4 | BOC INTERNET IMPACT STUDIES: INDIVIDUAL STUDY ASSESSMENTS

The individual BOC and Bellcore Internet impact studies ignore or exclude relevant facts, producing essentially the same inaccurate conclusions.

In this Section, we examine in detail each of the BOC and Bellcore studies that purport to identify the impact of the Internet on the PSTN. While the individual companies' approaches were each slightly different, all suffer from the general deficiencies that were identified in Section 3 — i.e., a limited examination of selected central offices serving ISPs, failure to address or consider overall network impact, and exclusion of relevant revenue sources.

Pacific Telesis

The Pacific Telesis submission consists of a two-page summary of a study of central offices that serve ESPs in Pacific's service area. Pacific presents figures that compare ESPs' network usage characteristics with the average usage for the central offices that were examined. It also includes an anecdote about one specific central office where a large ESP accounted for a significant fraction of the office's total usage. Pacific concludes with a rough estimate of the costs that serving ISPs imposes upon its network. There are four principal flaws in the Pacific study:

- Pacific looks only at end offices serving enhanced service providers, and provides neither a basis for comparison of ESPs with other end users of its network, nor any evidence that those other end users are in any way affected by data traffic on the PSTN, other than an unsubstantiated mention of "several instances" of slow dial tone and call blocking.

- Pacific's estimate of its revenues derived from on-line services is limited t understatement of revenues generated solely at the terminating end of cal ESPs, and thus ignores entirely the substantial revenues that are currently b realized by Pacific Bell from second residential access lines intended for usage, from ISDN, and from additional features, functionality, and sp connectivity arrangements that it provides to the ESPs.

- Pacific cites only one specific switch in its entire network where an constituted a significant fraction of total usage.

- Pacific fails to explain how the expenditures it claims were undertaken specifi because of ESP usage relate or compare to expenditures that the company w have undertaken had the ESP not been there, or that the Company has regu undertaken in other areas where no ESP is present.

The Pacific Telesis study looks only at on-line service providers, and fails to der strate any pervasive impact of the claimed ESP/ISP traffic patterns upon non-ESP bus or residential uses of its local exchange service. Indeed, its entire examination of traffic on its network is limited to 1.8% of its lines, and less than 5.2% of the ESPs i serving area, and is limited to a period of only two weeks.[65] Impact measurements made at central offices that serve ESPs rather than at the various points in the Pacific network where calls *to those ESPs* were originated. Thus, the Pacific Telesis stuc limited solely to the *terminating end* of ESP/ISP calls.

Pacific's estimate of total revenues from ESPs ($26-million) is derived entirely very conservative estimates of payments made by the ESPs themselves, and attribute revenues whatsoever to payments made by *ESP customers* for the Pacific Bell services they utilize in accessing their on-line service provider. Pacific's calculation consists sir of multiplying the total number of ESP access lines (which Pacific estimates at 110,000 the monthly business access line rate ($20).[66] Since no charge applies for *incoming* to an ordinary business line, no usage revenues are generated *at the ISP end of the* That result is then annualized and divided by an estimate of total annual ESP minute produce an estimated revenue of 0.2 cents per minute for calls to ESPs. Even so, i *Interconnection Order I* in CC Docket 96-98, the FCC found that local switching costs in fact also in the range of 0.2 to 0.4 cents per minute per end,[67] and that therefore by Pacific's own estimation its revenues are in the range of its costs.

65. Pacific Telesis study.

66. *Id.*, at 1.

67. *Interconnection Order I* in CC Docket 96-98, at para. 811. See also footnotes 14 and 46, *supra*.

There are several significant problems with Pacific's calculations. Not the least of these is the fact that Pacific has limited its estimated revenues solely to *recurring* charges; Pacific generates significant revenues from *nonrecurring* charges that must be included in the total ESP/ISP payments for services furnished to them. It should also be noted that Pacific's revenue estimate of $20 per access line per month[68] understates even those revenues generated directly from ESPs. Pacific's assumption that all lines that serve ESPs must be connected via a standard analog voice line does not take into account the varying prices for the varying services ESPs and ISPs require to serve their customers. As a result, Pacific ignores fees that are paid by the ESPs for these additional services, including charges for digital (T-1) connections (discussed in Chapter 2), Direct Inward Dialing (DID), multi-line hunt groups, and other special service arrangements necessary for providing data services. Although the Pacific study does mention these options for ESPs, it does not provide an analysis of ESP usage of these various methods of connecting to the network. Such an analysis is, of course, necessary for developing an accurate estimate of the actual revenues Pacific derives directly from ESPs, as well as to assess the actual burden ESPs could potentially place on the end office switches that serve them (since calls to ESPs served via a trunk-side connection will not block other users from gaining access to the switch).

