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Can broadband over powerline carrier (PLC) compete? A techno-economic analysis

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Abstract

Powerline carrier (PLC) communications have been heralded by the FCC as the "3rd wire" to every home, and have matured to the point of field trials and limited deployment. This paper examines the technology from a techno-economic perspective, factoring in regulatory issues and network design (focusing on the United States). Results indicate that PLC does not appear to represent a major disruptive technology, especially from a price-performance perspective. In addition, a baseline stochastic model created for the analysis shows that not only do competition and penetration matter, but locational distribution (i.e., how many consumers can share upstream equipment) is critical in determining PLC's competitiveness.

Keywords: Broadband over powerline (BPL); Powerline carrier (PLC); Techno-economic analysis; Access technologies

1. Introduction

Broadband penetrations in the United States have, especially until recently, lagged behind those of a number of other OECD countries. In Korea, one of the world leaders, not only are most households online, but 96.5% of these have *broadband* connectivity (ITU, 2003). Worldwide, the leading technology used for broadband is DSL (digital subscriber line), followed by cable—which leads in the United States. An emerging technology, powerline carrier (PLC), also known as broadband over powerline (BPL), is envisaged as a new solution that can provide lower costs to

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consumers. PLC is an access solution that transmits data over electricity wiring while simultaneously carrying electricity.

PLC, like most broadband solutions, provides always-on, high-speed connectivity (hundreds of kilobits/s or greater).[1] PLC is viewed as especially attractive because of several characteristics. Electricity service is nearly ubiquitous, and so the theoretical coverage from PLC is close to 100% (at least in the US—and most developing countries have higher electricity penetration than telephony). Most consumers have a reasonable expectation of quality and reliability from their power provider.[2] In addition, PLC can provide an elegant solution for in-home access and networking, since the signal can reach virtually any outlet in the home. This can provide connectivity to almost any location within the house, in a "plug and play" fashion.

For PLC to be successful, it must not only operate successfully from a technology point of view, but also present a viable business case. The two are interlinked, since its market share will depend on its price-performance, i.e., cost as well as throughput. The market space consists of not only well-entrenched alternatives (DSL and cable), but also alternatives such as fiber-to-the-home (FTTH), fiber-to-the-curb (FTTC), and broadband wireless. In addition to an analysis of the technology, and its economic implications, this paper highlights several issues relating to policy. After all, if PLC does not do well in the market, is not that simply a part of the natural competitiveness of the telecom industry? As will be shown, like all issues of telecom, regulation and competition play a vital role.

The next section describes PLC technology and its status, highlighting network (power distribution grid) design and its implications. The subsequent section discusses regulations pertaining to PLC, followed by a description of the model created for analysis. It is worth emphasizing that many of the costing numbers are not publicly available, and there will be differences between systems based on different physical infrastructure and designs. Given the great uncertainty in a number of parameters and variables, a stochastic model was created, using a range of parameters, to provide plausible and useful results. After presenting the results, the paper examines sensitivity and robustness of the variables. The concluding sections cover the implications of the analysis, including PLC's possible competitiveness in the market.

2. PLC technology

Electricity flows over powerlines at a near-steady 50 or 60 Hz (cycles per second), depending on the country's standard. If a signal is injected over this network at much higher frequencies, it would present minimal interference with the electricity delivery—somewhat analogous to DSL technologies using different frequency bands for voice and for data over the same copper infrastructure. Utilities have been transmitting communications signals over powerlines for many decades, mainly for control purposes. However, these signals usually operated at kilohertz ranges, and offered only modest transmission capacity, sometimes less than a kilobit per second. A relatively new idea has been to transmit broadband signals for communications purposes, i.e.,

[1] There is no universal definition of or standard for "broadband." The ITU (2003) terms connections with speeds of at least 128 kbps (kilobits per second) in one direction as broadband.

[2] The August 14, 2003, blackout notwithstanding. This paper focuses on the US, unless stated otherwise.