BELLSOUTH TELECOMMUNICATIONS, INC.

DIRECT TESTIMONY OF JOHN A. RUSCILLI

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

DOCKET NO. 000828-TP

NOVEMBER 1, 2000

Q. PLEASE STATE YOUR NAME, YOUR POSITION WITH BELLSOUTH TELECOMMUNICATIONS, INC. ("BELLSOUTH") AND YOUR BUSINESS ADDRESS.

A. My name is John Ruscilli. I am employed by BellSouth as Senior Director for State Regulatory for the nine-state BellSouth region. My business address is 675 West Peachtree Street, Atlanta, Georgia 30375.

Q. PLEASE PROVIDE A BRIEF DESCRIPTION OF YOUR BACKGROUND AND EXPERIENCE.

A. I attended the University of Alabama in Birmingham where I earned a Bachelor of Science Degree in 1979, and a Master's Degree in Business Administration in 1982. After graduation I began employment with South Central Bell as an Account Executive in Marketing, transferring to AT&T in 1983. I joined BellSouth in late 1984 as an analyst in Market Research, and in late 1985 I moved into the Pricing and Economics organization with various responsibilities for business case analysis, tariffing, demand analysis and price regulation. I served as a subject matter expert on ISDN tariffing in various

Commission and PSC staff meetings in Tennessee, Florida, North Carolina and Georgia. I later moved into the State Regulatory and External Affairs organization with responsibility for implementing both state price regulation requirements and the provisions of the Telecommunications Act of 1996 (the "Act"), through arbitration and 271 hearing support. In July 1997, I became Director of Regulatory and Legislative Affairs for BellSouth Long Distance, Inc., with responsibilities that included obtaining the necessary certificates of public convenience and necessity, testifying, FCC and PSC support, Federal and State compliance reporting and tariffing for all 50 states and the FCC. I assumed my current position in July 2000.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY BEING FILED TODAY?

A. The purpose of my testimony is to present BellSouth's position on nineteen unresolved issues in the negotiations between BellSouth and Sprint Communications Company, L.P. ("Sprint"). BellSouth and Sprint have negotiated in good faith and have resolved many of the issues raised during the negotiations. There are, however, issues about which the companies have been unable to reach an agreement. Twenty-nine of those issues were included in the Petition for Arbitration (the "Petition") filed by Sprint with the Florida Public Service Commission ("FPSC" or Commission") on July 10, 2000. My testimony addresses Issues 1, 3-12, 23, and 26-31 included in that Petition. Issues 16, 18, 21, 22, and 32-34 are addressed by Mr. Keith Milner, Issues 24 and 25 are addressed by Mr. Dave Coon, and Issue 35 is addressed by Ms.

Daonne Caldwell.

Issue No. 1: In the event that a provision of this Agreement or an Attachment thereto, and a BellSouth tariff provision cannot be reasonably construed to avoid conflict, should the provision contained in this Agreement prevail?

Q. WHAT DOES BELLSOUTH UNDERSTAND ISSUE NO. 1 TO BE?

A. BellSouth understands that Sprint is asking the Commission to make the BellSouth/Sprint Interconnection Agreement the final word if a conflict arises between a provision of, or attachment to, the agreement and a BellSouth tariff provision and a resolution cannot be negotiated.

Q. WHAT IS BELLSOUTH PROPOSING?

A. BellSouth is proposing that services provided to Sprint, in its capacity as a Alternative Local Exchange Carrier ("ALEC"), be provided out of the Interconnection Agreement. The agreement may refer to the tariff for rates, terms or conditions of a specific service, if the parties agree that it should do so. Such references included in the agreement, however, are applicable only as stated in the agreement. Of course, Sprint can use BellSouth tariffs for services related to its IXC business for internal purposes.

Q. IN GENERAL, WHY DOES BELLSOUTH FILE TARIFFS?

A. As the Commission knows, BellSouth files tariffs as required by both Florida Statute and the Commission. BellSouth, generally, files tariffs to enable the Company to offer the same services, at the same terms and conditions, to large groups of similarly situated users. This is true for each of BellSouth's tariffs. Inherent in the tariff process is the offering of services in a non-discriminatory manner.

Q. PLEASE COMMENT ON THE STATEMENT MADE BY SPRINT IN ITS PETITION DISCUSSION OF ISSUE NO. 1, THAT "BELLSOUTH'S PROPOSAL TO. . .RETAIN THE ABILITY TO MODIFY THE SPRINT/BELLSOUTH INTERCONNECTION AGREEMENT BY UNILATERALLY AMENDING ITS TARIFFS IS ANTICOMPETITIVE AND CONTRARY TO THE SPIRIT OF THE ACT."

A. BellSouth disagrees with Sprint's statement. The conditions under which a tariff would be referenced in the interconnection agreement would be specifically stated, and both parties would agree to the language. If Sprint wants a specific rate for the life of the agreement, the simplest approach is to include that rate in the agreement. Moreover, BellSouth cannot unilaterally amend its tariff as Sprint claims. Parties have an opportunity to challenge a BellSouth tariff filing.

Q. DOES THE WORDING THAT SPRINT PROPOSES SOLVE THE PROBLEM THAT SPRINT CLAIMS TO EXIST?

A. No. It appears that what Sprint is seeking is a freeze on rates in effect at the time the interconnection agreement is signed. Sprint's proposal does not lock in any tariff rates in Sprint's Interconnection Agreement. The proposal does not protect Sprint from price increases. Carriers such as AT&T, Sprint, WorldCom and BellSouth file tariffs and changes to those tariffs frequently, as the needs of their business change. To incorporate Sprint's language into the Interconnection Agreement does not prevent BellSouth from making changes to tariffs that Sprint and all BellSouth customers may use. What Sprint's language does is place Sprint in a dictatorial position of using Most Favored Nation conditions to pick and choose between the Interconnection Agreement and BellSouth's tariff.

Q. IS SPRINT'S PROPOSAL PERMITTED UNDER THE ACT?

A. Although I am not a lawyer, the position described above appears to be a violation of the Act. The US District Court for the District of Colorado, in a Findings of Fact and Conclusions of Law issued June 23, 2000, in Civil Action No. 97-D-152, US West Communications, Inc. v. Robert J. Hix, determined that "a tariff is not 'an agreement approved under' Section 252." (Section VI.B.-USWC'S PICK AND CHOOSE CLAIM-Conclusions of Law, ¶3) Further, in paragraph 12, the Court states:

> *Accordingly, the court holds that the MFN or pick and choose provisions of the interconnection agreements, to the extent they permit CLECs to incorporate tariff provisions into their interconnection agreements, VIOLATE the Act and are VACATED. Judgment shall be*

entered in favor of USWC and against AT&T, MCI, Sprint and ICG on the Second Claim for Relief in Civil Acton Numbers 97-D-152, 97-D-1667 and 97-D-2096 to the extent that the claim seeks relief on this issue. [Emphasis included in original text.]

MCI Telecommunications Corp. v. GTE Northwest, Inc., 41 F. Supp. 2d 1157 (D. Or. 1999) supports the Court's holding.

Q. WHAT IS BELLSOUTH REQUESTING OF THIS COMMISSION?

A. BellSouth asks the Commission to reject Sprint's language that it proposes to be included in the BellSouth/Sprint Interconnection Agreement, General Terms and Conditions.

Issue No. 3: Should BellSouth make its Custom Calling features available for resale on a stand-alone basis?

Q. WHAT IS BELLSOUTH'S POSITION ON THIS ISSUE?

A. BellSouth agrees to make available for resale any telecommunications service that BellSouth offers on a retail basis to subscribers that are not telecommunications carriers. BellSouth does not offer Custom Calling services (vertical services) to end users on a stand-alone basis, therefore, these services are not available for resale on a stand-alone basis to Sprint.

Q. WHAT HAS THE FCC DECIDED WITH REGARD TO THIS ISSUE?

A. Sprint's Petition quotes Section 251 (c)(4) of the Act as saying:

The duty:

(A) to offer for resale at wholesale rates any *telecommunications service that the carrier provides at retail to subscribers who are not telecommunications carriers; (BellSouth emphasis added.)*

BellSouth agrees that this is the correct section of the Act with regard to this issue. It does not, however, support Sprint's position.

As the FCC made clear in ¶877 of its First Report and Order:

On the other hand, section 251(c)(4) does not impose on incumbent LECs the obligation to disaggregate a retail service into more discrete retail services. The 1996 Act merely requires that any retail services offered to customers be made available for resale.

Sprint is not requesting a service that BellSouth offers at retail. On the contrary, Sprint is requesting BellSouth to create a new retail service (stand-alone custom calling services) and allow Sprint to resell it.

Q. HOW ARE CUSTOM CALLING SERVICES OFFERED IN BELLSOUTH'S TARIFF?

A. Section A13.9.2B. of BellSouth's General Subscriber Services Tariff (GSST) for Florida reads:

Except where provided otherwise in this Tariff, Custom Calling

Services are furnished only in connection with individual line residence and business main service. The features are not available in connection with Prestige® communications Service, Centrex-type Service or Access Line Service for Payphone Service Provider Telephones and SmartLine® Service.

The exceptions referred to in Section B. address primarily Custom Calling Services offered for use with PBX Trunk Service or Outward WATS Service. BellSouth does not offer its Custom Calling Services to its end-users (subscribers) on a stand-alone basis. These services must be purchased in conjunction with basic telephone service. Consequently, there is no retail service to resell.

Q. PLEASE ADDRESS SPRINT'S RELIANCE ON FCC RULE 51.613 (b).

A. Sprint's reliance on 47 CFR 51.613(b) is misplaced. The issue here is not whether a resale restriction applies, but whether there is a retail service being offered to end-users that Sprint can resell. This rule, and Section 251(c)(4)(B), address resale restrictions on "such telecommunications service". "Such ...service" refers to specific services that BellSouth provides to its end-users. Again, BellSouth does not provide Custom Calling services to end-users without also providing basic exchange service. Similarly, BellSouth can not provide vertical services to an ALEC's customer regardless of whether the ALEC provides the service via resale or via its own facility.

Q. PLEASE COMMENT ON SPRINT'S CATEGORIZATION, IN ITS

PETITION, OF HOW BELLSOUTH PROVIDES CUSTOM CALLING FEATURES TO END-USERS AS A "RESALE RESTRICTION."

A. First, in this case, whether BellSouth can technically offer Custom Calling services to Sprint on a stand-alone basis is questionable. I am not aware of any means to access Custom Calling Services except through a switch. Even if Sprint were to order these features as Unbundled Network Elements ("UNEs"), Custom Calling Features are only available in conjunction with local switching, and are defined as part of local switching.

Second, as stated in the previous answer, BellSouth is not applying a resale restriction to Sprint; however, BellSouth is concerned that a possible resale restriction could come into question. What happens in the case of a different ALEC requesting to resell the line (dial tone) of the BellSouth customer to whom Sprint is providing the stand-alone vertical services? An ALEC that resells a BellSouth customer's line is entitled also to resell vertical services to that customer. This is analogous to a previous ruling adopted by the FCC on September 27, 1996. In the Order on Reconsideration in CC Docket No. 96-98, the FCC states in ¶11:

> *Thus, a carrier that purchases the unbundled local switching element to serve an end user effectively obtains the exclusive right to provide all features, functions, and capabilities of the switch, including switching for exchange access and local exchange service, for that end user. [Emphasis added.]*

If the provider of service via UNEs has exclusive rights to the vertical services of local switching, it would appear that the provider of service via resale also has the same exclusive rights. If the FPSC requires BellSouth to provide vertical services to Sprint on a stand-alone basis, BellSouth will not be able to provide non-discriminatory resale to another ALEC.

Q. IS BELLSOUTH TRYING TO PROHIBIT SPRINT FROM RESELLING CUSTOM CALLING FEATURES OR TO MAKE SPRINT PURCHASE THE SERVICES FROM BELLSOUTH AT RETAIL RATES?

A. Absolutely not. BellSouth is in no way creating any barrier to competition, as Sprint alleges. To the extent Sprint suggests that BellSouth is requiring some specific action with regard to vertical features, Sprint is mistaken. BellSouth is not requiring Sprint to do anything. In fact, BellSouth affords Sprint with several options to provide existing services, or introduce new services, to Sprint's customers. For example:

- Sprint has the option of purchasing for resale, at the prevailing resale discount rate, BellSouth's local service, including any optional services that also require local service dial tone. In doing this, Sprint becomes the customer's provider of local services, therefore, competing with BellSouth.
- In addition, Sprint can buy UNEs and Sprint can avail itself of BellSouth's UNE Platform ("UNE-P") offering for existing customers. With this option, Sprint can become the facility provider at substantially less than the retail price. With the purchase of UNEs, Sprint can provide any service it chooses, in competition with BellSouth.

Q. WHAT IS BELLSOUTH ASKING THIS COMMISSION TO DO WITH REGARD TO ISSUE NO. 2?

A. BellSouth requests the FPSC to confirm the FCC's rules and deny Sprint's request that BellSouth make stand-alone Custom Calling Services, that are not available on a stand-alone basis to its non-carrier end-users, available to Sprint for resale.

Issue No. 4: Pursuant to Federal Communications Commission ('FCC') Rule 51.315(b), should BellSouth be required to provide Sprint at TELRIC rates combinations of UNEs that BellSouth typically combines for its own retail customers, whether or not the specific UNEs have already been combined for the specific end-user customer in question at the time Sprint places its order?

Issue No. 6: Should BellSouth be required to universally provide access to EELs that it ordinarily and typically combines in its network?

Issue No. 7: In situations where an ALEC's end-user customer is served via unbundled switching and is located in density zone 1 in one of the top fifty Metropolitan Statistical Areas ('MSAs') and who currently has three lines or less, adds additional lines, should BellSouth be able to charge market-based rates for all of the customer's lines?

Q. WHAT DOES BELLSOUTH UNDERSTAND THESE ISSUES TO BE?

A. BellSouth understands these issues to be whether BellSouth is obligated to combine UNEs for ALECs when the elements are not already combined in BellSouth's network.

Q. WHAT IS BELLSOUTH'S POSITION REGARDING ITS OBLIGATION TO COMBINE UNES?

A. As a general matter, it is neither sound public policy nor an obligation of BellSouth under the Act or the FCC's Rules to combine UNEs. In the FCC's Third Report and Order and Fourth Further Notice of Proposed Rulemaking, FCC 99-238, released November 5, 1999 ("UNE Remand Order"), the FCC confirmed that ILECs presently have no obligation to combine network elements for ALECs when those elements are not currently combined in the ILEC's network. The FCC Rules, Section 51.315(c)-(f), that purported to require incumbent LECs to combine unbundled network elements, were vacated by the Eighth Circuit, and those rules were neither appealed nor reinstated by the Supreme Court. On July 18, 2000, The Eighth Circuit reaffirmed its ruling that FCC Rules 51.315(c)-(f) are vacated.

BellSouth's position is that it will only provide combinations to Sprint at cost-based prices if the elements are, in fact, combined and providing service to a particular customer at a particular location. That is, BellSouth will make combinations of UNEs available to Sprint consistent with BellSouth's obligations under the Act and applicable FCC rules. In light of the Eighth

Circuit's ruling, BellSouth requests that this Commission not order BellSouth to combine UNEs in this proceeding.

Q. HOW DID THE FCC ADDRESS BELLSOUTH'S OBLIGATION TO COMBINE UNES IN ITS UNE REMAND ORDER?

A. The FCC concluded that BellSouth has no obligation to combine UNEs. As the FCC made clear, Rule 51.315(b) applies to elements that are "in fact" combined, stating that "[t]o the extent an unbundled loop is in fact connected to unbundled dedicated transport, the statute and our rule 51.315(b) require the incumbent to provide such elements to requesting carriers in combined form." (¶ 480) The FCC declined to adopt a definition of "currently combines" that would include all elements "typically combined" in the incumbent's network. *Id.* (declining to "interpret rule 51.315(b) as requiring incumbents to combine unbundled network elements that are 'ordinarily combined'...") It is nonsensical to suggest that the FCC meant for its Rule 51.315(b) to cover anything other than specific pre-existing combinations of elements for a customer when the FCC's orders specifically state that ILECs are not required to combine elements. As previously discussed, the Eighth Circuit has reaffirmed that BellSouth has no such obligation.

Q. WHY IS IT GENERALLY NOT IN THE PUBLIC INTEREST TO REQUIRE BELLSOUTH TO COMBINE UNEs?

A. First, requiring BellSouth to combine UNEs does not benefit consumers as a general matter, and would unnecessarily reduce the overall degree of competition in the market. Congress established several means to introduce competition, namely, resale, unbundling, and facilities constructed by new entrants. The requirements of the Act attempt to balance these three entry methods such that firms use the method that is most efficient for them. The greatest benefits, however, occur when firms build their own facilities. Expanding BellSouth's obligations beyond the Act's requirements would upset the balance intended by the Act. This is not just BellSouth's view – Justice Breyer of the Supreme Court agrees. As Justice Breyer points out in his opinion concurring in the Supreme Court's vacating of the FCC's unbundling rules:

> *[i]ncreased sharing (unbundling) by itself does not automatically mean increased competition. It is in the unshared, not in the shared, portions of the enterprise that meaningful competition would likely emerge. Rules that force every firm to share every resource or element of a business would create, not competition, but pervasive regulation, for the regulators, not the marketplace, would set the relevant terms.*
>
> *The upshot, in my view, is that the statute's unbundling requirements, read in light of the Act's basic purposes, require balance. Regulatory rules that go too far, expanding the definition of what must be shared beyond that which is essential to that which merely proves advantageous to a single competitor, risk costs that, in terms of the Act's objectives, may make the game not worth the candle. (142 L. Ed. 2d 834, 880)*

Second, requiring BellSouth to combine UNEs at cost-based prices, particularly Total Element Long Run Incremental Cost ("TELRIC")-based prices, reduces BellSouth's incentive to invest in new capabilities. TELRIC-based prices do not cover the actual cost of the elements, let alone represent fair prices in the market place. Again, Justice Breyer agrees, as evidenced by his observation that:

> *[n]or can one guarantee that firms will undertake the investment necessary to produce complex technological innovations knowing that any competitive advantage deriving from those innovations will be dissipated by the sharing requirement. The more complex the facilities, the more central their relation to the firm's managerial responsibilities, the more extensive the sharing demanded, the more likely these costs will become serious. (142 L. Ed. 2d 834, 879)*

Finally, requiring BellSouth to combine elements where such combinations do not, in fact, exist is inconsistent with the Act's basic purpose, which is to introduce competition into the local market. The intent was not to subsidize competitors where reasonable alternatives, to BellSouth combining UNEs, exist. ALECs can combine the UNEs themselves in collocation spaces, use the assembly point option, or build their own facilities. Even utilizing collocation to combine UNEs, the cost to the ALEC is just a few cents a month per combination. This view is also supported in Justice Breyer's opinion:

> *[i]n particular, I believe that, given the Act's basic purpose, it requires a convincing explanation of why facilities should be shared (or*

'unbundled') where a new entrant could compete effectively without the facility, or where practical alternatives to that facility are available. (142 L. Ed. 2d 834, 879)

Clearly, expanding BellSouth's obligation to include combining UNEs does not benefit consumers. Such action only provides an unwarranted subsidy to ALECs, disincents BellSouth to invest in its network, and discourages ALECs from building their own networks.

Q. WHAT DID THE EIGHTH CIRCUIT COURT OF APPEALS ("EIGHTH CIRCUIT") RULE REGARDING THIS ISSUE?

A. On July 18, 2000, the Eighth Circuit ruled that an ILEC is not obligated to combine UNEs, and it reaffirmed that the FCC's Rules 51.315(c)-(f) remain vacated. Specifically, referring to Section 251(c)(3) of the Act that requires ILECs to provide UNEs in a manner that allows requesting carriers to combine such elements in order to provide telecommunications services, the Eighth Circuit stated: "[h]ere Congress has directly spoken on the issue of who shall combine previously uncombined network elements. It is the requesting carriers who shall 'combine such elements.' It is not the duty of the ILECs to 'perform the functions necessary to combine unbundled network elements in any manner' as required by the FCC's rule."

Q. ARE THERE ANY EXCEPTIONS REGARDING COMBINING OF UNEs IN RELATION TO ISSUE 6?

A. There is one other exception to BellSouth's requirement to provide UNE combinations to Sprint. BellSouth has elected to be exempted from providing access to unbundled local switching to serve customers with four or more lines in Density Zone 1 of the Miami, Orlando and Ft. Lauderdale MSAs. To avail itself of this exemption, the FCC requires BellSouth to combine loop and transport UNEs (also known as the "Enhanced Extended Links" or "EELs") in the geographic area where the exemption applies. The FCC also requires that such combinations be provided at cost-based rates. BellSouth will combine loop and transport UNEs at FCC mandated prices as required in the FCC's UNE Remand Order in order to use the local circuit switching exemption.

Beyond this limited exception dictated by the FCC, BellSouth is under no obligation to physically combine network elements, where such elements are not, in fact, combined. Nevertheless, BellSouth is willing to negotiate rates for combining UNEs; however, such negotiations are outside of a Section 251 arbitration, and the rates for this service are not subject to the pricing standards in Section 252 of the Act.

Q. CAN SPRINT STILL COMPETE VIGOROUSLY FOR LOCAL SERVICE WITHOUT HAVING BELLSOUTH COMBINE UNES AT COST-BASED PRICES?

A. It certainly can. There are over 6 million BellSouth lines in service in Florida today. Each of those lines consists of existing combined facilities that Sprint, or any ALEC, in fact, can purchase today from BellSouth at cost-based rates. In addition, Sprint has several means other than having BellSouth combine UNEs to serve both new and existing customers. Any argument that Sprint cannot compete because BellSouth will not put UNEs together is nonsensical.

Q. WHAT IS BELLSOUTH ASKING THIS COMMISSION TO DO WITH REGARD TO THIS ISSUE?

A. BellSouth requests that the Commission find that BellSouth is required to provide UNE combinations to Sprint at cost-based prices only if the elements are, in fact, combined and providing service to a particular customer at a particular location.

Q. WHAT DOES BELLSOUTH UNDERSTAND THE DISPUTE ON UNBUNDLED LOCAL SWITCHING TO BE?

A. The dispute involves the application of the FCC's rules regarding the exemption for unbundling local circuit switching. BellSouth, in certain geographic areas, is not required to unbundle local switching for customers having four or more lines. Sprint asserts that even in such areas, BellSouth should not be allowed to raise prices for customers that have three or fewer lines, and that BellSouth should be required to provide up to forty lines at the cost-base rate. Sprint is apparently trying to rewrite the rules.

Q. WHAT IS BELLSOUTH'S POSITION ON THIS ISSUE?

A. BellSouth believes that the FCC's position is quite clear. Even if it were not, simple logic will lead to the conclusion that when a specific customer has four or more lines, whether they were purchased all at once, gradually over time, at one location, or spread over multiple locations, BellSouth does not have to provide unbundled local switching as long as the other criteria for Rule 51.319(c)(2) are met.

Q. WHAT IS THE FCC RULE THAT IS RELEVANT TO THE DISPUTE?

A. The relevant FCC Rule is 51.319(c)(2), which states:

(2) Notwithstanding the incumbent LEC's general duty to unbundled local circuit switching, an incumbent LEC shall not be required to unbundle local circuit switching for requesting telecommunications carriers when the requesting telecommunications carrier serves end-users with four or more voice grade (DS0) equivalents or lines, provided that the incumbent LEC provides non-discriminatory access to combinations of unbundled loops and transport (also known as the "Enhanced Extended Link") throughout Density Zone 1, and the incumbent LEC's local circuit switches are located in:

(i) The top 50 Metropolitan Statistical Areas as set forth in Appendix B of the Third Report and Order and Fourth Further Notice of Proposed Rulemaking in CC Docket No. 96-98, and

(ii) In Density Zone 1, as defined in § 69.123 of this chapter on

January 1, 1999.

Q. WHAT WAS THE FCC'S RATIONALE FOR THE FOUR OR MORE LINES CRITERIA IN RULE 51.319(c)(2)?

A. The FCC used the four-line cutoff to distinguish between the mass market and the medium to large business market. As long as the other criteria of Rule 51.319(c)(2) were met, the FCC determined that competitors were not impaired in their ability to serve medium to large business customers. The following portions of the UNE Remand Order demonstrate the FCC's rationale:

> We recognize that a rule that removes unbundling obligations based on line count will be marginally overinclusive or underinclusive given individual factual circumstances. We find, however, that in our expert judgment, a rule that distinguishes customers with four lines or more from those with three lines or less reasonably captures the division between the mass market – where competition is nascent – and the medium and large business market – where competition is beginning to broaden. ¶ 294

> In contrast, marketplace developments suggest that competitors are not impaired in their ability to serve certain high-volume customers in the densest areas. ¶ 297

The FCC's logic here is that the biggest part of the consumer market involves customers who have three or fewer lines. By the time a customer has 4 or more lines, the customer is either a mid-sized or a large customer, and ALECs are not impaired if they do not have access to unbundled switching to address the telecommunications needs of these classes of customers. Nowhere in the rule, nor in the rationale supporting it, does the FCC suggest that the incumbent LEC still has an obligation to unbundle local circuit switching for a portion of a medium to large business customer's lines, or for additional lines if the customer starts out with three lines or fewer.

Q. WHAT DOES THE PROVISION OF EELS HAVE TO DO WITH THIS ISSUE?

A. Basically, the thought is that if the incumbent LEC is willing to provide an EEL, the ALEC can haul the call anywhere in the area to the ALEC's switch. The FCC obviously concluded that, at least in the top 50 MSAs, switching is available from a number of sources. As long as the incumbent LEC allows the ALEC to have an EEL so that the end user could be connected to an ALEC's switch, it is not necessary for the incumbent LEC to unbundle local switching.

Q. WHAT DOES BELLSOUTH REQUEST OF THE COMMISSION?

A. BellSouth requests the Commission reject Sprint's attempt to rewrite the FCC's rules. Just as the FCC determined, ALECs are not impaired without access to unbundled local switching when serving customers with four or more lines in Density Zone 1 in the top 50 MSAs. Consequently, ALECs are not entitled to unbundled switching in these areas for any of an end user's lines when the end user has four or more lines in the relevant geographic area, as long as BellSouth will provide the ALEC with EELs. There has been no demonstration in this proceeding that Sprint is impaired without such access.

Issue No. 5: Should the Commission require BellSouth to provide access to packet switching UNEs under the circumstances specified in the FCC's UNE Remand Order on a location- or customer-specific basis?

Q. WHAT IS BELLSOUTH'S POSITION ON THIS ISSUE?

A. The Commission should not require BellSouth to provide packet switching UNEs to ALECs except as specified in the FCC's Rule 51.319(c)(5). Neither the 1996 Act nor the FCC's Rules require an ILEC to unbundle packet switching, outside of "one limited exception". The FCC rules do not address the issue of location- or customer-specific provisioning.

Q. WHAT WOULD BE REQUIRED IN ORDER FOR THIS COMMISSION TO DETERMINE THAT AN ILEC MUST PROVIDE ALECs WITH UNBUNDLED ACCESS TO PACKET SWITCHING CAPABILITIES?

A. The Commission would have to find that ALECs are impaired without access to these capabilities. Further, the Commission would have to find that the conditions established by the FCC that would trigger the unbundling of packet switching are insufficient.

Q. WHAT IS THE BASIS FOR BELLSOUTH'S POSITION?

A. In its UNE Remand Order, the FCC expressly declined "to unbundle specific packet switching technologies incumbents LECs may have deployed in their networks." (Para. 311) While the FCC adopted "one limited exception" to this rule, which I will discuss below, the FCC specifically rejected "e.spire/Intermedia's request for a packet switching or frame relay unbundled element." (Para. 312) Indeed, the FCC concluded that "e.spire/Intermedia have not provided any specific information to support a finding that requesting carriers are impaired without access to unbundled frame relay." *Id.*

Q. PLEASE EXLAIN THE "LIMITED EXCEPTION" TO WHICH YOU EARLIER REFERRED.

A. The FCC's Rule 51.319(c)(5) regarding packet switching requires that an ILEC provide unbundled packet switching <u>only</u> where <u>all</u> of the following conditions are satisfied:

(i) The incumbent LEC has deployed digital loop carrier systems, including but not limited to, integrated digital loop carrier or universal digital loop carrier systems; or has deployed any other system in which fiber optic facilities replace copper facilities in the distribution section (e.g., end office to remote terminal, pedestal or environmentally controlled vault);

(ii) There are no spare copper loops capable of supporting the xDSL services the requesting carrier seeks to offer;

(iii) The incumbent LEC has not permitted a requesting carrier to deploy a Digital Subscriber Line Access Multiplexer at the remote terminal, pedestal or environmentally controlled vault or other interconnection point, nor has the requesting carrier obtained a virtual collocation arrangement at these subloop interconnection points as defined under § 51.319(b); and

(iv) The incumbent LEC has deployed packet switching capability for its own use.

BellSouth has taken the necessary measures to ensure that ALECs have access to required facilities and therefore BellSouth is not required to unbundle packet switching.

Q. WHAT DID THE FCC FIND IN ITS DETERMINATION OF WHETHER ACCESS TO UNBUNDLED PACKET SWITCHING MET THE FCC's "NECESSARY" STANDARD?

A. The FCC stated in its UNE Remand Order that "no party alleged that packet switching was proprietary within the meaning of section 251(d)(2)" and "that the record provides no basis for withholding packet switching from competitors based on proprietary considerations or subjecting packet switching to the more demanding 'necessary' standard set forth in section 251(d)(2)(A)." (Para. 305) The FCC found it appropriate to examine packet switching under the "impair" standard of section 251(d)(2)(B).

Q. WHAT DID THE FCC FIND IN ITS DETERMINATION OF WHETHER ACCESS TO UNBUNDLED PACKET SWITCHING MET THE FCC's "IMPAIR" STANDARD?

A. The FCC determined that competing carriers would not be impaired without unbundled access to the incumbent LEC's packet switching functionality. (Para. 306) The FCC recognized that there are numerous carriers providing service with their own packet switches, and that "competitors are actively deploying facilities used to provide advanced services to serve certain segments of the market - namely, medium and large business - and hence they cannot be said to be impaired in their ability to offer service." *Id.*

Q. SHOULD THIS COMMISSION REQUIRE INCUMBENT LECs TO UNBUNDLE SPECIFIC NETWORK ELEMENTS USED TO PROVIDE PACKET SWITCHING?

A. No. I am not aware of any evidence that would demonstrate that ALECs are impaired without access to packet switching. In its UNE Remand Order, the FCC established the "impair" standards by which it would determine if a network element should be unbundled. The FCC concluded that

> [T]he failure to provide access to a network element would 'impair' the ability of a requesting carrier to provide the services it seeks to offer if, taking into consideration the availability of alternative elements outside the incumbent's network, including self-provisioning by a requesting carrier or acquiring an alternative from a third-party supplier, lack of

> access to that element materially diminishes a requesting carrier's ability to provide the services it seeks to offer. (Para. 51)

The FCC went on to say that a materiality component "requires that there be substantive differences between the alternative outside the incumbent LEC's network and the incumbent LEC's network element that, collectively, 'impair' a competitive LEC's ability to provide service within the meaning of section 251(d)(2)." *Id.*

Even though a state commission is authorized to alter the conditions established by the FCC for the unbundling of packet switching, an ALEC must prove that it is impaired by not having access to BellSouth's packet switching functionality on an unbundled basis.

Q. HAS THIS COMMISSION PREVIOUSLY CONSIDERED THIS ISSUE?

A. Yes.

Q. WHAT DOES BELLSOUTH REQUEST OF THE COMMISSION?

A. BellSouth requests that the Commission affirm the FCC's finding by reaching the same conclusion that it did in the Intermedia arbitration: Sprint has not demonstrated that it is impaired without access to unbundled packet switching from BellSouth, and that BellSouth is not required to provide packet switching capabilities to Sprint, on a location- or customer-specific basis, on an unbundled basis unless all four of the conditions in Rule 51.319(c)(5) are met.

Issue No. 8: Should BellSouth be able to designate the network Point of Interconnection ('POI') for delivery of BellSouth's local traffic?

Issue 29: Should BellSouth be allowed to designate a virtual point of interconnection in a BellSouth local calling area to which Sprint has assigned a Sprint NPA/NXX? If so, who pays for the transport and multiplexing, if any, between BellSouth's virtual point of interconnection and Sprint's point of interconnection?

Q. IN ESSENCE, WHAT IS THE NATURE OF THE DISPUTE BETWEEN THE PARTIES ON THIS ISSUE?

A. The issue is pretty simple. BellSouth has a local network in each of the local calling areas it serves in Florida. BellSouth may have 15, 20 or even more such local networks in a given LATA. Nevertheless, Sprint wants to physically interconnect its network with BellSouth's "network" in each LATA at a single point. This approach simply ignores that there is not one "network" but a host of networks that are generally all interconnected. Importantly, BellSouth does not object to Sprint designating a single POI at a point in a LATA on one of BellSouth's "networks", for traffic that Sprint's end users originate. Further, BellSouth does not object to Sprint using the interconnecting facilities between BellSouth's "networks" to have local calls delivered or collected throughout the LATA. What BellSouth does want, and this is the real issue, is for Sprint to be financially responsible when it uses BellSouth's network in lieu of building its own network to deliver or collect these local calls.

Sprint, to contrast its position with BellSouth's, expects BellSouth to collect its local traffic in each of BellSouth's numerous local calling areas in the LATA, and to be financially responsible for delivering these local calls, ultimately destined for Sprint local customers in the same local calling area, to a single point in each LATA. BellSouth agrees that Sprint can choose to build its own facilities to connect with BellSouth at a single, technically feasible point in the LATA selected by Sprint. Sprint, however, cannot impose a financial burden on BellSouth to deliver BellSouth's originating local traffic to that single point. If Sprint wants local calls completed between BellSouth's customers and Sprint's customers using this single Point of Interconnection, that is fine, provided that Sprint is financially responsible for the additional costs that Sprint causes.

Q. DOES BELLSOUTH'S POSITION MEAN THAT SPRINT HAS TO BUILD A NETWORK TO EVERY LOCAL CALLING AREA, OR OTHERWISE HAVE A POINT OF INTERCONNECTION WITH BELLSOUTH'S LOCAL NETWORK IN EVERY LOCAL CALLING AREA?

A. No. Sprint can build out its network that way if it chooses, but is not required to do so. Sprint can lease facilities from BellSouth or any other provider to bridge the gap between its network (that is, where it designates its POI) and each BellSouth local calling area.

Q. WHAT IS A POINT OF INTERCONNECTION?

A. The term Point of Interconnection is used in the Agreement, and in this issue, to describe the point(s) where BellSouth and Sprint's networks physically connect. In its First Report and Order, at paragraph 176, the FCC defined the term "interconnection" by stating that:

> *We conclude that the term "interconnection" under section 251(c)(2) refers only to the physical linking of two networks for the mutual exchange of traffic.*

Therefore, the term "Point of Interconnection" is simply the place, or places, on BellSouth's network where that physical linking of Sprint and BellSouth's networks takes place. Simply speaking, the Point of Interconnection is the place where facilities that Sprint builds connect to facilities built by BellSouth.

Q. IF SPRINT CAN INTERCONNECT WITH BELLSOUTH'S NETWORK AT ANY TECHNICALLY FEASIBLE POINT, WHY IS THIS AN ISSUE?

A. Recall that what we are talking about is interconnection with "local networks." The network architectures of the two companies are very important, and are actually why this issue exists. BellSouth has a number of distinct networks. For example, BellSouth has local networks, long distance networks, packet networks, signaling networks, E911 networks, etc. Each of these networks is designed to provide a particular service or group of services. With regard to "local networks," BellSouth, in any given LATA, has several such local networks, usually interconnected by BellSouth's long distance network.

For example, in the Jacksonville LATA, BellSouth has local networks in Jacksonville, Lake City, St. Augustine, Pomona Park, as well as several other locations. Customers who want local service in a particular local calling area must be connected to the local network that serves that local calling area. A customer that connects to the Jacksonville local network, for example, will not receive local service in the Lake City local calling area because Lake City is not in the Jacksonville local calling area. Likewise, an ALEC that wants to connect with BellSouth to provide local service in Lake City has to connect to the local network that serves the Lake City area. BellSouth's local calling areas, I would add, have been defined over the years either by this Commission or by BellSouth with the approval of this Commission.

When Sprint has a single switch in a LATA, then, by definition, that switch is located in a single BellSouth local calling area, for example, the Jacksonville local calling area, if that is where the switch is located. When a BellSouth local customer in Jacksonville wants to call a Sprint customer in Jacksonville, BellSouth delivers the call to the appropriate point of interconnection between BellSouth's network and Sprint's network in Jacksonville. This network configuration is illustrated on Page 1 of Exhibit JAR-1 attached to my testimony. BellSouth would be financially responsible for taking a call from one of its subscribers located in the Jacksonville local calling area and delivering it to another point in the Jacksonville local calling area, the Sprint Point of Interconnection. This scenario is not a problem.

The problem arises when a BellSouth customer located in a distant local calling area wants to call his next-door neighbor who happens to be a Sprint local subscriber. To illustrate this point, assume that Sprint has a single local switch in the Jacksonville LATA. A BellSouth customer in Lake City that wants to call a Sprint customer in Lake City picks up his or her telephone and draws dial tone from BellSouth's Lake City switch. The BellSouth customer then dials the Sprint customer. The call has to be routed from Lake City to Sprint's Point of Interconnection in the Jacksonville LATA, which, in my example, is in Jacksonville. Sprint then carries the call to its switch in Jacksonville and connects to the long loop serving Sprint's customer in Lake City. This call routing is shown on Page 2 of Exhibit JAR-1. The issue here involves who is financially responsible for the facilities that are used to haul local calls back and forth between Sprint's Point of Interconnection in Jacksonville and the BellSouth Lake City local calling area.

Q. HOW WOULD SPRINT CONNECT TO BELLSOUTH'S LOCAL NETWORKS THAT ARE OUTSIDE THE LOCAL CALLING AREA WHERE SPRINT'S SWITCH IS LOCATED?