In addition to understating revenues generated at the ESP end, Pacific ignored entirely the revenue sources associated with the *ESP customer's* end of ESP calls. In fact, Pacific generates far more revenue from end users of on-line services than it receives from the on-line service providers themselves. This is because, under Pacific Bell's local rate structures, all local calls are handled on a "sent paid" basis. Local calls placed from business subscriber lines in California are subject to *measured-use* charges that increase with the duration of the call.[69] Currently, Pacific Bell's local daytime measured-use rates are 3.33 cents for the first minute and 1.05 cents for each additional minute; thus, a 20-minute call to an ISP would result in approximately 23.3 cents in revenue to the telephone company.[70] Most residential subscribers opt for flat-rate service (although measured service is available on an optional basis in most localities). In California, the current flat-rate "usage charge" applicable to urban residential subscribers is $5.25 per month.[71] Assuming an average per-

68. Pacific Telesis study, at 1.

69. Pacific Telesis California Intrastate Tariff, Cal. PUC No. A5, Sec. 5.2.

70. Most business use of the Internet is assumed to occur during the business day rate period. Pacific Bell Tariff, Cal. PUC No. A5, Sec. 5.2.1.A.4, 10th Rev. sheet 210. These rates should be reduced by the applicable surcredit, currently 1.784%. Cal. PUC No. A1, 81st Rev. sheet 135.

71. This is calculated as the difference between the rate for a 1FR (single party flat rate, $11.25) residence line and that for a 1MR (single party measured rate, $6.00) residence access line. This uses the 1MR rate as a proxy for the non-usage-sensitive component of residential service. Because the 1MR rate actually includes an implicit

(continued...)

minute cost of 0.45 cents for transport and switching (within the range of local call costs identified in the FCC's *Interconnection Order I* ruling[72]), a residential subscriber would have to originate 19.44 hours per month of local usage before the $5.25 imputed monthly rate becomes unprofitable to Pacific for that individual customer (and an even greater amount if the usage included within the measured service $3 calling allowance is included). Therefore, to reach a non-compensatory level, flat-rated customers as a group would need to exceed monthly usage levels of at least 19.44 hours. Significantly, there is no evidence that Internet usage has raised overall usage levels to this extent. Based on the structure of Pacific's tariffs, however, a customer would have an incentive to choose the flat-rate pricing option at a lower monthly usage level — at roughly 17 hours.[73] Since ESP/ISP calls average approximately 10-15 hours per month,[74] it becomes apparent that both flat- and measured-rate local calling is fully compensatory to Pacific under existing intrastate tariffs.

According to recent Pacific Telesis earnings reports, the Company has experienced a significant jump in the demand for additional residential access lines, which it attributes particularly to dial-up Internet use.[75] For Pacific Telesis, access line growth was reported at a 4.4% annual rate. As the discussion in Chapter 3 demonstrated, these access lines constitute a source of tremendous amounts of revenue for the BOCs; one which the Pacific Telesis study does not acknowledge.

The Pacific Telesis study addresses what it describes as significant on-line service traffic at only one specific central office switch. That switch, however, is located in Silicon Valley, and cannot be considered typical of the average level of Internet use likely to be found elsewhere. Traffic concentrations at this single, unique point in Pacific Bell's network can hardly be taken as an indicator of an imminent meltdown.

---

71. (...continued)
usage allowance (of $3.00), the non-usage-sensitive component is actually less than $6. Assuming evening local rates and a 20-minute average call duration, the calling allowance is equivalent to approximately 6 hours of usage. Pacific Bell Cal. PUC No. A5, Sec. 5.2.1 and Sec. 5.2.4.

72. Based upon estimated switching costs of 0.4 cents per minute and average tandem/transport costs of 0.05 cents per minute. (see footnote 14, *supra.*). These costs reflect the following assumptions: (1) Most residential use of on-line services occurs during off-peak, late evening, night and weekend time periods; (2) minimal use of local tandem switching is required, because most local networks are designed to handle most calls on a direct trunked basis; and (3) half of the FCC's local transport proxy is used to reflect the primarily off-peak use of these services.

73. Based upon $8.25 worth of local calling (the $5.25 flat/measured rate differential plus the $3 measured rate calling allowance), and assuming 20-minute call durations at Pacific Bell's evening rates.

74. See footnote 57, *supra.*

75. On October 18, 1996, the *Wall Street Journal* reported that demand for second phone lines played a significant role in the strong third-quarter profits of Pacific Telesis, noting its report of year-over-year access line growth of 4.4%.

Pacific estimates that it has spent $2.6-million in incremental capital expense in the first quarter of 1996 to address ESP and Internet-related network impacts. However, the study is not clear as to exactly what sort of outlays were involved. But even if it specifically involved re-engineering of switches to increase capacity in situations where an ESP or other large-volume call recipient was present, it would still be incorrect to attribute all such costs to ESP/ISP use. As we have previously noted, ILECs routinely upgrade and expand capacity in their existing switches, for example, to accommodate normal growth in demand telephone lines for new residences and businesses. Pacific's study is silent as to how much of the $2.6-million *would have been spent anyway* on routine upgrades and capacity expansions.

Moreover, the Pacific Telesis study also claims that expenses for the remainder of the year "include another $11-million to meet the forecasted ESP demand for ISDN Primary Rate." The inclusion of expanded ISDN capacity is not legitimately due to ESP-related congestion. Indeed, as we have noted, PRI ISDN is actually a *solution* to a source of potential congestion problem that might otherwise arise. Such expenditures are *investments*, which the Company undertakes based upon the expectation that they will generate revenues, and profits, in the future. Pacific and the other BOCs have delayed introduction of ISDN for years. Even now Pacific seems to be asking the Commission to impose an access charge as a way to avoid having its shareholders bear the cost of a legitimate, and most likely highly profitable, business investment.

