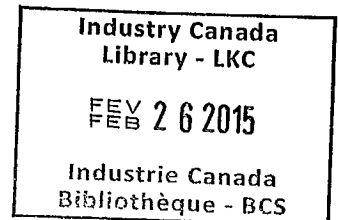


Internet Service Providers Report

Prepared for Industry Canada

Paul Chwelos
Management Information Systems Division
Sauder School of Business
University of British Columbia
2053 Main Mall, Vancouver, BC, V6T 1Z2

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Executive Summary

A survey of Canadian Internet Service Providers (ISPs) was conducted to assess the economic cost of the voluntary "notice and notice" (NN) approach to dealing with copyright infringement notices from rights holders. The eight large ISPs (having greater than 100,000 subscribers) and 48 of the estimated 472 small ISPs were surveyed and their current practices and costs documented. While this sample only includes 12% of all ISPs, it represents more than 80% of the subscribers of the ISP industry in Canada.

The majority of large ISPs (75%) and small ISPs (58%) are following the voluntary NN practice. The number of copyright infringement notices received by ISPs is growing over time and is related to the number of "high-speed" Internet subscribers (i.e., DSL or Cable subscribers). However, there is considerable variance in the number of notices received per subscriber per month. On average, large ISPs receive more notices per subscriber than do small ISPs. Within large ISPs, some ISPs receive 13 times as many notices per subscriber as other ISPs, and the range for small ISPs is even larger. Thus, the burden of following the NN regime varies considerably across ISPs.

The financial costs to ISPs of following the NN approach varied considerably across ISP size. For the average large ISP the cost of processing a notice is \$11.73, whereas for the average small ISP the cost is \$32.73. The fixed costs of notice processing were very difficult for respondents to assess, though larger firms were more likely to have engaged in either systems development or integration to partially automate or support notice processing. The observed differences in costs suggest that there are significant economies of scale in notice processing; the cost of processing a notice is lower for ISPs receiving a high volume of notices than it is for ISPs receiving only a small number of notices.

The vast majority of copyright infringement notices are sent either by US studios (representing movies, music, and television content) or software publishers, or by agents operating on their behalf. Less than 2% of notices could be attributed to Canadian copyright holders.

Introduction

The invention and widespread adoption of the Internet has revolutionized the way in which products that fall in the domain of copyright protection – books, pictures, movies, and music – are distributed and consumed. The industries whose products are easily rendered as digital content have had to adapt to this sea change on very short order. In this time, whole new industries, such as the Internet Access industry, have been spawned. The rise of the Internet challenges existing Intellectual Property Rights (IPRs) and copyright in particular, in ways that could not have been foreseen when these rights were drafted. Numerous legal challenges have arisen in Canada and other jurisdictions around both technical issues (such as mirroring, caching, and incidental copying) as well as more fundamental legal issues (such as whether storing files in a “shared directory” constitutes a violation of the Copyright Act). As has been argued elsewhere, there is need for a clarification of existing IPRs to sensibly address new technologies.¹

In the absence of legislation explicitly addressing copyright and the Internet, Canadian Internet Service Providers (ISPs) agreed to follow a “notice and notice” system that provided copyright holders a method to help protect their property rights on the Internet (as accessed through Canadian ISPs).² This agreement was reached in 2000 between the Canadian Association of Internet Providers (CAIP), the Canadian Cable Telecommunications Association (CCTA), and the Canadian Recording Industry Association (CRIA). Since then, CAIP and CCTA members have been voluntarily following this practice.

The procedures agreed upon in 2000 were as follows: (1) CRIA notifies a CAIP- or CCTA-member ISP in writing that an alleged infringement of CRIA's copyrights has occurred through the actions of a customer of the ISP; (2) the ISP notifies its

¹ See, for example, Cockburn and Chwelos (2001).

² A more detailed description of the impact of the issues surrounding copyright, ISPs, and rights holders is available in Chwelos (2003).

customer of the allegation, again in writing, and, (3) the ISP sends a written confirmation that it has done so back to CRIA.³

Objectives

The objective of the report is to provide an analysis of the economic impact of the current voluntary “notice and notice” (NN) copyright infringement regime followed by Canadian Internet Service Providers. This report will make an explicit distinction as to this impact on large and small ISPs, where the size of the ISPs is determined by the number of subscribers. The drivers of the cost of NN, including the volume of notices received and the economic costs of processing notices, will be examined.

Stakeholders

The stakeholder group under direct consideration in this study are the firms and individuals acting as commercial ISPs in Canada. Secondary stakeholder groups obviously directly affected by the Notice and Notice regime are individuals and businesses subscribing to Internet access through Canadian ISPs (subscribers) as well as individuals and firms who hold copyright over material available from the Internet through Canadian ISPs (rights holders). The economic analysis in this report will focus solely on ISPs.

Methodology

The primary methodology utilized in this study is a survey that samples the universe of Canadian ISPs. At present, the Canadian ISP Industry is believed to be comprised of approximately 480 ISPs, of which 8 are considered large (CAIP 2003).

³ This description of the CAIP/CCTA/CRIA notice and notice agreement is based on Thomson (2001).