A. It is my understanding that Sprint has agreed to establish at least one POI in each LATA. This is necessary because BellSouth is still not authorized to carry traffic across LATA boundaries. Sprint would build facilities from its switch (wherever that is located) to the POI in the LATA where the BellSouth local network is located. Once that POI is established, the issue remains the same. Who is financially responsible for the facilities needed to carry calls between that POI and the distant BellSouth local calling area in which a local call is to be originated and terminated? Since Sprint must establish a POI in each LATA, whether or not Sprint also has a switch in each LATA, is not relevant to resolving the problem that Sprint's network design has created.

Q. WHY DO YOU SAY THAT SPRINT MUST BE FINANCIALLY RESPONSIBLE FOR THE TRANSPORT OF THESE CALLS FROM LOCAL CALLING AREAS THAT ARE DISTANT FROM THE POINT WHERE SPRINT HAS CHOSEN TO INTERCONNECT ITS NETWORK WITH BELLSOUTH'S?

A. First, that is the only approach that makes economic sense. I will explain the rationale for that statement later. Second, the Eighth Circuit determined that the ILEC is only required to permit an ALEC to interconnect with the ILEC's existing local network, stating that:

> *The Act requires an ILEC to (1) permit requesting new entrants (competitors) in the ILEC's local market to interconnect with the ILEC's* <u>*existing local network*</u> *and, thereby, use that network to compete in providing local telephone service (interconnection).... (Eighth Circuit Court Order dated July 18, 2000, page 2) [Emphasis added.]*

This is a very important point. When Sprint interconnects with BellSouth's local network in Jacksonville, it is not also interconnecting with BellSouth's local network in Lake City. It is only interconnecting with the Jacksonville local network. The fact that Sprint is entitled to physically interconnect with BellSouth at a single point cannot overcome the fact that the single POI cannot, by itself, constitute interconnection with every single local calling area in the LATA.

Moreover, if that were true, think of the implications. Absent LATA restrictions, Sprint's theory would mean that Sprint could have a physical POI with BellSouth's "network" in Miami, and BellSouth would be required to haul local calls originating in Lake City and destined to terminate in Lake City all the way to Miami, at no cost to Sprint. That just does not make sense. Sprint can build whatever network it wants. It can interconnect with BellSouth's "network" wherever it is technically feasible. However, Sprint cannot shift the financial burden of its network design to BellSouth.

Q. CAN YOU ILLUSTRATE WITH AN EXAMPLE WHY YOU SAY SPRINT IS ATTEMPTING TO SHIFT ITS FINANCIAL RESPONSIBILITY TO BELLSOUTH AND THAT BELLSOUTH IS INCURRING COSTS ON BEHALF OF SPRINT?

A. Yes. The best way to describe these additional costs is to compare examples of two local calls in the same local area. One local call is between two BellSouth customers. The other local call is between a BellSouth customer and a Sprint customer. Let's assume that either set of customers are neighbors in Lake

City, to make the example more emphatic. First, let's examine what happens if both customers were served by BellSouth as depicted on page 3 of Exhibit JAR-1. When one neighbor calls the other, the call originates with one customer, and is transported over that customer's local loop to a local switch in Lake City, where the call is connected to the other customer's local loop. Importantly, the call never leaves the Lake City local calling area. Therefore, the only cost BellSouth incurs for transporting and terminating that call is end office switching in Lake City.

Now, let's compare what happens when one of these two customers obtains its local service from Sprint. Assume that the BellSouth customer calls the Sprint customer next door, as depicted on page 2 of Exhibit JAR-1. The BellSouth customer is connected to BellSouth's switch in Lake City. The BellSouth switch then sends the call to Jacksonville because that is where Sprint told BellSouth to send the call. The call is then hauled over facilities owned by Sprint from the Jacksonville POI (e.g. access tandem) to Sprint's switch. Sprint then connects the call through its end office switch to the long loop serving Sprint's end user customer back in Lake City. Again, these two customers live next door to each other. In one case the call never left the Lake City local calling area. In the other, BellSouth hauled the call all the way to Jacksonville and the only reason that BellSouth did so was because that is what Sprint wanted.

To make the point more simply, Sprint wants BellSouth to bear the cost of the facilities used to haul the call I just described between Lake City and

Jacksonville. There is nothing fair, equitable or reasonable about Sprint's position. Because Sprint has designed its network the way it wants, and has designed its network in the way that is most efficient and cheapest for Sprint, Sprint must bear the financial responsibility for the additional facilities used to haul the call between Lake City and Jacksonville. Sprint does not have to build the facilities. It does not have to own the facilities. It just has to pay for them. BellSouth objects to paying additional costs that are incurred solely due to Sprint's network design. It is simply inappropriate for Sprint to attempt to shift these costs to BellSouth.

Q. DO BELLSOUTH'S LOCAL EXCHANGE RATES COVER THESE ADDITIONAL COSTS?

A. No. BellSouth, in theory at least, is compensated by the local exchange rates charged to BellSouth's local customers for hauling local calls from one point within a specific local calling area to another point in that same local calling area. I say "in theory" because, as the Commission knows, there has always been a dispute over whether local exchange rates actually cover the costs of handling local calls. Certainly there can be no dispute that the local exchange rates that BellSouth's customers pay are not intended to cover and, indeed cannot cover, the cost of hauling a local call from one Lake City customer to another Lake City customer by way of Jacksonville.

Indeed, if Sprint is not required to pay for that extra transport which Sprint's network design decisions cause, who will pay for it? The BellSouth calling party is already paying for its local exchange service, and certainly will not agree to pay more, simply for Sprint's convenience. Who does that leave to cover this cost? The answer is that there is no one else, and because Sprint has caused this cost through its own decisions regarding the design of its network, it should be required to pay the additional cost.

Q. DOES BELLSOUTH RECOVER ITS COSTS FOR HAULING LOCAL CALLS OUTSIDE THE LOCAL CALLING AREA THROUGH RECIPROCAL COMPENSATION CHARGES?

A. No. This is also a significant point. The facilities discussed in this issue provide interconnection between the parties' networks. Their costs are not covered in the reciprocal compensation charges for transport and termination. Paragraph 176 of FCC Order No. 96-325 clearly states that interconnection does not include transport and termination: "Including the transport and termination of traffic within the meaning of section 251(c)(2) would result in reading out of the statute the duty of all LECs to establish 'reciprocal compensation arrangements for the transport and termination of telecommunications' under section 251(b)(5)". Simply put, the cost of interconnection is to be recovered through interconnection charges and the cost for transport and termination is to be recovered separately through reciprocal compensation. Reciprocal compensation charges apply only to facilities used for transporting and terminating local traffic on the local network, <u>not</u> for interconnection of the parties' networks.

In the Lake City example, reciprocal compensation would only apply for the use of BellSouth's facilities within the Lake City local calling area. That is, reciprocal compensation would apply to the facilities BellSouth uses within its Lake City local network to transport and switch a Sprint originated call. Reciprocal compensation does not include the facilities to haul the traffic from Lake City to Jacksonville. In the illustrations I have been using, BellSouth's customer originates the call. BellSouth does not receive reciprocal compensation for calls that originate from a BellSouth customer and terminate to a Sprint customer. Ultimately, however, what Sprint is requesting is for BellSouth to provide facilities, at no cost, for calls in both directions between the distant exchanges.

Q. IS THE ARRANGEMENT THAT SPRINT IS PROPOSING EFFICIENT?

A. Sprint might believe it is. Sprint seems to equate efficiency with what is cheapest for Sprint. Of course, that is not an appropriate measure of efficiency. Indeed, to measure efficiency, the cost to each carrier involved must be considered. Presumably, Sprint has chosen its particular network arrangement because it is cheaper for Sprint. A principal reason that it is cheaper is because Sprint is expecting BellSouth's customers to bear substantially increased costs that Sprint causes by its network design. It simply makes no sense for BellSouth to bear the cost of hauling a local Lake City call outside the local calling area just because that is what Sprint wants us to do. Sprint, however, wants this Commission to require BellSouth to do just that. If Sprint bought these facilities from anyone else, Sprint would pay for the facilities. Sprint, however, does not want to pay BellSouth for the same capability.

Sprint's method of transporting local traffic is clearly more costly to BellSouth, but Sprint blithely ignores the additional costs they want BellSouth to bear. Of course, these increased costs will ultimately be borne by customers, and if Sprint has its way, these costs will be borne by BellSouth's customers. Competition should reduce costs to customers, not increase them. Competition certainly is not an excuse for enabling a carrier to pass increased costs that it causes to customers it does not even serve. BellSouth requests that the Commission require Sprint to bear the cost of hauling local calls outside BellSouth's local calling areas. Importantly, Sprint should not be permitted to avoid this cost, nor should Sprint be permitted to collect reciprocal compensation for facilities that haul local traffic outside of the local calling area.

Q. HOW HAS THE FCC ADDRESSED THE ADDITIONAL COSTS CAUSED BY THE FORM OF INTERCONNECTION AN ALEC CHOOSES?

A. In its First Report and Order in Docket No. 96-98, the FCC states that the ALEC must bear the additional costs caused by an ALEC's chosen form of interconnection. Paragraph 199 of the Order states that "a requesting carrier that wishes a 'technically feasible' but expensive interconnection would, pursuant to section 252(d)(1), be required to bear the cost of the that interconnection, including a reasonable profit." Further, at paragraph 209, the FCC states that "Section 251(c)(2) lowers barriers to competitive entry for carriers that have not deployed ubiquitous networks by permitting them to select the points in an incumbent LEC's network at which they wish to deliver traffic. Moreover, because competing carriers must usually compensate incumbent LECs for the additional costs incurred by providing interconnection, competitors have an incentive to make economically efficient decisions about where to interconnect." (Emphasis added.)

Clearly, the FCC expected Sprint to pay the additional costs that it causes BellSouth to incur. If Sprint is permitted to shift its costs to BellSouth, Sprint has no incentive to make economically efficient decisions about where to interconnect.

Q. HOW DOES BELLSOUTH PROPOSE TO DELIVER ITS ORIGINATING LOCAL TRAFFIC TO SPRINT?

A. Although not required to do, BellSouth proposes to aggregate all of its end users' originating local traffic to a single location in a local calling area where such traffic will be delivered to Sprint. In the case of Lake City, BellSouth would transport the local traffic originated by all BellSouth customers in the Lake City local calling area to a single location in that calling area. This single location, where BellSouth aggregates it customers' local traffic, is not a Point of Interconnection as defined by the FCC. BellSouth, therefore, is using the term Virtual Point of Interconnection ("VPOI") to describe this central location. Sprint can pick up all local traffic originated by BellSouth end users in the Lake City local calling area at a single location, rather than having to pick up the traffic at each individual office. Sprint, however, is not required to pick up the traffic at that point; if it chooses it can pick up the traffic at individual end offices instead. Again, Sprint can pickup this traffic wherever it wants, as long as it is financially responsible for doing so.

Q. PLEASE EXPLAIN IN MORE DETAIL WHAT YOU ARE REFERRING TO AS A VIRTUAL POINT OF INTERCONNECTION.

A. The VPOI is the Point of Interconnection specified by BellSouth for delivery of BellSouth originated traffic to Sprint. Sprint would pay BellSouth the TELRIC rates for Interoffice Dedicated Transport and associated multiplexing, as set forth in the Interconnection Agreement, for BellSouth to transport local traffic and Internet traffic over BellSouth facilities from the VPOI to the POI designated by Sprint. The Interoffice Dedicated Transport mileage will be the airline mileage between the Vertical and Horizontal (V&H) coordinates of the VPOI and the Sprint POI. In addition, Sprint will compensate BellSouth for all associated multiplexing.

Q. WOULD SPRINT'S ABILITY TO COMPETE BE HAMPERED BY SPRINT'S INABILITY TO OBTAIN FREE FACILITIES FROM BELLSOUTH?

A. Absolutely not. First, Sprint does not have to build or purchase interconnection facilities to areas that Sprint does not plan to serve. If Sprint does not intend to serve any customers in a particular area, its ability to compete cannot be hampered.

Second, in areas where Sprint does intend to serve customers, BellSouth is not requiring Sprint to build facilities throughout the area. Sprint can build facilities to a single point in each LATA and then purchase whatever facilities it needs from BellSouth or from another carrier in order to reach individual local calling areas that Sprint wants to serve.

Q. WHAT IS BELLSOUTH ASKING THIS COMMISSION TO DO WITH REGARD TO ISSUE NO. 8?

A. BellSouth requests this Commission to find that Sprint is required to bear the cost of facilities that BellSouth may be required to install, on Sprint's behalf, in order to connect from a BellSouth local calling area to Sprint's POI located outside that local calling area. I believe this to be an equitable arrangement for both parties.

Issue No. 9: Should the parties' Agreement contain language providing Sprint with the ability to transport multi-jurisdictional traffic over a single trunk group, including an access trunk group?

Q. PLEASE BRIEFLY EXPLAIN BELLSOUTH'S UNDERSTANDING OF THIS ISSUE.

A. BellSouth believes that there are actually two distinct and separate issues. The first part of this issue appears to be that Sprint is asking for all 00- calls destined to Sprint to be routed by BellSouth over switched access trunks, and for BellSouth to recognize, for reciprocal compensation purposes, that a portion of the traffic over those trunks is actually local traffic.

Q. PLEASE COMMENT ON SPRINT'S REQUEST THAT NOT ALL OPERATOR SERVICE TRAFFIC (00-) ROUTED OVER ACCESS TRUNKS BE CLASSIFIED AS ACCESS TRAFFIC.

A. Operator Service (00-) traffic is a standard, accepted and well understood dialing pattern that switches traffic to Sprint, the interexchange carrier ("IXC"), for its use in providing operator services. Traffic using this dialing pattern is completed to the IXC over switched access facilities and is billed at switched access rates. Currently, when BellSouth end users who are presubscribed to Sprint the IXC for long distance service dial 00-, the call is sent forward to Sprint the IXC's switched access Feature Group D ("FGD") trunks. However, Sprint is now requesting that BellSouth allocate the billing for the 00- generated minutes between switched access and local, because Sprint apparently intends to use 00- for conventional long distance operator services, as well as for various local services through 00- access.

Q. WHAT IS BELLSOUTH'S POSITION ON THIS PART OF THE ISSUE?

A. 00- access is offered only as a dialing arrangement under Feature Group D access. It allows a customer to reach the operator of the carrier to which the customer is presubscribed. There is no prohibition on carriers using access service to provide local service. The carrier simply pays the price for access service. The prices for local interconnection are available only to those carriers who are a customer's local service provider or who provide a significant amount of local exchange service in addition to exchange access service. The public policy reason for this is to encourage local competition. Sprint is providing neither of these services but wants the lower prices, as well as reciprocal compensation revenues, despite the fact that it is not performing the functions that the lower prices are meant to encourage.

BellSouth is also concerned that Sprint's requested arrangement will result in arguments as to whether a given 00- call is local or interstate in nature. For example, Sprint could assert that the call is terminated once its operator answers the call even though the operator forwards the call on to some other destination for completion. For this reason, BellSouth urges the Commission to deny Sprint's request, with regard to this portion of Issue 9.

Q. PLEASE EXPLAIN BELLSOUTH'S UNDERSTANDING OF THE SECOND PART OF THIS ISSUE.

A. Sprint is asking that BellSouth, in lieu of establishing a reciprocal trunk group, place local traffic that originates from a BellSouth end user who is presubscribed to Sprint onto Sprint the IXC's direct end office switched access Feature Group D trunks.

Q. DOES SPRINT'S REQUEST APPEAR TO BE TECHNICALLY FEASIBLE?

A. BellSouth is continuing to explore this portion of Sprint's request. The technical experts of Sprint and BellSouth are working together to determine the technical feasibility. BellSouth has determined that existing access service arrangements do not permit Sprint to receive the service it has requested. If this service is technically feasible, and if this Commission determines that BellSouth must offer the service, Sprint should bear the cost of the service. On the surface, Sprint's request appears to be simple and straightforward. Further investigation, however, has shown the request, at least as BellSouth understands it, to be quite complex.

Q. WHY DO YOU SAY SPRINT'S REQUEST IS COMPLEX?

A. First, there are numerous technical points regarding Sprint's request that BellSouth continues to investigate. BellSouth needs to ensure that the request is fully and sufficiently defined in terms of Sprint's expectations for traffic originating from BellSouth's end users, traffic terminating to BellSouth's end users, as well as transit traffic. Transit traffic is local traffic that originates and terminates between end users that are not BellSouth's customers, but that BellSouth handles on a tandem switching basis. As presented, the request appears to relate only to traffic originating from BellSouth.

In addition, for a long distance call originating from a BellSouth end user that is presubscribed to Sprint the IXC, BellSouth routes the long distance call to

Sprint's Switched Access trunks. To implement Sprint's proposal, BellSouth's routing process will most likely need to be manually altered to analyze all intraLATA NXX codes. The current call routing instructions are issued in compliance with the industry standard, Telecordia defined, Routing Rules for a Hierarchical Network. Industry standards require a "tandem company", of which BellSouth is naturally one, to route calls in this manner.

It appears that if Sprint's request can be implemented, it will require "exception routing" to be performed on a non-standard, manually developed basis for <u>each</u> BellSouth end office and tandem, in order to circumvent established Routing Rules for Sprint NXX codes to Sprint IXC switched access trunks. BellSouth anticipates that the routing of subsequent Sprint NXX codes will also require updating on a manual basis. For BellSouth to determine which codes are assigned to Sprint requires a non-standard look-up of <u>all</u> codes to segregate those assigned to Sprint. This look-up does not occur today and would be unique to Sprint. It is important to note that, if BellSouth were to provide this capability to Sprint, it would be required to also offer the same capability to all carriers.

Q. WHAT IS BELLSOUTH REQUESTING OF THE COMMISSION ON THIS PORTION OF ISSUE NO. 9?

A. This issue is very complex from both a policy and a technical perspective. The technical experts of both companies have met and will continue to meet in an effort to more precisely define the details of Sprint's request. BellSouth hopes to have a more complete understanding of the ramifications of this issue prior to filing its rebuttal testimony in this case.

Issue No. 10: Should Internet Service Provider ('ISP') –bound traffic be treated as local traffic for purposes of reciprocal compensation in the new Sprint/BellSouth interconnection agreement, or should it be otherwise compensated?

Q. WHAT IS BELLSOUTH'S UNDERSTANDING OF THIS ISSUE?

A. BellSouth's position on this issue is that ISP-bound traffic is not local traffic eligible for reciprocal compensation, and should not be otherwise compensated. Our position has been presented to this Commission at length in three recent arbitration proceedings between BellSouth and ITC^DeltaCom, Intermedia and Global NAPS. As stated in my direct testimony, BellSouth agrees to apply the Commission's Order in the Intermedia Arbitration proceeding (Order No. PSC-00-1519-FOF-TP, dated August 22, 2000) to this case, as an interim mechanism. BellSouth, however, contends that the interim mechanism must be subject to true-up, pending an order from the FCC on inter-carrier compensation for ISP-bound traffic. BellSouth agrees to this as a conciliatory offer that avoids requiring the Commission to rehear this issue. BellSouth reserves the right, however, to appeal or seek judicial review on this issue.

Q. IF THIS COMMISSION DETERMINES THAT COMPENSATION SHOULD BE PAID FOR ISP-BOUND TRAFFIC, WHAT SHOULD BE THE RATES?

A. BellSouth's position is that a minute-of-use (MOU) compensation arrangement should not be applied to ISP-bound traffic. However, if this Commission considers an MOU compensation arrangement, at a minimum it should consider the characteristics of ISP calls as distinguished from local calls, as this Commission found in its order in the Global NAPs arbitration with BellSouth (Order No. PSC-00-1680-FPF-TP, dated September 19, 2000).

Local exchange rates do not take into account the calling characteristics of, nor do they compensate for access service such as ISP-bound traffic or traffic sent to IXCs. Access service characteristics were never considered when local rates were established. ISP-bound traffic bears little resemblance to local traffic. Indeed, for BellSouth, the typical call duration for a local call is between three and four minutes. On the other hand, an Internet call session generally lasts much longer than three to four minutes and may last several hours. As additional evidence, attached to my testimony as Exhibit JAR-2 is a Report of the NARUC Internet Working Group (March, 1998), and two supporting Bellcore studies which state that an average ISP-bound call is 20 minutes, as opposed to an average voice call of three minutes.

Q. HOW DO COSTS SUPPORTING COMMISSION APPROVED RECIPROCAL COMPENSATION RATES FOR LOCAL CALLS COMPARE TO COSTS FOR ISP CALLS?

A. Costs per minute for ISP calls are lower than such costs for local calls. The cost for local calls is a combination of call set-up cost and a per minute rate. In the cost support for reciprocal compensation, the cost of call set-up is spread over the duration of the local call, based on the average duration of approximately 3 minutes. Assuming that the average duration of ISP calls is 20-25 minutes (versus 3-4 minutes for an average local call), using the same reciprocal compensation rate for local and ISP calls means that call set up cost would be over recovered. Therefore, any per minute reciprocal compensation rate, if applied to ISP-bound traffic, should be a lower per minute rate to account for the longer call duration.

Q. WHAT IMPACT WOULD THE DIFFERENCE IN HOLDING TIMES HAVE ON THE COMMISSION'S PREVIOUSLY APPROVED RATES?

A. The Commission's previously approved reciprocal compensation rates are clearly overstated for a carrier that is predominately, if not entirely, serving ISPs. The effect is reflected most in the costs for end office switching. The Commission approved a rate of $.002 per minute to recover end office switching. The cost study for that rate included call setup costs to be recovered on a per minute of use basis; the more minutes that a call takes, the lower the per minute setup cost. The cost of $.002 per minute was based on local calls only with an average call duration of 2.708 minutes per call. Using an average call duration of 20 minutes, which more closely resembles ISP calls, would reduce costs by 36%. Using the Commission's approved methodology, this reduction would result in a cost of $.00128 per minute for ISP calls. The Commission's approved reciprocal compensation rates for tandem switching and common transport would also overstate cost for an ISP call; the magnitude, however, would be much less than the impact on end office switching costs. Again, BellSouth is not proposing to apply reciprocal compensation to ISP traffic. This analysis is provided to show only that the previously adopted rates for reciprocal compensation would overstate costs of ISP traffic.

Issue 11: Where Sprint's switch serves a geographic area comparable to the area served by BellSouth's tandem switch, should the tandem interconnection rate apply to local traffic terminated to Sprint?

Q. WHAT IS BELLSOUTH'S UNDERSTANDING OF THIS ISSUE?

A. BellSouth understands this issue to be whether or not Sprint's switch serves a geographic area comparable to the area served by BellSouth's tandem switch as the only criteria for determining if Sprint is permitted to charge BellSouth the tandem access rate.

Q. WHAT IS BELLSOUTH'S POSITION ON THIS ISSUE?

A. In order for Sprint to appropriately charge tandem rate elements, Sprint must demonstrate to the Commission that: 1) its switches serve a comparable geographic area to that served by BellSouth's tandem switches; and 2) its switches perform local tandem functions. Sprint should only be compensated for the functions that it actually provides. Sprint is only entitled to charge for tandem switching on the local calls that are, in fact, switched by the tandem. Sprint is not entitled to tandem switching compensation on local calls not switched by a local tandem, even if Sprint has a local tandem. Finally, the current rate structure for common transport is appropriate and the Commission should reject Sprint's proposed structure.

Q. PLEASE DESCRIBE SPRINT'S POSITION ON THIS ISSUE.

A. Sprint's position is that when its local switch covers a geographic area comparable to BellSouth's tandem, Sprint should always receive the rate for reciprocal compensation. Sprint totally disregards the FCC's other criteria for qualifying for tandem switching compensation – that Sprint's switch actually performs a tandem function on a given call.

Q. WHAT IS THE BASIS FOR BELLSOUTH'S POSITION ON THIS ISSUE?

A. The FCC posed two requirements before an ALEC is entitled to compensation at both the end office and tandem-switching rate for any particular local call. The switch involved has to serve the appropriate geographic area, and it has to perform tandem switching functions for local calls. BellSouth notes that in

Section 51.711(a)(1) of its Local Competition Order, the FCC states that "symmetrical rates are rates that a carrier other than an incumbent LEC assesses upon an incumbent LEC for transport and termination of local telecommunications traffic equal to those that the incumbent LEC assesses upon the other carrier <u>for the same services</u>." (Emphasis added) Again, in Section 51.711(a)(3), the FCC states that "[w]here the switch of a carrier other than an incumbent LEC serves a geographic area comparable to the area served by the incumbent LEC's tandem switch, the appropriate rate for the carrier other than an incumbent LEC is the incumbent LEC's tandem interconnection rate."

The FCC recognized that the ALECs might not use the same network architecture that BellSouth or any other incumbent carrier uses. That concern, however, is not an issue in this case. In order to ensure that the ALECs would receive the equivalent of a tandem-switching rate, if it were warranted, the FCC directed state commissions to do two things. First, the FCC directed state commissions to "consider whether new technologies (e.g., fiber ring or wireless network) <u>performed functions similar to those performed by an incumbent LEC's tandem switch</u> and thus whether some or all calls terminating on the new entrant's network should be priced the same as the sum of transport and termination via the incumbent LEC's tandem switch." (Local Competition Order ¶ 1090) (Emphasis added). Further, the FCC stated that "[w]here the interconnecting carrier's switch serves a geographic area comparable to that served by the incumbent LEC's tandem switch, the appropriate proxy for the interconnecting carrier's additional costs is the LEC tandem interconnection rate." Id.

Therefore, pursuant to Section 51.711, before charging BellSouth the tandem switching rate, Sprint must show not only that its switch covers the same geographic area as BellSouth's tandem switch, but that Sprint's switch is providing the same services as BellSouth's tandem switch for local traffic.

Q. HAS THE FCC DEFINED WHAT FUNCTIONS A TANDEM SWITCH MUST PROVIDE?

A. Yes. In its recently released Order No. FCC 99-238, the FCC's rules at 51.319(c)(3) state:

Local Tandem Switching Capability. The tandem switching capability network element is defined as:

(ii) Trunk-connect facilities, which include, but are not limited to, the connection between trunk termination at a cross connect panel and switch trunk card;

(iii) The basic switch trunk function of connecting trunks to trunks; and

(iv) The functions that are centralized in tandem switches (as distinguished from separate end office switches), including but not limited, to call recording, the routing of calls to operator services, and signaling conversion features.

Q. HOW DOES THE FCC'S DEFINITION OF TANDEM SWITCHING APPLY TO THIS ISSUE?

A. To receive reciprocal compensation for tandem switching, a carrier must be performing all of the functions described in the FCC's definition of tandem switching. It is not enough that the switch is simply "capable" of providing the function of a tandem switch, it has to be providing those functions for local calls. This is true, if for no other reason, because the reciprocal compensation rate for tandem switching is the same as the UNE rate for tandem switching. That rate recovers the cost of performing, for local calls, the functions described in the FCC's definition. Otherwise, the carrier would simply be receiving a windfall.

If Sprint's switches are only switching traffic for end users directly connected to that switch, then that is an end office switching function, not a tandem switching function. As stated in the FCC's definition, to provide tandem switching, Sprint's switch must connect trunks terminated in one end office switch to trunks terminated in another end office switch. Based on Sprint's testimony, Sprint does not claim that its switches provide that function. If, instead, Sprint's switches are connecting trunks to end users' lines, the local end office switching rate fully compensates Sprint for performing this function.

Q. WHAT OTHER SUPPORT DO YOU HAVE THAT CONTRADICTS SPRINT'S CLAIM THAT THE ONLY CRITERIA FOR DETERMINING

ELIGIBILITY FOR TANDEM SWITCHING CHARGES IS THE GEOGRAPHIC AREA SERVED?

A. As I have stated above, the FCC has a two-part test to determine if a carrier is eligible for tandem switching: 1) an ALEC's switch must serve the same geographic area as the ILEC's tandem switch; and 2) an ALEC's switch must perform tandem switching functions. This is not just BellSouth's view. In a case involving MCI (MCI Telecommunication Corp. v. Illinois Bell Telephone, 1999 U.S. Dist. LEXIS 11418 (N.D. Ill. June 22, 1999)), the U.S. District Court specifically determined that the test required by the FCC's rule is a functionality/geography test. In its Order, the Court stated:

> *In deciding whether MCI was entitled to the tandem interconnection rate, the ICC applied a test promulgated by the FCC to determine whether MCI's single switch in Bensonville, Illinois, performed functions similar to, and served a geographical area comparable with, an Ameritech tandem switch.*[9] *(emphasis added)*
>
> [9]*MCI contends the Supreme Court's decision in IUB affects resolution of the tandem interconnection rate dispute. It does not. IUB upheld the FCC's pricing regulations, including the 'functionality/geography' test. 119 S. Ct. at 733. MCI admits that the ICC used this test. (Pl. Br. At 24.) Nevertheless, in its supplemental brief, MCI recharacterizes its attack on the ICC decision, contending the ICC applied the wrong test. (Pl. Supp. Br. At 7-8.) But there is no real dispute that the ICC applied the functionality/geography test; the dispute centers around whether*

the ICC reached the proper conclusion under that test. (Emphasis added)

Indeed, the Ninth Circuit Court of Appeals viewed the rule in the same way, finding that:

> *[t]he Commission properly considered whether MFS's switch performs similar functions and serves a geographic area comparable to US West's tandem switch. (U.S. West Communications v. MFS Intelenet, Inc, et. al, 193 F. 3d 1112, 1124)*

Q. DOES SPRINT'S SWITCH SERVE A GEOGRAPHIC AREA COMPARABLE TO BELLSOUTH'S TANDEM?

A. Without additional information, it is not possible to determine whether Sprint's switch actually serves a geographic area comparable to BellSouth's tandem. Although Sprint's petition tends to suggest that Sprint's switch covers an area comparable to BellSouth's tandem switches, Sprint offers absolutely no evidence to support such a position. Even if one were to assume that Sprint's switch covers a geographic area similar to BellSouth's tandem, unless Sprint's switch is performing tandem functions, which the FCC has indicated is one of the required criteria that an ALEC's switch must meet, Sprint is not eligible for the tandem switching element of reciprocal compensation.

To illustrate the importance of this point, assume Sprint has ten customers in Orlando, all of which are located in a single office complex next door to

Sprint's Orlando switch. Under no set of circumstances could Sprint seriously argue that, in such a case, its switch serves a comparable geographic area to BellSouth's switch. See Decision 99-09-069, In re: Petition of Pacific Bell for Arbitration of an Interconnection Agreement with MFS/WorldCom, Application 99-03-047, 9/16/99, at 15-16 (finding "unpersuasive" MFS's showing that its switch served a comparable geographic area when many of MFS's ISP customers were actually collocated with MFS's switch).

Q. HAS THIS COMMISSION PREVIOUSLY RULED ON THE ISSUE OF APPLICABILITY OF RECIPROCAL COMPENSATION TO TANDEM SWITCHING?

A. Yes. This issue was addressed by this Commission recently in its August 22, 2000 Order No. PSC-00-1519-FOF-TP in Docket No. 991854-TP (Intermedia/BellSouth Arbitration). At page 12, the Order states:

> *In evaluating this issue, we are presented with two criteria set forth in FCC 96-325, ¶1090, for determining whether symmetrical reciprocal compensation at the tandem rate is appropriate: similar functionality and comparable geographic areas.*

Further, at page 14, the Order concludes:

> *We find the evidence of record insufficient to determine if the second, geographic criterion is met. We are unable to reasonably determine if Intermedia is actually serving the areas they have designated as local calling areas. As such, we are unable to determine that Intermedia*

should be compensated at the tandem rate based on geographic coverage.

As mentioned above, neither do we find sufficient evidence in the record indicating that Intermedia's switch is performing similar functions to that of a tandem switch. Therefore, we are unable to find that Intermedia should be compensated at the tandem rate based on similar functionality as well. This is consistent with past decisions of this Commission.

Earlier, the Florida Public Service Commission, in Order No. PSC-97-0294-FOF-TP, Docket 961230-TP, dated March 14, 1997, concluded at pages 10-11:

We find that the Act does not intend for carriers such as MCI to be compensated for a function they do not perform. Even though MCI argues that its network performs 'equivalent functionalities' as Sprint in terminating a call, MCI has not proven that it actually deploys both tandem and end office switches in its network. If these functions are not actually performed, then there cannot be a cost and a charge associated with them. Upon consideration, we therefore conclude that MCI is not entitled to compensation for transport and tandem switching unless it actually performs each function.

Similarly, Florida Order No. PSC-96-1532-FOF-TP, Docket No. 960838-TP, dated December 16, 1996, states at page 4:

The evidence in the record does not support MFS' position that its switch provides the transport element; and the Act does not contemplate that the compensation for transporting and terminating local traffic should be symmetrical when one party does not actually use the network facility for which it seeks compensation. Accordingly, we hold that MFS should not charge Sprint for transport because MFS does not actually perform this function.

Reinstatement of the FCC's rules previously vacated by the Eighth Circuit Court of Appeals does not alter the correctness of this Commission's conclusions.

Q. WHAT DOES BELLSOUTH REQUEST THE COMMISSION DO?

A. Absent evidence that Sprint's switches actually serve the same geographic area as BellSouth's tandems, and absent evidence that Sprint's switches do perform the functions of a tandem switch, BellSouth requests that this Commission determine that Sprint is only entitled, where it provides local switching, to the end office switching rate. BellSouth is not disputing Sprint's right to compensation at the tandem rate where the facts support such a conclusion. In this proceeding, however, Sprint is seeking a decision that allows it to be compensated for functionality it does not provide.

Issue No. 12: Should voice-over-Internet ('IP Telephony') traffic be included in the definition of 'Switched Access Traffic'?

Q. WHAT IS BELLSOUTH'S UNDERSTANDING OF ISSUE 12?

A. BellSouth understands this issue to be whether voice-over-Internet ("IP telephony") traffic should be included in the definition of "switched access traffic", which would obligate Sprint to pay switched access charges for such calls.

Q. WHAT IS BELLSOUTH'S POSITION ON THIS ISSUE?

A. BellSouth believes that the jurisdiction of a call is determined by the end points of the call, not the technology used to transport the call. Therefore, phone-to-phone calls using IP telephony, which originate and terminate in different local calling areas, are subject to switched access today. Under no circumstance would such calls be subject to reciprocal compensation.

Q. DO YOU AGREE WITH SPRINT THAT THIS ARBITRATION PROCEEDING IS NOT THE APPROPRIATE FORUM TO ADDRESS THE QUESTION OF WHETHER IP TELEPHONY SHOULD BE INCLUDED IN THE DEFINITION OF SWITCHED ACCESS AND, THEREFORE, SUBJECT TO ACCESS CHARGES OR OTHER FORMS OF TRADITIONAL TELECOMMUNICATIONS REGULATIONS?

A. With respect to long distance phone-to-phone IP telephony, there is no public policy question to address. Access charges, not reciprocal compensation, apply to long distance telecommunications. As with the issue of reciprocal compensation for ISP-bound traffic, the IP telephony issue is one that primarily should be addressed by the FCC. Although IP telephony should not be an issue in an arbitration of a local interconnection agreement, this Commission can address the questions regarding inter-carrier compensation for intrastate, interLATA, and local traffic.

Q. WHAT IS INTERNET PROTOCOL ("IP") TELEPHONY?

A. IP telephony is telecommunications service that is provided using Internet Protocol for one or more segments of the call. IP telephony is, in very simple and basic terms, a mode or method of completing a telephone call. The word "Internet" in Internet Protocol telephony refers to the name of the protocol; it does not mean that the service uses the World Wide Web. Currently, there are various technologies used to transmit telephone calls, of which the most common are analog and digital. In the case of IP telephony originated from a traditional telephone set, the local carrier first converts the voice call from analog to digital. The digital call is sent to a gateway that takes the digital voice signal and converts, or packages, it into data packets. These data packets are like envelopes with addresses which "carry" the signal across a network until they reach their destination, which is known by the address on the data packet, or envelope. This destination is another gateway, which reassembles the packets and converts the signal to analog, or a plain old telephone call, to be terminated on the called party's local telephone company's lines.

To explain it another way, Phone-to-Phone IP telephony is where an end user customer uses a traditional telephone set to call another traditional telephone set using IP telephony. The fact that IP technology is used, at least in part, to complete the call is transparent to the end user. Phone-to-Phone IP telephony is identical, by all relevant regulatory and legal measures, to any other basic telecommunications service, and should not be confused with calls to the Internet through an ISP. Characteristics of Phone-to-Phone IP telephony are:

- IP telephony provider gives end users traditional dial tone (not modem buzz);
- End user does not call modem bank;
- Uses traditional telephone sets (vs. computer);
- Call routes using telephone numbers (not IP addresses);
- Basic telecommunications (not enhanced);
- IP Telephone providers are telephone carriers (not ISPs).

Phone-to-Phone IP telephony should not be confused with Computer-to-Computer IP telephony, where computer users use the Internet to provide telecommunications to themselves.

Q. WHAT IS INTERNET PROTOCOL?

A. Technically speaking, Internet protocol, or any other protocol, is an agreed upon set of technical operating specifications for managing and interconnecting networks. In the above example, I referred to the gateways that convert the digital carrier voice signal into data packets and then from data packets back to digital carrier. The Internet Protocol is the language, or signaling, that these gateways use to talk to each other. It has nothing to do with the transmission medium (wire, fiber, microwave, etc.) that carries the data packets between the gateways, but rather the gateways, or switches that are found on either end of that medium.

Q. SHOULD IP TELEPHONY BE DEFINED AS SWITCHED ACCESS?

A. It depends. Calls utilizing Internet Protocol that originate and terminate in the same local calling area should be treated like any other local call. BellSouth's position is, if such traffic is truly local in nature, then it is not subject to switched access charges. Applicable switched access charges, however, should apply to a long distance telephone call regardless of whether Internet Protocol is used for a portion of the call.

Q. HOW ARE IP TELEPHONY CALLS DIFFERENT FROM INTERNET SERVICE PROVIDER (ISP) BOUND TRAFFIC?

A. Even though IP telephony and ISP-bound traffic both have the word "Internet" in their name, they are completely different services and should not be confused. The FCC's April 10, 1998 Report to Congress states: "The record... suggests... 'phone-to-phone IP telephony' services lack the characteristics that would render them 'information services' within the meaning of the statute, and instead bear the characteristics of 'telecommunication services'." Further, Section 3 of the Telecommunications Act of 1996 defines "telecommunications" as the "transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent and received." Thus, IP telephony is telecommunications service, not information or enhanced service.