In short, Pacific's study presents a collection of incomplete, highly selective, and distorted information that cannot provide a reliable assessment of the actual overall impact of ESP/ISP demands on the PSTN. Revenue sources are ignored and revenues are grossly understated. It is unclear whether the costs identified are appropriately allocated to on-line services, and, in any event, cannot be considered without considering upgrades and expenses Pacific would have made in the normal course of its operations. Finally, by looking at a very narrow subset of its central offices, and citing only one as evidence of serious traffic problems, Pacific's study offers no insights whatsoever as to the overall effect of ESP/ISP demands on the totality of its network.

U S West

U S West's study[76] consists of two pages of conclusions drawn from ten pages of attached charts, generated by data the company collected on a set of 64 ESP hunt groups in four states. The principal conclusion that U S West seems draw from its study is that "the

76. "U S West Communications ESP Network Study - Final Results," October 1, 1996.

usage patterns of the ESPs differ from other end users on the Public Switched Network."[77] How it makes the leap from that conclusion to some of its others (listed below) is unclear, especially given the data that the company has included. Four key problems with the U S West study can be readily identified:

- U S West does not cite any specific instances of trouble that result from ESP usage. It also fails to cite specific investments it has undertaken in order to increase network capacity as a result of purported congestion problems resulting from data traffic.

- U S West makes the claim that the ESP busy hour, which falls in the evening, imposes undue costs on the network. In reality, however, the later peak for ESP usage is actually good for the network, since it results in a more even distribution of calls overall, and uses capacity that would otherwise be idle during the evening hours.

- U S West fails to provide any sort of reasoning behind the figures it calculated for growth of ESPs. Their accuracy should not be accepted without some explanation of the reasoning or the data behind them. The accuracy of some of the other data presented is also open to question.

- U S West's calculation of costs imposed by ESPs is based upon the costs of calls terminated at ESPs, ignoring the fact that those costs are paid for by the originators of those calls.

One of the conclusions drawn by the U S West study is that the busy hour for ESPs most frequently occurs at 10 pm, substantially later than the busy hour for LEC central offices as a whole, which (for U S West) typically takes place around 4 pm.[78] Based upon this finding, U S West claims that "[c]ontinued ESP growth of this nature will drive network reengineering to accommodate evening busy hour usage."[79] U S West does not mention, however, that from a network perspective this usage characteristic is a positive development. If the majority of ESP calls occur during what would otherwise be off-peak hours, those calls take advantage of capacity that would otherwise simply be idle. Even the possibility that ESP traffic will actually cause the office busy hour to *shift* to 10 pm is not

77. U S West study, at 2.

78. *Id.*, at 1.

79. *Id.* at 1.

per se a problem, although a small capacity increment may be required.[80] The infusion of applications with non-coincident peaking characteristics (e.g., 4 pm business day, 7 pm residential social calling, and 10 pm on-line services calling) results in higher overall throughput in the switch, producing a lower overall average cost per minute of use.

U S West's projections for the growth of data services in its territory[81] are ambiguous. The Company fails to explain either its methodology or its source for the growth rates it assumes. It also does not provide an explanation as to whether those estimates are made inclusive or exclusive of the negative impact of the Company's proposed access charge for ESPs. Given that establishing any sort of firm statistical information about the Internet and other on-line services is difficult at best, there is little reason to accept U S West's projections at face value. Moreover, those projections fail to specify the form that the projected usage growth is expected to take. The U S West data appear to assume that growth will consist entirely of analog modems using the circuit-switched public network. If the Company makes ISDN or other trunk side connections available at reasonable prices,[82] that is unlikely to be the case. It is very likely that some, or even much, of the growth in ESP lines that has been projected by U S West will take the form of PRI ISDN, or leased trunk lines which, as has been previously explained, are non-blocking.

U S West's growth projections may also ignore non-ILEC ISP access arrangements, such as via cable television systems, wireless services, or other providers. The expansion in Internet content, including increased use of graphics, animation, audio, video, etc., suggests that the Internet is likely to outgrow the slow data transmission rates and other limitations of the PSTN long before the traffic and usage forecasts offered by U S West (and by others) come to fruition.

U S West fails to quantify in any way the expenses it claims to have incurred in order to accommodate data traffic or to address data-related congestion on its network. Although

80. It should be noted, too, that neither U S West nor the other BOCs claim that this has happened yet. Although Internet use is heaviest in the late evening, according to U S West the typical switch busy hour continues to be around 4 p.m. (U S West study at 1.) Indeed, based on U S West's data, the majority of ESPs had busy hours between 9 p.m. and 12 a.m.; however, *none* of the studied central offices had a busy hour during that period. (*Id.* at Attachment #5)

81. *Id.*, at 2.

82. As the company seems to be doing, based upon its intrastate tariffs for Minnesota and Oregon. In Minnesota, the tariff for a digital PBX was $1,671 in 1992, compared with $1,128 in 1996. *See*, U S West Minnesota Intrastate Tariff, Sec. 15.1.D.1. In Oregon, the corresponding rates are $1,600 in 1992 and $1,134 in 1996. *See*, U S West Oregon Intrastate Tariff, Sec. 15.1.D.1. Although digital PBX rates in both cases remain quite high, continued reductions of those tariffs will make the digital PBX option an increasingly attractive one for ESP/ISPs.

the Company claims that ESP and ISP use has "impacted our local network,"[83] it provides no real evidence of the degree of that impact, or of the associated costs, if indeed any such impact or cost is large enough to be measurable at all.