In order to ensure a representative analysis of large and small ISPs, the following methods were implemented:

1. Separate treatment of large and small ISPs.
2. For large ISPs (defined as those having approximately 100,000 subscribers or more), a census of the eight (8) large ISPs was completed.
3. For small firms, random sampling was used to ensure that the resulting estimates are representative of the overall ISP industry in Canada. The universe of ISPs in Canada is estimated at 480 firms (CAIP 2003). The sample frame was defined as the union of the membership lists of three industry associations CAIP (Canadian Association of Internet Providers), CCTA (Canadian Cable Telecommunications Association), and OTA (Ontario Telecommunications Association), along with the list of ISPs provided by www.canadianisp.com (excluding large ISPs). Taken together, this sample frame represented 345 ISPs, or 72% of the population. Excepting the eight large ISPs, each ISP had the same probability of being selected. A sample was drawn randomly from this sample frame.
4. Interviews were conducted by telephone with the ISPs selected. Where necessary, multiple respondents were used within the organization.

Surveys have been completed with the eight (8) large ISPs and forty-eight (48) small ISPs. Summary statistics for respondent firms are presented in Table 1. While the sample includes only approximately 12% of all the ISPs believed to be operating in Canada (56 of 480), it does represent over 80% of all Internet subscribers in Canada.

Analysis:

Awareness and Current Practice:

Large and small ISPs diverged in their awareness of "the current status of ISP copyright liability in Canada" (see Table 2). 100% of large ISPs indicated they

were aware of the current status of Canadian copyright law, and the majority were aware of copyright law as it pertains to ISPs in other jurisdictions (US, EU, and Australia.) On the other hand, only 46% of small ISPs indicated that they were aware of the current status of Canadian copyright law as it pertained to ISPs, and very few indicated awareness of other jurisdictions.

This difference is reflected in recourse to legal expertise, where all large ISPs either had in-house legal counsel dealing with copyright liability (87.5% of large ISPs) or had sought external counsel for copyright liability (12.5%); in stark contrast, only 2% of small ISPs had internal counsel and only 19% had ever sought external legal advice.

Only a minority of firms were aware of subscribing to any form of insurance that included liability for copyright infringement. Typically, these policies had deductibles in the range of \$100,000 per incident and included copyright insurance as part of professional liability insurance.

Three-quarters of large ISPs are currently following some version of a voluntary notice and notice system, versus only 58% of small ISPs. Clearly, NN is not currently universally applied by Canadian ISPs. In addition, NN, as currently practiced, has evolved from the original CAIP/CCTA/CRIA agreement in two ways. First, all ISPs now accept copyright infringement notices via email as well as in writing. Second, some ISPs no longer send a written (or email) acknowledgement back to the rights holder originating the copyright notice.⁴

Number of Copyright Infringement Notices

The number of infringement notices received by each ISP for all available years is presented in Table 3. Unfortunately, only large ISPs had what were judged to be reliable records on the number of notices received either on a monthly or yearly

⁴ Unfortunately, data on the number of ISPs sending acknowledgement back to the rights holder were not captured, so it is impossible to quantify this practice.

basis for any period longer than six months.⁵ Three major trends are evident from this table:

1. The number of notices is following a generally upward trend since ISPs began collecting these data (2001). In terms of number of notices received per ISP, the annual growth rate is 77.8% per year for the period 2001-2005.
2. The number of notices received by large versus small varies significantly. On average, large ISPs receive 3.3 times as many notices per high-speed (Cable or DSL) subscriber than do small ISPs.⁶
3. There is considerable variance in the number of notices received across ISPs. For large ISPs, the ratio of the max to the min is more than 13:1, indicating that on a per-subscriber basis, some ISPs get more than 13 times as many notices as other ISPs. The range is even larger for small ISPs, a number of which report receiving zero notices.⁷ Thus, there is considerable heterogeneity in the number of notices generated per subscriber, both within and across size categories of ISPs. The implication of this difference is that ISPs may bear very different burdens in terms of adhering to a Notice and Notice regime.

Analysis of Copyright Notices across Subscribers

The number of notices received by ISPs was analyzed in two ways. First, all ISPs reporting the number of subscribers and infringement notices currently being received (as of any month in Q1, 2005) were pooled and analyzed using cross-sectional techniques. The objective here is to uncover what are the current drivers of copyright infringement notices.

⁵ Data from small ISPs is much less accurate, since very few small ISPs actually maintain records of the number of notices received over time; instead, these numbers are largely based on the memory of the respondent.

⁶ The number of notices per high-speed (Cable or DSL) subscriber is calculated in Table 4. On average, large ISPs receive 7.7 copyright infringement notices per month per thousand high-speed subscribers whereas small ISPs report receiving only 2.3 notices per month per thousand high-speed subscribers.

⁷ Given the small size of some of these firms (fewer than 200 subscribers), this number is plausible.

There are fifty-one (51) firms that report the number of each type of subscribers (dial-up, Cable, and DSL) and the number of infringement notices as of 2005. The relationship between each type of subscribers and the number of infringement notices received was analyzed. Details of this analysis are presented in Appendix 1 below. Overall, two main results emerge. First, high-speed subscribers (Cable and DSL) generate more copyright infringement notices than do dial-up subscribers. Second, large ISPs receive more notices per subscriber than do small ISPs.

Analysis of Copyright Notices over Time

The evolving nature of copyright infringement notices over time was analyzed using econometric methods for panel data; the details of this analysis are presented in Appendix 2 below. Here the objective is to understand how the drivers of infringement notices have been changing over time. As noted above, the sample of firms able to supply notice data on a monthly basis is confined to a subset of the large ISPs.

As is apparent in Table 3, the total number of infringement notices received by ISPs is increasing over time, at an average rate of 77.8% per year. Analysis reveals that the effects of time differ, however, across subscriber types. In particular, the number of copyright notices received per high-speed subscriber (Cable or DSL) has been increasing over time at a steady rate whereas the number of copyright notices received per dial-up subscriber has been falling over time.