Q. DOES THE FCC VIEW ISP-BOUND TRAFFIC DIFFERENTLY THAN IP TELEPHONY IN TERMS OF APPLICABLE CHARGES?

A. Yes. Neither ISP-bound traffic nor long distance IP telephony transmitted traffic is local traffic; however, the FCC has treated the two types of traffic differently in terms of the rates that such providers pay for access to the local exchange company's network. Enhanced Service Providers ("ESPs"), or ISPs, have been exempted by the FCC from paying access charges for use of the local network in order to encourage the growth of these emerging services – most specifically access to the Internet. The FCC has found that ESPs and ISPs use interstate access service, but are exempt from switched access charges applicable to other long distance traffic. On the other hand, the transmission of long-distance voice services – whether by IP telephony or by more traditional means -- is not an emerging industry. In fact, it is a mature industry – one that is not exempt from paying access charges for the use of the local network. All other long-distance carriers currently pay these same access charges. BellSouth is required to assess access charges on long distance calls. To do otherwise would be to discriminate between long-distance carriers utilizing IP telephony and those who do not.

Q. WHY HAS BELLSOUTH INCLUDED AN EXCEPTION FOR LONG DISTANCE IP TELEPHONY IN ITS PROPOSED DEFINITION OF LOCAL TRAFFIC IN THE NEGOTIATIONS WITH SPRINT?

A. In seeking to include a sentence addressing IP telephony, BellSouth is simply attempting to be clear in the agreement that switched access charges, not reciprocal compensation, apply to phone-to-phone long distance calls that are transmitted using IP telephony. From the end user's perspective, and, indeed from the interexchange carrier's ("IXC's") perspective, such calls are indistinguishable from regular circuit switched long distance calls. The IXC may use IP technology to transport all, or some portion, of the long distance call, but that does not change the fact that it is a long distance call. Even if the Commission is unable to decide whether access charges apply, it is clear that reciprocal compensation does not.

Consider the example of a call from Jacksonville to Atlanta sent over Sprint's circuit switched network. Certainly, this call is a long distance call, and access charges would apply. If Sprint, however, transported that same call using IP telephony, Sprint's position is that the call from Jacksonville to Atlanta is a local call and that reciprocal compensation applies. Surely, Sprint's choice of transmission medium does not transform a long distance call into a local call.

Due to the increasing use of IP technology mixed with traditional analog and digital technology to transport voice long distance telephone calls, BellSouth's position is that it is important to specify in the agreement that such traffic is not local traffic, the same as any other long distance traffic is not local traffic.

Q. HAS INTERNET PROTOCOL TELEPHONY BEEN ADDRESSED BY THE FCC?

A. Yes. In addition to the Report to Congress mentioned earlier, in ¶104 of FCC Docket No. 96-149, the FCC states "[w]e further conclude that, subject to the exceptions discussed below, protocol processing services constitute information services under the 1996 Act." In ¶106, the FCC describes these exceptions.

> *. . . we have treated three categories of protocol processing services as basic services, rather than enhanced services, because they result in no net protocol conversion to the end-user. These categories include protocol processing: 1) involving communications between an end-user and the network itself . . . rather than between or among users; 2) in connection with the introduction of a new basic network technology. . .; and 3) involving internetworking (conversions taking place solely within the carrier's network to facilitate provision of a basic network service, that result in no net conversion to the end user. (Emphasis added.)*

In the issue at hand, phone-to-phone IP telephony (exception 3 above), a voice call made at the originating end that ends up a voice call at the terminating end, is a "no net" protocol conversion and, therefore, is not an information service, in accordance with the above FCC exceptions. Phone-to-phone Internet Protocol telephony has no net protocol conversion and should be treated as a telecommunications service.

Q. WHAT IS BELLSOUTH ASKING THIS COMMISSION TO DECIDE ON THIS ISSUE?

A. BellSouth agrees that the interstate portion of this issue should not be included in an arbitration proceeding on local interconnection. BellSouth urges the Commission to defer decision of whether IP telephony is switched access until the FCC makes a decision on the interstate issue. BellSouth, however, also urges the Commission to find, on this issue, that regardless of the FCC's decision on switched access, that reciprocal compensation is **not** due, under any circumstance, for non-local IP telephony transmitted traffic.

If the Commission determines that it must decide on contract language at this time, BellSouth requests that this Commission adopt the following language:

> Switched Access Traffic. Switched Access Traffic is described in the BellSouth Access Tariff. Additionally, any Public Switched Telephone Network interexchange telecommunications traffic, regardless of transport protocol method, where the originating and terminating points, end-to-end points, are in different LATAs, or are in the same LATA and the Parties' Switched Access services are used for the origination or termination of the call, shall be considered Switched Access Traffic. Irrespective of transport protocol method used, a call

that originates in one LATA and terminates in another LATA (i.e., the end-to-end points of the call) shall not be compensated as local.

Issue No. 23: Should the Agreement contain a provision stating that if BellSouth has provided its affiliate preferential treatment for products or services as compared to the provision of those same products or services to Sprint, then the applicable standard (i.e., benchmark or parity) will be replaced for that month with the level of service provided to the BellSouth affiliate?

Q. WHAT IS BELLSOUTH'S POSITION ON THIS ISSUE?

A. BellSouth believes that the retail analog is the appropriate analog for determining whether BellSouth provides service at parity to ALECs. Sprint seems to propose, inappropriately, that BellSouth's performance to its ALEC, if better than BellSouth's performance to its retail customers, serve as the basis from which parity should be measured. Moreover, under Sprint's proposal, some months the analog would be BellSouth's performance to its retail units, and some months it would be its performance to its ALEC. To make BellSouth's monthly standard a moving target is absurd and defeats the purpose of having self-effectuating, easily implemented performance standards in the first place.

Q. HOW IS THE TERM AFFILIATE DEFINED IN THE ACT?

A. The term "Affiliate" is defined in the Act as follows:

> AFFILIATE - The term "affiliate" means a person that (directly or indirectly) owns or controls, is owned or controlled by, or is under common ownership or control with, another person. For purposes of this paragraph, the term "own" means to own an equity interest (or the equivalent thereof) of more than 10 percent. (47 U.S.C. 153(1))

This definition would apply under the Act for all purposes. The definition of affiliate in the Act, however, is irrelevant in Sprint's proposal. The real issue is the extent that affiliate performance is used to assess discrimination.

Q. SHOULD THIS COMMISSION ALTER A PERFORMANCE MEASUREMENT STANDARD IN A SPECIFIC MONTH IF BELLSOUTH PROVIDES SUPERIOR SERVICE TO ITS AFFILIATES FOR ANY PERFORMANCE MEASUREMENT?

A. Absolutely not. In the context of performance measurements and enforcement mechanisms, the only current BellSouth affiliate that could potentially be relevant to this discussion is BellSouth's ALEC, because it is the only affiliate that can provide local exchange services. Sprint's concern is at best hypothetical. Inclusion in this discussion of any other BellSouth affiliate, none of which offer local exchange service, would be inappropriate. Moreover, BellSouth has a legal obligation to provide non-discriminatory service to all ALECs, including its own.

Q. IS BELLSOUTH'S POSITION THAT PERFORMANCE SHOULD BE ASSESSED BASED ON RETAIL SERVICE OFFERINGS CONSISTENT WITH THE FCC'S RULINGS?

A. Yes. Although the FCC, has in some instances made mention of affiliates, all assessments made by the FCC have been based on the BOC's performance to its retail customers. The test that the FCC actually applied in the BA-NY application focused on Bell Atlantic's retail service offerings and not to offerings to an affiliate. In ¶ 68 of the Order, the FCC found that Bell Atlantic provided nondiscriminatory access to interconnection trunking because the trunking that it provides to CLECs "is equal in quality to the interconnection that Bell Atlantic provides to its own retail operations . . ." Likewise, the FCC found that Bell Atlantic was compliant with Checklist Item 6 (unbundled local switching) based upon a finding that "the features, functions and capabilities of the switch [provided to the CLEC] include the basic switching function as well as the same basic capabilities that are available to the incumbent LEC's customers." (¶ 343) Upon review of the BA-NY Order, it is clear that the analysis that was performed to determine whether a retail analog had been met was simply to compare the performance provided to the ALEC to the performance that Bell Atlantic provided to its retail customers. Thus, it is obvious that performance to affiliates played no role in the analysis.

With respect to services measured by benchmarks instead of retail analogs, Sprint's proposal is irrelevant. With benchmarks, the only relevant test is whether the predetermined benchmark is met. The benchmark does not change from month to month, nor would the benchmark differ for ALECs and the BellSouth affiliate ALEC. Performance is measured and remedies are paid based on a constant benchmark.

Q. IF BELLSOUTH'S ALEC BEGINS PROVIDING SERVICE IN BELLSOUTH'S SERVICE AREA AT SOME POINT IN THE FUTURE, HOW SHOULD ITS PERFORMANCE BE USED?

A. As with all other ALECs, BellSouth will produce measurements for its ALEC, both individually and in the aggregate. In fact, BellSouth's ALEC will get the same treatment, use the same systems, receive the same measurements and be entitled to the same remedies as any other ALEC operating in BellSouth's service territory. In addition, the performance of the BellSouth ALEC will be included to develop the aggregate ALEC data used to determine performance for purposes of both Tier-2 and Tier-3. Further, BellSouth will provide to the Commission periodic performance results for its ALEC just as it does for any other ALEC operating in its territory. Thus, the Commission will have the opportunity to evaluate BellSouth's performance to its ALEC relative to all other ALECs. It would be more appropriate to address this issue if it becomes a problem, rather than unnecessarily complicate the plan to deal with a hypothetical occurrence.

Q. WHAT IS BELLSOUTH ASKING OF THIS COMMISSION WITH RESPECT TO ISSUE 23?

A. BellSouth is requesting that the Commission reject Sprint's proposal. The FCC has determined, and rightly so, that performance comparisons should be made to the service BellSouth provides its retail customers. There is no requirement, nor is there need for any, that BellSouth take one small aspect of "itself" (i.e., its CLEC) and create a separate standard based on performance to that affiliate.

Issue 26: Should the availability of BellSouth's VSEEM III remedies proposal to Sprint, and the effective date of VSEEM III, be tied to the date that BellSouth receives interLATA authority in Florida?

Q. WHAT IS BELLSOUTH'S POSITION ON THIS ISSUE?

A. BellSouth's position is that, because the FCC has identified the implementation of enforcement mechanisms and penalties to be a condition of 271 relief, it would be inappropriate to implement such mechanisms prior to BellSouth's obtaining interLATA relief. The FCC's view of enforcement mechanisms and penalties is that such a plan would be an additional incentive to ensure that an ILEC continues to comply with the competitive checklist after interLATA relief is granted. However, the FCC has never indicated that enforcement mechanisms and penalties are either necessary or required to ensure that BellSouth meets its obligations under Section 251 of the Act.

Therefore, because performance penalties serve no purpose until after interLATA 271 relief is granted, BellSouth recommends that its VSEEM III proposal take effect when the plan becomes necessary to serve its purpose; i.e., after BellSouth receives interLATA authority. Under BellSouth's proposal, each Florida ALEC that has incorporated the plan into its interconnection agreement will be eligible for payment of penalties by BellSouth at such time as BellSouth obtains interLATA relief in Florida.

Q. HAS BELLSOUTH AGREED TO A DIFFERENT IMPLEMENTATION SCHEDULE FOR TIER – 1 PENALTIES WITH SOME ALECs?

A. Yes. As part of an overall contract negotiation and settlement process, BellSouth has included a different implementation schedule in its interconnection agreement with certain ALECs. This negotiated arrangement was part of a settlement of numerous arbitration issues and is not part of BellSouth's standard VEEMS III offering. Basically, the difference in this negotiated agreement as compared to BellSouth's standard VSEEMS III proposal is that Tier I damages will be payable to an ALEC in all states in which the ALEC has an interconnection agreement with BellSouth once long distance relief is granted in any state. Thus, any ALEC in Florida that has incorporated the negotiated plan into its interconnection agreements will be eligible to receive Tier I damages once BellSouth receives long distance authority in any state. As with BellSouth's standard VSEEM III proposal, Tier-2 and Tier-3 remedies would take effect in a particular state when BellSouth obtains interLATA relief in that state.

Q. IS IT APPROPRIATE FOR THE FPSC TO ORDER IMPLEMENTATION

OF A SELF-EXECUTING REMEDY PLAN WITHOUT BELLSOUTH'S CONSENT?

A. Because enforcement mechanisms are not required by the Act nor by any FCC rule, BellSouth does not think it is appropriate for a state commission to order BellSouth to implement a self-executing remedy plan without BellSouth's consent. To the extent that any breach of contract issue should arise, there are perfectly adequate State law and Commission procedures available to address such situations. BellSouth's SQMs are fully enforceable through Commission complaints in the event of BellSouth's failure to meet such measurements.

Further, nothing in the Act requires a self-executing enforcement plan. The FCC has acknowledged as much in its orders. In its August 1996 Local Competition Order, the FCC notes that several carriers advocated performance penalties. *See Local Competition Order, 11 FCC Rcd at 15658 [¶ 305].* The FCC did not adopt such performance penalties in the Local Competition Order. Instead, it acknowledged the wide variety of remedies available to an ALEC when it believes it has received discriminatory performance in violation of the Act; *see FCC's Local Competition Order ¶ 129, 11 FCC Rcd. at 15565 (emphasizing the existence of sections 207 and 208 FCC complaints for damages, as well as actions under the antitrust laws, other statutes and common law);* and "encourage[d]" the States only to adopt reporting requirements for ILECs. Likewise, in its order approving Bell Atlantic's entry into long distance in New York, the FCC analyzed Bell Atlantic's performance plan "solely for the purpose of determining whether the risk of post-approval non-compliance is sufficiently great that approval of its section 271 application would not be in the public interest." Bell Atlantic Order, at ¶433 n.1326.

Furthermore, in its October 13, 1998 order regarding BellSouth's Section 271 application for Louisiana, the FCC reiterated that the existence of such an enforcement plan is not a pre-requisite to compliance with the competitive checklist, but rather is a factor that the FCC will consider in assessing whether the RBOC's entrance into the interLATA market would serve the "public interest." See FCC's Louisiana II Order, at ¶363 and n.1136. The FCC stated that "evidence that a BOC has agreed in its interconnection agreements to performance monitoring" (including performance standards, reporting requirements, and appropriate self-executing enforcement mechanisms) "would be probative evidence that a BOC will continue to cooperate with new entrants, even after it is authorized to provide in-region, interLATA services." Id. at ¶¶363-64.

In a recent Ninth Circuit decision, when discussing objective performance standards, the Court held that:

> *Neither the Act nor any FCC rule affirmatively requires states to do so, however. The FCC might have wanted the WUTC to impose more specific requirements, such as objective performance standards, on an incumbent like U.S. West, but again, our review seeks to determine solely whether the lack of those requirements violates the Act. In the absence of an FCC rule, the law does not require them.*

MCI Telecommunications, Inc. et al v. U.S. West Communications, 204 F.3d 1262 (9th Cir. March 2, 2000).

The FCC has made it clear that the primary, if not sole, purpose of a voluntary self effectuating remedy plan is to guard against RBOC "backsliding"; that is, providing discriminatory performance after it has received the so-called "carrot" of long distance approval.

Issue 27: Should BellSouth be required to apply a statistical methodology to the SQM performance measures provided to Sprint?

Q. WHAT IS BELLSOUTH'S UNDESTANDING OF THIS ISSUE?

A. BellSouth understands that in this issue Sprint is requesting the Commission to require BellSouth to provide the statistical methodology related to its VSEEM III plan, as part of its SQM.

Q. WHAT IS BELLSOUTH'S POSITION ON THIS ISSUE?

A. BellSouth is not required to provide information to Sprint that relates to a plan not being offered to Sprint. Sprint, inappropriately, is trying to merge the contents of two different plans. The statistical methodology that Sprint is requesting is part and parcel of BellSouth's VSEEM III remedies proposal, and not a part of BellSouth's SQM. As I stated before, VSEEM III is not being offered to Sprint and, therefore, Sprint is not entitled to the information being requested.

Issue 28a: Should BellSouth be required to provide Sprint with two-way trunks upon request?

Issue 28b: Should BellSouth be required to use those two-way trunks for BellSouth originated traffic?

Q. IS BELLSOUTH REQUIRED TO PROVIDE SPRINT WITH TWO-WAY TRUNKS, UPON SPRINT'S REQUEST?

A. Yes. In accordance with FCC Rule §51.305(f), BellSouth is required to, does, and will continue to provide Sprint two-way trunks at Sprint's request.

Q. SHOULD BELLSOUTH BE REQUIRED TO USE TWO –WAY TRUNKS FOR ITS ORIGINATED TRAFFIC?

A. No. Per ¶219 of the FCC's First Report and Order in Docket 96-98, BellSouth is obligated to put its originating traffic over two-way local interconnection trunks only where traffic volumes are too low to justify one-way trunks. In all other instances, BellSouth is able to use one-way trunks for its traffic, if it so chooses. Nonetheless, BellSouth is not opposed to the use of two-way trunks where it makes sense and the provisioning arrangements can be mutually agreed upon.

Issue 30: Under what conditions, if any, should the parties be permitted to assign an NPA/NXX code to end users outside the rate center in which the NPA/NXX is homed?

Q. WHAT IS BELLSOUTH'S POSITION ON THIS ISSUE?

A. BellSouth is not attempting to restrict Sprint's ability to allocate numbers out of its assigned NPA/NXX codes to its end users. It does not matter to BellSouth how Sprint chooses to allocate its numbers to its end users. Sprint can assign a telephone number to a customer who is physically located in a different local calling area than the local calling area where that NPA/NXX is homed. If Sprint, however, chooses to assign its telephone numbers in this manner, calls originated by BellSouth end users to those distant Sprint customers are not local calls. Consequently, such calls are not local traffic under the agreement and no reciprocal compensation applies. Further, Sprint should identify such long distance traffic and pay BellSouth for the originating switched access service BellSouth provides on those calls.

Q. WHAT DO YOU MEAN WHEN YOU SAY AN NPA/NXX IS ASSIGNED TO A RATE CENTER?

A. When Sprint, or any other carrier, is given an NPA/NXX code by the North American Numbering Plan Administrator, the carrier must assign that NPA/NXX code to a rate center. All other carriers use this assignment information to determine whether calls originated by its customers to numbers in that NPA/NXX code are local or long distance calls. When Sprint, or any other carrier, is given an NPA/NXX code by the North American Numbering Plan Administrator, the carrier must assign that NPA/NXX code to a rate center. All other carriers use this assignment information to determine whether calls originated by its customers to numbers in that NPA/NXX code are local or long distance calls. For example, assume that the administrator assigns the 305/336 NPA/NXX to Sprint. Sprint tells the administrator where 305/336 is assigned. Let's say Sprint assigns the 305/336 code to the Jupiter, Florida rate center. When a local carrier's customer calls a number in the 305/336 code, the local carrier bills its customer based upon whether a call from the location where the call originates to the Jupiter, Florida rate center is a local call or a long distance call. If a BellSouth customer in the Jupiter local calling area calls a number in the 305/336 code in this example, BellSouth treats the call as a local call for purposes of billing its Jupiter, Florida customer. Likewise, if a BellSouth customer in Miami calls a number in the 305/336 code, BellSouth would bill the customer for a long distance call.

Q. IS SPRINT RESTRICTED TO GIVING NUMBERS, ASSIGNED TO A PARTICULAR RATE CENTER, TO CUSTOMERS WHO ARE PHYSICALLY LOCATED IN THAT SAME RATE CENTER?

A. No. In the example above, Sprint is not restricted to giving numbers in the 305/336 code only to customers that are physically located in the Jupiter, Florida rate center. Sprint is permitted to assign a number in the 305/336 code to any of its customers regardless of where they are physically located. Again, BellSouth is not attempting to restrict Sprint's ability to do this.

Sprint could assign a number, say 305-336-7777, to one of its customers who is physically located in Jupiter, Florida. A BellSouth customer in Jupiter who calls 305-336-7777 would be billed as if he or she made a local call. BellSouth agrees that this is a local call and, therefore, appropriate reciprocal compensation should apply.

However, let's see what happens if Sprint disassociates the physical location of a customer with a particular telephone number from the rate center where that NPA/NXX code is assigned. Assume that Sprint gives the number 305-336-2000 to one of its customers in Miami. If a BellSouth customer in Jupiter calls 305-336-2000, BellSouth will bill its customer in Jupiter as if the customer made a local call. However, BellSouth would hand off the call to Sprint at a BellSouth designated point of interconnection. Sprint would then carry the call from that point of interconnection to its end user in Miami. The end points of the call are in Jupiter and Miami, and, therefore, would normally be a long distance call. To use a more extreme example, Sprint could elect to assign another number, say 305-336-3000 to one of its customers who is physically located in New York. A call from a BellSouth customer in Jupiter, Florida to 305-336-3000 would be treated as if he made a local call, but the call would actually terminate in New York, which plainly would be a long distance call. Under Sprint's proposal, BellSouth would pay reciprocal compensation on those calls from Jupiter to Miami or from Jupiter to New York, which are clearly long distance calls and should not be subject to reciprocal compensation.

Q. IS TRAFFIC JURISDICTION ALWAYS DETERMINED BY THE RATE CENTERS WHERE THE ORIGINATING AND TERMINATING NPA/NXXs ARE ASSIGNED, AS INDICATED IN SPRINT'S PETITION?

A. No. Traffic jurisdiction based on rate center assignment may be used for retail end user billing, but not for inter-company compensation purposes. The FCC has made it clear that traffic jurisdiction is determined based upon the originating and terminating end points of a call, not the NPA/NXXs of the calling or called number. One example is originating Feature Group A (FGA) access service. Even though the originating end user dials a number that appears local to him or her, no one disputes that originating FGA traffic is switched access traffic with respect to jurisdiction and compensation between the involved companies. As the Commission is aware, FGA access service is not a local service.

Another example is Foreign Exchange (FX) service. Here again, it appears to the originating customer that they are making a local call when, in fact, the terminating location is outside the local calling area. Further, because the call to the FX number appears local and the calling and called NPA/NXXs are assigned to the same rate center, the originating end user is not billed for a toll call. Despite the fact that the calls appear to be local to the originating caller, FX service is clearly a long distance service.

Q. WHAT IS THE CLOSEST PARALLEL TO THE SERVICE YOU HAVE DESCRIBED THAT IS THE SUBJECT OF THIS ISSUE?

A. The closest parallel is 800 service. While there are some comparable characteristics to the previously described Feature Group A (FGA) and Foreign Exchange (FX) service, the service described here does not use lines dedicated to a particular customer for transporting the call between rate centers. Instead, the calls in this issue are placed to a "toll free" number and routed over trunking facilities to a distant location that would normally incur a toll charge for the originating customer. By utilizing enough NPA/NXX codes, SPRINT could provide this "toll free" 800-like service throughout the state or the nation. Just as it is clear that 800 service is not local and that access charges apply rather than reciprocal compensation, it is also clear that service provided through the use of NPA/NXXs outside the local calling area where the NPA/NXX is assigned is not local and reciprocal compensation is not appropriate.

Q. WHEN SPRINT ASSIGNS NUMBERS IN THE MANNER YOU HAVE DESCRIBED, IS IT ATTEMPTING TO DEFINE ITS OWN LOCAL CALLING AREA?

A. No. When Sprint assigns numbers in the manner described, Sprint is not necessarily attempting to define a different local calling area for its customers than the local calling area offered by BellSouth. In fact, in the previous hypothetical example of the 305/336 code that Sprint assigns to Jupiter, Sprint does not need to have any customers who are physically located in the Jupiter local calling area. What Sprint is doing is offering free interexchange calling to customers of other LECs (i.e. BellSouth). Sprint is offering a service that allows BellSouth's local service customers to make "local" calls to selected customers of Sprint who are physically located in a different local calling area. At best, in the Jupiter example, Sprint is attempting to redefine the local calling area of BellSouth's customers in Jupiter.

Sprint is only permitted to define the local calling area for its customers. If, in the example, Sprint had any of its own local service customers in Jupiter, and offered those customers the ability to call Miami without long distance charges, then it could be said that Sprint was offering a local calling area in Jupiter that was different from BellSouth's. The local calling area, however, would be defined that way only for those customers to whom Sprint provided local service. Sprint is free to design whatever local calling area it wants for its customers. Sprint, however, is not free to determine the local calling area for BellSouth customers. Specifically, Sprint cannot provide interexchange service to BellSouth's local end-user customers and call that service local, even if it is provided on a toll-free basis.

Q. HOW DOES THE RESOLUTION OF THIS ISSUE IMPACT THE DEGREE OF LOCAL COMPETITION IN FLORIDA?

A. Some ALECs have claimed that BellSouth's position on this issue would impede local competition. However, the service at issue here has nothing to do with local competition. Using the Jupiter example, the service described in this issue does not create a local service, let alone any local service competition, in Jupiter. Local service competition is only created where Sprint offers local service to its own customers. The service at issue here is offered to BellSouth's local service customers in Jupiter, regardless of whether Sprint has any local service customers physically located in Jupiter. When Sprint allows a BellSouth customer in Jupiter to make a toll free call to one of its 800 service numbers, no local competition is created in Jupiter. Likewise, in the example, when Sprint assigns a number out of the 305/336 code to one if its customers in Miami, precisely the same amount of local competition is created in Jupiter (where the 305/336 code is assigned) as is created by Sprint's 800 service offerings; i.e., none. In this case, Sprint has no contact or business relationship with the BellSouth customers for use of this service. These customers remain, in fact, BellSouth's local service customers. There is nothing that Sprint is providing in this case that even resembles local service. Yet, Sprint claims that it should be paid reciprocal compensation for providing this service.

Q. WHAT OTHER COMMISSIONS HAVE ADDRESSED WHETHER THE SERVICE DESCRIBED IN THIS ISSUE IS LOCAL OR INTEREXCHANGE?

A. To my knowledge, only the Maine Commission has definitively ruled on whether the service described in this issue is local or interexchange service.

The California Commission has heard the issue, but did not decide whether the service was local or interexchange and deferred the issue of appropriate inter-carrier compensation to a later date.

Q. BRIEFLY DESCRIBE THE MAINE COMMISSION'S ORDER THAT YOU REFERRED TO ABOVE.

A. The Maine Commission's Order, attached to my testimony as Exhibit JAR-3, was issued on June 30, 2000 in Docket Nos. 98-758 and 99-593. The service at issue in that order is the same type of service described in this issue. (Order at p. 4) Brooks Fiber ("Brooks" – a subsidiary of MCI WorldCom) had been assigned 54 NPA/NXX codes that it had subsequently assigned to various exchanges that are outside the Portland, Maine local calling area. Brooks had assigned numbers from those codes to its customers who were physically located in Portland. The Maine Commission was trying to determine whether Brooks was entitled to retain the NPA/NXX codes used for the service. If the service was local, Brooks was entitled to the codes; if the service was interexchange, Brooks Fiber had to relinquish the codes. The Maine Commission concluded that the service was interexchange. Since Brooks did not have any customers at all in the rate centers where 45 of the codes were assigned, the Maine Commission ordered the Numbering Plan Administrator to reclaim those codes (Order at p. 29).

Now, there is a potential misunderstanding that could arise when reading the Maine Order. There are several references to ISP in the Maine Order. The reason is that Brooks had only given numbers in the NPA/NXX code to ISPs. This is not, however, the ISP reciprocal compensation that this Commission has previously addressed. Neither the Maine Commission findings on the nature of this traffic nor BellSouth's position on this issue depend on whether the number is given to an ISP. The same findings and the same position apply regardless of the type of customer who has been given the number. It is just a fact in the Maine case that Brooks had only given numbers to ISPs; therefore, there are references to ISPs in the Order.

Q. HOW DOES BELLSOUTH'S POSITION COMPARE TO THE MAINE COMMISSION ORDER?

A. BellSouth's position is completely consistent with the Maine Commission's Order. Most importantly, the Maine Commission found that the service was interexchange. (Order at pps. 4, 8-12, 18). The Maine Commission concluded that this service and FX service have some parallels but the closest parallel is 800 service. (Order at pps. 11-12) The Maine Commission found that Brooks is not attempting to define its local calling area with this service. (Order at p. 14) Finally, the Maine Commission concluded that this service has no impact on the degree of local competition. (Order at p. 13) Again, none of these findings depend on whether the number is given to an ISP or another type of customer.

Q. HAS THE COMMISSION ADDRESSED ASSIGNMENT OF NPA/NXXs IN ANOTHER PROCEEDING?

A. Yes. In its recent ruling in the Intermedia arbitration proceeding, Order No. PSC-00-1519-FOF-TP, Docket No. 991854-TP, dated August 22, 2000, this Commission stated, at p. 43,

> *If Intermedia intends to assign numbers outside of the areas with which they are traditionally associated, Intermedia must provide information to other carriers that will enable them to properly rate calls to those numbers. We find no evidence in the record indicating that this can be accomplished.*
>
> *Based on the foregoing, we find it appropriate that the parties be allowed to establish their own local calling areas. Nevertheless, the parties shall be required to assign numbers within the areas to which they are traditionally associated, until such time when information necessary for the proper rating of calls to numbers assigned outside of those areas can be provided.*

Q. WHAT IS BELLSOUTH REQUESTING OF THIS COMMISSION?

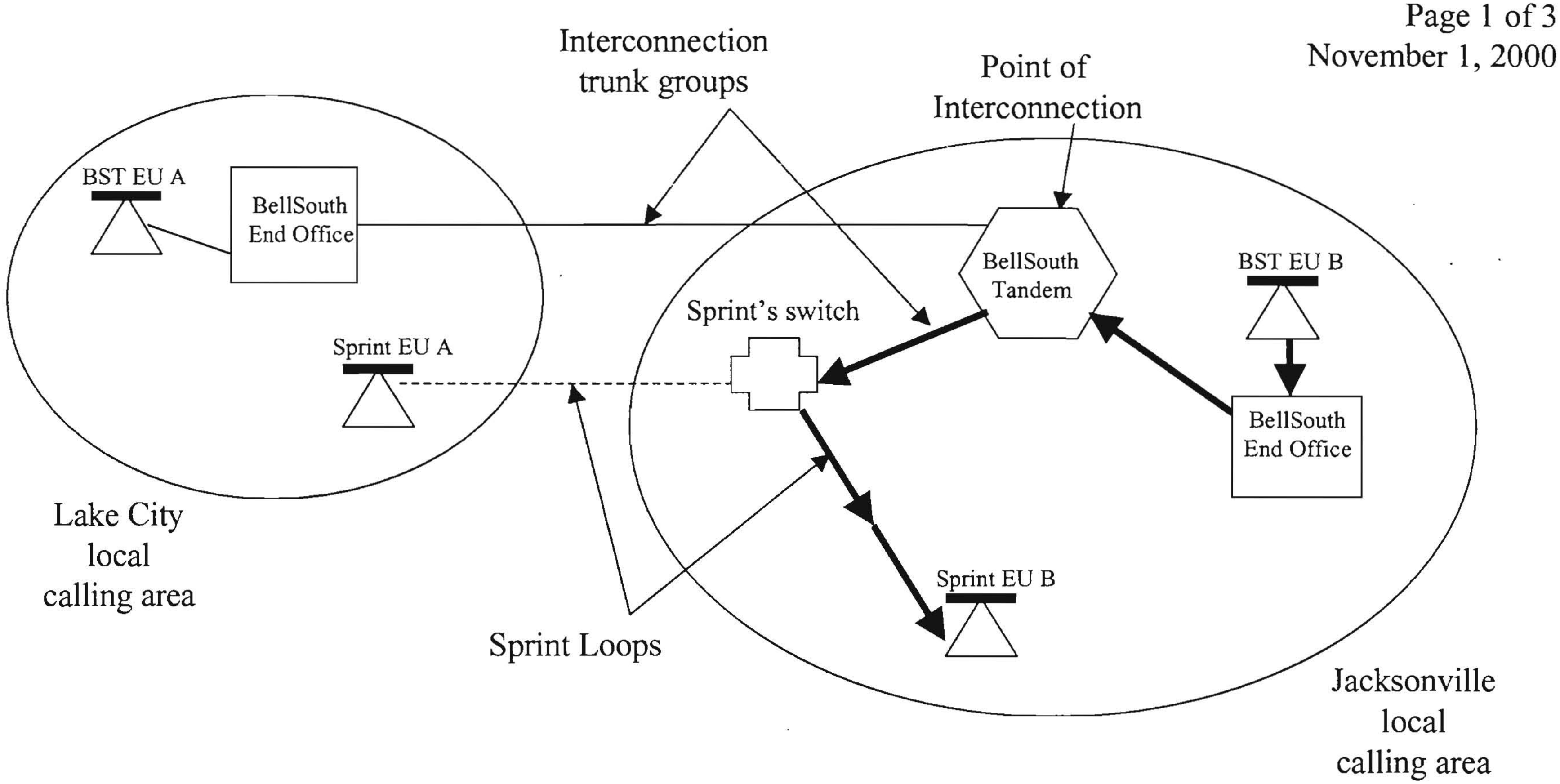
A. BellSouth is requesting that this Commission find that if Sprint assigns a telephone number to a customer who is physically located in a different local calling area than the local calling area where that NPA/NXX is homed, calls originated by BellSouth end users to those distant Sprint customers are not local calls and, therefore, reciprocal compensation does not apply. In addition, Sprint should be required to pay BellSouth for the originating switched access service BellSouth provides on those calls.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

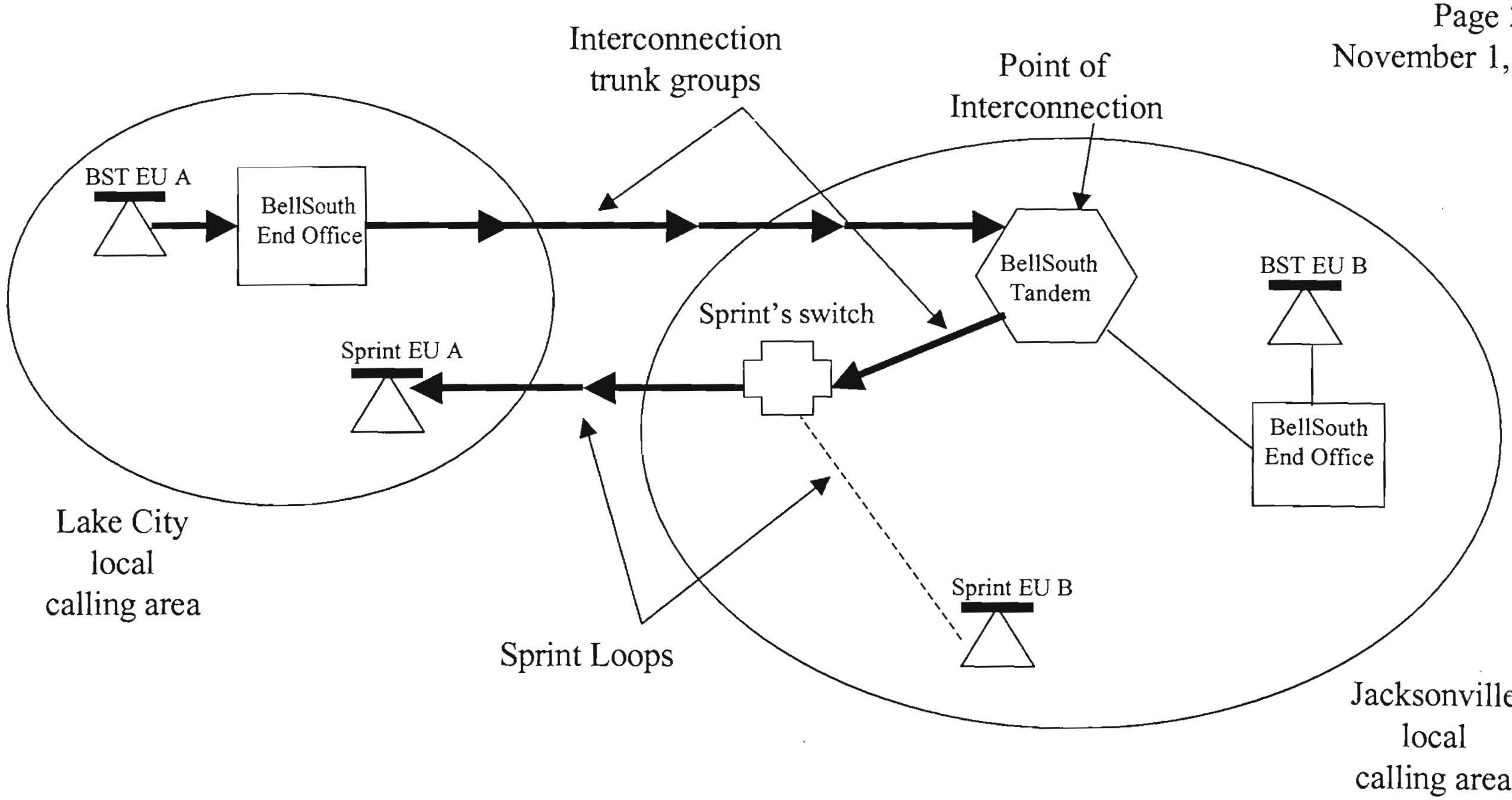
A. Yes.