U S West's data contain several other serious problems. For example, in support of the oft-repeated BOC claim that ESP usage characteristics are similar to those of IXCs, U S West presents a chart depicting average minutes of use for IXCs and ESPs.[84] However, the data presented in this chart are highly questionable. Indeed, it is apparent from U S West's chart that, while lines terminating at ESPs exhibit usage levels that range between about 20 and 45 minutes per hour per line throughout the day, IXCs seem to have no usage whatsoever between the hours of 9 p.m. and 7 a.m. This unlikely result makes an accurate assessment of the resemblance (or lack thereof) between IXC usage and ESP usage impossible. If anything, the U S West study fails to support this asserted relationship.

Moreover, in its chart entitled "Costs per Line,"[85] U S West presents its comparison of incremental costs per line, apparently for analog business lines, for various types of ESP and basic business access line customers. The fallacious assumption inherent in this calculation is clearly demonstrated by considering the derivation of the "incremental cost" of a business line. U S West attributes a non-usage cost of approximately $18 to the line (this amount is depicted as constant for the ESPs as well). For (non-ESP) business lines, it then adds approximately $4 in usage charges, for a total incremental cost of approximately $23. However (assuming it is using a consistent methodology for all services on the chart), U S West develops the "usage cost" of a business line in a unique manner. "Usage" in this case refers not to calls *originated* on that business line, but to calls *terminated* thereon. This definition of cost causation has no support, and is fundamentally at odds with the structure of U S West's tariffs and with the principle of "sent paid" pricing. U S West's mistaken assumption here is its notion that terminating use is the element for which a charge is to apply, and using this logic it readily attributes proportionately higher costs to ESPs than it does to business lines used for voice communications alone. Unless U S West can demonstrate that calls placed *to* business lines are uncompensated by the calling party — which it did not and clearly cannot do — there is simply no basis for this perversion of the cost causation principle.

NYNEX

83. U S West study, at 2.

84. *Id.* at Attachment #6.

85. *Id.* at Attachment #10.

The NYNEX study consists of some six charts depicting specific ISP multiline hunt groups, and the usage they each experience. In its cover letter to the FCC, NYNEX explains that about 200 companies use analog dial-up connections in its serving area, and that the number of lines being used in this way increases by approximately 10% each month. For the specific hunt groups it examines, NYNEX provides information about call attempts and overflow counts, as well as usage and holding times. The key problems with the NYNEX study are readily apparent:

- NYNEX, like U S West, fails to cite any specific examples of ISP-related traffic causing blocking at the level of the switch and, again like U S West, does not point to any specific investments it has made thus far that were necessitated by the growth of data traffic on its network.

- In presenting data only for selected ISPs, NYNEX provides no information about how data traffic impacts other users of its network, or the network as a whole, if indeed it does so at all.

- The NYNEX data indicate that any blocking problems that do occur are not problems at the level of the switch, but are instead associated with ISPs that have failed to provide a sufficient number of access lines for the number of customers they are attempting to serve in a given hunt group. Indeed, the charts presented by NYNEX address only calls to the specific Internet providers examined, and do not provide any information about other calls being handled by the same switch.

The charts that comprise the NYNEX study consist solely of ISP traffic patterns at selected central office switches. This study, therefore, presents no evidence that ordinary PSTN use is in any way affected by calls to ESPs/ISPs. Further, in cases where the NYNEX data show that calls to ISPs are being blocked, there is no way to distinguish between traffic creating blocking at the switch level and blocking caused simply by the limited number of lines a given ISP has configured in its multiline hunt group.

Indeed, it seems clear that the problematic switches in the NYNEX study are those where the ISP has failed to provision sufficient lines for the number of customers in the area. For example, one of the switches examined in the study, a DMS-100 DS-0 in Hempstead, had 450-660 of 500-700 call attempts blocked during its busy hours. However, given that the ISP in question had only a 22-line hunt group, it is hardly surprising that so many call attempts were blocked. That degree of blocking does not in itself indicate that the switch as a whole experienced congestion at any of those times. It simply indicates the presence of an unsatisfactory level of service from that particular ISP. Other switches studied by NYNEX, like the DMS-100 DS0 in White Plains, had high usage but no calls blocked, and it is reasonable to conclude that this is because the ISP there had an appropriate number of lines to support its average number of call attempts per hour.

NYNEX's New York Telephone Company local tariffs apply a substantial surcharge for PRI ISDN trunk-side connectivity,[86] which likely induces some ISPs to elect the less expensive line-side 1MB business line alternative. Although NYNEX demonstrated no switch congestion problems in its study, it would certainly eliminate any such problems that might arise by applying appropriate cost-based pricing for ISP access, and by not engaging in pricing practices that suppress and discourage efficient ISP serving arrangements.