Overall Analysis of Notices over Time and Subscribers

Putting the two preceding analyses together, the estimated number of copyright infringement notices generated per 1000 subscribers per month is indicated in Table 7.⁸ Three main effects are apparent from this analysis:

⁸ These estimates are calculated using the sample means of infringement notices and subscribers. Given the presence of firm type effects in the cross-sectional model and time-effects in the panel data model, the preferred specifications in Table 7 are cross-sectional Model 3 and panel Model 4. The results are presented

1. The number of notices generated per subscriber is higher for Cable and DSL subscribers than for dial-up subscribers. As of the start of 2005, the number of notices per subscriber is now approximately equal for Cable and DSL subscribers.⁹
2. The number of notices per subscriber is significantly higher for large ISPs than small ISPs. On average, large ISPs receive 2.7 times as many notices per high-speed subscriber as do small ISPs.¹⁰
3. The number of notices generated per high-speed subscriber has been increasing since 2001 at the rate of 25.3% per year.¹¹
4. The number of notices generated per dial-up subscriber has been decreasing since 2001 and it appears that, by 2005, dial-up subscribers have ceased to be a significant driver of copyright complaints for large ISPs.¹²

Sources of Copyright Infringement Notices

For the most part, ISPs did not keep records of the senders of infringement notices. However, two large ISPs were able to provide a sample of the sources of all notices for two recent time periods (2003-2005) spanning several months. These notices were grouped into categories, and the relative frequencies of these categories is listed in Table 8.

As can be seen, the vast majority of reported notices (96%) originated in the US, either from studios, software publishers, the Motion Picture Association of America

in terms of the marginal effect of an additional thousand subscribers of each type on the number of copyright infringement notices received each month.

⁹ This comparison of the difference of Cable versus DSL subscribers is taken from panel Model 4, evaluated at January 2005.

¹⁰ For this calculation, the average values of high-speed subscribers are used for both small and large ISPs and the effect sizes are taken from Model 3 of the Cross-Sectional results. They are calculated as $(3.45 + 4.62) / (0.73 + 2.28) = 2.68$.

¹¹ For this calculation, the average values of the interaction terms between month and Cable and DSL subscribers was taken from Model 4 of Table 6 and converted to an annualized value.

¹² Although the estimated effect of additional dial-up subscribers as of January 2005 in the panel model is negative and significant, the most sensible interpretation is that dial up subscribers have no effect on the number of copyright notices received. Dial up subscribers remain a significant driver of infringement notices for small ISPs.

(MPAA) or US firms acting on behalf of rights holders that were not revealed.¹³ Less than 2% of notices could be linked directly to Canadian rights holders, although it is not known what proportion of notices is ultimately on behalf of Canadian rights holders. Unfortunately, the ISPs could not separate out notices by type of media concerned (e.g., music, movies, television). Since most Hollywood studios represent at least two if not all of these categories of media, it is impossible to classify the type of media within the notices received from these studios. However, qualitative assessment of respondents within both large and small ISPs formed a strong consensus that the vast majority of notices from US studios now relate to movies rather than to music.

Current Notice and Notice Practices

Table 9 describes the typical process in ISPs currently following the Notice and Notice regime. The left column describes the eight steps typically undertaken in a large ISP when a copyright infringement notice is received in reference to one of their subscribers. The right column presents the corresponding process in small ISPs, which typically comprises six steps. Overall, the process in the large ISPs reflected some investment in information systems and administrative procedures to support and/or partially automate the notice and notice practice.

In no firm interviewed was all of the information required to comply with notice and notice available from a single completely integrated source. Nearly all ISPs have to bridge two completely separate sets of information systems in order to respond to notices. These two types of systems are: (i) provisioning systems (those systems aimed at actually providing Internet access to subscribers), and (ii) customer billing systems. This challenge for ISPs stems from the fact that rights holders cannot identify individual infringers on the Internet, and must instead report an Internet Protocol (IP) address and date/time to the ISP responsible for that IP address. To the extent that it is possible to link an IP address assigned at a particular date and time to a particular subscriber account, a number of data

¹³ The common term for such firms, which seek out infringers and deliver notice to them through an ISP, is "bounty hunter."

sources must be searched and manually linked. The most crucial information in this process – logs of which IP address was assigned to which device at what time – is most frequently produced as a by-product of operational systems and stored in a “flat file” format. As a result, these files are not indexed and neither do they have any integrity constraints built into them. Searching these logs is thus time consuming and not guaranteed to be 100% accurate. The data sources used by ISPs are listed in Table 10.

For large ISPs, this process required, on average, 12.3 minutes of labour versus 47.4 minutes in small ISPs. This difference may reflect the fact that a number of large ISPs have engaged in some measure of systems development or integration to automate or expedite at least portions of the process. ISPs also reported the hourly wage for the personnel processed infringement notices, inclusive of benefits and taxes available. For large ISPs, the average hourly labour expense was \$42.30, or 71 cents per minute; the comparable figures for small ISPs were \$41.47 per hour or 69 cents per minute. Based on the average labour cost per minute and the average number of minutes per notice, the average cost of the Notice and Notice practice (where confirmation of notice need not be seen to the rights holder and neither is there a billing process in place) is estimated at \$11.73 for large ISPs and \$32.73 for small ISPs.¹⁴ The large difference in this number reflects the fact that many of the very small ISPs process a very low volume of infringement notices (perhaps 2-3 per year) and, on average, require a great deal of time to do so.