PC DOCS #234565

Local Call from Jacksonville BST EU to Jacksonville Sprint EU

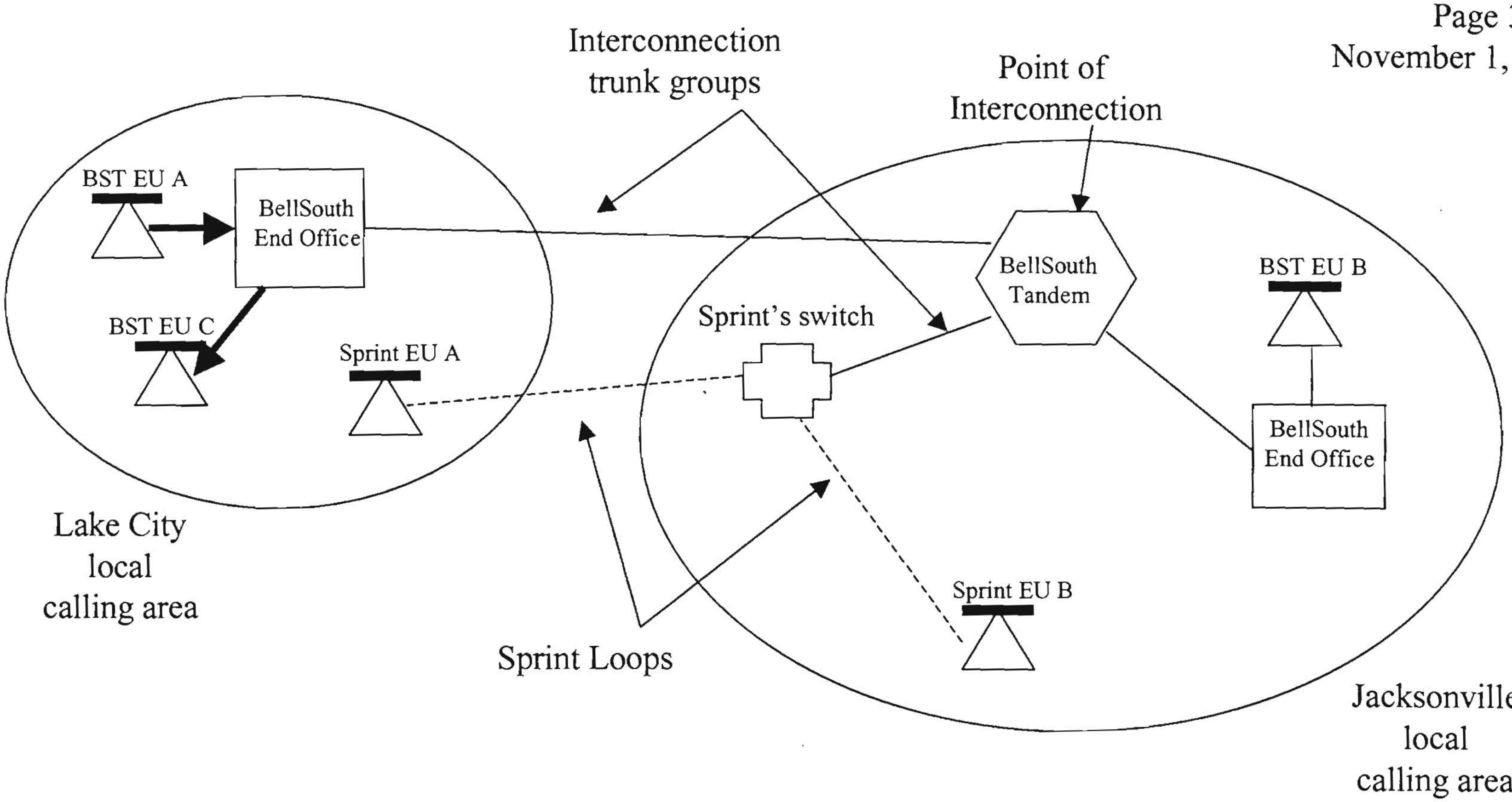


Local Call from Lake City BST EU to Lake City Sprint EU



#234365

Local Call from Lake City BST EU to Lake City BST EU



#234365

BELLSOUTH TELECOMMUNICATIONS, INC.
FPSC DOCKET NO. 000828-TP
EXHIBIT JAR-2
PAGES 1-60
NOVEMBER 1, 2000

PRICING AND POLICIES FOR INTERNET TRAFFIC ON THE PUBLIC SWITCHED NETWORK

REPORT OF THE NARUC INTERNET WORKING GROUP

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FINAL DRAFT

Submitted to the Committee on Communications at the NARUC Winter Meetings, Washington, D.C., March 1998

I. Introduction

Growing use of the public switched telephone network (PSN)[1] to access the Internet presents new, difficult policy concerns for regulators. Promotion of Internet use is consensus public policy nationally and even worldwide. But snowballing Internet growth has costs and allocative implications for Internet relayers (including providers of both the backbone network and access), for intermediate telecommunications carriers, and for end users, including both individuals and businesses.

This report is the product of efforts by members of the National Association of Regulatory Commissioners (NARUC) Communications Committee and Communications Staff Subcommittee to address current public policy issues on use of the PSN to access Internet services to exchange messages and information, transfer data, and conduct transactions. Some of the issues were first formally raised before the Staff Subcommittee in a provocative panel discussion at the NARUC Winter Meetings in Washington, D.C., in February 1997. The Internet Working Group was formed at the winter meetings and sent a questionnaire to industry players in mid-April 1997. The Working Group reviewed responses to its questionnaire, comments filed at the FCC Notice of Proposed Rulemaking (NPRM) on Access Charges,[2] and comments filed in response to the FCC Notice of Inquiry (NOI) regarding use of the PSN by Internet service providers.[3] A follow-up panel presented further discussion of the issues before the NARUC Communications Committee at its summer meetings in San Francisco in July 1997. The first draft of this paper was presented along with a request for comment at the NARUC Annual Meeting in Boston in November 1997.

AT&T reports that there will be 30 million Internet accounts for 43.2 million households and 2.1 million businesses by the year 2000. This growth will help people to do such things as pay bills, improve themselves through education, and work at home. Demands will also be made of the network to provide greater and greater bandwidth as multimedia, voice and other Internet applications become more commonplace. Intermediate telecommunications carriers (the ones that connect Internet end users to the Internet) are concerned that these increasing costs are not being borne by those causing the investments, thus straining the capabilities of some telecommunications resources previously deployed for other public and private purposes. The

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[1] The FCC has begun to use the term public switched network, or PSN, in place of the public switched telephone network, or PSTN. The term PSN applies to "any common carrier network that provides circuit switching between public users." *Newton's Telecom Dictionary*, 9th edition (New York: Flatiron, 1995), 914.

[2] FCC 96-488, released December 4, 1996, Access Charge Reform, CC Docket 96-262.

[3] FCC 96-488, released December 4, 1996, Usage of the Public Switched Network by Information Service and Internet Access Providers, CC Docket 96-263.

FCC's exemption of Internet service providers (ISPs) from access charges may be hindering migration of Internet use to more appropriate technology than the existing PSN, which is currently designed to handle voice traffic rather than data.

The Internet is first being deployed to large businesses and wealthier, more urban residential users. Schools, libraries and rural health care facilities nationwide are receiving subsidies for Internet investments under the Telecommunications Act of 1996, but there is no promise that other rural and low-income customers will receive Internet access any time soon. Planning for universal service has not addressed the means to support a ubiquitous national rollout of advanced telecommunications services maintained at affordable rates.

In this report, we analyze issues of PSN congestion, local access pricing, and universal service from the perspective of public service commissions concerned for the public interest, including the preferences of U.S. customers of telecommunications and Internet services and the broad range of providers of those services. Internet issues have also been addressed at the national level by the Federal Communications Commission (FCC), the Clinton administration, the National Telecommunications and Information Administration (NTIA) — the Administration's policy advisory arm — and the Rural Utility Service (RUS) in the Department of Agriculture.

We first address, in a qualitative way, the technical impact of the Internet on the PSN. We limit our analysis to consideration of calls dialed to *reach* the Internet. Some of this congestion is due to ISP failure to provide a sufficient number of connections for their users, so the users experience busy signals when they attempt to dial in.[4] We do not address a second problem, the phenomenon known as the "worldwide wait," named because of slow responses to user requests while they are online to the Internet. Nor do we address congestion problems that may arise as a result of dial-ups to computers that do not involve connections with the Internet.

In Section II we review technical solutions for the problems posed to the PSN and some other vehicles for access to the Internet. The question is posed as to whether the PSN is the appropriate vehicle in the long term for carrying this traffic or whether some other network is better suited. We discuss the various technologies that may be used to provide access to the Internet, and their suitability and likelihood of becoming the preferred method of access in the short term and long term. We provide an initial, broad analysis of the costs of migrating the PSN to a data environment and relate this to currently available technology and emerging technologies.

Section III attempts to bridge the gap between the current regime of ISP exemption from access charges and appropriate pricing for the future. We examine the effects of the exemption,

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[4] Many software programs allow the user to instruct the computer to continue to dial until it successfully connects with the other computer. In the worst cases, repeated dialing may last an hour or more when the ISP has insufficient capacity for its customers. If many callers are engaged in repeated redialing, their combined calls could make a large contribution to busying out a switch

exploring the positive and negative results of the exemption up to now and into the future for Internet use and the PSN. We discuss pricing options that may be suitable for high bandwidth data users as the PSN migrates toward a data environment.

Section IV is a discussion of some universal service issues raised by deployment of Internet services. The burden may fall on states to fund any early diffusion of advanced telecommunications services to high-cost and low-income areas. We examine possible state and federal policies for making Internet service available and affordable throughout the United States.

Having explored all of the issues and provided an analysis of the various dynamics and viewpoints we summarize the Working Group's conclusions and recommendations in Section V.

II. Technical Sources and Engineering Solutions to Possible Internet Congestion

The Internet is a packet-switched backbone network designed for data transfer, delivery, and retrieval. An important difference between packet-based and circuit-based networks (that is, the traditional, analog, circuit, local portion of the telephone network or PSN) is that the public switched circuit network relies on a continuous connection through the switching and transport networks to transfer voice or data, while the packet network is active only when delivering packets. In a circuit network, a channel is established for communications between the end users, and that channel is maintained until the connection is terminated. In addition, packets can be stored off-network for later access, delivery, or retrieval by an individual or group of users and need not be transported in sequence or over the same pathway. Thus a continuous packet connection to the Internet does not tie up the Internet work as an analog circuit connection would.

Because a continuous connection is maintained, using the analog voice network for data communications over the Internet is much less efficient than using a packet-switched network. In an Internet call, the Internet Service Provider (ISP) as well as the ISP's customer may be considered end users. ISPs are often connected both to a packet network over high speed dedicated facilities on one side for communication with the Internet and to the PSN through local business lines on the other side to provide access for end user customers. When an ISP bridges the circuit-switched PSN and its packet-switched network, the mismatch of technology is only partially mitigated by modems. Modems (modulator/demodulators) convert digital data for transmission over the local (or toll) analog network to the interconnection point of an ISP where it is packeted for delivery over the Internet network.

There is little doubt that the Internet has caused changes in the capacity used for some PSN calls and in the average duration and number of calls. The Internet has also affected the patterns of local use among and within LECs. LEC data show that the average duration of Internet calls is considerably longer than that of local voice calls. The LECs claim that the growth in number and duration of Internet calls has caused facility congestion problems in interoffice trunking common in multi-office exchanges and extended area service (EAS) arrangements. ISPs, on the other hand, allege that empirical data do not prove the existence of congestion on the Internet. They and other observers believe the PSN, if properly managed, will be able to accommodate the growth with little problem. While many organizations debate the locus, frequency, and severity of Internet access congestion using the PSN, the technical community is preparing short-, medium- and long-term solutions. This section examines some possible directions that PSN access to the Internet network may take.

The long-term scenario foreseen by all respondents to the Working Group survey is the relocation of interoffice data services from the PSN to a digital packet network. Access to the packet "cloud" could be achieved through many means, including improved resource management, residential Integrated Services Digital Networks (ISDNs), digital subscriber loops (DSLs), or displacement of dial-up over analog modems with cable modems or wireless.

Respondents to the NARUC survey and to the FCC's NOI regarding Usage of the Public Switched Network by Information Service and Internet Access Providers (Docket 96-263) provided valuable insight into specific mechanisms of the congestion problem but not its scope. The primary problem is excessive blocking of calls at originating end offices due to resources in use by calls to Internet service providers (ISPs). Sub-problems include:

1. Quantities and configuration of (inbound) line control modules (LCMs)

2. Insufficient interoffice trunking

3. Lack of sufficient terminating CPE (for example, ISP modems) as blocked users persistently re-dial

ISPs must work to avoid the third type of problem above, where their modem banks are oversubscribed and caller retries "busy out" the switch. The same "first order" statistics developed by telcos can assist ISPs in designing the capacity of their trunks and modem banks.

Two fundamental premises must be presented as background. The first is that all communications networks are designed to meet probabilistic demand calculated at the busiest hour of the day, week, month, and year — and are not designed to provide service to all customers simultaneously. The second is that this busy hour exists during the work day and consists mostly of voice calls. While it is true that, on average, call durations ("holding times") by modem to ISPs are longer than voice calls (Bellcore: 20 minutes compared to three minutes, respectively), it is the total traffic offered in centum-call-seconds (CCS) that is the center of the congestion problem. While many respondents could identify PSN usage attributable to Internet calls, no telephone company contended that the Internet has *in general* caused shifts in the busy hours. At face value, this would indicate (falsely) that the existing voice network is sufficient for Internet callers and that no additional capital equipment is required. Rather, situations arise where additional equipment has been required to maintain quality of service. In their survey responses, PacBell and Bell Atlantic cited examples of congestion in their Santa Clara and Herndon end offices, respectively.

Short Term: Improved Resource Management

The primary reaction to congestion on the access side of the switch is to reconfigure line units. Bellcore viewed the problem of congestion as separate issues of trunking and access and provided different solutions for each.[5] In the short term, Bellcore noted that the present mode of operations can be managed better, reducing switch stress by de-loading switches and routing Internet calls more intelligently.

A moderately complex task is to rebalance subscribers across existing line concentrators (there is a range of lines which can share a single line unit based on the number of minutes at any given time the lines are experiencing). A more interventionist (and costly) step, if rebalancing is unsuccessful, is to regroom the switch by adding line units and reassigning customers.

Interoffice trunking congestion may still occur even in the absence of access line overload. One telco that has extensive ISP subscribership on primary rate interface (PRI) digital trunks has still had to utilize foreign exchange (FX) trunking to process these calls over the interoffice network. While FX-type trunking can be used to alleviate congestion on the voice trunk groups, it can still result in a less efficient use of the trunks themselves.

One solution recommended by Bellcore is the installation of equipment "upstream" of the switch that would divert, based on dial number, ISP calls from switch line concentrators used by voice customers. This "pre-switch adjunct" equipment is already being sold by Lucent and Nortel, manufacturers of the dominant Class 5 switch models. Each of these product solutions has characteristics or limitations that make them less than attractive in all situations.

The Internet Access Coalition, which contends that the Internet access congestion issues arise from poor resource management within switches, notes that digital trunking by ISPs is technically feasible but is not economical. Dial-up calls to ISPs that have T-1 or Primary Rate ISDN would bypass the switch components that are subject to access congestion. Their analysis, however, showed that, in many regions, an ISP would find it cheaper to operate analog lines (prone to congestion) than equivalent ISDN-PRI or T-1 service that is non-blocking.

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[5] Amir Atari and James Gordon, *Impact of Internet Traffic on LEC Networks and Switching Systems* (Red Bank, NJ: Bellcore), 1996.

Medium Term: Technological Solutions

Some emerging products and services have the potential to operate without congestion to the PSN. We will briefly introduce options for digital subscriber loops (DSLs), ISDN, and Internet routers. While each of these is technically attractive, each also has economic or locational impediments to deployment.

1. **Digital Subscriber Loop**

Digital Subscriber Loop (xDSL) technology is a potential long-term access technology that would use existing copper pairs to connect customers directly to the packet "cloud." The particular variant of xDSL to consider, according to vendor ADC, is based on speed, operating distance, upstream and downstream speed differential, and suitable applications. xDSL will someday be a high-performance (T-1 or higher) access solution for the 80 percent of customers within 18,000 feet of an end office, but currently it is not generally available. Similarly, cable modems offer local area network (LAN) style Internet connections to customers, but existing cable infrastructure is suitable only for 15 percent to 20 percent of potential users. Other potential Internet access media include powerline carrier (Norweb) and satellite downlink.

2. **ISDN**

Both Primary Rate and Basic Rate ISDN (PRI and BRI) are viable technical solutions for alleviating access congestion. ISDN pricing, however, has been inconsistent, and some respondents, including AT&T, believe that the associated network and customer premises costs and technical limitations mean that widespread deployment is years away, while others, such as Bell Atlantic and U S West) noted that ISDN is an affordable option that will meet the needs of the market for years to come.

Digital trunks such as Primary Rate ISDN and T-1 can link ISP points of presence (POPs) with ISP modems and alleviate load on switches, but current tariffs are higher than for equivalent POTS lines. Bellcore notes that the packet ("D") channel of Basic Rate or Residential ISDN could be used by customers to connect to existing telco packet networks. Residential ISDN connections bypass switch components prone to congestion.

3. **Router Development**

Internet routers could potentially be the bridge between the current voice telephony and the data network of tomorrow. In the short run, traffic could be routed over a dual network. There is even debate that the dual network may continue in the long run due to the sheer expense of converting the PSN to a data friendly network. Under the dual network concept, voice would be processed according to one set of parameters and traffic destined for an ISP could be routed onto data facilities. In the long run, the Working Group envisions that all data (including voice) could be processed in a uniform manner. Right now, it appears that packets may be the most likely method for backbone networks, with a variety of digital solutions for local access. Some parties advocate that a more efficient configuration would be for routers to be placed at all switches, therefore, the originating switch could determine if a call is addressed to or from an ISP and thus route its traffic onto a data network.

The location of routers is a function of cost. The basic assumption with using a router system is that there would be new costs associated with processing traffic over these facilities. If transport is charged for traffic from the router, then ISPs have a much greater incentive to build their own facilities to the office with a router than to pay the ILEC to transport the traffic. Of course, the placement of its own facilities to a router would require a higher profit threshold for the ISP, so whether it would go into a rural area using its own facilities is unknown. In other words, rural areas may still have difficulty obtaining Internet service either due to having to make a toll call (or pay a higher transport cost) because the ISP server is in a distant area or because providing transport to a closer office with a router involves more facilities placement cost on the part of the ISP. Requiring ILECs to provide the transport from the routers to the ISP does not solve the bandwidth problem unless hi-cap facilities are placed and then priced close to cost. Then the matter simply becomes one for the ISP of revenues versus cost.

Routers could be placed in tandem, however, this does not stop Internet traffic from entering the PSN. Tandem router placement may be an acceptable solution but once bandwidth requirements increase, congestion could become a problem for both the ILEC and the end users' requirements. Tandem placement of a router could be very useful if there is terminating end office switch congestion. Tandems are typically designed to carry significant traffic flows. However, there has been no contradictory evidence to the ISP contention that the switch congestion problem most often spoken of is with the terminating switch. It is before this switch that traffic must be diverted. Therefore, locating the router at the tandem and then providing hi-cap transport between the router and the ISP server could solve many problems for the terminating switch.

Long Term: Network Evolution of the Internet and Internet Access

The Internet, beginning at backbone level, has begun the transition to packet technology. The backbone technology chosen by MCI, UUNET, and others is Asynchronous Transfer Mode (ATM). ATM is similar to frame relay (FR) and X.25 networks in that it is a shared resource, gaining efficiency by multiplexing many streams together to provide virtual private services.

Bell Atlantic and U S West, in their survey responses, anticipated the full spectrum of ATM and frame relay networks, using xDSL and cable modems as well as improved analog dial for access.

BellSouth, in comments in CC Docket No. 96-263, outlined a proposed network which the company said would be suitable in the long term. BellSouth stated that the Commission's current rules regarding protocol conversion would make it impossible for it to implement such a network, however. Dial-up connections would be routed to the network access server that would, in turn, be connected to a "radius" or routing server. In other words, based on the number dialed by the Internet subscriber, the radius server would identify the Internet provider to which the network access server should establish a data connection. The network access server would then make the connection to the underlying ATM/Frame Relay network to which the Internet provider would also be connected.

The possible paths discussed here for long-term Internet evolution are based upon developing technology and media. Given the rapid progress in the fields of communications and electronics, in just a few years the Internet may well use as yet unheard-of technology to speed the transport of data to and from the end user. The trend seems clear: as we move ahead in time, the capability of higher speeds of data transport will move closer and closer to the end user.

Costs of Reducing Congestion

Many levels of solutions can be applied to the general problem of PSN congestion, the ultimate being relocation of data services to broadband packet networks. While the costs of this solution have not been estimated, the costs of some solutions are more easily calculated. We have figures for the cost of labor to reconfigure switches but lack cost data on line cards themselves and the new category of pre-switch adjuncts, as deployed. Cost data are available for some ways for ISPs to mitigate congestion, including digital T-1 or ISDN PRI. Regulators must use the information they have and obtain the further information they need to develop pricing strategies to encourage the use of data-friendly infrastructure. Because competition is in a nascent stage and the Internet is growing so rapidly, it may not be sufficient to wait for new providers to place their facilities.

III. Appropriate Structure and Charges for Local Network Access

Access Charges

Although several avenues are open for evolution to networks that support data better than the existing PSN, the current exemption of ISPs from access charges inhibits that transition. The number of people subscribing to the Internet keeps growing, but unless the Internet acquires more bandwidth it may encounter an application constraint both on its own backbone and on the PSN. The comparative price of compatible CPE and local lines with packet switching capability versus current analog modems and circuit switching is a disincentive for Internet users to migrate to "data-friendly" technology. The exemption of ISPs from access charges distorts prices and sends incorrect economic signals to end users and Internet service providers. Until end user demands for bandwidth force ISPs to use what are probably more expensive data networks, ISPs will continue to purchase analog lines and use modems to change digital messages to analog and back to digital packets for delivery over the packet network. So, to some unknown extent, the exemption is helping to keep the Internet from growing into a mature multimedia network.

The ISP exemption grew out of the FCC's Computer II proceedings in the 1970s, in which the

Commission introduced a distinction between basic and enhanced communication services. Enhanced services include access to the Internet and other interactive computer networks. In a 1983 access charge order the FCC decided that even though enhanced service providers (ESPs) may use the facilities of local exchange carriers to originate and terminate interstate calls, they should not be required to pay interstate access charges.[6] In its 1997 access charge decision, the FCC decided to maintain the exemption. The Commission noted that the term "information services" in the 1996 Telecommunications Act appears to be similar in meaning to "enhanced services."[7] The Act establishes a policy "to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services, unfettered by federal or state regulation."[8]

The FCC decision means ESPs (including ISPs) may purchase services from incumbent local exchange carriers under the same intrastate tariffs available to end users. They pay business line rates and the appropriate subscriber line charge rather than interstate access rates. Business line rates are significantly lower than equivalent interstate access charges because of separations allocations, pervasive flat and message rates for local business service, and the per-minute rate structure of access charges.[9] On the other hand, interexchange carriers (IXCs) at least for now must pay access charges for similar connections to the PSN.

Most ISPs purchase analog business lines from the LEC at a fixed cost per month. Most households and businesses can purchase access to the Internet through a flat monthly charge from an ISP. The local usage on the lines over which they place calls to access the Internet is generally priced on a flat monthly or message (per-call) basis. These rates are based on local usage rates. The lack of true time-related charges on either end of these calls encourages long call durations. The ILECs claim that the long holding times associated with Internet calls burden the PSN and have caused, and may continue to cause, network congestion and blocked calls. If the ESP exemption were discontinued, the LECs argue, a more accurate pricing signal would be sent which would encourage ISPs to seek more efficient methods of serving their end users.

The access charge exemption is a preference for a certain class of users of the public switched network, just like the home mortgage payment exemption is a tax preference in the federal income tax system. A preference acts like a subsidy to a certain group or function, foregoing funds that would otherwise go to common use. It is as an active policy preference that the exemption has been supported — something that will encourage development of the Internet and the many benefits we can see from having this new means of information exchange, plus

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[6] FCC 1997 Access Charge NPRM, para. 284.

[7] Ibid., para. 284.

[8] 47 USC, para. 230(b)(2).

[9] FCC 1997 Access Charge NPRM, para. 285.

innovations yet to come. There is a strong public interest argument for government promotion of the Internet. The Internet User Coalition, for example, commented to the Working Group that the Internet provides citizens a venue for political speech and access to information, lifelong learning, communications and commerce.

ISPs argue that exemptions were justified in the first place and continue to be needed now to support a nascent industry. Many commenters in FCC dockets and the Working Group's survey argued that applying any extra charges to the ISPs would stymie the Internet's growth. ISPs argue that the access charge exemption is an incentive for investment and innovation in information services and thus serves U.S. industrial policy. The ISPs and their supporters say that even though the Internet business has grown, it is still volatile and prospects for success are uncertain.

Another argument for keeping the exemption is that the existing access charge system is inappropriate. BellSouth maintains that it is better to keep the current access charge exemption than to apply an access charge regime that was designed for circuit-switched voice telephony. Most telecommunications industry analysts agree that access charges are too high. The FCC said it saw no reason to extend the existing imperfect access charge regime to an additional class of users, when it could have detrimental effects on the growth of the information service industry and the existing structure.[10]

Those who continue to be opposed to the access charge exemption for ISPs now and in the immediate future claim that Internet use is already causing congestion, particularly in the switch from which the ISP is served. The Alliance for Public Technology, in comments on the FCC access charge NPRM, said ISPs are thus paying less for using the local network than other businesses, even though some claim they impose greater demand for ports, switches, lines and other network elements. Bell Atlantic suggested the exemption creates a financial disincentive to switch to data networks where they are available, encouraging ISPs to purchase circuit-switched services instead of packet-based. The general exemption of ISPs may also ignore differences in traffic patterns among ESPs and even in Internet uses, another commenter suggested. Some of these providers may pose a larger immediate burden on the network than others.

Rural Utilities Services (RUS) told the NARUC Internet Working Group that the ISP exemption means rural telephone companies are losing toll support they would otherwise receive because many calls made to access the Internet are toll calls. Because the rural carriers do not have access to the toll revenues by virtue of the exemption, local rates are forced up as plant must be put into place to handle the increased "local" traffic, and revenues must be generated to recover the cost of this plant. (This issue is discussed further below, in section IV. on universal service.)

Whether or not ISPs are causing congestion now on the public switched network, the access

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[10] FCC 96-488, para. 288.

charge exemption encourages growth of Internet use that can lead to overloading a network designed for voice communications. Asked whether the exemption influences network deployment decisions all respondents to the working group survey who answered the question said it does. AT&T said the exemption discourages CLECs and ILECs from developing new service offerings that have to compete with below-cost access services used by ISPs. The company said neither CLECs nor ILECs are receiving accurate economic signals that would encourage them to upgrade networks or engineer existing ones more efficiently because they are being denied the revenue streams to pay for the upgrades or transition activities. BellSouth and U S West made similar arguments.

The access charge exemption has an influence on who will win and who will lose in the marketplace for telecommunications services. Interestingly, many ISPs no longer argue for the exemption on nascent industry grounds, but on competitive grounds. They suggest that independent ISPs are now battling ISPs affiliated with other carriers so the independents need a price break to level the playing field. Some ISPs also suggest that since they have no adequate widespread technological alternative to ILEC networks, to continue the exemption will force ILECs to upgrade. Until that happens, they claim the exemption is a monetary recognition of the PSN's shortcomings for data transmission. ISPs and others also allege that the revenue from the second line which computer users tend to order has not been considered as an offset to any additional PSN costs. They further point out that many ISPs are phone companies themselves and argue that those ISPs would not be providing Internet service if it imposed unrecoverable costs.

Other telecommunications companies see the exemption as giving unfair competitive advantage to ISPs. AT&T commented that the IXCs are paying "artificially high non-economic subsidy laden charges" and ISPs are paying below costs. AT&T maintained that IXCs are at a competitive disadvantage since ISP services (voice over net, faxes) are cross elastic. Bell Atlantic and U S West advanced similar arguments from the perspective of the ILECs. Bell Atlantic suggested that if IXCs moved voice traffic onto the Internet, and the exemption continued, LEC costs would increase without an adequate cost recovery mechanism. Resellers agreed that preferential treatment of ESPs over other telecommunications service providers gives "unwarranted competitive advantage." The Telecommunications Resellers Association said ISPs should be brought under the access charge regime.

Jurisdictional Issues

Any discussion of the appropriate pricing for network access to the Internet must include jurisdiction. While it is the Internet Working Group's strong hope that any pricing options advanced herein would be applied on both the interstate and intrastate level, should that not be the case, the Internet Working Group would offer its analysis and conclusions for consideration by the states.

The FCC's finding that ISP traffic is exempt from interstate access charges is not readily interpreted as a decision regarding the jurisdictional nature of the traffic. It does not make it any less an interexchange, and ultimately an interstate and international, connection. BellSouth commented that the exemption should not and does not change the underlying jurisdiction of the traffic. The FCC decision leaves state regulators with jurisdiction for local rate and policy applications. It is reasonable for them to interpret this traffic as local by default. Yet the reason the FCC can apply its exemption to interstate access in the first place is that at least some of the traffic traverses state and national boundaries. In general, only the local phone dial-up number makes it appear local. This was true with call traffic into many early toll resale enterprises. If the incoming ISP traffic is on a toll call or 800 number, intra- or interstate access charges are being applied today.

If ISP traffic is interstate, as the FCC's assertion of jurisdiction to apply the ESP exemption indicates, then this issue is ripe for reevaluation under jurisdictional separations. Comprehensive jurisdictional separations reform is currently under investigation and assigned for resolution to the Federal-State Joint Board on Separations.[11] The NPRM does not refer specifically to ISP traffic, but to data traffic generically, in its request for comments on these issues.

If the traffic is interstate, a workable solution was suggested by several parties to apply to ISP traffic only the traffic-sensitive portion of access charges without any common line component. This is the intended ultimate goal of the access reform ordered by the FCC for Tier A LECs' interstate access charges[12], and a solution recommended by several parties in the FCC's NOI on the Internet.[13]

If ISP traffic can, due to the exemption, be interpreted as jurisdictionally local, states do have options for solving the problems associated with this rapidly growing segment of local traffic. The solutions then would have to be with regard to local service pricing. If the jurisdiction of the traffic is split, identification of the local traffic that is Internet directed would be necessary. This could necessitate the imposition of considerable registration and reporting requirements.

Changes in pattern of use, call duration and number of calls may make the existing separations (Part 36 methodologies) process inappropriate due to resulting large separations shifts for some companies. Under Part 36 many portions of the network are allocated based on jurisdictional minutes-of-use (MOUs) or weighted jurisdictional MOUs. An increase in usage caused by the Internet calls could vastly increase the allocation of cost to the intrastate jurisdiction due to the ESP exemption. This is because the exemption causes LECs to treat the costs of serving ESPs

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[11] CC Docket No. 86-280, Jurisdictional Separations Reform and Referral to the Federal-State Joint Board, released October 7, 1997.

[12] Access Charge Reform, First Report and Order, FCC 97-158.

[13] Usage of the Public Switched Network by Information Providers, FCC 96-488.

(which include ISPs) as a cost of serving local end users.

In general, LECs claim the Internet causes their revenue requirement to increase because they may need to install more inter-office and switching facilities to handle the vast increase in traffic caused by the Internet, while a lower percentage of the total cost is allocated to the interstate jurisdiction due to the ESP exemption. Compounding this problem is that the Internet may cause the need for network upgrades all the way to the end users as essential service requirements under universal service programs expand to meet basic end user demands. This separations problem causes the company's intrastate jurisdictional allocations to increase, which may result in requests by some companies for intrastate rate increases claimed to cover costs primarily incurred for a jurisdictionally mixed or interstate service.

At this time the Working Group agrees that Internet traffic is indiscernible. However, the Working Group believes that this is because no one is attempting to record the traffic. Much as 800 traffic was originally viewed as indiscernible and later able to be tracked, so too could be the case with Internet traffic.

Options for Pricing Internet Access

Most interested parties agree that government should not establish a social goal with respect to which technology or network is used to deliver Internet services. However, many parties fail to acknowledge that government already has influenced the growth of the Internet by extending the ESP exemption to ISPs. While in the past Internet traffic was not of such a magnitude or sophistication to affect the PSN, its continuing growth leads one to question whether the time has come to reconsider how Internet traffic is priced. Should government continue the preferential rates for ISPs, apply traditional access charges to them, or design a new pricing mechanism? As we discuss the various dynamics associated with pricing PSN access to the Internet, we must keep sight of the overall fundamental network change — whether the result is a data-friendly PSN or a dual PSN composed of one network (route) for voice and one for data.

In regard to the standard argument of whether ISPs should pay traditional access charges, some parties concede that if the Universal Service Fund is designed to recover all needed local revenues, typical interstate access rates could decline sharply and then ISPs could pay the new access rates. By doing this, the rates would be close to cost and that would send the correct market signals to ISPs as to whether or not they should obtain another method of access which would give them the data capabilities that their users need or desire.

However, current access charges are based on voice technology. Given the growing data usage of the network, the Working Group is concerned that the traditional rate structure for access charges may not reflect future network usage. Therefore, we have explored rate structures which may be more suited to data traffic. We recognize that this leap in rate structures from the current regime may produce a "gap" between rate structure and actual network deployment of technology, but we believe, at this juncture, that regulators must begin to prepare for the fundamental change the network will undergo. Most commenters did not offer any pricing options for Internet usage. Basically there were two viewpoints: continuation of the ISP exemption and an access rate that is lower than current access rates.

All the commenters to the working group survey agreed that end users should not be required to pay for the ISPs' use of the PSN. If any increased charges are to be paid, the commenters suggested, they should be paid by the ISP directly. However, all parties also recognized that any increased costs to the ISPs will be passed along to end users.

Alternatives to a voice-based pricing scheme were not advanced, although several ISP commenters expressed concern about usage-sensitive pricing. Some sort of flat rate, cost based, block rate pricing might alleviate some ISPs' concerns over their cost volatility. Moreover, many ISPs want the ability to purchase UNEs, without being designated a carrier.

One suggestion offered by the Working Group was that wireless interconnection rates be used as a surrogate for ISPs' access to the PSN. Only one party commented on this suggestion. It argued that wireless interconnection rates should not be assessed on ISP providers because while an Internet call is roughly 20 minutes in duration, a wireless call is 2 ½ minutes for cellular and 5 seconds for paging. Therefore, wireless service is not analogous to Internet service and the rate should not be transferred. In short, whereas a wireless customer may view a $0.20 call to be affordable (based on a rate of $0.08 a minute for a 2.5-minute call) an ISP user would not view a $1.60 call to be reasonable (based on $0.08 a minute for 20 minutes).

The Working Group also explored the possible development of a special category of end user (if the exemption continues) whereby outgoing call volumes above a certain level would require the end user to be migrated onto a service which is priced and engineered to recover and account for the high call volume. However, the Working Group is mindful that the application of some sort of per minute local measured service (LMS), in many states and localities, is either statutorily forbidden or politically obstructed. Also, if a pricing scheme were applied to Internet traffic only, it could be challenged as discriminatory and subject to litigation. Another solution could be to charge all customers in markets without LMS for all incoming local calls above a certain level. This could eliminate the need to separately identify the traffic as Internet directed. If a high enough set amount of incoming traffic were free each month, ISPs would likely be the primary recipients of this charge.

Another idea put forth by the Working Group was the use of the Signaling System 7 (SS7) network and rates to process Internet calls. All carrier commenters rejected the idea of using the SS7 network. They argue that the SS7 network is designed and maintained as a signaling network and could not handle Internet traffic, even though it is similar to packet technology. Also, many commenters are concerned that the implementation of local number portability (LNP) will consume the spare capacity of the SS7 network. Consequently, there is little spare bandwidth on the SS7 network for other traffic. No commenter addressed the question of whether the SS7 network could be expanded to fulfill this function.[14]

Most commenters to the survey argue that there should be only one access charge structure since the network is performing the same function regardless of whether voice (analog) or data (packet) is being transmitted. However, if access charges are not brought down to cost and government feels the need to keep the cost of access to the Internet low, care should be taken to at least price the services and/or facilities close to cost. This pricing policy would have the effect of incenting the providers of the PSN to deploy a more data-friendly network and of encouraging the use of more data-friendly facilities on the part of end users and ISPs.

Reciprocal Compensation

In addition to general concerns about the appropriate pricing for access to the Internet, regulators have recently been faced with the question of what compensation should be paid between carriers for the exchange of this traffic. It should first be noted that although the battle over pricing access to the Internet has spilled over into reciprocal compensation, the general pricing and costing dynamics mentioned earlier in this paper have not changed. What we now address is the question of cost recovery/revenue generation when some ILECs bypass the end user and ISPs and instead focus on intermediate carriers as their revenue source. This section will discuss the various options for resolving the reciprocal compensation question should a state commission assert its jurisdiction in resolving a dispute on this issue, as a number of commissions already have.

The basic allegation in the reciprocal compensation disputes is that all calls to ISPs are long distance. To support this conclusion some carriers are claiming that in order for the FCC to have exempted ISPs from access charges, it must have assumed that the nature of ISP traffic, both to and from the ISP, is long distance, perhaps even interstate. The Internet Working Group asked participants in the group's survey whether the ESP exemption creates an incentive for CLECs to want ISP servers at their end offices in order to recover the terminating unbundled local switched rates. AT&T replied that the exemption perpetuates uneconomic behavior in many forms, but that Internet traffic is interstate, not local, so the reciprocal compensation portions of interconnection agreements are inapplicable.[15] We have already discussed the pragmatic matters associated with identifying traffic destined to ISPs or large terminating users. We will assume that these end users are somehow identifiable. With that caveat, there are four basic avenues to resolve the compensation issue.

The first avenue would be to agree with the carriers who assert that some or all calls to the ISPs

[14] Bellcore did advance this viewpoint in its paper, "Architectural Solutions to Internet Congestion Based on SS7 and Intelligent Network Capabilities," Atari and Gordon: Bellcore, 1997.