Finally, based upon the NYNEX data for second line growth summarized in Chapter 3, Internet and on-line service traffic should properly be considered a source of significant amounts of revenue for the company. Indeed, the 1.26-million second residential lines reported by NYNEX in 1995[87] translate into $33.3-million in revenues for that year.[88] And given that the corresponding revenue figure for 1994 was approximately $28.9-million,[89] the second line revenue stream is growing at 9.3% annually.

Bell Atlantic

Of all the BOCs, Bell Atlantic's study provided the greatest depth of analysis of the data that it collected on ESP usage. However, Bell Atlantic makes many of the same misleading assumptions and conclusions as the other studies. Among them are these:

- Bell Atlantic notes that a large fraction of ESPs (roughly 50%) in its territory connect to its central offices via PRI ISDN using trunk port connectivity and hence bypassing the Line Concentration Module (LCM). However, it does not point out that PRI ISDN is inherently non-blocking at the terminating switch, and that therefore the use of this arrangement all but eliminates data traffic congestion in such switches.

- In calculating the revenues it derives from data traffic on its network, Bell Atlantic ignores the fact that local calls are *sent paid.* Many Bell Atlantic business lines are provided on a measured-rate basis, so the Company receives duration-based

86. *See* Table 1.

87. NYNEX, *1995 Profile & Statistics, op. cit.* footnote 49, *supra*, at 33.

88. Based upon an weighted-average rate in New York state for unlimited local residential service of $26.45, including touch tone charge, SLC, surcharges, and taxes. *See*, FCC Industry Analysis Division, Common Carrier Bureau, *Reference Book: Rates, Price Indexes, and Household Expenditures for Telephone Service*, July, 1994, Appendix 2: Residential Telephone Rates by City, October, 1993. Note that this figure is calculated exclusive of installation charges for those lines.

89. Based upon the $25.10 rate cited in the previous footnote, and 1.150-million access lines in 1994 (NYNEX, *1995 Profile & Statistics, op. cit.* footnote 49, *supra*, at 33).

revenues from calls to ISPs placed over those lines. Moreover, for reasons discussed previously, the presence of flat-rate pricing of the calling party's line in no sense makes such calls free. Rather the flat-rate incorporates a usage component that will on average cover the company's usage-related costs.

- Bell Atlantic further ignores other sources of revenues, including the substantial amount of revenues it derives from second lines, revenues from residential and business customers who purchase ISDN connections, and revenues from ISPs that purchase additional features (direct inward dialing services, for instance) that are tariffed separately from basic business analog or ISDN rates.

According to the Bell Atlantic study, of the 4,887 ISP circuits it examined, fully half used PRI connections, with the remaining half using standard analog business line-side connections.[90] Bell Atlantic subsequently stated that the fifty percent figure was representative for all ESP/ISPs it serves.[91] This means that fully half of the ISP lines in Bell Atlantic's serving territory are non-blocking at the terminating end office switch, a fact that Bell Atlantic does not mention in its study. For instance, in its discussion of elements of the network, Bell Atlantic states that "if all lines are at the 25-30 CCS level, then the LU (line unit) can accommodate only about 65 subscriber lines."[92] Nowhere does it make clear that PRI ISDN bypasses the line unit, and that as a result the 65-line limitation does not occur for ISPs using that technology. Since Bell Atlantic has implemented rates for its PRI ISDN service only slightly higher than for basic business service, there is reason to conclude that most, if not all, ISP growth in Bell Atlantic's territory will similarly be ISDN, thus eliminating the possibility of blocking at the central office switch that terminates calls to the ISP.

One of the conclusions of the Bell Atlantic study is that traffic levels for ISPs are "significantly above normal customer traffic levels."[93] In this context, the definition of the word "normal" is ambiguous. "Normal" could mean the average for the network as a whole. In that case, it is not a particularly fair comparison, since by definition ISPs are large-volume call recipients. The correct comparison — and one that Bell Atlantic does not offer — is that between ISPs and PBX trunks in groups of comparable size, as this study developed in Chapter 2. There is no reason to expect that ISP traffic will be any higher than that of other comparable large end users.

90. Bell Atlantic study, at 5.

91. *Id.*, at 15.

92. *Id.*, at 8.

93. *Id.*, at 7.

The Bell Atlantic study significantly understates the revenues it derives from data traffic by ignoring entirely the substantial revenues that the company derives from customers of ISPs who purchase second lines, incur measured or flat-rate local usage charges, or upgrade to ISDN. In calculating revenues from ISPs, the Bell Atlantic study estimates revenue per ISP line at $17.00 per month.[94] This results in an estimated total revenue for PSTN service of approximately $8.2-million in 1996.[95] However, Bell Atlantic, like Pacific Bell, has reported extremely strong earnings growth figures, which it attributes in large part to the growth in demand for second residential access lines. Indeed, Bell Atlantic's CEO, Raymond F. Smith, recently stated that the rate of additional line growth in his territory is increasing, and that additional lines produce significant incremental revenue. In a March 19, 1996, speech to a group of securities analysts at a Merrill Lynch Telecommunications CEO Conference, Smith said:

> In 1995, sales of secondary lines at Bell Atlantic increased more than 50 percent, fueled by surging demand for Internet and telecommuting applications.
>
> Unlike traditional horizontal line growth, which would have significantly added to our capital expenditures, the vertical growth we experienced in '95 brought most of the revenues down to the bottom line. *That's because we were able to provision new lines and services from idle capacity in an existing plant.*[96]

Finally, the Bell Atlantic study draws a comparison between ISPs and IXCs in its conclusion, which merits comment. Bell Atlantic calculates that, in contrast with its interstate switched access charge (the charge IXCs pay) of $0.02 per minute, ISPs pay only $0.0009 per minute of use. As the discussion of additional BOC revenues has shown, the actual amounts that should be attributed to on-line service usage of the PSTN are potentially significantly higher. That aside, the relevant comparison is not with the uneconomic level of rates that Bell Atlantic and other ILECs impose upon IXCs. Rather it is with the forward-looking incremental *cost* of the service that is supplied to ISPs.