Another way to calculate the average cost of processing an infringement notice is to weight the cost for the ISP by the number of notices processed to produce an industry average per-notice cost. When this weighting is applied to large firms, it has little effect: \$11.76 versus \$11.73.¹⁵ That is, the cost of processing each notice

¹⁴ Calculations based on figures from Table 9:

Large ISPs: Average Cost = 12.29 minutes * \$0.71 per minute + \$3.00 overhead = \$11.73

Small ISPs: Average Cost = 47.43 minutes * \$0.69 per minute + \$0.00 overhead = \$32.73

¹⁵ Calculations based on figures from Table 9:

Large ISPs: Average Cost = 12.16 minutes * \$0.72 per minute + \$3.00 overhead = \$11.76

Small ISPs: Average Cost = 16.77 minutes * \$0.31 per minute + \$0.00 overhead = \$5.20

within large ISPs is more-or-less fixed and doesn't vary with the number of notices processed.¹⁶ The weighted approach reveals a very significant difference for small ISPs, with the average cost dropping from \$32.73 to \$5.20. The conclusion to be drawn from this weighted comparison for the cost of notice processing at small ISPs is that firms that process more notices do so, on average, at a much lower cost per notice. That is, there appears to be an economy of scale in notice processing: the more notices processed, the lower the cost of each notice.

The fixed costs associated with notice processing were very difficult for respondents to quantify. These fixed costs include all of the investments undertaken in order for an ISP to conform to the Notice and Notice standard. These investments include the development of business process and administrative systems to perform notice and notice, development of databases or record-keeping systems to track notices, and systems development or systems integration work to automate or support the notice and notice process. The majority of large ISPs, as well as "larger" small ISPs, had undertaken either systems development of systems integration work of this sort. For example, a few ISPs have developed systems that automate or support the process of linking an IP address at a given date and time to a subscriber account or to link a subscriber account to a billing address. However, the vast majority of respondents were unable to quantify these expenditures; indeed, the number reporting is so small that confidentiality concerns prohibit reporting anything other than the approximate range of these figures, which was \$50,000 to \$300,000. Large ISPs, on average, assessed an "overhead" cost of \$3.00 per notice, reflecting their estimate of these fixed costs spread out over the number of notices processed, as well as other overhead not included in labour costs (e.g., buildings and maintenance). Because small ISPs did not account for or estimate any overhead or fixed costs associated with notice processing, their estimates of the average cost of notice processing are

¹⁶ The total cost of processing notices, of course, depends directly on the number of notices: total cost is the product of average cost (\$11.76 for large ISPs) and the number of notices processed (4426 per month for large ISPs as of Jan 2005) for a total average cost of approximately \$38,900 dollars per large ISP per month as of January 2005.

likely underestimates. However, the magnitude of the underestimate is likely to be quite small because small ISPs typically had not engaged in systems development or integration, and neither did they have employees dedicated to notice processing.

Note again that there was considerable variation in the reported cost per notice. Confidentiality concerns make reporting the range of costs impossible, but the ratio between the highest and lowest costs within Large ISPs was nearly a factor of 10:1, and the range for small ISPs was even larger. For the most part, these differences in cost are idiosyncratic reflections of the choices made in the past – some many years ago – about the specific IT architecture and infrastructure implemented by each ISP. Since information systems work in a complex network of complementary components (e.g., computing hardware, operating system software, database systems, transaction processing systems, financial systems, middleware, networking hardware, etc.), the information architecture in a particular firm displays both lock-in due to switching costs and path dependency.¹⁷ Not only do the current costs of adhering to Notice and Notice vary considerably across ISPs, but the costs of integrating or automating these systems in the future will also vary considerably. Again, these variations in current and future costs imply considerable difference in the burden of Notice and Notice across ISPs.

Pricing and Implications for Consumers

The pricing practices of ISPs and their perception of the degree of price competition within the market is presented in Table 11. Although nearly all ISPs have changed their prices in the last three years, nearly all providers of Internet access priced their offerings very close to their competitors. There was a perception that perhaps only two firms in the industry were “price setters,” with the remainder of firms being price followers. Nearly all ISPs offered some form of promotional pricing, and the perception is that the churn rate (subscribers switching ISPs) is very high in the market. One approach that large ISPs have taken in an attempt to reduce churn is to offer discounted pricing on “bundles” of service,

¹⁷ See, for example, Shapiro and Varian (1999) for a discussion of the economics of information technology and systems.

typically consisting of some combination of Internet access, telephone service, Cable TV service, and wireless telephone service. While 100% of large ISPs had chosen to offer bundles, very few of the small ISPs were able to because almost none of these ISPs provided more than one of these services.

Given the competitiveness of the Internet access market, it appears likely that prices haven't increased as a result of notice and notice to this point in time. It is possible, however, that absent these notice and notice costs, prices of Internet access would have fallen more than they actually have.

In many large ISPs, the resources and people who handle infringement notices typically have other duties; in many organization the "abuse desk" handles copyright notices, as well as issues like SPAM, denial of service, inappropriate content, etc. Some ISPs suggested that the ability of their abuse departments to attend to these other issues may have been compromised as a result of the increasing number of copyright notices. Consequently, the quality of service experienced by subscribers may be lower than would have been otherwise.

