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Analysis of the urban/rural broadband divide in Canada: Using GIS in planning terrestrial wireless deployment

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Abstract

Millions of Canadians residing in Canada's northern, isolated, rural, and remote communities do not have broadband Internet access. This situation has led to a national "broadband divide." That is, the deployment of wireline broadband is very limited in Canada's northern, isolated, rural, and remote areas because of the significant expense of installation and maintenance of the wired infrastructure needed to reach dwellings in these locations.

Terrestrial broadband wireless technology, on the other hand, does not entail the same kind of physical infrastructure. As a result, there are dramatic changes in how spatial considerations affect the provision of broadband Internet services (BIS) to areas beyond the urban zone. In particular, the spatial question is now focused on assessing the capacity for different technological solutions to reach profitable population bases, and brings to the forefront organizations that are developing non-line-of-sight (NLOS) technologies that would permit wireless Internet access over much greater distances than current solutions.

We begin this paper by establishing the importance of broadband connectivity to Canada's northern, isolated, rural, and remote communities. This discussion comments on the role of the Government of Canada in the provision of broadband connectivity to residents of these communities, and outlines the current regulatory issues that govern wireless services and policy formulation.

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The second part of the paper illustrates the use of geographic information system (GIS) approaches in the study of wireless broadband planning and deployment. Case study findings suggest that GIS applications can make a significant contribution to the analysis of wireless deployment planning, to the understanding of the relationships between wireless signal sources and consumers, and to the spatial configuration of terrestrial wireless broadband networks. We conclude the paper by discussing how the GIS approach employed could be used to inform the public policy process with regard to increasing access to broadband Internet services in all regions of the country, and thereby providing the opportunity for all Canadians, regardless of location, to fully participate in the Information Society.

Keywords: Broadband divide; Accessibility; Infrastructure; WiMAX; 802.16; 802.22; GIS; Wireless; Terrestrial wireless; Internet; Accessibility; Spatial analysis; Social equity; Public policy

1. Introduction

We begin this paper by briefly describing broadband and related technologies for the purpose of context. We then define Canada's urban/rural broadband divide and distinguish this concern from issues involving the digital divide. Next, we establish the importance of broadband connectivity to Canada's northern, isolated, rural, and remote communities. This part of the paper considers the role of the Government of Canada in the provision of broadband connectivity to residents of these communities and outlines some of the current regulatory issues affecting wireless services and policy formulation. The second part of the paper discusses the use of geographic information systems (GIS) methods and technologies in terrestrial broadband wireless Internet service planning and deployment. To illustrate our argument, the results of a preliminary, GIS-based study of the potential market that could be served by connecting Canada's northern, isolated, rural, and remote communities to terrestrial broadband wireless technology are presented. We conclude the paper by exploring several policy issues and options arising from our investigation.

2. Broadband

Broadband telecommunications in this paper refers specifically to high-speed Internet access that connects an end-user to the Internet backbone[1] (Industry Canada, 2001). Individuals are typically connected to the Internet through an Internet Service Provider (ISP), where the transfer speeds are faster than dialing to an Internet connection that has a maximum of 56–64 kilobits per second (Kbps) (CRTC, 2004). In many present situations, broadband is being residentially provided in urban areas between 1 and 7 megabits per second (Mbps), which is roughly eighteen times the bandwidth of a dialup connection (Rogers High Speed

[1] The Internet backbone is the wireline and wireless network infrastructure that links all the parts of the Internet together.