Bellcore

94. *Id.*, at 15.

95. *Id.*, at 13.

96. Raymond F. Smith, speech delivered at Merrill Lynch Telecommunications CEO Conference, March 19, 1996 (emphasis added).

A final piece of evidence to which the BOCs and BOC representatives refer in making their case for Internet access charges is a study prepared by Bellcore on data traffic and the PSTN.[97] The Bellcore study provides both a description of the alleged costs that are presently being imposed upon the LECs by data traffic, and also offers a more long-term view of technologies that would migrate that traffic, in part or entirely, away from the PSTN. One of the key conclusions reached by Bellcore is that, due to the inefficiency with which the circuit-switched voice network handles data calls, "any long term solution necessarily involves a staged migration from the present mode of operation towards some packet network solution."[98] While the Bellcore study arrives at the correct *long term* conclusion, there are flaws in its assessment of the immediate problems that data traffic poses to the PSTN. Among these flaws are:

- In assessing network costs of on-line service use, the Bellcore study, like the BOC studies, discounts the substantial revenues that data traffic currently generates.

- The theoretical analysis presented in the Bellcore study is very detailed; however, it provides little in the way of evidence regarding the applicability of its assumptions in the actual BOC networks.

- The Bellcore study reaches the appropriate conclusion regarding the long-term migration of data traffic to a network based on a technology more appropriate than the PSTN; however, with the exception of cable modems as an option, it does not consider the likelihood of competitive entrants to provide data networks faster and more cost-effectively than the BOCs.

Like the individual BOC studies, Bellcore fails to consider the substantial revenues that the ILECs currently derive from the growth of Internet and other on-line services. According to Bellcore, the growth of on-line services has increased the load on ILEC networks while providing "very little compensating revenue."[99] It claims, for example, that second line revenues are "unlikely to offset capital expenditure,"[100] without providing any justification for that assertion. Such a notion is, of course, at odds with recent earnings reports and other statements by a number of the BOCs, which expressly associate significant

97. Amir Atai, Ph.D. and James Gordon, Ph.D., "Impacts of Internet Traffic on LEC Networks and Switching Systems," Red Bank, New Jersey, Bell Communications Research, Inc., 1996.

98. *Id.*, at 1.

99. *Id.*, at 2.

100. *Id.*, at 4.

earnings growth with second line demand and the ability of the BOCs to meet that demand using *existing* capacity.[101]

Another important flaw in the Bellcore study is its inherently theoretical approach. Bellcore develops a mathematical model to estimate the cost impact of reinforcing the circuit-switched network, and argues that given the growth of data traffic "solutions need to be put in place quickly in order to protect the integrity of the PSTN."[102] However, Bellcore does not provide any evidence or quantification of congestion problems that might be occurring in the real world. The theory presented in the Bellcore Study provides little evidence that the problems it describes are actually problems the ILECs currently face. The traffic properties associated with long-duration calls as described by Bellcore become important only when such calls represent a significant portion of total traffic at any given network service point. While this can occur in a central office that serves an ISP/ESP and in which the ISP/ESP traffic has not been properly balanced with other traffic, the *de minimis* fraction of total network usage represented by such long-duration calls reduces the applicability of Bellcore's analysis.

Finally, the Bellcore study maintains the implicit BOC assumption that the Internet access problem will only be solved by the BOCs acting to reinforce the BOC networks (albeit with more appropriate technologies than some of the BOCs themselves seem to suggest). With the exception of cable modems, which Bellcore does mention as a potential solution, there is no discussion of the possibility that other non-ILEC providers might create a data-friendly, packet-switched network independent of the existing PSTN. This is likely to occur, however, if the BOCs are required by regulators to facilitate such competition through expanded co-location and unbundling (including subloop unbundling). It is highly probable that this sort of competition will prove essential to the creation and growth of a data-friendly network (or networks) capable of providing service at prices far more affordable than those the BOCs have been willing to implement.

---

101. On October 18, 1996, the *Wall Street Journal* reported that demand for second phone lines played a significant role in the strong third-quarter profits of Bell Atlantic, BellSouth, Pacific Telesis, and SBC, noting these companies' reports of year-over-year access line growth of 3.7%, 4.9%, 4.4%, and 5.2%, respectively, with average line growth reported at 4.7%.

- Since January, BellSouth reported activating 203,000 new additional residential lines, an annual growth rate exceeding 23%, bringing total additional residence lines to 1.5-million. (BellSouth Press Release, October 17, 1996.)