Conclusions

The economic impact of the voluntary Notice and Notice Regime followed by the majority of Canadian ISPs varies considerably from firm to firm. In most small firms, the overall impact to date is not significant. In large firms, however, the economic impact is currently significant and is growing over time. Nevertheless, an order of magnitude difference exists in these costs on a per-subscriber basis even among large firms, in part due to differences in internal information architecture and in part due to unexplained differences in the number of copyright infringement notices received per subscriber.

Based on the responses to the survey, an estimate of the total cost of notice and notice to the Canadian ISP industry can be calculated. The survey estimated the average cost of processing a notice at \$11.76 for large ISPs and \$5.20 for small ISPs (Table 9). On average, large ISPs indicated that they receive, on average,

4,426 notices per month as of January 2005; the equivalent figure for small ISPs is 18 notices per month (Table 3). In the universe of Canadian ISPs, there are a total of 8 large ISPs and 472 small ISPs (Table 1, CAIP 2003). Combining these figures reveals that the overall cost of following the NN practice in Canada is approximately \$460,000 per month, with the vast majority of this being borne by large ISPs (90.4%).¹⁸

If some form of Notice and Notice Regime were made mandatory through a revision of the Copyright Act, there would be a number of financial impacts. First, some measure of fixed costs would be incurred in all ISPs, both small and large, as a result of putting the information systems, business processes, and tracking and reporting mechanisms in place that would be required to conform to the new standards. In particular, some ISPs would need to move from the version of NN currently practiced to a version that explicitly includes an acknowledgement back to the rights holder that the notice has been forwarded to the subscriber. This version is sometimes referred to as "Notice and Notice and Notice" to reflect the third version of the (acknowledgement of the) notice sent back to the rights holders. Because a significant proportion of small ISPs (42%) and even large ISPs (25%) do not currently practice NN, these firms will have to make significant investment in getting "up to speed" with any NN practice (Table 2).

Second, in describing their current costs, respondents indicated that operational costs are highly sensitive to the details of the mandated Notice and Notice Regime, along such dimensions as the format of notices, response requirements and timeframes, accuracy requirements, statute of limitations (how long notices and associated records must be stored), and many others.¹⁹ If a mandated NN regime required conformance to high standards of accuracy, then some firms would

¹⁸ Calculations based on figures from Tables 1 (number of firms), 3 (number of notices), and 9 (costs):
Total Large ISP cost = 8 ISPs * 4426 notices per month * \$ 11.76 per notice = \$ 416,398.08
Total Small ISP cost = 472 ISPs * 18 notices per month * \$ 5.20 per notice = \$ 44,179.20
Total ISP cost = \$416,398.08 + \$44,179.20 = \$460,577.28
% Large ISP cost = \$416,398.08 / \$460,577.28 = 90.4%

¹⁹ From responses to the ISP Questionnaire, Question 3, especially section g.

choose to invest in increasing the accuracy and reliability of their systems and methods for linking IP addresses to individual subscribers.

Third, within large firms, a mandatory Notice and Notice Regime may require considerable systems development or systems integration costs, although these costs will vary significantly across firms depending on their existing architectures.²⁰ Further, some large firms indicated that they would have to roll out multiple versions of such systems for different regions or provinces. While these development efforts could automate portions of the notice and notice process, thereby reducing variable labour costs, they would introduce a new class of capital costs that would have to be amortized across the total volume of notices processed in the lifetime of the system and hardware comprising that system. The net impact on total costs per notice for large ISPs is therefore not obvious, except to note that economic rationality should prevent large ISPs from engaging in automation if it were, on net, expected to raise their total costs.

The most critical driver of the economic impact of a mandatory Notice and Notice Regime would be the volume of notices that ISPs would receive under this Regime. Large ISPs already process a significant volume of notices (hundreds per day in peak periods) and have made investments in supporting and automating this process; however, the cost of processing each notice remains at approximately \$11.76. None of the large ISPs anticipated being able to significantly lower this cost.²¹

Not only is the number of notices a direct driver of costs within both large and small ISPs, but it may also be a significant factor in determining where the greatest economic burden falls (measured on a per-subscriber basis). If the volume of notices continues to increase, it would be expected that the large ISPs would, to the extent possible, continue to automate their notice and notice process.

²⁰ From responses to the ISP Questionnaire, Question 3, especially section k.

²¹ From the responses to the ISP Questionnaire, Section 3 questions d, g, h, and i.

However, even a significant increase in the volume of notices would not make it financially viable for small ISPs to automate their notice and notice process. This difference in the "transaction volume" of notices may result in a lower variable and average cost per notice for large ISPs than for small ISPs. This situation would be analogous to an economy of scale in copyright infringement notice processing, and thus may result in a competitiveness disadvantage for small ISPs.

This competitive implication has played itself out in many information technologies that enabled firms to reduce variable costs at the expense of significant fixed costs of systems development or integration. Electronic Data Interchange (EDI) is one long term example of such a technology: the adoption rate of EDI within Fortune 1000 firms (i.e., very large firms) is more than 95%, but among all other US firms, the adoption rate is less than 2%. Small firms simply do not have sufficient transaction volume to defray the fixed costs, and are thus unable to justify adoption of the technology. Depending on the volume of copyright notices, small Canadian ISPs may find themselves in a similar position with respect to their efficiency of processing copyright infringement notices.

References:

The Canadian Association of Internet Providers (CAIP), "The Canadian ISP Count, 2003: How many, where they are, and what they do," 2003, 9 pages.

Chwelos, Paul, "Assessing the Economic Impacts of Copyright Reform on Internet Service Providers" prepared for Industry Canada, 2003.