[15] See U S West, 7.

are long distance calls. By reaching this conclusion the commission could simply acknowledge that there is a massive amount of traffic which does not originate and terminate within an ILEC's local calling area. Given that neither the Telecommunications Act nor the FCC has eliminated the distinction between local and non-local, this could be a solution. However, one would first need to examine whether all of the calls, or at least a majority of them, can be traced to their termination points. After this measurement is done, one could employ the use of PIUs (percentage of interexchange use) to assess charges. The difficulty associated with this solution is that regulators would have to undertake a task that they have not typically done. They would have to look behind an end user's private network to determine where traffic is ultimately terminating. Furthermore, regulators may find that such a determination is used to support an ILEC's claim that all end users should be paying access charges since the existence of the intermediate carrier does not change the nature of the end user's call to the ISP. If a state believes that the service provided by ISPs is a carrier-type (and non-local) service, and the FCC agrees, then a state commission may find this solution a desirable means to correct a perceived incongruity in the treatment of ISPs vis-à-vis IXCs.

Another option is not to look behind an end user's private network, regardless of whether it is open or closed to the general public, and continue to treat such traffic as local, including the non-application of access charges. While the Telecommunications Act did continue the distinction between local and non-local service, one can assert that this distinction lies primarily in the nature of traffic which carriers are processing. Therefore, if traffic processed within only one network would be considered local, then the same traffic processed within two networks covering the same local calling area should still be considered local. Furthermore, if a state determines that the flat rate usage packages which are currently being subscribed to by its end users are cost compensatory of all the minutes the end users are generating, this option is further supported. It may be inappropriate from a public interest viewpoint to assess access charges to a private network for traffic which terminates to it, especially when it has been determined that end users are fully compensating the LEC for traffic which they are generating. If a state were to allow access charges to be assessed in this situation, it may wish to develop an understanding with the ILEC concerning the adequacy of the ILEC's network in processing data transmissions and further steps which may need to be taken to develop that network. Lastly, this option would continue to provide CLECs with a revenue stream to finance the building of their networks.

A third avenue to resolve this dispute is that there be no compensation exchanged between carriers for traffic to an ISP. The argument for this option is that so long as no carrier is receiving compensation for calls to ISPs, each will have the same perspective on ISPs. For example, right now many ILECs have a very large majority of their residential customers subscribed to low flat rate usage service. As such, it is very difficult to obtain additional revenues from their customers for the large amounts of traffic they generate once they start subscribing to the Internet. So, as alluded to earlier in this paper, the ILECs arguably are not being compensated for the usage of their networks. With the existence of an intermediate carrier, not only are the ILECs perhaps not compensated, but they must pay carriers for termination on the other carriers' networks. By not allowing compensation to flow between the carriers, neither carrier would be compensated for this traffic. This is how both carriers would come to view ISPs in a similar manner. The revenue which they could generate from the ISPs would be the charges they directly assess to the ISP. The only complexity in this argument would be those ILECs and their associated end users who subscribe to local minutes-of-use service. In this scenario the ILEC is being compensated by the end user for the use of its network, so the dynamic of the non-recovery of costs through flat rate end user charges does not exist. The difficulty of distinguishing between Internet minutes that are subject to flat rates and those subject to minutes-of-use charges may render this solution unworkable. Another potential adverse effect of this scenario may be that, once CLECs are no longer compensated for ISP traffic, their traffic imbalances become so great that they are unable to sustain themselves financially. This dynamic would be very difficult to assess currently because if a CLEC is marketing mostly to ISPs, they will intentionally have few other customers. Therefore, assessing whether they can be financially sustainable in the long run may not be readily achievable today.

The fourth avenue open to regulators is more complex. This solution requires that ISPs be assessed a "termination surcharge" when calls to it attain a certain level. In this manner, non-ISP end users do not have to have any of their rates adjusted. It would be the ISP who would pay for the traffic terminating to it. The complexity in this solution is when the end user resides on a carrier's network different from the carrier network on which the ISP is located. This is because, technically speaking, the carrier which is owed money from the ISP is the end user's carrier. In this situation it may be that the ISP's carrier becomes the collection agent for the originating carrier. In this scenario, the terminating carrier could still be paid the terminating charges owed to it. The result could be a sort of netting.

IV. Relationship of Internet Access and Universal Service

Universal service is a complex issue with a seeming myriad of ongoing controversies. The issue involves setting and achieving objectives for telecommunications infrastructure and subscription levels. In terms directly relevant to the Internet, the issue is the degree to which advanced telecommunications infrastructure should be ubiquitously available and which services should be included as universal service offerings?

Many businesses and institutions have turned to virtual private networks to meet their computer and telecommunications needs. This trend is fostered by the technological availability of virtual channels within the PSN providing bandwidth or capacity reservation at flat rates. Higher-speed PSN offerings are based on an access line charge with usage priced on a per-unit basis. Further, video transmissions are handled by the PSN as data. Because of these dynamics, questions arise regarding the appropriateness of differentiating data and video transmissions on the PSN and what type of rates to charge for potentially bursty and voluminous transmissions, particularly in relation to the pricing of voice traffic. Currently, because one can obtain bandwidth at a flat rate and because video-dedicated channels appear more reliable, they are more attractive than typical switched or derived video channels on the PSN. As a result carriers have an incentive to invest in adjunct networks that carry high speed, high volume data and video transmissions but do not have the incentive to invest in advanced infrastructure placed in the PSN itself. This has the undesirable effect of denying or delaying the general offering on the PSN, to residential and small business customers, of a reasonably priced high speed form of access to the Internet.

Universal service planning should address the means to support the concomitantly necessary investments for designated advanced telecommunications services for which customer demand will not garner sufficient revenue to support facility placement. Such concerns would encompass the need to subsidize, in some areas, infrastructure necessary to provide advanced services or to facilitate Internet access. Even the current USF rules may inadvertently be slowing the roll out of advanced telecommunications to the general public. This is because, in some cases, the diversion of educational, health care and library institutions' usage, and attendant revenues, from the PSN to private two-way video and data networks has and will continue to exacerbate the need for support funding to keep the rates for advanced telecommunications services low enough to be considered affordable. This problem is particularly acute in rural and low income areas.

In addition, there are overlapping and conflicting aspects to the drive for a ubiquitous national roll out of advanced telecommunications services and the need to define, and maintain at affordable rates, "basic" or "essential" telecommunications services. In this debate, regulators must be careful not to over-plan the deployment of advanced services. Where regulators believe companies are making significant infrastructure inroads, or are trending to this, caution should be employed so that one does not fund infrastructure investments that would have occurred anyway. Many rural and low-income markets often experience a lag in such investment. The question becomes, "When is such a lag intolerably long?"

Of course universal service is only one of many public policy goals for telecommunications industries, some of which conflict in real world applications. Additional goals include: (1) development of competitive markets, (2) placement of telecommunications infrastructure in all markets, (3) encouragement of technological innovation, (4) use of deregulation, lesser regulation and/or non-regulation, and (5) affordable access for essential public institutions.

Many of these often conflicting goals are directly incorporated into Section 706 of the Telecommunications Act, "Advanced Telecommunications Incentives." Congress allowed a period of time to see whether or not the competitive market can provide the needed facilities to all Americans in a timely and reasonable fashion. If after three years under the Act the FCC finds that the market mechanisms have failed, it is authorized to remove barriers to investment and promote competition.[16] No funding remedies are authorized in this section.

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[16] On January 26, 1998, Bell Atlantic filed a petition with the FCC requesting that the deregulatory steps authorized under Section 706 of the Act be taken at this time due to the slow deployment of the advanced network features like high-speed broadband capacity over packet switched networks. This petition attempts to sidestep the review procedure contemplated in the law and foreshortens the period envisioned by Congress for the provisions that foster local competition to take effect. Many RBOCs seem to be looking for novel routes through which to provide in-region services before they receive FCC approvals under Section 271 of the 1996 Act.

In Section 254(h), on the other hand, the provision of advanced telecommunications services is allowed to be subsidized, and that subsidy is limited to specified schools, libraries and health care institutions. Other ratepayers may not directly benefit in their homes and businesses from this subsidy for higher capacity services to these institutions. There currently is no provision for direct subsidy for the general public of the higher capacity services when provided to their homes and small businesses. In fact there are price disincentives built into accessing the Internet at low speeds such as an increase in the subscriber line charge for subscription to a second line for modem connections. While this higher subscriber line charge is based on cost and is a means to limit the size of the support funding for basic lines, it is nonetheless an example of how the Universal service goals for basic and advanced services can operate in conflict.

Network traffic directed to use ISP services is currently exempt from application of interstate access charges regardless of its jurisdictional pattern. Practically, this policy results in the assignment of most ISP traffic to local usage, thereby shifting the relative usage and jurisdictional costs of this traffic to the states. A more meaningful jurisdictional assignment of Internet traffic should reflect the realities of the shared network facility. Lacking that, there appears to be an implicit subsidy from intrastate service for some ISP traffic when one compares it to treatment of similar IXC traffic. If the FCC continues to exempt ISP traffic from explicit interstate access charges, it must develop an explicit interstate subsidy mechanism, as required under the 1996 Act, to replace the current implicit subsidy based on a jurisdictional shift of the traffic to local.

Consideration of universal service objectives and access charge reform objectives must go hand-in-hand if regulators are to prevent the opportunity for arbitrage inherent in the current melange of historical pricing policy and forward-looking market objectives. What we find today in the Internet and its access providers is a hybrid of services and technologies that frustrate application of traditional regulatory paradigms. The Internet and its interplay with local telecommunications networks displays carrier, enhanced service provider, and broadcast media attributes. Therefore, the categorization of ISPs as a distinct class of customers from traditional IXCs may be a necessary interim step to achieving a compensation model that is acceptable today for application to Internet access over the PSN — and possibly, soon thereafter, to all interconnects with the local network for origination and termination of telecommunications transmissions.

Under the 1996 Act, subsidy for advanced telecommunications and information service capabilities is allowed only when they are being deployed in the networks of telecommunications carriers and the services are being subscribed to by a substantial majority of residential customers. Such a subscription level would make these services eligible for consideration for inclusion in the definition of services supported by the federal USF. The demand of the institutions eligible for support under Section 254(h) for such advanced telecommunications services over the PSN is being diverted to private connections that have been made more affordable by the subsidies under that section. This leaves a smaller total demand on the PSN over which to spread the costs of such services. This results in higher prices which further reduce residential demand for the PSN-based services. Therefore, to the extent that demand for advanced telecommunications services is diverted away from the PSN by private connections, the inclusion of advanced services in the definition of universal service will be delayed. In some rural and low-income or high cost areas this may delay the delivery of access to information technologies and services.

Lastly, states are authorized under Section 254(f) to develop additional definitions and standards to advance universal service within a state as long as they are funded so as not to rely on the federal USF mechanisms. Advancement of Internet accessibility through higher speed connections to homes would require greater bandwidth than is supported under current FCC USF rules. This appears to leave states to fund any general advancement in data speed connectivity on the PSN from in-state sources. This burden is exacerbated because states have to bear the cost of infrastructure necessary to process Internet traffic which in turn has been encouraged by the implicit subsidy inherent in the ISP exemption.

Should ISPs Contribute to the Universal Service Fund?

There is a continuing controversy over using universal service funding to make advanced services for Internet access and information services ubiquitously available at affordable prices. That controversy also spills over into the issue of whether ISPs can and should contribute as "telecommunications carriers" to federal universal service programs. USF funding therefore ties back to the ongoing policy debate regarding the intent of the Act and the effect of the FCC's exemption of the ISPs from access charges, effectively declaring them end users rather than telecommunications carriers. Definitions are evolving regarding what is an end user, a service, a facility, and a carrier. Regardless, ISPs benefit from the subsidies for advanced services to the institutions designated in the Act when those subsidies make it possible for those institutions to use their services. In addition there is a blurring of the definitions of data, voice, and video when it comes to telecommunications applications. The Internet is capable of carrying voice transmissions and entrepreneurs are attempting to fully tap that capability and that market. As beneficiaries of subsidies to institutions accessing the Internet, and due to their public offering characteristiecs, it can be argued that ISPs should share in the cost of subsidizing services that are deployed to access the ISPs' services.

The Telecommunications Act states in Section 254(d) that every interstate telecommunications carrier shall contribute to the fund with equity and nondiscrimination. The FCC's previous exemption of Internet service providers from the "telecommunications carrier" designation for public policy reasons made sense at that time, but may prove inconsistent with the application of the Act's principles of explicit rather than implicit subsidization for universal service. Redefinition of ISPs as a distinct class of carriers and application of some form of economically based access charges and assessment for USF purposes could end this historical subsidy to ISPs and make them contributors to the explicit subsidies that promote use of their services. If the legal distinction between carriers cannot be made for purposes of applying access charges, another alternative may be to go ahead and assess ISPs and provide universal service funds directly to the ISPs to offset the charges.

V. Conclusions

At its inception and for many years thereafter, the PSN carried only voice communications. Growth in data transmission in recent years has resulted in a network that is heavily used for different types of communications. The current technology used for transmission of voice does not appear to be optimal for data. It is imperative that all participants in the telecommunications market, including regulators, have a clear understanding of how the PSN interrelates to the data network and how voice and data telephony are converging.

From a technical point of view, it is important that the PSN start migrating to a network which is data friendly. While it is understood that the PSN of today needs to undergo some fundamental changes to achieve this goal, we should also understand that all of the necessary changes do not have to occur on what is typically termed "the PSN." For instance, data traffic could be diverted onto a separate, data-friendly network for delivery to the Internet backbone by adding switch adjuncts into the network. Technology such as xDSL could also be employed in the loop to provide the premises connections which would permit high transmission speeds, thus keeping the last mile from being the choke point in data transmission. Many technologies could and will be used to provide quality data transmission capabilities in the future.

To make the transition to the data-friendly network will involve capital outlays. It is not enough that the Internet be able to process data. The loops and switches of the PSN must also be capable of doing so. Given that there is little compensation today for the increased traffic already traversing the network, due at least in part to the ISP access charge exemption, carriers may not be willing to make the investments needed to upgrade the network without a reasonable expectation of capital recovery. Because the FCC has determined that this investment for network upgrades will not be recovered through access charges paid by the ISPs, it is important that we devise some means to fund transformation of the PSN from primarily a voice network into one which can process any type of traffic desired, whether it be voice, data, or video. This funding could come from the end users who call the ISPs, the ISPs themselves, or the universal service fund. Of course we must always be careful not to fund technological and pricing developments which will occur naturally. However, we must weigh this concern against whether the pace of technology development is acceptable when a large segment of society may not be provided timely access to advanced telecommunications technologies.

PSN traffic and advanced telecommunications infrastructure are evolving symbiotically. In recognition of this, costs imposed on the PSN by those accessing the Internet should be equitably shared among the originators, conveyors and recipients of these communications in a manner that promotes technological innovation, network reliability and service quality, infrastructure investment, competitive markets, and ultimately, universal service. Numerous controversies have arisen regarding jurisdictional cost allocations, application of access charges or other local pricing options, payment of reciprocal compensation, and receipt of and assessment for universal service funding for PSN facilities. These controversies may be resolved equitably, vis-à-vis all telecommunications carriers and end users, if they are addressed systemically with recognition for their interplay. By seeing these controversies in focus in this paper, regulators and public policy makers may be able to avoid the perpetuation of some of the seemingly endless applications to the evolving PSN of inadequate and piecemeal fixes to often outmoded pricing and policy models. Such refreshed vision may engender innovative options and perspectives that otherwise might not be considered.

In summary, the telecommunications network is undergoing a transformation. It is imperative that the public continue to perceive the network as seamless. While it may be that several networks will be used to deliver the telecommunications services of tomorrow, all of them will have to interact to connect all users. Viewing the networks separately, without taking into account how they relate to each other in a unified communications system, would jeopardize the potential they hold to provide benefits for all consumers and to society as a whole.

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PRICING AND POLICIES FOR INTERNET TRAFFIC ON THE PUBLIC SWITCHED NETWORK

DRAFT REPORT OF NARUC INTERNET WORKING GROUP

NARUC Winter Meeting
March 1 & 4, 1997
Washington, D.C.

Jeff Richter-PSCW

Project History

- Panel at 1997 Winter Meetings (2/97)
- Workgroup formed
- Questionnaire sent out mid-April
- Responses (5+3) in May & June 1997
- Summarized Comments in FCC NOI re Usage of PSN by ISPs
- Numerous conf. calls
- NRRI accommodates project on its Website: *www.nrri.ohio-state.edu/internet.htm*
- Panel at Summer meetings
- First draft paper issued for comment at Annual Meeting in Boston (Nov. 1997)

Working Group Participants

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- Mark Long (FL)
- Vivian Witkind-Davis (NRRI)
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Topics of Discussion

- The Problem? Growing Internet Use.
  - But, this is the policy!!
- Technical Solutions
- Pricing Decisions & Options
  - Reciprocal Compensation
- Universal Service
- Conclusions

Policy Questions Addressed

- Network Congestion
- Reliability & service quality
- Investment and Innovation
- Definitional: e.g. service, facility, carrier
- Universal Service
- Competition
- Jurisdiction & Authority

Basics of the Networks

Internet - a packet-switched backbone network

- designed for data transfer, delivery, and retrieval.
- always in a dormant "ready" mode
- active only when delivering packets.
- packets can be stored off-network for later access, delivery, or retrieval

PSN - a circuit based network

- Designed for voice transmission; can handle data
- Connection through the switching and transport networks
- Continuous until the connection is terminated.

Part 36 SEPARATIONS

- jurisdictional minutes of use allocators
- ISP exemption from access charges
- Lower interstate/intrastate traffic ratio
  - Local traffic reported
  - Internet traffic minutes appear local

Additional costs?

- Lack of empirical evidence of overall PSN congestion effect
- What about additional revenues?
- LECs as ISPs

THE ISP EXEMPTION

- FCC's Computer II proceedings (1970s)
  - Enhanced Service Providers (ESPs) - Internet and other interactive computer networks
- 1983 access charge order
- 1996 Access charge NPRM, par. 284
- Access charge reform decision
  - May 8, 1997, Docket No FCC 97-158
- TA 96 policy

Telecommunications Act of 1996

"to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services unfettered by federal or state regulation"

Arguments for maintaining the exemption

- Support for nascent industry
- Public Interest
- Venue for social goods
- Access Charges are not economically bas
- Competition
  - Price break for CLEC ISPs
  - Force ILEC network upgrades
- Encourage CLEC network development

Arguments against the exemption - Short-term

- ISPs pay less and tax PSN more
  - traffic differences
- Loss of toll revenue for rural ILECs
  - Incremental plant investment

SO WHAT?

- In an Internet call, the two end users are the Internet Service Provider (ISP) and the ISP's customer.
- Internet service providers (ISPs) are connected to both networks:
  - the packet network over high speed dedicated facilities for exchange with the Internet, and
  - the PSN through local business lines to provide dial-in access for end users.

ESP Exemption

Why local connections for dial-in?

- The FCC exempts Enhanced Service Provider (ESP) traffic from access charges
- the FCC has interpreted that ISPs are ESPs
- Therefore, ISPs not required to pay access charges
  - On the other hand interexchange carriers (IXCs) must pay access charges for similar connections to the PSN.

So basic PSN service less efficient BUT more attractive

- cheaper for end users
- modems bridge gap
- flat or per-call local prices

PSN CONGESTION??

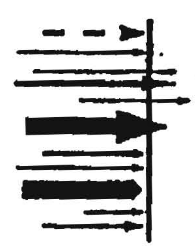
- Call durations
  - Voice ~ 4 minutes, Internet ~20 minutes
- Second busy hour in the evening
- Exacerbated by flat rate pricing
- Could result in congestion of several PSN components

Locus of Congestion

- Access Line Congestion
  - Increase blocking, dial tone delay
  - Line units added or reconfigured
- Trunk Side Congestion
- ISP termination - not enough modems
- NOT to be confused with Internet slowness

Jurisdictional Nature of traffic:

- Local or Interexchange
- Inter- or Intra-State
- Inter-Net



Policy: One PSN or Two?

- Access and Separations
- Analog vs. Digital line basis

Government Policy Goals

- Development of competitive markets
- Ubiquitous Infrastructure
- Encourage technological innovation
- Use of de-/lesser/non-regulation
- Affordable access for essential institutions
- Universal Service
  - basic/essential service
  - rural issues

Universal Service Planning

- Infrastructure objectives
- Ubiquitous advanced data service?
- Revenue base for investment
- Subsidy for Internet access in rural areas?
  - Diversion of Education, Health care and Library usage
- Caution: Subsidy for infrastructure the market will "soon enough" provide

Avanced Services: what's between Secs. 254(h) & 706

- Funds for schools, libraries & rural health care in Sec. 254
- No funds for res. or small business
- Current disincentives for additional low-speed connections
  - SLCs

The ISP "Subsidy"

- Shared PSN facilities
- ISP exemption [illegible] forces:
  - [illegible]
  - [illegible] subsidy [illegible]
- Continuation should require an explicit subsidy mechanism
- Redress involves access charge and separations reform

ISP: Unique Class of Customer or Carrier?

- traditional regulatory paradigms frustrated
- Internet as carrier, ESP and broad[illegible]

- Options:
  - create a unique ISP rate design [illegible]
  - a new, more [illegible] rate design model [illegible]
  - new interconnection [illegible] model

Arguments against the exemption - Long-term

- Network overload encouraged
- Discourages new competitive offerings
- Harms IXC entry
  - Cost imposition of Access
  - Loss of revenue

What is the short-term evolution of Internet access?

Two schools of thought:

- PSN management
  - Sufficient revenue?
- Migration to data networks
  - Sufficient incentives?
  - Business - PL, Centrex, ISDN
  - Residence - ISDN

Bellcore

Internet Traffic Engineering Solutions Forum

- SS7-based solutions, 10/97
  - Line-side Redirect: pre-switch
    - route calls directly to ISP, i.e., via PRI, T-1
  - Trunk-side Redirect: post-switch
    - divert traffic to packet 'cloud' for transport
- Improve "Present Mode of Operation" 6/96
  - Add, reconfigure line units

Is ISDN a short-term mass solution?

- PRI for ISP's prevents line-side congestion
- Debate on consumer BRI use continues
  - already passed over by the market for the next generation of digital lines?
- Affordability
- Technical limits
  - speed, distance

Long-term Evolution of the Internet and Internet access?

- Internet has gone packet
  - ATM backbones, Frame Relay
- Last Mile
  - xDSL
  - cable modems
  - improved analog?
- LECs as protocol converters
  - LEC modem banks?

Structure and Charges for Local PSN Internet Access

- Government should not establish a specific technology as a social goal.
- Continue the preferential rates?
  - This may be affecting technological advances
- If charged for PSN, it should be:
  - forward looking
  - to ISP, not end user

States may act

- Section 254(f) - state option for expanded US definition w/state funding
- Bandwidth definition for basic service
- States fund infrastructure for PSN-Internet access

ISP USF Contribution?

- ISP Exemption makes them non-carriers
- Internet driving infrastructure advancement
- Indirect beneficiaries of institutional subsidies
- ISP service has public offering characteristics
- Assess ISPs & give some direct USF benefits?

Conclusions

- Must understand PSN: Data and Voice
- More data friendly PSN necessary
- Massive capital outlays required
- Symbiotic evolution: traffic and investment
  - share costs between originators, conveyors and recipents
- Systematic solutions not piecemeal

Bellcore
Bell Communications Research

Impacts of Internet Traffic on LEC Networks and Switching Systems

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Impacts of Internet Traffic on LEC Networks and Switching Systems

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Abstract: *The past year has seen explosive growth in internet traffic. Currently, the most common way of accessing the internet is via the switching systems and the interoffice trunk facilities of the Public Switched Telephone Network (PSTN). The PSTN was designed to carry voice calls that have an average call holding time of about 3 minutes. The nominal 3 minute call assumption pervades all aspects of telco equipment design such as switch engineering, line concentration ratios, and trunk group sizes. However, internet calls violate this fundamental assumption and have a mean holding time of the order of 20 minutes with some calls lasting for many hours.*

This long holding time traffic severely taxes the PSTN. It requires additional equipment to be provisioned, without compensating revenues, and potentially affects service performance for all users. Internet traffic, which is packet data in nature, can in principle be carried much more efficiently on data networks. However, since the PSTN currently represents the only near-universal access method, any long term solution necessarily involves a staged migration from the present mode of operation towards some packet network solution.

This paper reviews the impacts of internet traffic on the PSTN. It summarizes the impact of internet traffic on transmission and switching equipment, the need for comprehensive revisions to existing engineering and planning algorithms, and the implications of these issues for operational practices and operations support systems. It also provides analysis of the cost of supporting internet traffic on the PSTN. Finally, it describes a number of possible solutions. In each case the current barriers to implementing the solution are discussed.

I. INTRODUCTION

The past year has seen explosive growth in internet related telephone traffic – specifically, calls from residential and business subscribers across the public switched telephone network (PSTN) to internet service providers (ISPs).[1] Although there are alternative methods of accessing the internet (to be discussed later in this paper), the only near-universal access currently available to the public is via modem calls across the PSTN. After reaching an ISP, such calls are converted back into data format so that they can be piped directly into a local internet gateway, or transmitted across a packet network to a remote gateway. This network architecture is illustrated in Figure 1.

1. For the purposes of this discussion internet traffic may be taken to include internet, work at home (WAH), telecommuting and on-line services calls, all of which appear to have similar characteristics.

The rapid growth in internet traffic has been stimulated by a number of developments, including: (i) the increased power and availability of personal computers (PCs), (ii) the growth in commercial uses of the internet, and (iii) the popularity and increased ease of access to the world wide web (WWW) via web browsers such as Netscape. In addition, the growth in corporate telecommuting and work-at-home (WAH) employment has created an environment in which users are more comfortable with on-line services and are more likely to use PCs for work and leisure.

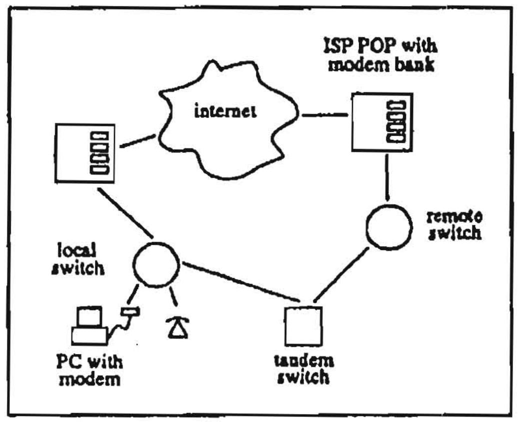

Figure 1: Internet Access via the PSTN

The rise in internet traffic provides an important indication that the center of mass in telecommunications is shifting towards data applications and services. Although the PSTN is currently used to carry internet calls in circuit switched mode, these calls are essentially data calls. They are generated in packet data format by PCs, and can in principle be carried far more efficiently and cost effectively over data networks. Suitable data networks exist today. However, due to cost and equipment limitations, access to these networks is largely limited to high volume business users. As access to data networks becomes universally available, the volume of data traffic generated by applications such as point of sale transactions, electronic commerce, video telephony, etc., will dwarf the traffic currently carried by the PSTN.

The trend towards data will challenge telecommunications network and service providers in a number of significant ways. In general, it will be necessary to develop engineering, planning, operational and business procedures to cope with new networks and services. The first major challenge is being met by local exchange carriers (LECs) in the form of internet traffic. This traffic has significantly increased the load on LEC networks, while providing very little compensating revenue. While its volume poses an immediate threat to the capacity of the PSTN, at a more fundamental level its qualitatively new characteristics are challenging the engineering, forecasting, planning and operational procedures established by the Bell System over the past 80 years.

At present, a number of LECs are analyzing the internet phenomenon, and debating the best path forward. Since the PSTN currently represents the only near-universal access method, any long term solution necessarily involves a staged migration from the present mode of operation towards some packet network solution. The principal requirements of the migration strategy are that it be cost effective (i.e., provide the desired capabilities for reasonable investment), and that it be sufficiently flexible to evolve towards future technologies (e.g., ATM). Confusing the issue are a host of uncertainties associated with tariffing, time to market of new technologies, demand forecasts, etc. Notwithstanding the complexity of the problem, solutions need to be put in place quickly in order to protect the integrity of the PSTN.

The object of this paper is to review in more detail the various impacts of internet traffic on the PSTN, and provide a high level summary of possible solutions. In particular, based on analysis of traffic data, it summarizes the impact of internet traffic on transmission and switching equipment, the need for comprehensive revisions to existing engineering algorithms, and the implications of these issues for operational practices and operations support systems (OSSs). The paper also provides analysis of the cost of supporting internet traffic on the PSTN. Finally, it describes possible solutions, including more efficient use of existing PSTN equipment, as well as solutions based on packet networks (ISDN, Frame Relay, ATM). In each case the current barriers to implementing the solution are summarized.

II. GROWTH IN INTERNET AND RELATED TRAFFIC

As noted above, growth in internet traffic is tied to a number of factors including: PC penetration (percent of U.S. households with PCs), modem penetration (percent of PCs with modems), growth in corporate telecommuting and WAH employment (these users tend to be high volume users), and a range of less easily quantifiable factors such as time to market of new technologies (e.g., ADSL) and customers' willingness to pay for 'hot' new applications. Based on Bellcore's market analysis, Figure 2 shows conservative demand projections for internet access out to the year 2001. The demand is broken down into two categories: dialup access via the PSTN using POTS and ISDN lines (lower part of Figure 2), and alternative 'dedicated' access methods such as ADSL, which effectively bypass the PSTN (upper part of Figure 2). Note that the y-axis in Figure 2 has no units. Figure 2 illustrates anticipated average relative growth in U.S. internet traffic over the next 5 years. More detailed assumptions and information are required in order to be precise about growth in particular LEC markets.

The demand forecasts in Figure 2 are conservative, in the sense that conservative assumptions were made regarding the rollout of new technology. They suggest that by 2001, internet traffic will approximately double relative to its present value. If more aggressive assumptions are made, the demand could be significantly higher – as much as 5 times its present value by 2001. In fact, these estimates may well be too low, since they are based on analysis of numbers of households. No accounting is made for growth in per household internet traffic, which itself could be quite significant. In brief, the figures indicate that while new technologies such as ADSL and cable modems will grab a segment of the internet access market, the PSTN will support most internet access traffic for at least the next 5 years.

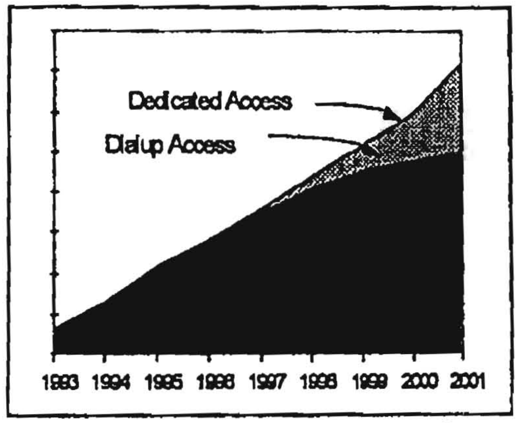

Figure 2: Forecast Demand for Internet Access

III. CHARACTERISTICS OF INTERNET TRAFFIC

Today's PSTN has evolved over the past 80 years to become a very efficient carrier of voice telephony. This evolution has occurred in a carefully planned fashion based on detailed understanding of the characteristics of voice traffic. The well established engineering model for voice calls assumes that: (i) the average call holding time is around 3 minutes, (ii) the statistical call holding time distribution is well approximated by an exponential distribution, and (iii) call arrivals are Poisson. These mathematical assumptions have been validated via analysis of measured data. In conjunction with appropriate demand forecasting models, they are used to engineer the PSTN. For example, the operations support systems (OSSs) that monitor trunk usage in the PSTN, utilize the above model to decide when and where additional trunking capacity should be provided. The large scale economics of the PSTN – e.g., its return on capital investment – are largely determined by how efficiently it can carry traffic across shared switching and transmission resources. Appropriate traffic models quantify what efficiencies can be achieved for a given grade of service (GOS).

Traditional models of voice telephony are embodied in a range of widely used standards, engineering procedures, OSSs, and cost models [1]. They underlie the traffic, measurement and engineering sections of Bellcore's LATA Switching Systems Generic Requirements (LSSGR) [2], that for many years have provided a benchmark for the functionality and performance expected of LEC switches in the U.S. They are likewise embedded in Bell System OSSs such as TNDS and COER [1], as well as in vendor supplied planning and engineering systems for specific switches. Finally, they are incorporated in tools used by the RBOCs for estimating the cost of the network switching and transmission equipment required to meet projected growth, based on detailed breakdowns of capital costs, etc.

Internet traffic is qualitatively different from traditional voice traffic. Based on current data analysis, internet calls have a mean holding time of the order of 20 minutes, and their distribution is not exponential.[1] Instead, the holding times of internet calls are statistically distributed according to a power law distribution. This means that with non-negligible probability, one can encounter calls with very long durations – e.g., 12 hours, 24 hours or longer. Traditional and internet call holding time distributions are illustrated in Figure 3. The plots in this figure give the probability that a call holding time will be greater than the time value on the *x*-axis. The 'flatter' shape of the internet distribution indicates that internet call durations vary widely from a few seconds to many hours. In contrast, the probability that a traditional voice call will last longer than a 10 minutes is very low, and the probability that it will exceed one hour is virtually zero. Traditional call holding times tend to be clustered far more closely around the average value of 3 minutes.

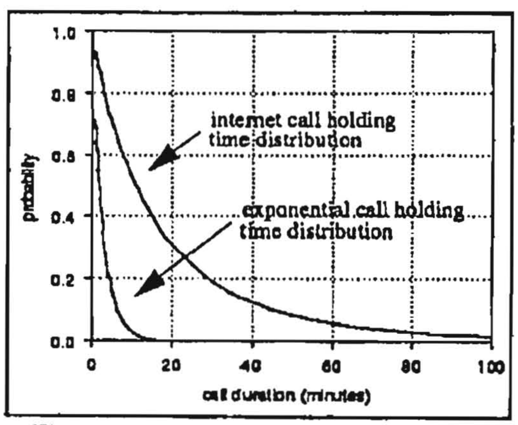

Figure 3: Call Holding Time Distributions

In addition to qualitative differences, internet traffic is also quantitatively different from traditional voice traffic. PSTN traffic loads are typically measured in units of centum call seconds (ccs), representing one hundred seconds of connect time. For example, a subscriber line which generates an average of 2 calls per hour with an average call holding time of 3 minutes is said to generate 2x(3x60)/100 = 3.6 ccs load, where the maximum possible load per line is 36 ccs. Historically, residential and business subscriber lines are expected to generate 3 - 6 ccs, with residential lines at the lower end of this scale and business lines at the higher end. The PSTN is engineered around this expectation. If a subscriber now starts using the same line to carry internet calls, as well as regular voice calls, the average load generated per line can rise to 10 ccs or higher. In this case, the network is suddenly required to handle about 3 times the load for which it is engineered.

IV. IMPACTS ON THE PSTN

The nature of internet traffic creates a number of issues for network engineering. The most immediate impact is due to the much higher loads generated by internet users. When significant number of subscriber lines suddenly generate 3 times their engineered load, one can expect significant congestion to occur in several parts of the PSTN: the local access switch, the backbone trunk and tandem network, and at the terminating switch which is connected to the ISP. Since internet traffic from a wide geographic area is typically funneled into the terminating switch, acute congestion is most likely to occur first at the terminating switch. In such cases, lines between the terminating switch and the ISP have been observed to be loaded to 30 ccs or more. Under these conditions, only a fraction of calls can successfully complete. That is, most calls are blocked due to lines not being available.

The congestion that has been observed in other parts of the PSTN – the access switches and trunking network – is partly due to elevated loads, and partly due to other less obvious causes. Line peripheral units in LEC switches are engineered to traditional traffic levels i.e., 3 - 6 ccs per line. In particular, line concentration ratios (LCRs) – the ratio of lines to trunks – are matched to these loads, so as to provide a uniformly good grade of service to subscribers e.g., <1% calls blocked. Internet usage can increase the load generated per subscriber line to 10 or more ccs, resulting in excessive blocking of call attempts, dialtone delay, and related problems. In summary, internet traffic can result in dramatic degradation of service quality.

The occurrence of excessive blocking is illustrated in a heuristic way in Figure 4. Figure 4 shows two blocking curves derived from traditional traffic models. One curve is for a scenario in which a group of lines is offered traditional exponential calls. The other is for a scenario in which 4% of the lines are effectively blocked out (i.e., continuously occupied) by long holding time internet calls. In the latter case, the presence of the internet calls produces a sixty-fold increase in the blocking experienced by the exponential traffic (from 0.05% to approximately 3%). Figure 4 shows that a small percentage of internet traffic can have a dramatic impact on network performance.

1. Based on preliminary analysis of recently collected data. More work is underway to refine internet traffic models.

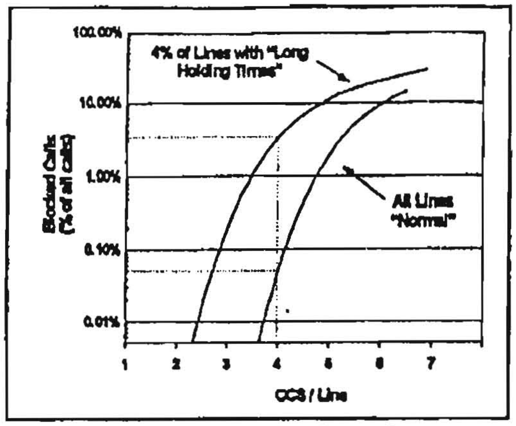

Figure 4: Blocking Scenarios

Within the PSTN, the only answer to this problem is to reduce LCRs i.e., to provide more trunks (and other switch resources) per subscriber line. In this way one regains the established grade of service, at the cost of providing additional network equipment. Since line terminating equipment is the largest capital component of switch cost, internet traffic has the potential to cost LECs large sums of money in 'out of cycle' capital expenditure. First cut estimates suggest that this cost will exceed $35M per region per year. However, this estimate is based on incomplete analysis, and the actual cost is expected to be much higher. Further studies are underway in Bellcore to produce more accurate estimates of this cost. Figure 5 shows Bellcore's analysis of a hypothetical scenario, which involves 30 central offices (COs) providing internet access, several tandem switches, and two internet 'hub' COs (i.e., terminating switches). For the purposes of this study, Bellcore's SCIS tool was used to estimate incremental capital and operational costs on a per switch basis.