- Bell Atlantic reported that "continued growth in home computer use propelled gross sales of secondary residential telephone lines to nearly 233,000 in the third quarter, more than 60 percent above year-earlier levels." (Bell Atlantic Press Release, October 17, 1996)

See also the Raymond F. Smith, speech, *op. cit.* at footnote 96, *supra*.

102. Bellcore study, at 2.

Bellcore astutely points out that packet-switched networks, which constitute a far more appropriate means of transmission of data traffic than the PSTN, exist today, but that "due to cost and equipment limitations, access to these networks is largely limited to high volume business users."[103] The pricing of data network access such that residential users could afford it could well lead to a migration of data traffic off the PSTN before congestion causes more than isolated problems there.

From the ISP perspective, Bellcore concludes that "the competitive cost of basic line side connections is undoubtedly attractive to ISPs. However, line side connections are more expensive [for ISPs] to maintain operationally, and as multiline hunt group sizes grow, there may be some cost incentive for ISPs to move towards trunk or PRI interfaces."[104] Such a shift by ISPs to trunk port connections will do much to reduce the instances of blocking at the end office switch. Indeed, virtually all of the potential switching problems cited by the Bellcore study are eliminated by trunk-side connectivity.

103. *Id.*, at 1.

104. *Id.*, at 6.

5 | CONCLUSION

The BOC studies present an inaccurate picture of the effect of data traffic on their networks, overstating the costs and congestion, while understating the revenues generated. They do not justify the imposition of access charges upon ESPs and ISPs.

As the preceding sections have demonstrated, the BOC studies present an inaccurate and incomplete assessment of data traffic on local telephone networks. The BOC studies must be recognized for what they are: a collection of anecdotal evidence about a limited number of central office switches, from which the incorrect conclusion is drawn that data traffic presents a serious problem for the PSTN as a whole. This analysis has demonstrated conclusively that the BOC studies do not justify the imposition of access charges on Internet and other enhanced service providers.

Examining the design of the local telephone network and of a typical Class 5 switch, as this Study did in Section 2, reveals where congestion potentially can occur in the public switched network. Any congestion or other problems in the Internet itself, or in a particular ISP's network configuration, pose no cause for concern by the BOCs, since these problems do not significantly affect users of the PSTN. Far from having their entire networks threatened by data traffic overload, congestion and blocking is likely to occur at only a few distinct points in the network, primarily end offices that serve large ESPs, and possibly the particular interoffice trunks that serve those end offices. Indeed, the BOC studies themselves report switching problems that are entirely confined to the end offices that serve ESPs/ISPs. This Study has demonstrated that alternatives that route data traffic around the line concentration module (LCM) (or the Line Unit (LU) in the Lucent 5ESS switch), the only switch component at which blocking *may* occur, are routinely and easily configured.

In their studies, the BOCs significantly overstate the costs they incur as a result of data traffic. Data traffic has caused only a small number of problems that have required the BOCs to add or upgrade central office equipment. And it is impossible to say based on the BOC studies how many of those central office upgrades would have been undertaken even if no data traffic passed over the PSTN at all. Although the BOCs advocate a per-minute access charge as a way to cover the purportedly *higher* costs imposed by ESP traffic on

their networks, this Study presented an analysis that demonstrates that data traffic does not impose disproportionate costs when compared to voice traffic. In fact, increased data traffic is likely to result in *lower* overall per-minute costs for the ILECs, by making efficient use of idle network capacity.

Moreover, none of the BOC studies provide a complete accounting of the revenue streams that data traffic generates. From second line sales to ISDN, ESP/ISP traffic is generating demand for a variety of products and services that the BOCs profitably provide. Indeed, the BOCs have an excellent market opportunity to meet their customers' growing need for cost-efficient, high-bandwidth data networks. Investment in such data-friendly technologies, by the BOCs or their competitors, would also remove data traffic from the voice PSTN entirely, thus eliminating even the small potential for congestion that presently exists in certain elements of the network. The imposition of access charges is unnecessary, since the BOCs are already fully compensated for data traffic, and such charges would impede the ability of consumers to benefit from on-line services.

The long term solution for accommodating increased data traffic on local ILEC networks lies in the stimulation of competition and in the deployment of appropriate *data-friendly* transmission technologies, and *not* in the imposition of access charges for use of the circuit-switched PSTN.

While it should be apparent that the growth of the Internet and other on-line services does not present any serious congestion or revenue problem for the existing ILEC networks, the requirement that ISPs and their users continue to rely upon the circuit-switched PSTN to connect to one another does present formidable technical impediments to the continued growth and development of these new technologies.

Dial-up calls placed over the PSTN require that whatever is transmitted thereon somehow fit within the bandwidth of a voice conversation. Remarkable advances in modem technology have pushed the envelope far beyond anyone's expectations as recently as ten years ago, but the laws of physics and mathematics will soon work to limit further data rate gains. The current maximum voice-grade dial-up data rate is 57.6 kbps, the recently announced "X-2" technology by US Robotics.[105] With compression, even higher effective rates would be achievable at the 57.6 kbps base rate. However, with the proliferation of graphics, animation, video and other high-bandwidth applications, even these higher data rates will prove inadequate.