Cockburn, Iain and Paul Chwelos, "Intellectual Property Rights and the Transition to the Knowledge-Based Economy," Doing Business in the Knowledge Based Economy: Facts and Policy Challenges, L. Lefebvre, E. Lefebvre, and P. Mohnen (eds), Boston, MA: Kluwer Academic Publishers, 2001, pp. 349-390.

Industry Canada (IC), "Telecommunications Service in Canada: An Industry Overview," June 15, 2005

<http://strategis.ic.gc.ca/epic/Internet/insmt-gst.nsf/en/sf07007e.html>

Shapiro, C., and H.R. Varian, Information Rules: A Strategic Guide to the Network Economy, Boston, MA: HBS Press, 1999. ISBN 0-87587-863-X

Thomson, Jay, "September 17, 2001: Re: Consultation Paper on Digital Copyright Issues," <http://www.caip.ca/issues/copyright/sept1701.htm>

Appendix 1: Cross-Sectional Analysis of Current Copyright Notices

The data for the 51 ISPs reporting subscriber type and copyright infringement notices in 2005 were analyzed using ordinary least squares (OLS), and the results are presented in Table 5. Given the skewed nature of the data on the dependent and independent variables, log transformations were used. A Box-Cox test failed to reject the log-log specification, whereas the linear and log-linear specifications were rejected.

A simple OLS regression of (log) subscribers of each type on (log) infringement notices is Model 1. The number of notices is related to the types of subscribers in the whole sample of firms, with the impact of high-speed subscribers being greater than dial-up subscribers.

The difference in the number of notices received per high-speed subscriber (noted above) prompted exploration of the impact of the size of the ISP on the number of notices. Model 2 includes an indicator variable for large ISPs, which is positive and significant, confirming that large ISPs receive more notices than small ISPs even after controlling for the number and type of subscribers.

Model 3 replaces the ISP size indicator variable with three interaction terms between the size indicator and the number of subscribers of each type. Two of these three indicators are positive and statically significant, demonstrating that large ISPs receive more infringement notices per Cable and DSL subscriber than do small ISPs. There is no difference in the impact of dial-up subscribers across ISPs of different sizes. A model including both the indicator as well as the interactions could not be run due to multicollinearity.²²

Overall, then, analysis of the current relationship between subscriber type and copyright infringement notices received indicate that:

²² The Variance Inflation Factor of such a model was greater than 120, whereas values over 10 are usually considered indicative of multicollinearity.

- High-speed subscribers (Cable and DSL) generate more copyright infringement notices than do dial-up subscribers as of January 2005
- Large ISPs receive more notices per high-speed subscriber than do small ISPs as of January 2005.

Appendix 2: Analysis of Copyright Notices over Time using Panel Data

All ISPs able to report monthly numbers of subscribers and infringement notices for a period of at least six months are pooled and analyzed using panel data techniques. The relationship between subscribers of various types and infringement notices over time was tested using a random effect model for cross-section and time-series data of the form:

$$y[i,t] = B \cdot x[i,t] + u[i] + e[i,t]$$

Random effects is considered the appropriate specification of the $u[i]$ term because (a) the firms represent a sample of the population, and (b) the $u[i]$ are expected to be orthogonal to the number of subscribers. In total, there were 162 observations of infringement notices at a particular ISP in a particular month. The earliest observations are from 2001, and the latest from January of 2005.

The results of this analysis are in Table 6. As a baseline, Model 1 reproduces the analysis without time effects. For large ISPs, the number of copyright notices is positively and significantly related to the number of high-speed subscribers (i.e., Cable and DSL) but unrelated to the number of dial-up subscribers.

A linear time effect is introduced in Model 2 using a month variable that starts at 1 in the first month in the sample and increases by 1 for each subsequent month. The impact of the month variable is so strong (the explanatory power of the model, measured by percentage of variance explained, jumps markedly) that all of the estimates for the effects of subscribers become insignificant. Obviously there is a significant time trend in the number of notices received by large ISPs; Model 3 explores a quadratic time trend with the introduction of month squared. However, the squared term is insignificant, so time appears to have a linear effect within the sample data. Finally, Model 4 breaks this time trend into an interaction of the month variable with each subscriber type. All three of these interactions are significant, although two are positive (DSL and Cable) and one (dial-up) negative.

Thus, the number of notices received per DSL and Cable subscriber per month has been increasing over time whereas the number of notices received per dial-up subscriber per month has been decreasing. As with the cross-sectional analysis above, the direct impact of time could not be included along with the interaction terms due to extreme multicollinearity.

Taking Model 4 as the preferred specification, the analysis of the number of ISP notices generated by subscriber type over time indicate:

- The number of copyright notices received per high-speed subscriber (Cable or DSL) has been increasing over time at a constant rate.
- The number of copyright notices received per dial-up subscriber has been falling over time at a constant rate.

Tables:

Table 1: Respondent Firms

	Large ISPs	Small ISPs
Number of Firms	8	48
Mean Subscribers	766,000	6,400
Median Subscribers	733,000	1,400
Types of Internet Access	Dial-up, DSL, Cable	Dial-up, DSL, Cable, Wireless
Provinces Served	All	AB, BC, NB, NL, ON, QC, SK
Total Subscribers Represented	6,128,000	307,200
Universe of Firms ²³	8	472
Sampling Rate of Firms	100%	10.2%
Universe of Subscribers ²⁴	8,000,000	
Sampling Rate of Subscribers	80.4%	

Key Implication: Respondent firms represent 100% of the large ISPs in Canada and more than 80% of all subscribers in Canada.

