 1989 and then the United Kingdom in 1990 (Jain, 1999). The United States legislated spectrum auctions in 1993. The concept of auctioning to determine the "highest valued use" (Coast, 1959, quoted in Faulhaber, 2006) has become a key factor of the spectrum auctions. Jain (1999) noted that the 1993 U.S. auction for Personal Communication Services (PCS) netted $20 billion in revenues. In the recent Third Generation (3G) auctions in Europe, €100 billion were accumulated, with over €50 billion for Germany alone (Forge & Blackman, 2006). In Canada, to date there has been three auctions,

starting in 1999, for various parts of the spectrum[3]. Some estimates the value of the licenses acquired since 1999 total over $1.7 billion[4].

Some authors have noted the advantages of spectrum auctions including their relative speed compared to previous competition hearings, the "transparency" of auctions in that "they avoid potential and actual government decisions that are biased towards or against individual industry players", and that they "ensure spectrum ends up in the hands of those who value it most" (quotes from Grünwald, 2001, pg.726). At a recent conference on Mobile Business, the President and CEO of the Canadian Wireless Telecommunications Association gave a speech advocating the use of spectrum auctions as "enlightened regulation" and that an "open spectrum" auction would "level the playing field" and allow for the "full potential of market forces" (Barnes, 2007). He went on to suggest that government-imposed "artificial measures" (1) created an economic distortion of the marketplace, (2) could cost taxpayers hundreds of millions of dollars in lost revenue, and (3) may undermine investments in research and new technologies (Barnes, 2007).

However, spectrum auctions can often be problematic, and by no means have all auctions gone smoothly. New Zealand's first auction featured a problematic bidding system (Grünwald, 2001) and in the U.S. there were cases in the auctions where bidders defaulted or declared bankruptcy immediately after the auction (Faulhaber, 2006). Snider (2007) also documents a number of other problems in the American auctions in what he called the "$480 billion Spectrum Giveaway." From a public interest perspective spectrum auctions have been criticized for a number of reasons, not least of which is their tendency to encourage the concentration of spectrum ownership in the hands of deep-pocketed incumbent carriers. By encouraging the inflation of spectrum prices, auctions place spectrum beyond the reach of potential new entrants and community and non-profit bidders who cannot match the resources of major incumbents. Consumers are hurt in the process, as the concentration of spectrum ownership undermines competition, keeps prices high and discourages the development of new services (Geist, 2007; Rose & Lloyd, 2006; Melnyck, 1997). Governments, meanwhile, have little incentive to improve spectrum auctions that have netted them billions of dollars in revenue in recent years.

Among the few mechanisms available to curb the worst excesses and outcomes of spectrum auctions are the use of spectrum "set asides" (spectrum set aside for use by new entrants and/or communities) and "spectrum caps" (which limit the amount of spectrum that a firm can hold). These mechanisms are what Barnes termed "artificial measures." With most community wireless networking initiatives limited to using existing unlicensed spectrum in increasingly crowded, relatively high frequency bands in the 2.4 GHz and 5 GHz ranges, their ability to expand and develop new applications is hindered (Lakshmipathy, 2007; Meinrath, 2005). An increased emphasis on spectrum auctions and property rights in spectrum threaten to undermine efforts to improve access to the open spectrum on which community wireless networking initiatives depend. As Meinrath warns, "wireless technologies and the public airwaves that are this medium's lifeblood are rapidly being cordoned off, made proprietary, and licensed - a process being driven by a desire to maximize profit margins, not serve the public good" (Meinrath, 2005). Additional spectrum is required to satisfy the social requirements of Canadians, in order to meet the needs of under- and unserved communities, and to satisfy growing demand for access to spectrum from citizens and communities themselves.

[4] Completed auction information available from Industry Canada's Spectrum Auction website: http://strategis.ic.gc.ca/epic/site/smt-gst.nsf/en/h_sf01714e.html

The Future of Spectrum Management and Policy in Canada

In 2005 the Canadian government launched the Telecommunications Policy Review Panel (TPRP) which was a public consultation on the future of Canadian telecommunications policy. This consultation concluded in March, 2006 with dozens of submissions from various academic, and community groups, as well as telecommunications and cable corporations voicing their perspectives. The 3-person TPRP issued a final report, calling for less regulation and increased reliance on market forces in order to promote the growth and competitiveness on Canada's telecommunications industry. Included in the TPRP's report are a discussion of spectrum policy and a number of recommendations regarding spectrum regulation, utilization and management designed to ensure access to sufficient spectrum to meet demand for new wireless services and in order to extend broadband connectivity to all rural and remote communities in Canada. Among the TPRP's recommendations was an endorsement for releasing more spectrum for licence-exempt applications and use. However, the panel also recommended a great reliance on market forces in the allocation of spectrum (i.e. more auctions). Such a continued use of auctions for spectrum can only reinforce the disadvantageous position in which community/municipal and broadband projects find themselves in with respect to access to spectrum.

The recommendations of the TPRP are currently being reviewed by the Conservative government. Early indications are that, along with U.S. policy developments, the TPRP report will exercise a strong influence on the direction of future telecommunications policy making, including spectrum policy, in Canada[5].

[5] See also Longford, 2007, pages 18-19 for a further discussion of the TPRP's recommendations.

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