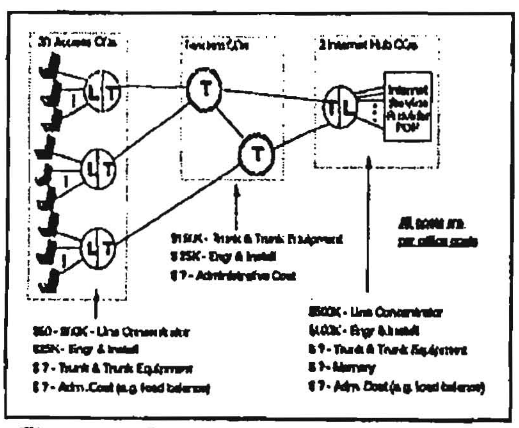

Figure 5: Cost of Supporting Internet Access

The largest cost components in all switches were associated with line terminating equipment. Note that trunk and administrative costs were not included in this study. Based on extremely conservative assumptions, the annual cost of supporting internet access in an ISP point-of-presence (POP) serving area was estimated to be in the range $2.7M to $4.2M+. (Costs vary according to factors such as vendor specific capital and operational costs.) A typical LEC will contain many such POP service areas. Note that this expenditure is likely to generate little compensating revenue for the LEC. Many subscribers will simply use their existing flat rate lines for internet access, resulting in zero additional revenues to the LEC. Others may purchase a second line – second line sales have risen substantially recently – however, the additional revenue from this source is unlikely to offset capital expenditure.

For more accurate estimates of the additional cost to LECs of supporting internet traffic on the PSTN, it is natural to turn to traditional traffic models. These models have been used in the past to engineer such quantities as LCRs, switch resources, trunk groups, etc. However, the qualitatively new characteristics of internet traffic imply that the traditional models are no longer valid. For example, it is not sufficient to simply plug the new elevated subscriber line loads into traditional traffic models, and recalculate line concentration ratios. The traditional models are overly optimistic and will tend to under-estimate the internet impact. New models are required, which account for the much greater variability in internet call holding times. This point is illustrated in Figure 6 below.

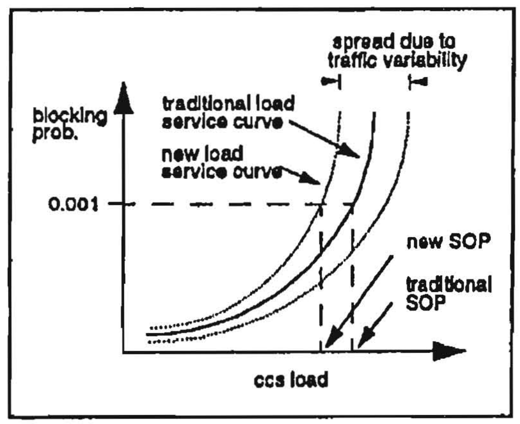

Figure 6: New Engineering Models

Figure 6 shows a traditional 'load-service' curve (solid line), for example, one that might be generated using an Erlang B or Poisson formula. For a given grade of service (i.e., blocking probability), such a curve is used to calculate a 'safe operating point' (SOP) for the relevant equipment. The SOP is the largest load that can be carried by the equipment while still meeting the GOS criterion. In the presence of internet traffic, switches and trunks can no longer be assumed to operate on the solid curve in Figure 6. Instead, they will tend to operate in some band around this curve, indicated by the dashed lines. It follows that in the presence of internet traffic, one must engineer the network more conservatively, according to the left-most dashed line. The overall impact of this effect is to de-load network equipment.

and reduce network efficiency. The magnitude of this effect – i.e., the additional cost to the network associated with new engineering criteria – is yet to be fully quantified. However, work is underway in Bellcore to address this issue, and to provide suitable new engineering models in the near future. These models will replace the traditional models developed in the Bell System over the past 80 years.

Going beyond fundamental traffic models and capital costs, the increased variability of internet traffic will impact the operation of LEC networks in a variety of ways. In the area of operations and facility management, current procedures for load balancing and monitoring switch performance may prove inadequate for internet traffic. Severe difficulties have already been encountered in load balancing switches carrying significant levels of Internet traffic. This problem is presently being studied by Bellcore to determine what changes are required to current procedures, and what new switch measurements may be needed. As noted in section 3, a number of the large scale OSSs and support tools used by LECs are based on traditional traffic models. These OSSs need to be updated to accommodate internet traffic. If they are not, the tendency will be for these tools to underestimate network resources, potentially resulting in poor service to subscribers, and sub-optimal network planning.

Finally, from the LEC perspective, it is important that equipment vendors, particularly switch vendors, be aware of these issues, and take necessary steps to incorporate new traffic models and engineering algorithms into their engineering, provisioning and planning tools. Switch vendors also need to consider whether new traffic measurements should be provided by switches, so that their customers can better track and respond to changing traffic profiles.

V. NETWORK SOLUTIONS

As noted above, the most common internet access arrangement at present is for ISPs to be connected to the local 'terminating' PSTN switch via large multiline hunt groups, consisting of hundreds or perhaps thousands of lines. No special actions are taken within the PSTN to identify or route internet access traffic separately, or at a different grade of service, from regular voice traffic – internet traffic uses exactly the same switches, trunk groups etc. This situation will be referred to below as the present mode of operation (PMO).

Sections I - IV discussed various PSTN impacts of internet access traffic in the PMO. It was noted that since the PSTN currently represents the only near-universal access method, any long term solution to these problems necessarily involves a staged migration from the PMO towards some packet network solution. This section describes a number of solutions that will relieve pressure on the PSTN, and ultimately allow internet traffic to be carried in an efficient, economical fashion. These solutions may be characterized as short term (ST), medium term (MT) and long term (LT). In each case the current barriers to implementing the solution are discussed.

As shown in Figure 7, internet solutions may be broadly characterized according to whether they are implemented in the access switches of the PSTN, or in the inter-office trunking network. Trunking solutions generally attempt to reduce stress on the PSTN by de-loading the switches as far as possible, and by trunking internet traffic more intelligently. ***Trunking solutions, however, do not address the central problem of internet traffic, which is that the PSTN is not designed to efficiently carry packet data traffic. Access solutions do address this problem. They attempt to siphon off internet traffic at the edge of the PSTN, before it enters PSTN switch and trunk facilities.*** Once the internet traffic is separated from voice traffic, it is then routed onto data networks, where it can be carried very efficiently. Access solutions have far more long term potential to reduce the cost of carrying internet traffic, and for this reason are likely to form the basis for any long term network solution.

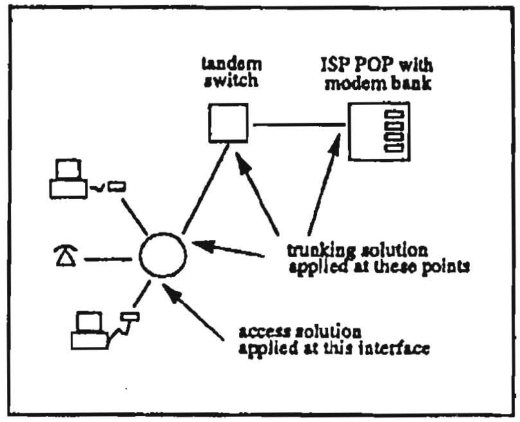

Figure 7: Access versus Trunking Solutions

It is possible to take advantage of both broadband technologies such as B-ISDN, Frame Relay, and ATM to provide a more efficient interface to ISPs as well as narrowband technologies such as Advanced Intelligent Network (AIN) or Local Number Portability (LNP) to more efficiently route the data calls within PSTN to switching systems that can better handle the data calls. While the underlying technology for these solutions is largely in place, a network planning assessment is needed to select the most promising and cost effective of these technologies to implement.

The trunking and access solutions discussed in this section are listed below, together with their characterization as short term, medium term or long term:

TRUNKING

- managed PMO (ST)
- numbering solution (ST)
- modem pool in CO (ST)
- post-switch adjunct (ST)

ACCESS

- managed PMO (ST)
- packet mode ISDN (MT)
- pre-switch adjunct (MT)
- ADSL (MT/LT)
- cable modems (MT/LT)
- packet radio (LT)

Managed PMO Trunking Solution

Trunking solutions address the problem of congestion in the trunking network and terminating switch. Although trunking solutions are technically feasible, they may not be within the full control of LEC for a number of reasons. First, an ISP buys only as many lines as it deems necessary to the terminating switch. For the most part, ISPs are content to provide a much poorer grade of service than in the PSTN. Internet traffic is growing so fast that customer retention is not an issue (at least in the near term), and customers themselves generally expect many calls to be blocked. Consequently, with too few lines to accommodate the offered load, congestion is likely to be a chronic problem on ISP lines.

This congestion can be contained by putting ISP lines on separate peripherals so that other customers are not affected. It could also be ameliorated by: (i) connecting the ISP to the terminating switch via trunk or primary rate ISDN (PRI) interfaces, (ii) connecting the ISP directly to tandem switches via trunk or PRI interfaces, so that switches are de-loaded, and (iii) connecting the ISP to remote integrated digital loop carrier (IDLC) interfaces, which could be engineered to an appropriate grade of service. The latter three actions would improve the LEC operations and facilities aspects of this problem.

However, ISPs currently perceive little incentive (e.g., in terms of cost) to move away from basic line side connections, and so they typically opt to be connected to the switch via multiline hunt groups. In some cases this choice may be made in ignorance of other options, or through failure to recognize the potential cost / performance advantages of more efficient interfaces. The competitive cost of basic line side connections is undoubtedly attractive to ISPs. However, line side connections are more expensive 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.

This issue highlights the role of tariffing in influencing practical network solutions. The tariffs applied to various line types by public utilities commissions (PUCs) in many cases reflect a traditional view of how subscribers utilize network equipment. Tariffs are set in part so that different classes of customers pay in proportion to their usage of network resources. However, internet traffic has distorted traditional patterns of network usage, and undermined the LECs' ability to recover costs in proportion to usage. Bellcore is currently helping the LECs address this issue through data studies in support of tariff changes.

AIN Routing / Numbering Solution

The main idea in this solution is to assign switched based dialed number (DN) triggers to pre-advertised internet or on-line telephone numbers. Once the originating switch recognizes that the call is destined to an ISP (based on the defined trigger), it can then either route these calls to a tandem or a large switching system that has sufficient capacity to carry the data calls (e.g., an inner-city switch which is under-utilized at night), or decide to route them out of the PSTN entirely and use a packet network to concentrate the data traffic for transport to the ISP. In either case, the first step in this solution would be to detect the data calls using the defined trigger, and segregate them from voice calls for more efficient transport and routing. The office-based DN trigger is available in most modern switching systems.

One implication of this approach is that every call through the switch must be screened for this trigger, which will typically require additional processor capacity. In the case of equivalent AIN triggers, there may be a substantial hit on switch processors, which translates into a substantial reduction in switch capacity, due to this potentially non-revenue producing internet traffic. A potential advantage of the AIN / numbering solution is that it concentrates internet traffic in relatively few places (e.g., designated trunk groups) and thereby achieves economic efficiencies in the engineering of CO equipment, as well as minimizing capital expenditure for high performance interfaces between selected tandems and ISPs.

Once a data call has been detected, it can then either use translations and routing tables in the switching systems to route the calls to pre-selected switches or alternatively launch a routing query to an AIN Service Control Point (SCP). The advantage of using SCPs is that switches do not need to store large routing tables that are subject to frequent change. SCPs permit intelligent routing based on availability of modem ports or routes, time-of-day and day-of-week routing, and other criteria that LEC and ISP can agree upon. Additionally, the LNP architecture offers the advantage of maintaining the same access numbers while routing the calls in way that is most cost effective for the LEC or ISP. Thus end-users always dial the same number to access the ISP. However, the network routes the call based on paths that are most suitable from a network capacity and cost point of view.

Modem Pool in Central Office / Post-Switch Adjunct

Instead of providing 1MB line interfaces to the ISP, in which case the ISP maintains its own modem pool, the LEC, as a value added service, could maintain a modem pool (or equivalent equipment) on its own premises, concentrate the output of this modem pool into high speed digital pipes (DS1/DS3) either at end offices or tandems, and then transport the aggregated data stream to the ISP across a data network (e.g., Frame Relay). This implementation may provide a more attractive interface for the ISPs – maintenance of large modem pools is an acknowledged problem – while providing the LEC with the opportunity to engineer the network so as to avoid the LHT related problems. One business driver for this solution is that ISPs desire to extend their local calling areas as far as possible, so that customers benefit from local calling rates. Widely deployed modem pools / adjuncts effectively achieve this objective. The business case, and deployment, implementation and engineering guidelines for this solution need to be more fully analyzed.

Managed PMO Access Solution

Within the local access switch, it is possible to take some actions to reduce or manage the impact of internet traffic. For example, if it is possible to identify heavy Internet users, one can provide IDLC interfaces for these users, which are engineered independently of other lines to provide the required grade of service. Educated management of access switches will provide limited relief from internet problems – if nothing else, it is better for operations staff to understand the problem than to operate in a blind fashion. However, managed operation of access switches within the PMO will result in significant 'out of cycle' equipment expenses, and will not provide any substantial long term relief from internet problems.

Packet Mode ISDN

Data transmission only uses a fraction of the 64 kbps circuit switched bandwidth which is held up for the duration of internet calls. Specifically, data packets are sent back and forth across the circuit in rapid bursts followed by relatively long idle periods, and thus the bandwidth remains unused for most of the call. The inefficiency of carrying packet data over circuit switched networks was the main driver for developing packet switched networks such as X.25, Frame Relay, etc.

Ideally, one needs a simple method of identifying internet calls as data calls, and routing them to a data network before they enter the PSTN. In its packet mode services, ISDN provides such a method. Circuit mode ISDN calls operate in much the same way as traditional analog POTS calls. They seize a 64 kbps circuit and retain it for the duration of the call, regardless of whether the bandwidth is used or not. In contrast, packet mode ISDN calls do not reserve any fixed amount of bandwidth – they use bandwidth only as required. In packet mode calls, packets are sent as the subscriber generates them, and the switch is engineered to multiplex multiple packet streams together onto shared communication channels, so that bandwidth is utilized effectively, and all users receive an acceptable level of packet delay performance.

Packet mode services constitute a different paradigm for communications. They were included in ISDN for the purpose of carrying packet data traffic, but for a variety of reasons have not been made generally available to the public. Some of these reasons are possibly connected to questions concerning the capacity of ISDN packet handlers (which siphon off packet data traffic at the access side of the switch), and some may be related to lack of (pre-internet) applications and positioning of these products within the market place.

Although there are issues concerning the capacity, engineering and cost of ISDN peripherals, packet mode ISDN in principle constitutes the most attractive solution for identifying and segregating data calls at the access side of the switch. Implementation of ISDN as a practical solution may require interactions with switch suppliers to understand current limitations of packet handlers, and possibly increase their capacity in line with projected demand for packet mode services. Interaction may also be required to investigate appropriate engineering algorithms for ISDN switches. These same issues are currently arising through the use of packet mode ISDN services for point of sale (POS) transaction traffic.

Pre-Switch Adjunct

The idea of a pre-switch adjunct is to put some equipment with switching and modem capabilities between the subscriber and the local access switch. This adjunct equipment would perform some sort of table lookup on each call origination, to determine whether the call is destined to an ISP, or whether it is a regular voice call. In the first case, the adjunct equipment would route the call to a data network (via a modem function) and totally bypass the LEC switch. In the case of a voice call, the adjunct would simply pass the call to the LEC switch, and call setup and billing would proceed normally.

The idea behind the access node is valid – to siphon off data calls before they hit the LEC switching network. However, there are a variety of technical and business issues which need to be resolved with this approach, including the engineering and operations issues surrounding support of the adjunct, the cost of the additional equipment versus other solutions, implementation of billing, etc. In addition, since the adjunct resides between the subscriber and the local access switch, which is the subscriber's primary point of contact to the network, the pre-switch adjunct solution raises sensitivities to issues such as reliability, priority for emergency calls, recovery from failures, overload control, etc.

Asymmetric Digital Subscriber Loop (ADSL)

ADSL is an emerging technology that would replace or supplement the existing POTS or ISDN line between the subscriber and the local access switch. ADSL provides more bandwidth from the switch to the subscriber than in the reverse direction, from the subscriber to the switch. This arrangement is based on the expectation that subscribers will typically want to receive more information (e.g., video images) than they send. ADSL also provides the capability to siphon off data calls on the access side of the switch, before they enter the PSTN. These calls could then be routed to a packet network for efficient transport. Although it represents a potential solution, the timeframe and economics of ADSL rollout and acceptance are not clear.

Cable Modems

Cable modems utilize a shared hybrid fiber coax (HFC) medium and a media access control (MAC) scheme to share bandwidth among a subset of customers from a cable head-end. Cable modem technology has the potential to provide attractive high speed data access to cable-equipped subscribers. However the implementation details of this technology are still being explored. Since most, if not all, cable modem technology is implemented with a MAC scheme that allows for collisions and retransmissions, many details of the modem architecture, MAC scheme, traffic characteristics, line length (i.e. propagation time), deployment topologies, etc. will affect the real-world throughput of these devices. Vendor claims of 100 times narrowband ISDN bandwidth may greatly overstate their realizable throughput in realistic deployment scenarios. The aggregation of the upstream bandwidth of these devices is also dependent on traffic characteristics, as the upstream bandwidth is limited.

As with packet mode ISDN and ADSL, cable modems represent a solution in which internet traffic would be carried over data networks rather than the PSTN. Since cable lines are owned by cable companies, cable modems represent a potential competitor to the LECs. In order to retain market share, the LECs either need to team with cable companies, or deploy alternative solutions that are competitive with cable modems in terms of access speed, ease of installation, etc. As with ADSL, the timeframe and economics of cable modem rollout and acceptance are not clear.

VI. CONCLUSIONS

Due to a variety of market drivers, including wider availability of personal computers, the popularity of web browsers, and the rapid increase in internet service providers, internet traffic on the PSTN has experienced explosive growth in the past 6 to 12 months, and is projected to continue this growth for at least the next 5 years. The public switched telephone network (PSTN) will be the main carrier of Internet access traffic for the foreseeable future. The PSTN is already struggling under the increased volume of this traffic, and network problems such as congestion, excessive blocking of subscriber calls, and exhaustion of switch capacity point to the danger of network failures unless effective short term and long term network solutions are identified and implemented soon.

Internet traffic is essentially data traffic, and can be carried most effectively on data networks. However, since the PSTN is currently the only near-universal method of access, any long term solution will necessarily involve a staged migration from the present mode of operation to some data network solution. The burning issue for LECs is how to engineer this migration in a cost effective and timely manner, given current technological constraints. This paper has identified a range of actions that can be taken to orchestrate a satisfactory long term solution. The final solution for each LEC may include a number of these actions, and could well be influenced by the unique business strategies and network plans of that LEC.

Regardless of the ultimate solution selected by an LEC, there is a substantial amount of work required in order to cost out the alternatives, perform interoperability testing of various supplier equipment, formulate appropriate engineering and operations plans for the network, and translate these technical advances into attractive products and marketing strategies. In parallel with this activity, it may be desirable for the LECs to jointly support the industry in formulating common equipment / interface standards and functional requirements, to facilitate service offering and interworking within the U.S. market.

REFERENCES

[1] *Engineering and Operations in the Bell System.* Bell Telephone Laboratories, 1983.

[2] *LATA Switching Systems Generic Requirements.* Bellcore Document TR-TSY-000064.

LIST OF ACRONYMS

ADSL	asymmetric digital subscriber loop
AIN	advanced intelligent network
ATM	asynchronous transfer mode
B-ISDN	broadband ISDN
CO	central office
COER	Bell System OSS (see reference [1])
DN	dialed number
GOS	grade of service
HFC	hybrid fiber coax
IDLC	integrated digital loop carrier
ISDN	integrated services digital network
ISP	internet service provider
LATA	local access and transport area
LCR	line concentration ratio
LEC	local exchange carrier
LHT	long holding time
LNP	local number portability
LSSGR	LATA Switching Systems Generic Requirements
MAC	media access control
OSS	operations support system
PC	personal computer
PMO	present mode of operation
POP	point of presence
POTS	plain old telephone service
PSTN	public switched telephone network
PUC	public utilities commission
RBOC	Regional Bell Operating Company
TNDS	Bell System OSS (see reference [1])
WAH	work at home
WWW	world wide web

Bellcore

Architectural Solutions to Internet Congestion Based on SS7 and Intelligent Network Capabilities

A Bellcore White Paper by Dr. Amir Atai and Dr. James Gordon

Abstract: The explosive growth of the internet has created problems for the Public Switched Telephone Network (PSTN), which for the foreseeable future will provide the majority of users with internet access via dialup modems. Based on current growth rates, the volume of 'internet' traffic on the PSTN is forecasted to rival or overtake 'regular' telephone or fax traffic in the next few years. This represents an enormous shift in the volume and nature of the PSTN traffic.

All of the solutions proposed to date recognize that it is necessary to off-load internet traffic from the PSTN. The PSTN is optimized for circuit-switched voice traffic, whereas internet traffic is most efficiently carried by packet-switched networks. In the search for effective off-load strategies, the first impulse has been to look for technological answers, i.e., to employ a new class of equipment to siphon traffic off the PSTN.

However, it is equally important, and perhaps more cost effective, to explore the use of existing features and capabilities in the voice network to develop efficient strategies to carry internet traffic. Intelligent Network capabilities, and those provided by Signaling System No. 7 (SS7) infrastructure, can be used to construct off-load architectures with flexible routing and call control. This report describes a number of such architectures.

1. Introduction

Reed Hundt, outgoing chairman of the FCC, recently voiced the need for a "... high speed, congestion-free, always reliable, friction-free, packet-switched, big band-width, data friendly network that is universally available, competitively priced, and capable of driving our economy to new heights. .. If we build it, the wonders will come." [A]

The authors of this paper are in agreement with Chairman Hundt's desire for ready public access to high speed data networks and the internet. The center of mass in the telecommunications industry is shifting away from traditional voice technology to data networking. High speed public data networks are needed to support a range of advanced telecommunications and information services that will become available in the near future, including commerce over the web, multimedia applications, and internet telephony.

However, while data networks will be a key ingredient of the future, the existing voice network (the PSTN [1]) will not become obsolete overnight, or even for many years. For one thing, there is a huge investment in the PSTN which cannot simply be discarded. Furthermore, the PSTN is a sophisticated system that offers an array of advanced features that cannot be matched by data networks in their present stage of maturity. With intelligent planning and packaging of services, voice and data networks should in fact complement and augment one another, for the greater benefit of subscribers.

The integration of voice and data services was planned well in advance by the 'minders' of the telecommunications infrastructure. For example, work began as early as twenty years ago on an Integrated Services Digital Network (ISDN), that would combine voice and data services. While ISDN has enjoyed a recent surge in popularity due to the growth in internet traffic, its penetration is still very small.[2] Efforts to simplify ISDN or-

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1 Public Switched Telephone Network.

2 According to references in a recent FCC report (reference D), approximately 70% of subscriber lines can in principle support ISDN. However, only 1% of access lines actually have ISDN equipment deployed. And only 1.4% of internet users employ ISDN service.

dering and provisioning are currently underway, with the goal of increasing ISDN penetration. However, support for ISDN may be eroded by competition from newer technologies such as high speed analog modems and Asymmetric Digital Subscriber Loop (ADSL).

In principle, ISDN should have provided a 'data pipe' into residential homes, to supplement the existing 'voice pipe'. As always, access is one of the main barriers to the growth of data services – the famous 'last mile' problem. In the absence of widely available data access to residential homes, data services will tend to remain niche products, available to limited segments of the population. The need for 'universal' high speed data access might be satisfied in the future by technologies such as ADSL and cable modems. In the near term, however, these products are unlikely to achieve widespread deployment, due to immaturity of the technology and the initial expense of equipment.

Over the next few years, the PSTN will provide the vast majority of residential users with access to the internet and other data networks. Using voice circuits or 'pipes' to access data networks is not an ideal solution. However, it is the only alternative that is feasible in the short term. Ironically, in spite of the failure to deploy large scale residential data access, internet traffic may well drive the first widespread integration of voice and data networks. Due to popularity of the World Wide Web, etc., dialup internet traffic on the PSTN has experienced dramatic growth over the past two years. This in turn has created problems for the PSTN, leading network operators and equipment vendors to seek ways of off-loading internet traffic from the PSTN onto data networks.

At present, the pros and cons of various internet off-load strategies are being debated, and subject to marketplace evaluation. For example, carrier meetings such as Bellcore's Internet Traffic Engineering Solutions Forum (ITESF)[3] are actively exploring architectural solutions for the internet congestion problem.

In the search for solutions, the first impulse has been to look for technological answers – i.e., to employ some new class of equipment to siphon traffic off the PSTN. However, it is equally important to explore the potential for using existing features and intelligence in the voice network to develop efficient strategies for carrying internet traffic. In particular, the Signaling System No. 7 (SS7) and Intelligent Network (IN) capabilities of the PSTN have the potential to enhance the management, and streamline the transport of internet traffic, whatever technology and network equipment is employed.

This paper reviews a number of network architectures that facilitate the inter-working of the PSTN and data networks and, in particular, that allow internet traffic to be off-loaded from the PSTN onto data networks for more efficient transport. The pros and cons of these architectures are discussed. A particular emphasis of the paper is on the possible role of IN and SS7 capabilities in supporting the flexible transport and management of internet traffic. The main conclusion of the paper is that SS7 and IN capabilities can significantly improve the attractiveness of both pre-switch and post-switch off-load architectures.

2. Problem Statement

Internet traffic creates a number of problems for the PSTN, but ultimately the most critical problem is that it upsets the PSTN's established economics. Internet traffic increases the load on PSTN resources, requiring the purchase and deployment of additional PSTN equipment, in order to carry the excess traffic. It follows that internet traffic increases the costs experienced by network operators. In contrast, it results in little or no compensating revenue. Or, as in the case of second lines, the revenue is outweighed by the increased costs.[a]

At present, many local exchange carriers (LECs) are in a holding pattern with regard to internet traffic, while potential solutions are evaluated. Although sufficient equipment has been added to cope with current demands, there is a clear recognition that better solutions are required. Furthermore, practical workable solutions are needed soon, since there appears to be no slow-down in the rate of growth of internet traffic.

One example of internet growth concerns the recent introduction of flat-rate pricing for some popular on-line services. Bellcore measurements suggest that under flat-

3 The ITESF was created in 1997 and meets quarterly. At the time of writing, membership includes 8 carriers from the U.S., Canada, and Australia. Its goal is to understand the impact of internet traffic on LEC networks, share best practices, and identify architectural solutions. Equipment suppliers are also invited by the ITESF to discuss relevant current and future products.

rate pricing plans, users will stay on-line up to twice as long (on average) as under metered rate plans. Understandably, given the number of online users, this doubling of call duration can result in significantly higher loads for the PSTN. Internet growth forecasts from several sources all point to continued rapid growth. For example, by the year 2000 it is estimated that 30% of US households will be on-line, compared to 15% in 1997.

The continued growth of internet traffic adds to the costs of network operators. Since tariff relief is unlikely in the near term, the only solution to this problem is to proactively reduce costs by carrying internet traffic more efficiently. There are many proposed architectures for doing this, and the challenge for carriers is to identify the best off-load strategies, and synthesize the one(s) that are most cost effective, and that are consistent with network evolution. The final solution may well make use of many different elements, including new types of equipment, and the use of IN capabilities in creative and novel ways.

For a brief description of internet-related problems on the PSTN, and a survey of architectural solutions, the reader is referred to an earlier Bellcore white paper on this subject.[C] The impact of internet traffic has been documented in more detail in studies by Bell Atlantic, NYNEX, Pacific Bell and US WEST (see the web pages for these companies), and a comprehensive overview is provided by a recent FCC paper.[D] In addition, internet congestion has been discussed in numerous technical magazines and mass media articles and a more general perspective on how internet traffic affects PSTN engineering is given by the Bellcore article.[E] Many suppliers have developed, or are in the process of developing, products aimed at alleviating or solving internet congestion on the PSTN.

3. Key Issues

3.1 Why off-load?

The root cause of internet congestion is that internet calls have a much longer duration than the voice calls for which the PSTN was designed. Typical internet calls have an average duration of 20 minutes or longer, while average voice calls last 3-5 minutes. In addition, a segment of internet users stay online for many hours at a time. The probability of a voice call exceeding one hour's duration is less than 1%. In contrast, more than 10% of internet calls will exceed one hour.

In a circuit-switched network such as the PSTN, these long holding time (LHT) calls tie up both switch resources and interoffice trunks, and cause congestion that affects all users. Bellcore traffic modeling, supported by field measurements, shows that small increases in the amount of internet / LHT traffic can significantly increase the probability of call blocking (the main quality of service measure in the PSTN). For example, if 4% of users generate internet calls with 45 minute call holding time, then the probability of blocking increases from 1% to 7% (assuming no additional network equipment is deployed).

Even though an internet call lasts much longer (on average) than a voice call, the line is not actively used during the entire call. It is estimated that internet users utilize only 1/5 to 1/6 of a voice circuit's bandwidth. The on-off nature of internet traffic makes it ideal for packet switching, which 'multiplexes' (i.e., combines) several users' traffic onto a single channel. It is anticipated that multiplexing gains of 300% to 500% can be achieved by transporting internet access traffic on packet-switched versus circuit-switched networks. The efficiencies obtained through statistical multiplexing result in lower capital and operational costs, provided the traffic is of sufficient volume, and assuming that a data network infrastructure is in place. These reduced costs are a principal motivation for off-loading internet traffic from the PSTN onto data networks.

3.2 Present Mode of Operation

Before discussing off-load architectures, it is useful to understand the present mode of operation (PMO). Presently, most Internet Service Providers (ISPs) interface to local exchange carrier (LEC) networks via multi-line hunt groups or Primary Rate ISDN (PRI) (see Figure 1). Typically, the switches that ISPs connect to are chosen (by the ISPs) in order to maximize the free calling area. Often they are residential switches that were not designed to handle high volumes of traffic, particularly LHT traffic.

As shown in Figure 1, calls from many originating (or ingress) switches are routed through tandems or direct trunk groups to the terminating (or egress) switch, where they gain access to the ISP modem pool. This network topology funnels traffic into the egress switch, and can easily lead to congestion unless carefully engineered by the LEC. Routine operation of switches includes the task of provisioning new lines, and load balancing new and existing lines across line peripherals, so that uniformly good service is provided to all customers.

The fact that LECs often do not know what lines are used for internet access makes provisioning and switch load balancing a non-trivial and laborious task. It is estimated that internet-related load balancing costs a large LEC on the order of $30 million dollars a year in additional operations costs. Nevertheless, it is an important function. If allowed to occur, traffic imbalances on switches will cause non-uniform blocking for users, leading to poor service for subscribers, and other capacity management problems for the LEC.

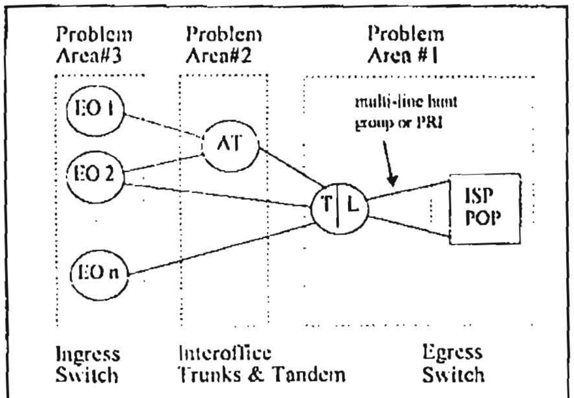

Figure 1: PMO Problem Areas

In Figure 1, the switches most likely to experience congestion problems are the egress switches which serve ISPs (Problem Area #1). As noted above, multi-line hunt groups (1MB lines) are a common method of connection between the egress switch and ISP. However, there is a significant movement on the part of LECs and ISPs towards primary rate ISDN (PRI) for the following reasons. For LECs, PRI has the advantage of being a trunk-side rather than a line-side connection. Since there is no concentration on trunk-side connections, PRI connections reduce the likelihood of switch congestion. (Specifically, they eliminate the problem of congestion in switch line modules.)

For ISPs, PRI connections have several advantages, though they are more expensive than 1MB lines. First, 1MB lines make it difficult to achieve high modem densities due to wiring constraints. By virtue of simpler physical wiring, PRI connections support higher modem densities. Second, digital carriers (such as PRI and D-4) provide better transmission quality, which is important for recently introduced 56kb modems. Finally, ISPs can obtain network management information via the PRI (signaling) D-channel. This information is valuable to ISPs, since it allows them to track calling numbers, customer usage patterns, etc.

In Figure 1, the second segment of the network that is impacted by LHT traffic comprises the interoffice trunks and access tandems (Problem Area #2). Since under normal circumstances trunks carry both voice and internet traffic, additional internet traffic requires the provisioning of additional trunks to ensure adequate service for both voice and data users. The least congested elements in Figure 1 are likely to be the originating or ingress switches (Problem Area #3). Initially, ingress switches are unlikely to experience congestion, since only a fraction of all subscribers are internet users. However, as internet penetration grows, internet-related congestion will progressively occur in more and more ingress switches, causing similar problems to those in egress switches.

Understanding internet congestion from a network perspective is critical in designing cost-effective solutions. At current internet penetrations, it is estimated that 25% to 33% of all switches can be categorized as egress switches. Based on the above discussion, the most immediate network segments to de-load are Problem Areas #1 and #2. However, ingress switches (Problem Area 3) may also be congested in certain high-penetration areas, and addressing congestion in ingress switches will become more important as time goes on. Effective internet off-load architectures need to address all three problem areas, and be capable of reducing congestion where it is most acute, as determined by internet penetration levels, varying traffic patterns and communities of interest.

3.3 Off-Load Architectures

Faced with the growth of internet traffic, carriers have a fundamental choice. They can continue to add equipment to the PSTN in order to maintain service quality for all customers, while carrying internet calls on the same facilities as regular voice calls. Alternatively, they can adopt some new network architecture – referred to here as an off-load architecture – which effectively segregates internet traffic from regular voice traffic, and allows internet traffic to be carried more efficiently over dedicated facilities or a packet network.

If the first course is adopted, there are several short term engineering approaches which can be used to fine tune the PSTN for internet traffic. One such approach is to identify heavy internet users (by some means), and terminate their lines on digital switch modules that are more flexible in term of line concentration ratios. For example, new classes of line modules and 'Next Generation' Digital Loop Carrier systems can be used to support line concentration ratios as low as 1:1, potentially eliminating blocking at the line concentration level of the switch.

In this approach, heavy internet users would be carried on the same facilities (i.e., switch modules and trunks) as voice customers. However, the engineering rules for both switches and trunks would be modified (i.e., made more conservative), in order to provide acceptable service to all customers. Apart from its higher cost, this approach raises a number of practical issues, including: (i) the development of new engineering procedures, (ii) the development of provisioning and load balancing procedures for shared switch modules, and (iii) planning and managing network capacity in the presence of several distinct classes of traffic.

While the above approach undoubtedly provides immediate relief for network operators, and is appropriate in the short term, it fails to address the fundamentally different nature of internet traffic. If dialup internet traffic continues to grow at forecast rates, its volume will soon rival that of regular voice traffic on the PSTN. In this situation it no longer suffices to adopt makeshift solutions to internet congestion. Instead, it becomes desirable to treat internet traffic as a distinct class of traffic with its own requirements, and to develop network architectures that can transport internet traffic efficiently, and provide the features required by end-users.

A simple form of internet off-load architecture would be to segregate internet traffic within the PSTN. According to this strategy, one would identify internet calls (e.g., by means of intelligent network capabilities), and route them over dedicated switch modules and trunks within the PSTN. This strategy may well prove to be cost-effective in the medium term, and provide an intermediate step towards a full data off-load architecture. It could be implemented using existing SS7 and IN capabilities, and avoids a number of evolution issues associated with data networks and protocols (see section 3.6).

Ultimately, however, data networks will provide the most efficient means of carrying internet traffic. By taking advantage of statistical multiplexing gains, data networks can efficiently transport internet calls. Furthermore, data networks will in time provide the features and services that are most closely aligned with internet (and other data) applications. If the decision is made to migrate towards a full data off-load architecture, the question arises as to how best to achieve this goal. As noted above, for the foreseeable future the PSTN will provide the majority of users with access to the internet and other data networks. It follows that a key element of any data off-load strategy is to decide at what point within the PSTN one should re-direct internet calls onto a data network. There are two basic options:

1. Post-Switch (Trunk-Side Redirect) – In a post-switch architecture, internet calls are allowed to pass through the ingress switch, before being re-directed out of the PSTN and onto a packet network for final delivery to an ISP. The main benefit of this approach is that internet calls by-pass the PSTN's interoffice trunks and the egress switches, and are instead transported by a packet network. However, the ingress switches are still involved in both the signaling and transport phases of internet calls.

2. Pre-Switch (Line-Side Redirect) – In a pre-switch architecture, internet calls are intercepted and re-directed onto a packet network on the line side of the ingress switch. The goal is to by-pass all PSTN elements (ingress switch, trunks, and egress switch). Note that although the ingress switch is no longer involved in internet call transport, it may still be involved to some extent in call-related sig-

naling. However, its involvement is minimal in comparison to a post-switch architecture.

Sections 4 - 6 provide examples of these two classes of off-load architecture. They also describe the features and capabilities needed to make post-switch and pre-switch architectures effective, flexible and robust. And they comment on the pros and cons of the architectures from a technological and cost perspective.

3.4 Internet Call Identification, Routing

A problem common to all internet off-load architectures is how to identify and route internet versus voice calls. The most straightforward approach to this problem is to provide full 10-digit number translations (i.e., routing instructions) within every switch in the PSTN. However, this solution could be an administrative nightmare, and would not provide as much flexibility as other alternatives. The following discussion describes several other methods for internet call identification and routing.

IN Office-Based Triggers – One option is to obtain all ISP and on-line service provider (OSP) telephone numbers, and configure office-based 'triggers' for these numbers. Every call entering the switch would be screened against the list of numbers. Internet calls would 'hit the trigger' (i.e., be positively matched against a known ISP / OSP number), causing the switch to issue a query for routing instructions. Advantages of this scheme are that there is no need to alter dialing plans (i.e., ISP / OSP numbers), and this type of trigger should be available on all modern switching systems, since it is required by many basic IN and SS7 type services. Disadvantages are that ISP / OSP numbers are not always known in advance, and office-based triggers consume additional switch processing power, since every originating call (both voice and internet) must be screened against the trigger.