²³ Source: CAIP (2003)

²⁴ Source: IC (2005)

Table 2: Awareness of Copyright Laws & Current Practices

	Large ISPs			Small ISPs		
	Yes	No	Don't Know	Yes	No	Don't Know
Aware of Canadian Law	100%	0%	0%	46%	54%	0%
Aware of US Law	75%	25%	0%	40%	58%	2%
Aware of EU Law	63%	38%	0%	21%	77%	2%
Aware of Australian Law	50%	50%	0%	19%	79%	2%
Internal Legal Counsel for Copyright Liability	88%	13%	0%	2%	92%	4%
Sought External Counsel for Copyright Liability	13%	88%	0%	19%	77%	4%
Copyright Insurance	25%	13%	63%	15%	67%	19%
Current Practices						
Universal Notice and Notice	75%			50%		
Selective Notice and Notice	0%			8%		
No Answer / Other	25%			42%		

Key Implication: Large ISPs are more aware of copyright laws and are much more likely to have retained legal advice on copyright issues than small ISPs.

Table 3: Average Number of Copyright Infringement Notices per ISP per Month

	Large ISPs			Small ISPs		
	Notices	Annual % Change	N	Notices	Annual % Change	N
2001	443		1			
2002	595	34%	3			
2003	2198	269%	4			
2004	4372	99%	6			
2005 (Q1)	4426	67% ²⁵	7	18	n/a	47
2001-2005 Average		77.8%			n/a	

Key Implication: The number of copyright infringement notices received by large ISPs is increasing at an average rate of 77.8% per year.

Table 4: Variance in Copyright Infringement Notices, Q1 2005

	Large ISPs				Small ISPs			
	Mean	Min	Max	SD	Mean	Min	Max	SD
CI Notices / 1000 HS subscribers / month	7.7	1.2	15.8	5.2	2.3	0.0	51.7	8.5

Key Implication: Large ISPs receive more copyright infringement notices per high-speed subscriber than do small ISPs (approximately 3.3 times as many).

²⁵ Annual % Change for 2005 calculated for Jan 2004 – Jan 2005.

Table 5: Cross-Sectional Analysis of Copyright Notices, Q1 2005

Dependent Variable: Log Infringement Notices Per Month

	Model 1	Model 2	Model 3
Log Dial-Up Subscribers	0.2811 (0.0743)***	0.162 (0.0507)***	0.1765 (0.0538)***
Log DSL Subscribers	0.414 (0.0751)***	0.1782 (0.0571)***	0.1565 (0.0597)**
Log Cable Subscribers	0.7065 (0.0657)***	0.3497 (0.0617)***	0.3598 (0.0641)***
Large ISP Indicator		4.7253 (0.5888)***	
Log Dial-Up Sub * Large ISP			-0.2140 (0.1718)
Log DSL Sub * Large ISP			0.5813 (0.1641)***
Log Cable Sub * Large ISP			0.3711 (0.0619)***
Constant	-3.3171 (0.5376)***	-1.4721 (0.4194)***	-1.4767 (0.4350)***
Observations	51	51	51
R-squared	0.7200	0.8833	0.8879

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Key Implications:

- High-speed subscribers (Cable or DSL) generate more copyright infringement notices than dial-up subscribers.
- Large ISPs receive more copyright infringement notices per high-speed subscriber than do small ISPs.

Table 6: Panel Analysis of Copyright Notices, Large ISPs, 2001- 2005

Dependent Variable: Log Infringement Notices Per Month

	Model 1	Model 2	Model 3	Model 4
Log Dial-Up Subscribers	-0.0125 (0.1537)	0.0673 (0.1640)	0.0016 (0.0495)	1.0521 (0.5223)**
Log DSL Subscribers	1.5609 (0.2046)***	0.4506 (0.3567)	0.2226 (0.0885)**	-0.9101 (0.5030)*
Log Cable Subscribers	1.7191 (0.2531)***	0.5972 (0.3977)	0.2934 (0.0898)***	0.2010 (0.0918)**
Month		0.0377 (0.0093)***	0.0710 (0.0281)**	
Month Squared			-0.0005 (0.0005)	
Log Dial-Up Sub * Month				-0.0244 (0.0120)**
Log DSL Sub * Month				0.0278 (0.0119)**
Log Cable Sub * Month				0.0035 (0.0008)***
Constant	-14.2616 (3.3461)***	-1.4893 (4.8853)	1.9458 (1.2051)	3.4597 (1.2183)***
Observations	162	162	162	162
R-Squared: Within	0.3476	0.3578	0.3416	0.2935
R-Squared: Between	0.2843	0.5926	0.6241	0.7118
R-Squared: Overall	0.1682	0.4387	0.4820	0.4960

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Key Implication: Over the period 2001-2005, the number of copyright infringement notices received per high-speed (Cable and DSL) subscriber increased while the number of notices received per dial-up subscriber decreased.