105. "U.S. Robotics Releases Preliminary Performance Data on its High-Speed X2 Modem Technology," Press Release. Downloaded from U.S. Robotics home page, http://x2.usr.com/news/betatest.html, January 9, 1997.

The existing ILEC subscriber distribution plant is capable of supporting significantly higher data transmission rates; the limitation here is the continued reliance upon *circuit-switching* rather than one of the various *packet-switching* protocols for the transmission of data. These alternative network technologies are available today, but have not been deployed on a mass scale by the ILECs. Competing local carriers could speed this deployment *if they were provided access to individual outside plant loop components currently under the exclusive control of the incumbent LECs.*

While the focus of this report has been the use by on-line services of the existing circuit-switched public network, continued reliance on the PSTN is not a satisfactory solution to the needs of ISPs, ESPs and their customers. The future of ISP/ESP communications lies in the development of alternative, data-friendly networks that possess the capacity to route packetized data traffic at high speeds. The development of a competitive marketplace at the level of the local exchange will ensure that the demand for such networks is met as quickly and efficiently as possible.

Appendix A

Second Lines Attributable to On-Line Service Use — ETI Analysis

Recurring Revenues Derived from Additional Residential Access Lines Attributable Primarily to Internet Use

(A) Year	(B) Households With Telephone Service	(C) Additional Residential Lines	(D = C / B) Percentage of Total Lines That are Additional Lines	(E = Value of D, 1990) Baseline Percentage of Second Lines	(F = D -E) Second Lines in Excess of 4.38%
1990	88,350,000	3,870,325	4.38%	4.38%	0.00%
1991	89,379,000	6,537,450	7.31%	4.38%	2.93%
1992	90,997,000	8,335,973	9.16%	4.38%	4.78%
1993	93,036,000	8,845,773	9.51%	4.38%	5.13%
1994	93,694,000	11,499,550	12.27%	4.38%	7.89%
1995	94,233,000	13,890,593	14.74%	4.38%	10.36%

	(G = 50% of F, 1990-1994) Attribute to Internet Usage (See Notes)	(H = G X B) Lines Dedicated to On-Line Use	(I) Average National Residential Rates (Includes SLC)	(J = I X H) Monthly Revenues From On-Line Lines	(K = J X 12) Annual Revenues
1990	0.00%	0	15.94	$0	$0
1991	1.47%	1,311,024	16.66	$21,841,659	$262,099,905
1992	2.39%	2,174,846	16.67	$36,254,679	$435,056,151
1993	2.56%	2,385,085	16.77	$39,997,872	$479,974,469
1994	3.95%	3,697,561	16.83	$62,229,950	$746,759,400
1995	6.41%	6,043,721	17.20	$103,951,999	$1,247,423,985
				Total	**$3,171,313,911**

Notes: Derivation of Column G: The percentage of additional residential lines in 1990 was selected as a conservative baseline for this analysis. This analysis assumes that in any given year, 4.38% of all additional residential lines were used primarily or exclusively for voice calls. From 1990-1994, half of the additional residential lines in excess of 4.38% were classified as primarily for ESP/ISP dial-up access. For 1995, the entire increase in the percentage of second lines in excess of 4.38% (i.e., 10.36% -7.89% = 2.47%) is added to the 1994 attribution, (3.95%) resulting in 6.41%.
This analysis accounts only for revenues derived from second residential access lines. It does not account for revenues derived directly from ESPs/ISPs (i.e., business lines, ISDN, leased lines, etc.)

Source for Columns A, B, C, and D: FCC Industry Analysis Division, "Percentage Additional Residential Lines for Households with Telephone Service (End of Year Data)," (chart), December 12, 1996. Source for Residential Rates (Column I): FCC, Monitoring Report, 1996.

Revenues Derived from Installation of Additional Residental Access Lines Attributable Primarily to Internet Use

(L) Year	(M = H) Lines Dedicated to On-Line Use	(N =CHANGE IN M) Internet Lines Installed In Year	(O = 33% of M) "Churn" (Lines Disconnected and Re-Installed)	(P = N + O) Total Installed Lines For On-Line Use	(Q) Installation Charges	(R = Q X P) Total Revenues From Installation
1990	0	0	0	0	43.06	$0
1991	1,311,024	1,311,024	437,008	1,748,032	42.00	$73,417,340
1992	2,174,846	863,822	724,949	1,588,770	41.52	$65,965,749
1993	2,385,085	210,239	795,028	1,005,267	41.38	$41,597,961
1994	3,697,561	1,312,476	1,232,520	2,544,996	41.00	$104,344,852
1995	6,043,721	2,346,160	2,014,574	4,360,734	40.91	$178,397,610
					Total Installation	**$463,723,513**
					Total Revenues Derived from On-Line Service Use	**$3,635,037,424**

Notes: Lines Dedicated to On-Line Use is based on the analysis presented on the previous page.
Churn (Column O, above) refers to the number of access lines disconnected and reinstalled in a given year.
Total Revenues Derived from On-Line Service Use refers to both recurring revenues and installation charges.
Source for Installation Charges: FCC, Monitoring Report, 1996.

ECONOMICS AND
TECHNOLOGY, INC

ONE WASHINGTON MALL
BOSTON, MASSACHUSETTS 02108-2617