LNP Routing of ISP Numbers – Since LNP will soon be widely deployed (under regulatory mandate), the option exists of configuring ISP / OSP numbers as LNP ported numbers, and using LNP queries to obtain routing information for internet calls. In LNP, inter-switch intra-LATA calls to a ported NPA-NXX hit an LNP trigger, causing routing queries to be sent to an LNP database. With modifications, the same mechanism could possibly be used to route internet calls. For instance, the Location Routing Number (LRN) returned by an LNP query could point to an Internet Call Routing (ICR) node (see sections 4 and 5), rather than a 'ported-to' switch as is the case in LNP. This strategy has at least two advantages. First, there is no need to alter dialing plans. Second, it gives ISPs the flexibility of moving location and / or carrier, in a way that is completely transparent to their customers. ISP customers would continue to dial the same access numbers, and the network would ensure that calls got routed to the ISP's new location or carrier. Of course, this use of LNP raises a number of protocol and administration issues, which would need to be addressed before it can be implemented in the network.

IN Single Number Service – Currently, ISPs advertise many access numbers to their customers. For example, different numbers may be used for different calling areas, different modem banks (i.e., different speed modems) within the same calling area, etc. Single Number Service is an intelligent service within the PSTN, that allows calls to a single number to be routed to different locations based on various criteria. For example, calls can be routed to the nearest ISP point of presence (POP) during business hours, and to a remote central location outside of business hours. Different 'single' numbers could be used for 28.8 versus 56kb modems, or the network itself could route calls to the correct modems based on stored customer information. For ISPs, Single Number Service can greatly simplify the administration of access numbers and technical support call centers. Note that in future internet off-load architectures, the location of modem functionality may shift from the ISP POP to some other location (e.g., access server). Single Number Service would make such changes transparent to ISP customers.

***XX Service Code** – A final method is to assign a special service code to internet calls, such as the 800 service code used for toll free calls. The advantage of the service code approach is that it makes it easy for switches to determine that an originating call is an internet call. This detection would occur early in the switch's digit analysis, in contrast to an office-based trigger where the switch must wait for the user to finish dialing all digits and then compare the results with the trigger list. An obvious disadvantage of the service code approach is that it changes the user dialing plan.

3.5 Access Server and ICR Node

The assumption underlying all off-load architectures is that, once an internet call has been identified, it can be routed to some transport facilities outside of the normal PSTN. These facilities could be dedicated point-to-point links to an ISP, or they could be a packet network. In either case, there is typically a need for some intermediate network element that will act as an interface between the PSTN and the non-PSTN internet transport facilities.

We refer to this element as an access server (AS). Note that the term AS is a loose one, that could describe several types of equipment with different functionality. For example, the AS could take incoming calls from SS7 trunks in the PSTN, and forward them over PRI to ISPs. In this case, no data transport is involved. However, the AS is required to be capable of SS7 signaling. Alternatively, the access server could incorporate modem bank functionality. In this case, the AS would terminate incoming PSTN calls, convert them to packet format, and forward them to ISPs over a packet network. In all cases, the common feature of the AS is that it acts as a *transport* interface between the PSTN and internet facilities.

Several of the off-load architectures discussed below utilize a new type of SS7 *signaling* node, which we refer to as an Internet Call Routing (ICR) node. The ICR node contains the routing intelligence for internet calls. It is a central network element, that controls internet call routing via instructions to ingress switches and / or access servers. Signaling between the ICR node and switches is via SS7. Signaling between the ICR node and access servers will probably be via some other (possibly proprietary) protocol.
We emphasize that access servers and ICR nodes (Bellcore's terms) are relatively new elements in the PSTN (though they have precedent in existing adjunct equipment such as intelligent peripherals and voicemail systems). Functionally, access servers and ICR nodes are not well-defined, and can be expected to evolve according to market demand, changes in internet protocols, etc. The functions of access servers and ICR nodes are described in more detail in sections 4 and 5 below.

3.6 ISP Issues

While LECs have some latitude within the present mode of operation (PMO) to improve the handling of internet traffic within their own networks, significant efficiencies will only be achieved by moving to off-load architectures. This in turn requires the participation or cooperation of other parties, chiefly ISPs. In order to be attractive to ISPs (and their customers), off-load architectures must provide a number of key capabilities. These can be summarized under the three headings of administration, authorization and authentication (AAA).

ISPs are extremely sensitive about relinquishing the administration of modems (or modem functionality) to third parties such as LECs. One reason is that they have 'grown up' with existing modem technology, and have become very efficient at maintaining it. A more fundamental reason is that retaining control of modems allows ISPs to directly manage their own customer bases, without relying on third parties, and without having third parties intrude on this relationship. Sensitivities regarding customer access are heightened by the fact that some LECs have ISP subsidiaries.

A key element of many off-load architectures is to move modem functionality away from ISPs and closer to end users, so that internet calls can be converted to packet format as early as possible, to take advantage of multiplexing gains. As a pre-condition for the successful implementation of off-load architectures, it is therefore critical that LECs address the ISP concerns regarding access to, and security of, ISP customer information. (Note that LECs are not necessarily enthusiastic about taking over modem maintenance. However, they recognize that it may be a necessary step in obtaining the benefits of off-load strategies.)

Similarly, ISPs do not want to give up authorization and authentication functions. They want to maintain their own private databases of customers in good standing, and regulate access to their facilities via their own authentication procedures. Currently, internet protocols will not easily support joint authentication by the network provider and ISP. Joint authentication requires that one separate the physical event of a modem answering a call from the user authentication process. Achieving joint authentication would allow the LEC to regulate access to its transport network, and the ISP to separately regulate access to its own facilities.

Given the ISPs' concerns, the capability to perform joint authentication is another pre-requisite for moving modems away from ISPs and closer to end users. Tunneling protocols may provide an answer to this problem, as well as providing better capabilities for encryption, and performance guarantees for traffic streams carried by shared internet facilities. In fact, satisfying the ISPs' technical and business requirements may depend more on the future evolution of internet protocols than it does on the LECs' service offerings.

4. Post-Switch Architectures

Post-switch architectures, which intercept calls on the network side of access switches, provide a solution for internet congestion that is potentially more integrated with existing PSTN functionality. PSTN ingress switches are currently the main repository for call processing logic, routing intelligence and subscriber line features. By relying on ingress switches to identify and route internet calls, post-switch architectures can potentially take full advantage of IN and SS7 signaling capabilities to efficiently transport and manage internet traffic.

4.1 Description of Architectures

This section describes three post-switch architectures. Note that all three architectures utilize the same technique to identify internet versus non-internet calls. As described in Section 3.4, an ingress switch has the option of identifying internet calls by means of 10-digit dialed number translations, or by means of IN triggers and SCP query / responses. Beyond this common element, the three architectures use different strategies to achieve efficient signaling and transport.

Architecture A: Line / PRI Interface

Architecture A is illustrated in Figure 2. It shows a simple arrangement in which the ingress switch routes internet calls to an Access Server (AS). The AS acts as an interface between the PSTN and a data network. Note that in this architecture, the AS and switch are connected by a regular telephone line (e.g., multi-line hunt group) or Primary Rate ISDN (PRI). At present, these two methods are the most prevalent means of connecting switches to adjunct equipment.

There are disadvantages to both line and PRI interfaces. The line interface is difficult to manage at a switch level, due to the size of multi-line hunt groups, and the present lack of Operations Support Systems (OSS) capabilities for non-standard engineering, tracking, measurements, etc. In addition, the line interface is likely to be expensive, given that line unit costs are predicated on 'traditional' subscriber usage patterns and line-concentration ratios. Internet lines tend to be more heavily utilized than regular lines, requiring more investment in switch equipment per subscriber line. Finally, the line interface provides no capability for intelligent signaling, which could be used for example to monitor subscriber usage and identify heavy users. On the plus side, by relying on the ingress switch, architecture A can provide dynamic routing (e.g., in case of modem congestion), but only if the modems are directly adjacent to the ingress switch (i.e., are located in the AS).

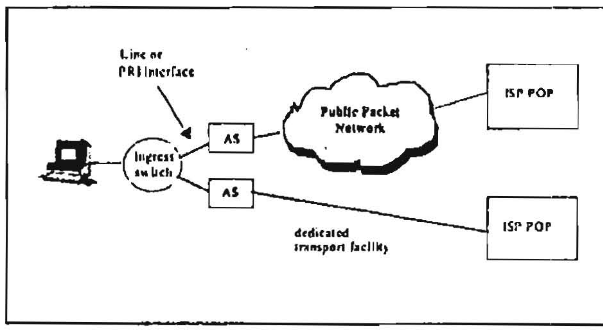

Figure 2: Post-Switch Architecture A (line / PRI)

In comparison, the PRI interface is functionally attractive, since it supports out-of-band signaling that can potentially be customized to the internet application. PRI is also easier to manage than multi-line hunt groups, as described in section 3.2. However, for reasons associated with current switch architectures and provisioning limitations, PRI may be unsuitable for large scale deployment in the network. In effect, there may be insufficient capacity for PRI terminations in the PSTN to support large scale use.

Architecture B. SS7 Trunk Interface & ICR Node

There are strong practical motivations for requiring the interface between the ingress switch and AS to be an SS7 trunk. SS7 trunks are the basic means of transporting calls between switches inside the PSTN, and are readily provisionable on almost all switches in the network. Due to their availability, and also their streamlined support in existing OSSs, SS7 trunk architectures offer the best hope of providing a widely deployed, scaleable architecture for internet traffic.

However, current access servers do not support an SS7 trunk interface. The use of SS7 trunks implies that calls are setup using the SS7 protocol and the Common Channel Signaling network. This in turn implies that call setup signaling for internet calls must be processed by an SS7 capable node. At present, access servers are relatively simple devices, which perform the functions of a modem bank, without any call processing or SS7 intelligence. It is probably not economical to implement SS7 capabilities in the AS. This strategy would make the AS too expensive to deploy on a large scale. Also, individual access servers would not handle sufficient traffic to warrant the expense of a dedicated SS7 link.[4]

One approach which solves this problem is illustrated in Figure 3. The architecture in Figure 3 features: (i) a new type of SS7 node (an Internet Call Routing (ICR) node) which can perform SS7 call setup signaling with ingress switches, and (ii) an upgraded AS that has a non-SS7 signaling interface to the ICR node. While implementing a non-SS7 signaling interface is likely to increase the cost of AS, its advantage is that it can be less sophisticated than the standardized SS7 protocol, and can utilize existing capabilities within commercially available access servers for Q.931 based signaling. Consequently, the AS in Figure 3 has the potential to cost less than a fully SS7 capable AS.

[4] A single SS7 link has the capacity to handle many thousands of Access Server ports. Access servers typically have from several hundred up to 700 ports. A single SS7 link can therefore handle 40 plus access servers at typical engineered loads.

The ICR node in Figure 3 is critical to call setup, since the AS cannot cut-through an SS7 trunk connection by itself. Instead, it relies on signaling from the ICR node to tell it which circuit the call is coming in on, and to complete the connection. Note that the ICR node will monitor AS ports / modems to determine whether it has free modems that can be used to answer the incoming call. If not, the ICR will use standard SS7 signaling to release the call, and provide busy tone at the ingress switch. Although we have described the ICR node as a new type of SS7 node, it may in fact be an existing SS7 node running an Internet Call Routing application. The ICR node also has the potential to perform intelligent functions, beyond simple call setup and teardown.

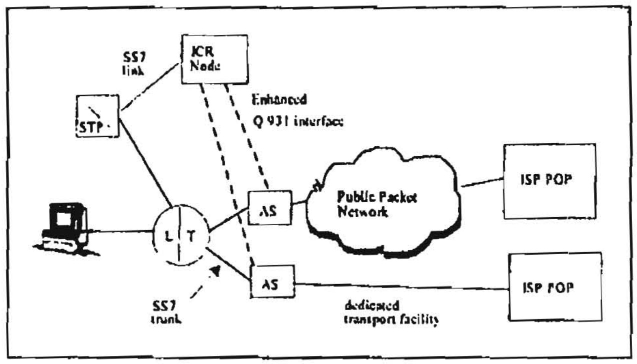

Figure 3: Post-Switch Architecture B

As discussed above, the immediate advantage of Architecture B is that it utilizes SS7 supported trunks to connect ingress switches to access servers. This can facilitate its wide-spread deployment throughout the PSTN, and make it easier to scale up as internet traffic grows. However, Architecture B also has a number of other advantages. The ICR node can be owned and operated either by the LEC or by an ISP. Also modem bank functionality can be situated either in the AS itself, or in the ISP box in Figure 3. In the first case packet transport could take advantage of multiplexing gains. In the latter case, transport would be via circuit emulation, and would not realize any multiplexing gain. However, these options for modem locations may make the architecture more flexible in addressing the future business needs of ISPs.

Note that having modems located on the ISP premises is closer to the present mode of operation (PMO). In this case, the AS simply provides an SS7 supported trunk termination co-located with the ingress switch, and internet calls are transported in circuit-switched or circuit emulation mode to the ISP. In future, as data protocols evolve, ISPs may find it desirable to have the LEC maintain modems at the AS, and have internet calls delivered to them in data format, to take advantage of multiplexing gains on data networks. Architecture B facilitates both options.

Architecture C. SS7 Trunk Interface & Gateway Node

Finally, Figure 4 – Architecture C – shows a more evolved version of Architecture B. In this architecture, the ICR node handles both call signaling and call transport. Calls are routed from access servers to the ICR using PRI trunks, for example. The ICR node acts as a hub, providing a common platform where a variety of access technologies such as T1, ISDN PRI, Frame Relay, modem pools and routers can be made available to both ISPs and corporations. Consolidating access from numerous egress switches into this type of hub is anticipated to provide operational efficiencies for LECs and ISPs. As the internet continues to expand and evolve, it can make it easier for ISPs to upgrade and stay current with new equipment, and also to gain faster access to new markets with smaller up-front capital cost.

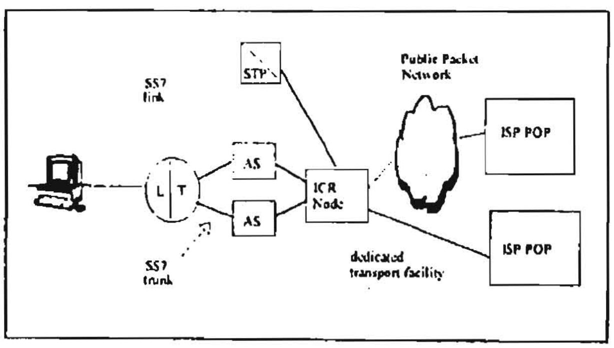

Figure 4: Post-Switch Architecture C

4.2 Post-Switch Issues

The advantage of post-switch architectures is that they take advantage of the intelligence that resides in network switches and SCPs, to better route and manage internet traffic inside the PSTN. For example, they can utilize sophisticated SS7 and IN triggers, routing functionality and traffic controls. Of course, post-switch architectures are based on the assumption that one would want to allow internet calls inside the PSTN. There are reasons why this may be the case.

It is possible to view internet traffic as merely a problem for the PSTN, that should be banished to external data networks as soon as possible. Alternatively, it is possible to imagine internet traffic as requiring the first true large scale integration of the PSTN and data networks. In the latter view, internet traffic is not so much a problem as an opportunity. By bringing this traffic into the PSTN, and managing it intelligently, the opportunity exists to offer a range of new internet-related features and services that packet networks, in their present stage of maturity, cannot support. Post-switch architectures may therefore constitute a longer term goal for network operators.

The immediate challenge for post-switch architectures is to justify the cost of burdening ingress switches with the triggers and additional signaling required to support internet call routing. This additional burden could be significant. For example, deploying office-based triggers in order to identify internet versus voice calls could increase call processing times in the switch. This translates into a corresponding reduction in switch capacity, and the possible need for processor upgrades in some switches. The capacity impact will vary based on switch technology and the type of triggers or translations used (e.g., 6 vs. 10 digit).

Although post-switch architectures do not off-load internet traffic from ingress switches, they can conceivably improve the situation of these switches by intelligently managing internet traffic. For instance, although the situation is improving, many ISP facilities are under-engineered in comparison to the PSTN, resulting in very high levels of blocking in the ISP busy hour. Ineffective call attempts utilize trunk and switch resources only for very short periods of time (e.g., 0.9 - 1.5 seconds). However, taken across a network, their cumulative effect can be significant. In certain cases it is possible that they could inflate the load on switch processor by a non-negligible amount and result in significant increase in the load on trunks. Both of these effects necessitate the addition of more switching and trunk capacity to the network, if the established level of service is to be maintained.

However, SS7 and IN traffic monitoring capabilities can be used to block internet calls at the ingress switch if the target ISP facility is known to be congested. By using these capabilities, the ingress switch does not waste time processing calls that are bound to fail once they reach the ISP. Similarly, inter-office trunk resources are not tied up on calls that cannot be served. This type of call throttling can ensure that ingress switches and trunk resources are used efficiently.

Finally, we note that intelligent routing inside the PSTN can be used to route internet calls to alternate facilities, in the event that the primary facility (e.g., modem bank) is congested. And more generally, intelligent routing can be used to route internet calls flexibly, based on time of day or other appropriate criteria. This can allow ISPs to efficiently manage their own resources, schedule upgrades, etc. Similarly, from the LEC perspective, flexible routing can be used to route internet traffic through facilities (e.g., downtown offices) that are not heavily utilized during the 9-11 PM internet busy hour. This will help to maximize the efficiency of PSTN resources.

5. Pre-Switch Architectures

As described in Section 4, post switch architectures reduce internet congestion on interoffice trunks and egress switches. However, ingress switches are still involved in transport. Pre-switch architectures, which intercept calls on the line side of ingress switches, have the advantage of totally by-passing the PSTN, including ingress switches. (However, note that PSTN elements may still be involved to some extent in call-related signaling).

The common element of pre-switch architectures is an adjunct box that resides in front of the switch and has the capability to re-direct calls (e.g., onto a data network). The intelligence to re-direct internet vs. voice calls can reside in the adjunct box, ingress switch, or in another network element. Calls that are identified as voice calls are passed through the adjunct to the ingress switch for normal processing through the PSTN. Internet calls are intercepted and re-directed onto dedicated transport facilities for delivery to ISPs.

Although adjunct boxes are conceptually simple – they merely act as a call re-direct mechanism – they raise a number of issues. For instance, once an adjunct redirects a call and takes the switch out of the call path, the switch still needs to know how to handle incoming calls to the busy line, in order to support features such as call forwarding, call waiting and voicemail. Less obviously, the switch needs to retain the capability for operator interrupt, access to calling party information by law enforcement agencies, wire tapping and billing, for / during internet calls.

It follows that pre-switch adjuncts cannot act independently of the switch. Instead there needs to be a mechanism to maintain a consistent view of call and line states between the switch and adjunct. Additionally, in cases where per-call billing is required, billing information for the redirected call needs to be collected (somewhere). These problems are not necessarily difficult to solve. However, they require advance thought and planning. A final issue with pre-switch architectures is that they may not be able to support ISDN customers. To date, preswitch mechanisms for re-directing ISDN calls have not been proposed.

5.1 Description of Architectures

Proposed pre-switch adjunct architectures make use of an embedded base of Integrated Digital Loop Carrier (IDLC) technology. In an IDLC configuration, a Remote Data Terminal (RDT) is used to terminate a group of customer lines at a location that is (nominally) remote from the switch. The RDT is connected to a digital switching system via a DS1 or OC-3 carrier which, by multiplexing many customer lines onto a single carrier, provides efficiency in the local loop and enhanced operations capabilities.

Note that there are several standard protocols that can operate over the RDT-switch interface, including TR-57, TR-8 and GR-303. Of these, GR-303 is the most recent and the most powerful in terms of its signaling capabilities and ability to support new (e.g., internet) applications. At present, however, GR-303 is not widely deployed in the network. It follows that IDLC-based pre-switch adjuncts which are capable of working with TR-57 and TR-8 (as well as GR-303) will have wider applicability within the network. On the other hand, GR-303 provides a standardized interface that can be implemented on multiple vendors' equipment. Non-GR-303-based adjuncts rely on a signaling interface (between the RDT and ICR node, see below) that is currently not standardized (i.e., is proprietary to individual vendors).

As suggested above, there are at least two approaches for re-directing internet calls in pre-switch adjuncts, namely non-GR-303-based and GR-303-based solutions. These are described in more detail below.

D. SS7 Based Line Side Call Redirect

The first approach for pre-switch architectures is to use the ingress switch for digit collection and trigger assignment, but to place call routing intelligence in a separate network element. This approach is illustrated in Figure 5. In this scenario, an Internet Call Routing (ICR) node controls the RDT via a signaling interface that could be proprietary, or that could conceivably be developed into a standard interface to facilitate the mixing and matching of equipment from different vendors. The ICR node is SS7 capable and utilizes SS7 (ISUP) signaling to control the setup and teardown of circuits through the switch.

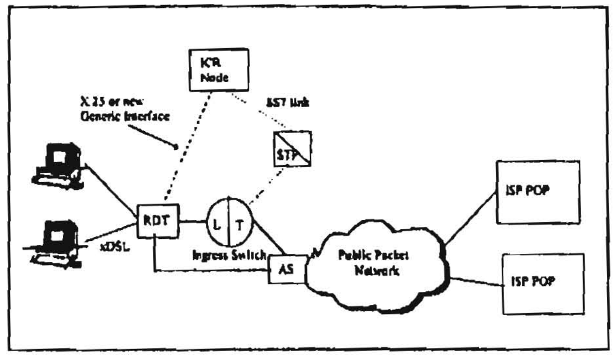

Figure 5: SS7 Based Line Side Off-load Architecture

In Figure 5, incoming internet calls hit a trigger in the switch, which causes the switch to issue a query for routing instructions (to an SCP). When routing information is received, an SS7 call setup message is sent to the ICR. The ICR informs the RDT to re-direct the call to a data network, and at the same time sends an SS7 release message back to the switch, forcing the switch out of the call path. A final step is for the RDT to signal the switch that the subscriber line is busy (off-hook), so that calls arriving from the network do not interfere with the ongoing internet call.

The philosophy behind this approach is to put internet call routing intelligence in a central network element (the ICR node) rather than a simple, unintelligent element (the RDT) on the edge of the network. This can make it easier to implement changes to internet call routing, since only the ICR nodes must be upgraded, rather than a large number of RDTs, which do not necessarily have the operations support for frequent changes or upgrades to internet call routing functionality.

Note that by placing internet call routing intelligence in the ICR node, rather than the RDT, this architecture can potentially work with TR-57 and TR-58, as well as GR-303. Also note that the ICR node in Figure 5 is similar in functionality to the one employed in post-switch architecture B. In fact, the same ICR node could conceivably control both pre-switch adjuncts and post-switch access servers. This type of combined ICR node would support very flexible off-load architectures.

E. Non-SS7 Line Side Call Redirect

The second approach, illustrated in Figure 6, is based on enhancements to the GR-303 standard. In this approach, RDTs may be co-located with ingress switches, and the GR-303 interface is used to support the signaling required to re-direct and manage internet calls. Incoming internet calls can be identified (via a trigger) and routed (via a table lookup) in either the switch itself, or in the RDT. In the first case, the switch is responsible for normal call processing, including dialtone generation. If an internet call is detected, the switch signals the RDT via GR-303 to re-route the call onto a data network. In this case, internet call filtering can be provisioned on a per-line basis, and the potential exists to overflow internet calls onto the PSTN if the data network is unavailable. It does, however, involve a real-time hit on the ingress switch, to support the call filtering, routing and signaling functions.

The second case is again based on GR-303, but relies on internet calls being identified and routed in the RDT rather than the switch. In this case the RDT is provisioned with DTMF receivers so that it can register dialed digits. (The RDT may or may not provide dialtone.) It is also provisioned with the routing information for internet calls. When an internet call is detected in the RDT, the RDT itself re-routes the call to a data network, and informs the switch of this action. This case minimizes the impact of internet traffic on the ingress switch, but requires some non-standard functionality in RDTs, and new call flows between the RDT and switch.

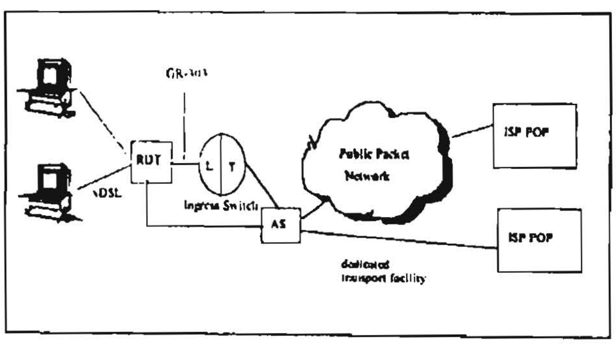

Figure 6: Non-SS7 Based Line Side Off-load Architecture

5.2 Pre-Switch Issues

The pre-switch architectures described above are attractive because they de-load internet traffic from the ingress switches, as well as from inter-office trunks and egress switches. They do, however, involve a tradeoff. Deploying equipment at the edge of the network, particularly if it involves significant complexity or intelligence, can be an expensive proposition, due to the amount of equipment and the operational effort involved in installing and maintaining the equipment. It also leaves one vulnerable to stranded investment, if technology changes.

One strategy for obtaining the benefits of pre-switch architectures, while avoiding the pitfall of stranded investment, is to place internet call routing intelligence in an ICR node, as in Figure 5. Placing intelligence in the ICR node, rather than the RDTs, has the potential to make RDTs simpler, less expensive and, consequently, less vulnerable to the risk of stranded investment. The ICR node could also be used to implement intelligent functions beyond simple call setup and teardown, and could potentially be used to support both pre- and post-switch architectures (see Figures 4 and 5). Finally, the ICR node can work with all IDLC technology (not just GR-303), though it currently depends on a proprietary signaling interface to the RDT.

More generally, the key to the effective use of pre-switch architectures is to balance the amount of equipment deployed, versus the amount of internet traffic off-loaded from the PSTN. Measurements of internet usage show that internet users will vary from heavy to light. In general, a small percentage of heavy users can generate a large percentage of the total internet traffic. A much larger number of light users generate the balance of the traffic. For example, it is not unusual to find that 20% of internet users generate about 55% of the total load, and that 40% of users generate more than 80% of the total load.

The best strategy for a pre-switch architecture is to deploy only as many adjuncts as are required to terminate the lines of identified heavy users. This strategy minimizes the line-related costs associated with deploying adjuncts, while maximizing the traffic-related benefit that one obtains by off-loading internet calls onto data networks. The key question is what percentage of subscriber lines should be moved onto pre-switch adjuncts. Even supposing that one has an effective strategy for identifying heavy users (which may itself be problematical), one still needs a formula for where to draw the line between heavy and light users.

As one moves lines onto pre-switch adjunct terminations, the per-line equipment costs will steadily rise. However, the same is not true of the traffic-related savings. Initially, one will obtain great savings by moving a core of heavy users onto adjuncts. As one continues, however, progressively smaller savings are obtained, since one is capturing only light users. In general, there will be an optimal operating point, where total savings (traffic-related cost savings minus equipment costs) are maximized. Identifying this optimal operating point – which may vary from switch to switch, and would also vary over time as traffic patterns change – is a critical issue for pre-switch architectures.

The problem of identifying heavy users in the first place, as a prior step to moving them onto adjuncts, is likewise important. Specifically, one needs the capability to reliably measure and rank order subscribers' internet usage, via statistically valid sampling. Currently, there are several methods for identifying heavy users. Off-line processing of SS7 data, collected by means of some portable SS7 collection system or device, can provide a snapshot of heavy users as well as other useful information. This approach has been used in the absence of permanently deployed SS7 data collection systems. As permanent systems come on-line, it will be preferable to analyze data using automated systems and filters.

One alternative to an external measurements system is to utilize switch traffic and provisioning systems to measure subscriber usage, and manage heavy users. An advantage of this approach is that the measurements can be integrated into the switch provisioning flow, in order to load balance heavy users across line peripherals. A possible disadvantage is that existing switch systems may not capture full call data, or may present aggregate data in a way that is not useful for the identification of heavy users. This issue is being addressed in Bellcore's switch provisioning systems.

Another alternative that avoids external measurements systems is to use the capabilities of the Intelligent Network architecture to identify the heavy users. This function can be implemented in the ICR node or in SCPs.

Beyond the immediate problem of identifying and managing heavy internet users, a further benefit of collecting internet traffic usage measurements is to provide traffic data and performance measurements concerning ISPs. As internet connection services evolve, traffic data will become valuable to ISPs, for purposes of marketing and service differentiation. In addition, there is a market for third party validation of ISP performance. Other applications of traffic / performance measurements are to provide network traffic and usage measurements for ISPs so that modem pools can be engineered optimally for a given Quality of Service. Finally, LECs can also use traffic reports to size and engineer the DS1/ISDN trunk groups between switches and access servers, and to support engineering of the Frame Relay or ATM transport network.

Lastly, note that once heavy users have been identified using PSTN / SS7 measurements, and are moved onto pre-switch adjuncts, the task of monitoring their usage and grooming users on a continuing basis may need to be performed by the pre-switch adjuncts themselves, or by the ICR node. Once users are moved onto adjuncts, they will no longer have visibility through SCP or switch-based measurements, unless this capability is specifically implemented in the switches and SCPs.

6. Other Feature Capabilities

In this section we briefly describe some SS7 and IN-based features to improve internet call control and routing.

A. Alternate Routing on Busy Modem Pools

A common and widespread problem with current internet access is that calls are often blocked due to busy modems. Furthermore, when users are not successful in connecting to a modem pool on the first attempt, they often retry. Measurements show that internet calls have a much higher re-attempt rate than voice calls (an average of 5 re-attempts for each blocked internet call).

These re-attempts further increase the load on the network and can actually decrease the call completion rate (snow ball effect).

It is possible that when a particular modem pool is busy, there are other modem pools with available capacity. To implement alternate routing for calls that encounter a busy signal (i.e., busy modem), the network needs to monitor the status of internet access lines. Also in certain scenarios where the number of re-attempts are high, it may be beneficial to invoke a call throttling mechanism to stop some of the calls from entering the network. SS7 and IN capabilities can be used to implement alternate routing and call throttling mechanisms. These advanced routing features will ensure that modems at various locations are utilized in an optimal manner, and can also increase call completion rates for customers.

B. Multiple Trunk Groups Routing on Busy Trunks

Another advanced routing feature that can be useful in the internet access network is the capability of supporting three or more alternate trunk groups as choices for routing the call. If the first trunk group is busy, then an attempt to terminate on the second trunk group will automatically be made, and if all trunks in the second trunk groups are busy, the third trunk group will be used. Using this feature, if there are some temporal variations in internet traffic, multiple routes are available for forwarding the call to an AS. This will result in cost effective engineering, as one does not have to over engineer a particular trunk group and the corresponding number of modems in a particular AS.

C. Decision Based Routing

Other decision based and flexible routing can be used in these architectures. Examples include routing based on time of day, or based on NPA-NXX of the calling party, or possibly even routing some calls to less congested AS for the most preferred customers, etc.

D. Internet Call Throttling

Current blocking levels for accessing ISPs are much higher than the traditional performance levels for which PSTN switches and trunks are engineered for (typically 1% blocking or less). The amount of blocking varies among ISPs, also depends on particular locations, and time of day, etc. Ineffective attempts impact the PSTN in two ways. The first impact is on switch processors. A re-attempt call uses about the same amount of switch processor resources to setup and clear the call as a successful (answered) call. The second impact is that an ineffective (busy) call also uses the inter-office trunks for a small (but non-negligible) duration. A busy call ties up the direct trunks for about 1.3-1.8 seconds, and tandem trunks for 0.9 to 1.4 seconds.

Clearly the amount of re-attempt traffic generated depends on the ISP probability of blocking. If ISPs improve call completion rate, the majority of ineffective traffic will disappear. However, at current marginal performance levels the network resources wasted due to ineffective attempts is not negligible. Thus, it may be justified to design a call throttling scheme to control ineffective attempt at the originating switches. A cost / performance study is needed to determine the cost of deploying such control schemes vs. the savings obtained by blocking some calls at the edge of the network.

7. Discussion

This paper has outlined five architectures for off-loading internet traffic from the PSTN onto data networks. Three of these are post-switch architectures, and two are pre-switch architectures. These architectures can be compared and evaluated under three main headings:

1. *Technical issues* — What are the technical issues that need to be resolved before the architecture can be implemented, and what is the timeframe for resolving them? These issues include such items as protocol interworking, tunneling, feature support, additional OSS capabilities, etc.

2. *Cost / business issues* — What are the cost/benefits of adopting a particular architecture? To what extent will it reduce the costs associated with carrying internet traffic on the PSTN? By virtue of new technology (e.g., ADSL), can a solution architecture not only reduce current costs, but also result in new services and revenues?

3. *Strategic Issues* — Finally, what are the strategic implications of adopting a particular architecture? How does the architecture fit with other service offerings, and the general evolution of the network?

Will it facilitate potential new services such as internet telephony, and support sophisticated signaling interfaces between voice and data networks (e.g., marriage of SS7 and TCP/IP)?

We conclude with some general observations on the pros and cons of the proposed off-load architectures. Leaving aside strategic issues, the intent of off-load architectures is to reduce PSTN costs by carrying internet traffic more efficiently. Additional benefits may include better service to internet users, and the potential to support new internet or data oriented services for residential subscribers, business subscribers and ISPs. However, in the short term, the focus is on reducing PSTN costs.

The effectiveness of the above architectures depends on the usage patterns of internet users, and on how costs are distributed throughout the PSTN. Pre-switch architectures capture internet traffic before it enters the PSTN. Because of this, they eliminate or reduce the costs associated with ingress switches, which constitute a significant portion of the total network costs. Pre-switch architectures also have the potential to capture internet traffic very efficiently, provided one can solve the problem of identifying heavy internet users. If this problem is solved, pre-switch adjuncts can be targeted specifically at a relatively small number of heavy users, resulting in maximum impact for minimum expenditure.

One problem with pre-switch architectures is that they move the onus of identifying heavy users onto other systems, such as OSSs, external measurement systems, etc. Unless pre-switch architectures are supported with systems necessary to identify and groom heavy users on an on-going basis (which may itself involve some cost), these architectures are likely to be ineffective, and may even result in increased costs. Identifying the optimal percentage of subscriber lines to move onto pre-switch adjuncts (possibly on a switch-by-switch basis), and ensuring that switches are maintained at the optimal operating point, requires fairly sophisticated data collection systems, and provisioning / work order processes.

Finally, an additional risk factor associated with pre-switch architectures is that they operate at the edge of the network. Capturing traffic at the edge of the network, where it is diffuse, can potentially result in significant cost savings as described above, but may also result in stranded capital investment if technology or subscriber usage patterns begin to change. Dealing with aggregated (internet) traffic streams inside the PSTN, would be a safer strategy, since one then obtains efficiencies of scale in deploying and operating off-load equipment. The risk of stranded investment can be addressed by providing a plausible evolution strategy for pre-switch equipment.

SS7 and IN capabilities have the potential to be effectively integrated with pre-switch architectures, so as to address the above concerns. As described briefly in sections 5, SS7 and IN capabilities can be used to identify heavy users prior to their being moved onto pre-switch adjuncts. (Once they are moved, their usage may need to be monitored by alternative means.) Furthermore, use of SS7 signaling to support internet call routing, as in Architecture D, permits routing intelligence to be controlled from inside the network. This in turn reduces the risk of stranded investment in adjuncts, and makes it easier to upgrade and manage routing databases, etc.

However, at present the integration of pre-switch adjuncts with SS7 signaling requires some novel network arrangements and non-standard signaling. These issues need to be addressed by the industry. Some have raised fundamental concerns regarding the pre-switch adjunct architecture. Critics of this architecture argue that it may not be a good idea to put triggers and call processing capabilities in another box in front of the switch. The argument is that this strategy gradually results in having another substantial switch (the adjunct) standing in front of the Class 5 switch.

In contrast to pre-switch architectures, the post-switch architectures described in Section 4 make it unnecessary to explicitly identify and manage heavy internet users. By default, ingress switches are used to route all internet calls to AS, by means of 10-digit number translations or IN-based routing. This constitutes an advantage for post-switch architectures since, as discussed above, the identification and management of heavy internet users is a non-trivial problem.

By capturing internet traffic on the network side of ingress switches, post-switch architectures can take advantage of economies of scale in the deployment of off-load equipment. Architecture C (Section 4) takes this idea to its logical conclusion, by routing all internet calls and signaling through a hub ICR facility. If internet traffic grows into a high penetration, large scale service as has been forecasted, this type of hub facility can be used to provide economical connectivity between LECs and ISPs.

As the market evolves towards more sophisticated, value-added internet services, the hub arrangement may well prove to be very attractive to ISPs and corporations, since they can avoid owning and operating their own AS equipment. Instead, the hub facility could be operated by an LEC or third party, and the ISP or corporation could simply subscribe to new equipment according to their own customers' or employees' needs. The hub operator would manage a variety of AS equipment from multiple vendors, achieving economies of scale by serving many ISPs and corporations.

A major disadvantage of post-switch architectures, at least in the simplest implementations, is that they do not address ingress switch costs. In addition, they potentially incur some additional costs through the deployment of IN capabilities on switches, SCPs, ICR node, and the implementation of IN triggers on switches. However, it should be noted that SS7 and IN nodes are already widely deployed. Thus there may only be some incremental cost associated with carrying or processing the signaling required for off-load function.
As with pre-switch architectures, SS7 and IN capabilities can address the weaknesses of post-switch architectures, by means of flexible call routing, and a number of traffic flow control features that can be custom designed for internet traffic management.

8. Conclusions

In conclusion, there are pros and cons to both pre- and post-switch architectures. These two classes of architecture have strengths in different areas. In reality, an optimal strategy could utilize both types of architecture, depending on traffic volumes, congestion levels in ingress switches, and overall economics.