Table 7: Estimates of Effect Size: CI Notices per 1000 Subscribers, Q1 2005

	Cross-Sectional			Panel, evaluated at Q1 2005			
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 4
Small ISPs							
CI Notices / 1000 Dial-Up subscribers / month	2.59	1.49	1.63				
CI Notices / 1000 DSL subscribers / month	1.94	0.83	0.73				
CI Notices / 1000 Cable subscribers / month	4.47	2.21	2.28				
Constant	0.04	0.25	0.25				
Large ISPs							
CI Notices / 1000 Dial-Up subscribers / month	2.59	1.49	1.63	n/s	n/s	n/s	-2.61
CI Notices / 1000 DSL subscribers / month	1.94	0.83	3.45	12.27	n/s	1.75	3.12
CI Notices / 1000 Cable subscribers / month	4.47	2.21	4.62	14.75	n/s	2.52	3.14
Constant	0.04	33.60	0.25	0.00	1.04	414.67	66.81

Notes: 1. Estimates come from Tables 5 and 6. 2. The effect of the constant terms have been adjusted by 1/2 the squared standard error of the estimate to correct for the bias in log-log estimation. 3. Effect sizes from are evaluated at the mean values of notices and subscribers and "month" set at Jan 2005.

Key Implications:

- High-speed subscribers (Cable or DSL) generate more copyright infringement notices than dial-up subscribers.
- Large ISPs receive more copyright infringement notices per high-speed subscriber than do small ISPs.

Table 8: Most Frequent Originators of Copyright Infringement Notices²⁶

Rank	Source	Approx %
1	US Studios (Movie, TV, Music)	52.2%
2	US Software Publishers	17.9%
3	Motion Picture Association of America (MPAA)	13.8%
4	US Bounty Hunters	12.4%
5	Canadian Software Publishers	1.8%
6	Other	1.8%
7	Canadian Music (CRIA)	0.1%

Key Implication: The majority (98%) of copyright infringement notices come from non-Canadian sources.

²⁶ Source: Sample of notices from Large ISPS, 2003-2005

Table 9: Typical Notice and Notice Process and Associated Costs

Large ISPs			Small ISPs																																																														
<div>1Receive notice, extract relevant information - IP address, date, time, infringing content, originator of notice.</div> <div>2Verify information in notice to see if valid.</div> <div>3Entry in incident database created to store details of notice.</div> <div>4Look up IP address lease to identify either MAC address of device or subscriber account ID directly.</div> <div>5(If necessary) Look up MAC address in modem database, link to subscriber account ID.</div> <div>6Look up user contact information in subscriber/billing database.</div> <div>7Email notice prepared from template and sent to subscriber.</div> <div>8Details stored in incident database.</div>			<div>1Receive notice, extract relevant information - IP address, date, time, infringing content, originator of notice.</div> <div>2Look up IP address lease to identify either MAC address of device or user account directly.</div> <div>3(If necessary) Look up MAC address in modem database, link to user account ID.</div> <div>4Look up user contact information in subscriber/billing database.</div> <div>5Contact customer by email</div> <div>6Record of notice stored in subscriber account.</div>																																																														
<table><tr><td></td><td>by ISP</td><td>by Notice</td></tr><tr><td>Average Time Required (minutes)</td><td>12.3</td><td>12.2</td></tr><tr><td>Average Marginal Cost / Minute</td><td>\$ 0.71</td><td>\$ 0.72</td></tr><tr><td>Overhead Cost / Notice</td><td>\$ 3.00</td><td>\$ 3.00</td></tr><tr><td>Average Cost / Notice</td><td>\$ 11.73</td><td>\$ 11.76</td></tr></table>				by ISP	by Notice	Average Time Required (minutes)	12.3	12.2	Average Marginal Cost / Minute	\$ 0.71	\$ 0.72	Overhead Cost / Notice	\$ 3.00	\$ 3.00	Average Cost / Notice	\$ 11.73	\$ 11.76	<table><tr><td></td><td>by ISP</td><td>by Notice</td></tr><tr><td>Average Time Required (minutes)</td><td>47.4</td><td>16.8</td></tr><tr><td>Average Marginal Cost / Minute</td><td>\$ 0.69</td><td>\$ 0.31</td></tr><tr><td>Overhead Cost / Notice</td><td>\$ -</td><td>\$ -</td></tr><tr><td>Average Cost / Notice</td><td>\$ 32.73</td><td>\$ 5.20</td></tr></table>				by ISP	by Notice	Average Time Required (minutes)	47.4	16.8	Average Marginal Cost / Minute	\$ 0.69	\$ 0.31	Overhead Cost / Notice	\$ -	\$ -	Average Cost / Notice	\$ 32.73	\$ 5.20																														
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Table 10: Typical Data Sources used in Notice and Notice

Data Source	Large ISPs			Small ISPs		
	Used?	Flat File	RDBMS	Used?	Flat File	RDBMS
DHCP Log File	83%	✓		60%	✓	
RADIUS or similar	17%		✓	13%		✓
MAC Address	83%		✓	29%		✓
Subscriber / Billing Account	100%		✓	38%		✓
Incident Database	100%		✓	0%		✓
Average Number of Data Sources		3			2.2	
Average time data retained						
Current File		5.2months			9.7months	

Key Implication: Following the NN practice requires ISPs to integrate data across multiple systems and data formats (on average, 3 different data sources for large ISPs and 2.2 different sources for small ISPs).

Table 11: ISP Pricing

	Large ISPs		Small ISPs	
	Yes	No	Yes	No
Price Changes	88%	13%	60%	40%
Pricing Close to Competitors	100%	0%	72%	28%
Versions	88%	13%	60%	40%
Three Versions of High-Speed	100%		59%	
Other	0%		41%	
Promotions	100%	0%	68%	32%
Bundles	100%	0%	n/a	

Key Implication: The Canadian ISP industry is price competitive, with the majority of ISPs offering promotions to attract new customers and setting their prices to be close to their competitors.

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