Many of the technical issues associated with the implementation of off-load architectures are now reasonably well understood. Work programs in these areas (e.g., requirements / standards development) are mapped out, and are waiting for expressions of interest from the industry. Business case and cost analysis efforts is not as well advanced. Information to evaluate the cost effectiveness of various architectures certainly exists, but needs to be assembled and synthesized into a coherent picture.

In this paper, various internet off-load architectures have been described with somewhat of a near term focus in mind. It may be advantageous for network providers and equipment suppliers to also rethink the overall network evolution to better understand the direction of the PSTN in terms of incorporating new technologies that would facilitate the support of all traffic types including voice, data, and video applications.

A principal contribution of this paper is to highlight the potential use of SS7 and IN capabilities not only to enhance the effectiveness of both pre- and post-switch architectures from a technical point of view, but also improve their economics by providing the flexibility to adapt to a rapidly changing internet traffic patterns.

Acknowledgments

The main objective of this paper was to stimulate industry debate and discussion on the solutions for the internet congestion problem. The views expressed here are those of the authors, and do not represent the views of Bellcore. The authors gratefully acknowledge discussion with many industry members including members of the ITESF, and the following Bellcore subject matter experts: Michelle Baughman, Rob Bond, Faad Ghoraishi, Gail Linnell, Maria Pontones, Ann Merrell, John Mulligan, Fred Russell, Janet Quinlan, Mike Terner, Janice Warner, and Stan Wainberg.

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FPSC DOCKET NO. 000828-TP
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PAGES 1-31
NOVEMBER 1, 2000

STATE OF MAINE
PUBLIC UTILITIES COMMISSION

June 30, 2000

PUBLIC UTILITIES COMMISSION
Investigation into Use of Central Office Codes (NXXs) by New England Fiber Communications, LLC d/b/a Brooks Fiber
Docket No. 98-758

ORDER REQUIRING RECLAMATION OF NXX CODES AND SPECIAL ISP RATES BY ILEC'S (ORDER NO. 4)

NEW ENGLAND FIBER COMMUNICATIONS D/B/A BROOKS FIBER
Proposed Tariff Revision To Introduce Regional Exchange (RX) Service
Docket No. 99-593

ORDER DISAPPROVING PROPOSED SERVICE (PART 2)

WELCH, Chairman; NUGENT and DIAMOND, Commissioners

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I. SUMMARY OF DECISION

We address two cases in this Order. In the Investigation Case (Docket No. 98-758), we direct the North American Numbering Plan Administrator (NANPA) to reclaim the central office (NXX) codes acquired by New England Fiber Communications d/b/a Brooks Fiber (Brooks) that it is using for an unauthorized interexchange service and not for facilities-based local exchange service. Brooks shall discontinue the unauthorized service in six months. In a related matter, we find that Brooks's tariff filing in Docket No. 99-593 for a proposed "regional exchange" (RX) service is unjust and unreasonable, and we disapprove the filing.

In the Investigation Case, we also require Bell Atlantic-Maine (BA) (with the participation of all other incumbent local exchange carriers (ILECs) as access providers) to offer the special retail service to Internet Service Providers (ISPs) that Bell Atlantic proposed in response to our last order in the Investigation Case. In addition, we require Bell Atlantic to provide the same service with a wholesale discount.

II. BACKGROUND

In our Order issued on June 22, 1999 in the Investigation Case, we made factual findings and factual and legal conclusions, all of which we had proposed in prior orders. Those included findings that the service provided by Brooks was interexchange rather than local and that the 54 NXX codes Brooks had acquired outside its Portland area exchange were not being used to provide local service. We also requested comments about a proposal set forth in the Order for a special retail service to be offered by ILECs to ISPs. The proposed service would be an interexchange service, but would provide a substantial discount from existing retail toll rates. Because it would be an interexchange service, it also would provide a more appropriate level of revenue to the ILECs than Bell Atlantic was receiving for the "local" traffic under the interconnection agreement between BA and Brooks.

Following comments that we received on that proposal, the Staff Advisors for the Commission issued an Examiner's Report and Supplemental Examiner's Report. The Examiner's Reports not only addressed the issue of the discounted rate mentioned above, but also recommended that we should order the NANPA to reclaim the 54 NXX codes that have been assigned to Brooks, and that we should disapprove Brooks's tariff filing in Docket No. 99-593 for "RX service."

Several parties filed exceptions and other comments to the Examiner's Reports. We will discuss those within the headings below.

III. RECLAIMING NXX CODES

In the Notice of the Investigation Case, we raised questions about the resolution of this case with respect to Brooks's use of the 54 NXX codes assigned to areas outside its Portland area exchange that Brooks has claimed are being used for local service.

We have made findings and factual legal conclusions about Brooks's service and the use of those codes, but we have not addressed the issue of the disposition of those codes in any detail since the initial Notice.

In the June 22, 1999 Order, we found that Brooks was not providing local exchange service in those locations of the state that are outside of its Portland area exchange, and that it was not using the central office (NXX) codes it had acquired from the North American Numbering Plan Administrator (NANPA) for the purpose of providing local exchange service. We found that Brooks has no local switching facilities or loops deployed in any of the locations outside its Portland area exchange to which the 54 non-Portland codes are nominally assigned. Brooks was instead using the NXX codes for the purpose of providing an interexchange service that it characterized as like foreign exchange ("FX-like").

Brooks's "FX-like" service uses the interoffice trunking of another carrier rather than dedicated facilities provided by Brooks. Brooks created the FX-like service by the expedient of acquiring a group of NXXs from the NANPA and assigning various geographic locations to them that are outside of its Portland area exchange, even though it had no local exchange customers in those locations and all of its local exchange service customers were located in the Portland area exchange. As a result, calls to the numbers assigned to locations outside the Portland area exchange, which in reality were calls to Brooks customers located in the Portland area exchange, were rated (at least by Bell Atlantic) as if they were calls to the assigned locations, e.g., Augusta. If a call originated within the Augusta basic service calling area (BSCA) and was directed to a Brooks number that was assigned to Augusta, Bell Atlantic rated it as a "local" call. Nevertheless, the call would be routed from a Bell Atlantic customer over a local loop owned by Bell Atlantic, through a local switch owned by Bell Atlantic, over trunking owned by Bell Atlantic to Bell Atlantic's access tandem in Portland, then to Brooks's switch in Portland, and finally to a Brooks ISP customer, also located in Portland.

Because Brooks was not using the 54 NXX codes for the provision of local exchange service, we found that it had no need for them, that their use by Brooks could lead to the exhaustion of NXX codes in the 207 area code, and that Brooks's use of those codes was an unreasonable act or practice by Brooks under 35-A M.R.S.A. § 1306.

The Federal Communications Commission (FCC) has delegated "significant additional authority" to this Commission to "take steps to make number utilization more efficient" and authorized the Commission to utilize "tools that may prolong the life of the existing area code." *In the Matter of Maine Public Utilities Commission, Petition for Additional Delegated Authority to Implement Number Conservation Measures*, CC Docket No. 96-98, Order (Sept. 28, 1999) (FCC *Delegation Order*), ¶¶ 5, 8. The FCC stated:

> The CO Code Assignment Guidelines provide that carriers shall activate NXXs within six months of the "initially published effective date." We are, however, concerned that enforcement of the Guidelines has been lax. Reclaiming NXX codes that are not in use may serve to prolong the life of an area code, because these codes are added to the total inventory of assignable NXX codes in the area code. Therefore, we grant authority to the Maine Commission to investigate whether codeholders have activated NXXs assigned to them within the time frames specified in the CO Code Assignment Guidelines, and to direct the NANPA to reclaim NXXs that the Maine Commission determines have not been activated in a timely manner. We also extend this reclamation authority to instances where, contrary to the CO Code Assignment Guidelines and Maine's rules, a carrier obtaining NXX codes has not been certified as a provider of local exchange service or has not established facilities within the certified time frame. This authority necessarily implies that the Maine Commission may request proof from all carriers that NXX codes have been "placed in service" according to the CO Code Assignment Guidelines as well as proof of certification in the specified service area and proof that facilities have been established within the specified time frame. We further direct the NANPA to abide by the Maine Commission's determination to reclaim an NXX code if the Maine Commission is satisfied that the codeholder has not activated the code within the time specified by the CO Code Assignment Guidelines or has obtained numbering resources without being certified to provide local exchange service.

FCC *Delegation Order* at ¶ 19 (footnotes omitted). According to the quoted portions of the *Delegation Order*, this Commission may require the NANPA to reclaim codes when a carrier either is not certified as a provider of local exchange service or fails to establish facilities within the required time period. *Delegation Order* at ¶ 19. The NANPA *CO Code Assignment Guidelines* (*Guidelines*) require carriers to "activate" codes within six months of the "initially published effective date." *Guidelines* at § 6.3.3. The failure to establish facilities is by itself a ground for reclaiming NXX codes. *Delegation Order* at ¶19.

A. <u>Requirements that a Carrier Using NXX Codes Have Local Exchange Authority and Facilities</u>

In its exceptions, Brooks argued that, as long as it had either obtained authority to provide service, or has met the test of establishing facilities, we cannot require the NANPA to reclaim codes assigned to Brooks. According to this argument, Brooks would be permitted to keep all the codes if it were acting contrary to Maine law with respect to authority but had established facilities in a timely way; or it could keep all the codes if it had lawful authority but had built no facilities. Brooks has misread the *Delegation Order*. Under that Order, there are two independent conditions that allow the Maine PUC to require the return of the codes: first, if Brooks has no authority for the service it provides; and second, regardless of whether or not Brooks has authority, if Brooks has not established facilities within the allowed time.

In fact, Brooks has failed both tests. Brooks has not established facilities for local exchange (or any other kind of) service within the 6-month period required by the NANPA *Guidelines* in the areas outside its Portland area exchange to which the 54 NXX codes are assigned. Brooks has built absolutely no facilities (e.g., loops or switching) for local exchange (or any other kind of service) in those exchanges and has no customers in those exchanges.

Brooks has obtained general statewide authority under 35-A M.R.S.A. § 2102 to provide both local exchange and interexchange service.[1] That does not end the inquiry into whether Brooks has authority to provide service to a specific area, however. The FCC *Delegation Order* states that a carrier must be "certified" to provide local exchange service. We construe that statement, consistent with language in the *Guidelines*, to require that a LEC must obtain all necessary authority to provide the service that requires the use of NXXs. The *Guidelines* § 4.1.4 states that an applicant for an NXX code:

> must be licensed or certified to operate in the area, if required, and must demonstrate that all applicable regulatory authority required to provide the service for which the central office code is required has been obtained.

We have previously found that Brooks does not have the authority under its approved terms and conditions to provide local exchange service in any location in Maine outside its Portland area exchange. Notwithstanding general authority under section 2102, a utility does not have the authority to provide service to an area, unless its approved terms and conditions define those areas as part of its facilities-based local exchange service territory. A utility cannot offer a service without approved terms and conditions "that in any manner affect the rates charged . . . for any service." 35-A M.R.S.A. § 304. Brooks's approved terms and conditions limit the service area in which it will provide local exchange service to its Portland area exchange. Under current policies, consistent with the *Central Office Code Guidelines* and the FCC *Delegation Order*, we will grant authority to provide facilities-based local exchange service only for areas where a LEC can demonstrate that it will be able to provide facilities-based service within six months. Absent that showing, we would not approve a term or

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[1] As pointed out by Brooks's exceptions, Brooks does have authority under section 2102 to provide interexchange service. It obtained that authority on September 9, 1997 in Docket No. 97-559.

condition for Brooks to provide facilities-based local exchange service outside its Portland area exchange.[2]

B. Requirement that NXX Codes Be Used For Local Exchange Service

In addition to the two requirements that are specifically stated in the FCC *Delegation Order*, we believe the *Delegation Order* and the *Guidelines* also require that NXX codes must be used for local exchange service rather than interexchange service. In our prior order we found that the "FX-like" service presently provided unlawfully[3] by Brooks is interexchange. In reaching the conclusion in our prior orders that the Brooks "FX-like" service is an interexchange service, and that Brooks is not using the 54 non-Portland NXX codes for local exchange service, we relied primarily on the definitions of local exchange and interexchange services contained in Chapter 280 of the Commission's rules, and on the substantively identical definitions contained in the interconnection agreement between Brooks and Bell Atlantic.

In its exceptions, Brooks suggested that the NANPA *Central Office Assignment Guidelines* do not necessarily require that NXX codes be used only for local exchange service. We disagree. The *Guidelines* state that NXX codes "are assigned to entities for use at a Switching Entity or Point of Interconnection they own or control." *Guidelines* § 3.1 and 4.1. They "are to be assigned only to identify initial *destination addresses* in the public switched network." Guidelines § 3.1 (emphasis added). "Assignment of the initial code(s) will be to the extent required to *terminate* PSTN [public switched telephone network] traffic *as authorized or permitted by the appropriate regulatory or governmental authorities ...* ." Guidelines § 4.1 (emphases added).

The quoted *Guidelines* leave little doubt that NXX codes are to be used only for the purpose of providing facilities-based local exchange service. IXCs generally do not terminate traffic at end-user locations. Except where they use special access (which, because it is dedicated, does not require switching or NXX codes), IXCs hand over their interexchange traffic to a facilities-based local exchange carrier, most often at a tandem switch. The LEC carries the call to a local switch and local loop, and then

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[2]In our recent orders granting authority to provide facilities-based local exchange service, we have restricted the authority to provide service granted at the certification level pursuant to 35-A M.R.S.A. § 2101, rather than at the term and condition level. If Brooks should pursue an argument in any forum that it has the authority to provide facilities-based service throughout Maine solely because of the order granting it authority to provide local exchange service, issued pursuant to Section 2102 in Docket No. 97-331, we will not hesitate to reopen that Order and review whether we should amend it in a manner consistent with other recent orders.

[3]The "unlawfulness" of offering the present service is due to the fact that Brooks is offering the service without approved rate schedules and terms and conditions. As noted above, Brooks does have authority under 35-A M.R.S.A. § 2102 to provide interexchange service.

terminates the call at the called customer, i.e., the destination address. As we found in our prior orders, Brooks is not terminating traffic on "destination addresses" in any of the 54 non-Portland locations.

The conclusion that the *Guidelines* require that NXX codes be used only for local exchange service is supported by the requirement in the FCC *Delegation Order* that an applicant for an NXX code be certified as a provider of "local exchange service."

C. Further Discussion of Prior Finding that the Brooks Service is Interexchange

In finding that Brooks's "FX-like" service was interexchange, not local, we relied in part on Brooks's characterization of the service as being "like" foreign exchange service. Although foreign exchange service has a local component (the "local" service of one exchange is brought to a customer in another exchange, hence the name "foreign"), it is the routing of calls from one exchange to another, between which toll charges otherwise would apply, that makes the service interexchange.[4] Brooks is correct that FX service has attributes of local service, because it brings local service to a remote location, but the primary purpose of FX is as a toll substitute, and we reaffirm our prior finding that FX is an interexchange service.

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[4]The interconnection agreement between Brooks and Bell Atlantic does provide definitions of local and interexchange traffic; these definitions apply to the traffic of both Brooks and Bell Atlantic. They are identical to the Commission's definitions in Chapter 280. Under those definitions, we concluded that the traffic that originated from areas outside the Bell Atlantic Portland BSCA, and that terminated in Portland, is interexchange. Bell Atlantic and the other ILECs gather that traffic using their loops and local switches in the various locations outside Brooks's Portland area exchange, and they carry it over interoffice transport facilities to Brooks's only switch, located in Portland. Because the traffic is interexchange, it is subject to the access charge provisions of the Brooks-BA interconnection agreement (for interexchange traffic) rather than the reciprocal compensation provisions (for local traffic).

As explained in our prior orders, the definitions of interexchange traffic in Chapter 280, § 2(G) and the BA-Brooks interconnection agreement expressly depend on toll charges applying; traffic between exchanges that have "local" (EAS or BSCA) calling is not considered interexchange. The BA-Brooks interconnection agreement refers to BA's retail tariff to determine whether a call is local or interexchange.

If any doubt should arise about our interpretation of the Brooks-BA interconnection agreement, we would not hesitate to reconsider our approval of that agreement to ensure that its definitions of local and interexchange traffic would not lead to an exhaustion of scarce public numbering resources.

FX (foreign exchange) service in effect brings the local exchange service of a distant ("foreign") exchange to another exchange. Thus, for example, a customer located in Portland who subscribes to FX service for Augusta will be provided with an Augusta telephone number and may make calls as if the customer were located in Augusta. Calls to locations within the basic service calling area (BSCA) for Augusta will be toll-free. If the customer's Augusta telephone number is provided to callers located in the Augusta BSCA, they may dial that number and be connected, toll-free, to the customer in Portland. For customers (e.g., ISPs) seeking to gather traffic from distant exchanges without the caller incurring a toll charge, this is a particularly valuable feature of FX service. However, for "traditional" FX service, the customer must pay for the cost of the transport facilities (ordinarily dedicated) between Portland and Augusta. Those costs are often substantial. Customers subscribe to FX to avoid paying toll charges, and to allow others to call them without toll charges,[5] but typically they must have substantial toll-calling volume between the two locations to justify the cost of the dedicated transport facilities.

Brooks's exceptions do not profess to relitigate our prior finding that its "FX-like" service is interexchange.[6] Nevertheless, Brooks does cite to us a decision of the California Public Utilities Commission, *Order Instituting Rulemaking on the*

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[5]Customers occasionally subscribe to FX service for an exchange that is within the BSCA of the home exchange. Nevertheless, even that FX service normally is for the purpose of avoiding toll charges. For example, a Portland customer might subscribe to FX service for Freeport, which is within the Portland BSCA. Freeport's BSCA includes Brunswick, but Portland's does not. Accordingly, the Portland customer, using the Freeport number, may call toll-free to locations, including Brunswick, that are within the Freeport BSCA; and persons in Brunswick may call toll-free to the customer in Portland by dialing the Freeport number.

[6]On May 1, 2000, AT&T filed a Petition to Intervene, accompanied by comments that purport to address our Order issued on June 22, 1999. When we grant a late petition to intervene, the intervenor is entitled to participate only in issues that are not yet settled and cannot seek to relitigate decided issues. AT&T's comments, however, do primarily argue that Brooks's "FX-like" service is local, notwithstanding the fact that this issue has been fully litigated. Nevertheless, we grant AT&T's petition so that we can address other arguments in its comments.

We cannot let pass, however, AT&T's statement that "ILECs themselves treat calls from their end-user customers to their own foreign exchange customers as local under their retail tariffs." AT&T's statement is nothing more than a description of the "local" component of FX service; it ignores the interexchange component. In any event, the placement of a service in a carrier's tariff is not necessarily determinative of its substantive character. As we found in our prior orders, the very purpose of FX service is as a substitute for toll (interexchange) calling, and FX customers pay substantial amounts in lieu of toll charges. AT&T and Brooks would have us redefine the interexchange component as "local."

Commission's Own Motion Into Competition for Local Exchange Service, Rulemaking 95-04-043; *Order Instituting Investigation on the Commission's Own Motion Into Competition for Local Exchange Service*, Investigation 95-04-044, Decision No. 99-09-029, California Public Utilities Commission, (Sept. 2, 1999) (California PUC *Rulemaking/Investigation Order*) apparently to support its argument that its existing "FX-like" service, and its essentially identical proposed RX service, are "economically efficient" and will avoid "unnecessary duplication" of the incumbent's network. We address those arguments in Part IV below. Brooks also claims, however, that the California PUC designated "foreign exchange service as a local exchange service."

The California Commission addressed a service configuration established by a "competitive local carrier" (CLC) that is identical to the configuration that Brooks established in Maine, with the distinction (probably insignificant in the long run) that the California CLC was using only two NXX codes.

We see nothing in the California PUC decision (particularly in the portion of the order quoted by Brooks) that suggests that FX service as a whole is local rather than interexchange. The California Commission did rule that charges to the *caller* should be rated by virtue of the "location" of the rate center (i.e., the location to which the rate center is assigned) rather than by the rate center of the ultimate destination. Thus, as under the present Brooks configuration in Maine, if the NXX were assigned to an area within the local calling area of the caller, no toll charge would be assessed on the caller. To that extent, the California decision is not necessarily remarkable.[7] If, indeed, a carrier is offering a reasonable and legitimate FX service, the normal expectation is that end users who dial a "local" number will not be charged toll charges for those calls, even though those calls are routed to a place to which toll charges normally apply. Another normal expectation, however, is that the FX subscriber (the customer that causes the call to go to the remote exchange) pays rates for that transport service that take into account the lost toll revenue.

The California PUC did not ignore the interexchange component of the service. It addressed this component as a compensation issue, stating:

> We conclude that, whatever method is used to provide a local presence in a foreign exchange, a carrier may not avoid responsibility for negotiating reasonable interexchange intercarrier compensation for the routing of calls from the foreign exchange merely by redefining the rating designation from toll to local.

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[7]What is remarkable about the California decision, however, is the fact that such a substantial portion of the order addressed the issue of how calls made by end-users should be rated. The California approach would be paralleled here if our investigation concentrated primarily on the fact that some of the independent ILECs in Maine have rated the calls to the 54 non-Portland codes as toll calls to Portland.

> The provision of a local presence using an NXX prefix rated from a foreign exchange may avoid the need for separate dedicated facilities, but does not eliminate the obligations of other carriers to physically route the call so that it reaches its proper destination. A carrier should not be allowed to benefit from the use of other carriers' networks for routing calls to ISPs while avoiding payment of reasonable compensation for the use of those facilities.

Cal. Order at 32.

And:

> We conclude that all carriers are entitled to be fairly compensated for the use of their facilities and related functions performed to deliver calls to their destination, irrespective of how a call is rated based on its NXX prefix. Thus, it is the actual routing points of the call, the volume of traffic, the location of the point of interconnection, and the terms of the interconnection agreement – not the rating point – of a call which properly forms a basis for considering what compensation between carriers may be due.

Cal. Order at 36.

The California PUC never labeled the California CLC's "FX-like" service as wholly local or interexchange.[8] Brooks's claim that the California PUC found the service to be local exchange service is incorrect.

While the comparison of Brooks's "FX-like" service to traditional FX service has some parallels, we find that an even better comparison is to 800 service. Unlike "traditional" FX service, the Brooks service does not use any dedicated lines. Instead, as in the case of 800 service, Brooks's "FX-like" calls are placed to a "toll-free" number and routed over trunking facilities to a distant location that normally incurs a toll charge. It is beyond argument that 800 service is interexchange and that the charges paid for 800 service are charges for an interexchange service, paid instead of regular toll charges.[9] As discussed in more detail below, in connection with our rejection of

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[8]Based on its discussion about the considerations to be addressed in determining proper compensation, it is arguable that the California PUC considers FX service to be neither local nor interexchange, but *sui generis*.

[9]The California *Rulemaking/Investigation Order* recognized that, in addition to FX service, "another traditional method to provide toll-free calling is '800' service," and that if the California CLC had provided 800 service, it would have to pay "intercarrier switched access charges."

Brooks's proposed RX service, there is nothing preventing Brooks from providing a true 800 service, aside from its apparent unwillingness to pay for it.

We also doubt that Brooks has any real interest in retaining the 54 non-Portland NXX codes for any technical or engineering reason, or for any reason beyond the economic advantage that the codes provided, since 800 or some equivalent service would provide the same or better toll-free access to ISP customers. A toll-free service that uses trunking facilities rather than dedicated facilities can be provided efficiently (from an engineering perspective) using either the Brooks "FX-like" configuration or an "800-like" configuration. The significant difference between the two methods is the vastly greater number of NXX codes used in the Brooks configuration. We suspect that the real difference to Brooks between those two alternatives is that, by continuing to argue that it should be permitted to use 54 NXX codes to provide its service, on the ground that the "FX-like" service is "local exchange service," it may hold onto its hope that it might avoid paying Bell Atlantic for the interexchange transport service provided by Bell Atlantic. By contrast, under an 800-like service, it would be clear without any doubt that Brooks would have to pay the legitimate interexchange costs of long-distance transport, either by using (and paying access charges for) the facilities of another carrier or by paying for the costs of providing its own facilities.

The record makes clear that Brooks's "FX-like" service is being used by Brooks's ISP customers for the purpose of allowing the ISPs' customers who are outside Portland (and who are customers of Bell Atlantic or other ILECs rather than of Brooks) to call the ISPs from locations throughout the state without paying toll charges. It has exactly the same purpose as "traditional" FX service: it is a substitute for interexchange toll service. Alternatively, it is a variant on "800" service, which is a recognized interexchange service. We therefore reaffirm our finding that Brooks's "FX-like" service is an interexchange service, not a local exchange service.

D. Conclusion to Part III: Reclaiming NXX Codes

In this Order, pursuant to our authority under the FCC Delegation Order, we order the NANPA to reclaim the 54 non-Portland NXX codes assigned to Brooks, pursuant to the schedule described in Part V below. Brooks is not using those codes for purposes that are consistent with the NANPA *Guidelines* or the requirements of the FCC *Delegation Order*. It does not have the authority from this Commission to provide local exchange service to anywhere in Maine outside its Portland area exchange (the municipalities of Portland, South Portland and Westbrook); it has no loop, switching or other facilities in, or local exchange service to, those areas; and the "FX-like" service that it is providing with the use of the 54 non-Portland NXX codes is an interexchange service.

With regard to the procedure that we must use to order NANPA to reclaim NXX codes, the FCC stated:

> We note that the CO Code Assignment Guidelines dictate substantial procedural hurdles prior to reclamation of an unused NXX, in part to afford the codeholder an opportunity to explain circumstances that may have led to a delay in code activation... . We clarify that the Maine Commission need not follow the reclamation procedures set forth in the CO Code Assignment Guidelines relating to referring the issue to the Industry Numbering Committee (INC) as long as the Maine Commission accords the codeholders an opportunity to explain extenuating circumstances, if any, behind the unactivated NXX codes.

FCC *Delegation Order* at ¶ 20 (footnote omitted).

Brooks has had an ample opportunity in this proceeding to contest the findings and rulings we have made previously, and in this Order. Our findings fully support an order to the NANPA to reclaim the unused Brooks codes.

In Part VI below we address a service, to be furnished by the ILECs (and other carriers who wish to provide it), that will provide a reasonable substitute for the Brooks service, so that ISPs and their customers may continue to have affordable access to the Internet. We expect that it will take some time to implement that service, and we do not want to disrupt service to either ISPs that subscribe to the Brooks service or their customers. We therefore will delay the effective date of reclamation for a period of six months after the date of this Order so that Bell Atlantic and other ILECs will have sufficient time to establish the services and rates described in Part VI, and so that ISPs (and IXCs on a wholesale basis) will have a reasonable opportunity to subscribe to those services.

IV. CLAIMS BY BROOKS AND OTHER PARTIES THAT THE COMMISSION'S RULINGS IMPEDE COMPETITION AND EFFICIENCY

Brooks and others make an argument suggesting that the Commission's findings and rulings, and the rulings proposed in the Examiner's Report (that we now adopt), will impede local competition in Maine. In our view, the activities of Brooks that we have investigated in this case have nothing to do with local competition. Brooks's service does not create any local exchange service or competition whatsoever outside the Portland area exchange, which is the only exchange in which Brooks has any local exchange customers. The amount of local exchange competition created by Brooks's "FX-like" service is precisely the same as the amount of local exchange competition created by WorldCom's 800 service offerings in Maine's remote regions, i.e., none. Brooks has not built any local exchange facilities in the exchanges outside of Portland, and Brooks has no customers in those exchanges. Brooks has no contact with the callers in those exchanges who use Brooks's service to call the ISPs and has no idea who is "using" the service. The callers are in fact customers of Bell Atlantic, of the independent ILECs, and possibly of other CLECs. There is nothing that Brooks is providing in any of those non-Portland exchanges that resembles local competition in any meaningful sense of the word, a fact bome out eloquently by all of the activities Brooks is not doing.

Contrary to what Brooks, AT&T and some others have implied, this Commission has been extremely receptive to, and supportive of competition for all facets of telephone service. On the interexchange side, the Commission has acted vigorously to reduce access rates everywhere in Maine, all to the advantage of vigorous interexchange competition. With respect to local competition, we have recently allowed, over the ILECs' objection, a trial of facilities-based local competition using Internet Protocol (IP) to go forward with virtually no regulatory intervention.[10]

The comments and exceptions filed by Brooks, as well as those by AT&T, also suggest that the Commission is constraining competition by placing restrictions on Brooks and other competitors in the way they define their local calling areas. Specifically, Brooks suggests the Commission is requiring it to be bound by the definitions used by incumbent local exchanged carriers (ILECs), and that such restrictions on competitive LECs are not appropriate in a competitive marketplace. On the contrary, we have not restricted Brooks or any other CLECs from how they define their own retail local calling areas or from the retail rates they want to charge. Brooks is free to offer calling areas of its own design so long as, when it uses the facilities of others to accomplish that end, it pays for those facilities on the basis of how their owners define them for wholesale purposes (interexchange or local). Wireless carriers already offer calling areas vastly different from those offered by wireline carriers, but have built (or leased) facilities that enable them to provide such calling areas.

With its "FX-like" service, however, Brooks is not attempting to define its own calling area. In the areas to which the 54 non-Portland Brooks NXX codes are assigned, Brooks is not offering a different calling area from those offered by the LECs. Its "FX-like" service is not a "local calling area" for Brooks's customers (who are all in Portland) or for anyone else. What Brooks is doing in the non-Portland locations is offering free interexchange calling to customers of *other* LECs that allows them to call a selected number of Brooks customers (ISPs) located in Portland. Brooks is in effect attempting to redefine the local calling areas of *other* LECs. If Brooks had any of its *own* customers served by its own facilities (either by building them itself or by purchasing UNEs), in one of the locations outside of Portland, e.g., Augusta, and offered those customers the ability to call *all* customers in Portland without toll charges, then it could be said that Brooks offered a local calling area in Augusta and, in particular, that its local calling area differed from the ILEC's local calling area. With its own customers in any area, Brooks would be free to delineate whatever "calling area" it wants for those customers, subject to the condition that if such a call is carried over the facilities of another carrier, it must compensate that carrier for the use of its facilities. However, Brooks has no authority to provide local exchange service and no facilities or

[10] *See Time Warner Cable of Maine, Request for Advisory Ruling Regarding Pilot Program*, Docket No. 2000-285, Advisory Ruling (Apr. 7, 2000).

customers in locations outside of Portland, and therefore cannot and does not have "local calling areas" in those places.

As discussed above, what Brooks is attempting to do is offer free incoming long distance *interexchange* service to customers of ILECs who are outside Portland and who want to call Brooks's customers in Portland. Although that goal should not be confused with the offering of a local calling area, we have no objection to the goal itself. Our objections are to the use of 54 NXX codes to accomplish that end, when reasonable alternatives exist; and to the notion that Brooks is somehow entitled to use the facilities of someone else, for free, to accomplish that goal. When a carrier uses facilities of others, it cannot unilaterally redefine wholesale arrangements between itself and the carriers that actually carry its traffic simply by declaring that its calls are "local" if that recharacterization is to its financial advantage. A carrier's retail definitions of local and interexchange do not govern whether it pays local or interexchange wholesale rates to other carriers that carry its traffic.

Brooks also suggests that we are deterring it from deploying a more efficient means of providing foreign exchange service, stating that its service is "an efficient functional equivalent to the *local service* provided by the incumbent BA-ME" (emphasis added). The claim is extravagant: Brooks is not offering an equivalent to local service, i.e., an ability to call all customers within a local calling area. At best, it is offering an "efficient functional equivalent" to Bell Atlantic's foreign exchange service. If the need to conserve NXX codes were not a concern, Brooks's claim that a trunking-based FX system is more economical than a system that uses private lines might have merit.[11] However, 800 service also uses trunking rather than dedicated lines between exchanges and provides the same level of efficiency as the Brooks "FX-like" configuration, but does not require any NXX codes.[12] Brooks's approach may be "innovative," but its claim that our orders "discourage the use of new technologies," and

[11]The use of trunking facilities, which are shared by all users, is typically more cost-efficient than the use of facilities that are dedicated solely to the use of a single customer. On the other hand, at least for some customers, foreign exchange service that uses private lines that are dedicated solely to the use of that customer are likely to be more reliable because blocking either of trunking circuits or switching, caused by high traffic volumes, is less likely to occur. Emergency 911 and alarm services typically use dedicated circuits to reach remote exchanges.

[12]The California *Rulemaking-Investigation Order* suggests that in the absence of allowing California CLCs the option of using NXX codes for the purpose of providing an "innovative" FX service, CLCs would be required to place switching in every location in which they wished to have a local presence. It does not appear that the California PUC considered 800 service as a reasonable alternative to the NXX-code-based FX service. If one of Brooks's customers in Portland subscribed to an 800 service (provided by Brooks or any other carrier), it would not be necessary for Brooks (or one of the California CLCs in a parallel situation) to place switching in remote exchanges. With 800 service, a local customer in Augusta who was served by a LEC other than Brooks

its suggestion that it should not be saddled with the configuration of the ILECs' network, is disingenuous. Brooks is quite willing to use that network to reach the Brooks switch in Portland, but does not want to pay for its use.

V. REJECTION OF BROOKS'S PROPOSED RX SERVICE

In Docket No. 99-593, Brooks filed proposed terms, conditions and rates schedules for it to provide "Regional Exchange (RX) service." We disapprove the filing because we find the proposed service is not just and reasonable and because Brooks cannot provide the service without the 54 non-Portland NXX codes, which are not available to it for this service.

Pursuant to the provisions of Chapter 110, § 1003(b) of the Commission's rules, we issued a summary Part I Order on May 26, 2000 for this docket stating our conclusions. Part V of this Order constitutes Part 2 of the Order for Docket No. 99-593.[13]

The proposed service would use 54 (or more) NXX codes solely for the purpose of rating calls, so that calls from various locations throughout the State that terminate in Portland would be rated as local (non-toll). While it is a legitimate goal for a carrier to provide toll-free interexchange calling, there are reasonable alternatives to the service proposed by Brooks that do not needlessly use scarce NXX codes. One of those is traditional 800 service; another is the 800-like service we have ordered the ILECs to provide. Neither of these uses any NXX codes within the 207 area code. Nothing prevents Brooks, as an interexchange carrier, from providing an 800-like service itself. Nothing prevents it from buying such a service from another carrier, for example, its parent WorldCom. Under the present circumstances, where we are attempting to avoid the need for an additional area code in Maine, and where other services are available that are technologically equivalent, Brooks's use of 54 codes solely for the rating of interexchange traffic is unreasonable.

No service (even if there were appropriate compensation to the carrier actually providing the interexchange transport) justifies the extravagant use of NXX codes and 7-digit numbers within those NXXs proposed by Brooks. It would take only two or three

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(e.g., Bell Atlantic) would dial an 800 number. That number would be switched by a switch owned by the LEC providing service in Augusta and then routed to Brooks's customer in Portland. Brooks would need switching only in Portland.

[13]On June 2, 2000, the Examiner, pursuant to Chapter 110, §§ 103 and 1302, issued a Procedural Order that stated good cause for suspending the 5-day deadline for the issuance of the Part 2 Order.

The Part I Order in Docket No. 99-593, as well as the Procedural Order, incorrectly identify the date of deliberations as May 16, 2000. The correct date was May 9, 2000.

more Brooks-like arrangements, each with one ISP customer, to completely exhaust Maine's numbering resources. Brooks proposes to use numbers at the rate of 550,000 for ten customers (equivalent to a "fill" rate of under two one thousandths of one percent). Brooks also suggests that "in a pooling environment, Brooks's . . . use of limited NXXs cannot be said to encourage exhaustion." "Pooling" is the allocation of 1000 numbers within an NXX, which contains 10,000 numbers. Although pooling, which will occur soon, provides sufficient flexibility to allow us to delay the return of the particular codes that Brooks is not using for local exchange service for six months, its suggestion is not persuasive. A use rate of ten in 55,000 is not that much better than ten in 550,000. It is also likely that in a majority of the locations to which the Brooks codes have been assigned, there will not be any competitive LEC service in the near future. If there are no other CLECs to use some or all of the other 9000 numbers, assigning Brooks 1000 numbers out of 10,000 effectively ties up all of the 10,000 numbers in an NXX and would prevent the NXX from being used more effectively in a different location. Moreover, if in exchange where only Brooks was assigned a 1000 block of numbers, it were to use only 10 numbers, the use rate is still only ten in 550,000.

Brooks's proposed service (like the identical "FX-like" service it is presently offering without authority) also *depends* on the use of the 54 non-Portland NXX codes; it cannot offer the service without them. Those codes are not available to Brooks for the proposed service any more than they are for its present "FX-like" service. The reasons given in Part III, in support of our ruling that Brooks could not use the codes for the present service, apply with equal force here. Brooks does not meet any of the requirements of the FCC *Delegation Order* and the NANPA *Guidelines*. It does not have authority to provide local exchange service in any of the 54 non-Portland areas, and it has no facilities in those locations for the provision of local exchange service. In addition, the proposed service is an interexchange service rather than a local exchange service, and NXX codes may be used only for local exchange service.

Brooks argues that we should follow the reasoning of the California PUC *Rulemaking-Investigation Order* in order to allow it to use the codes for the purpose of providing the FX-like/RX service. We decline to do so for three reasons. First, the California PUC did not even consider the important questions of whether a carrier using an NXX must provide local exchange service to the place where the code is assigned, whether it must have local exchange facilities, or whether NXX codes may be used for interexchange services. It did not discuss the NANPA Guidelines or the contents of the delegation order that the FCC has issued to the California PUC granting it certain authority over the use and assignment of NXX codes.[14]

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[14]As discussed above in Part III, the California PUC did not even clearly rule that the service being offered by its CLCs – virtually identical to the service offered by Brooks in Maine – was a local exchange service.

Second, even if the California PUC could lawfully allow CLCs in California to use NXX codes for a service like Brooks's service in Maine, it is apparent, as a policy choice, that the California PUC has placed a higher value on the ability of its CLCs to offer the FX-like service based on the use of NXX codes than on the conservation of those codes. It stated:

> We disagree with Pacific's claim that the Pac-West service arrangement should be prohibited because it contributes to the inefficient use of NXX number resources. While we are acutely aware of the statewide numbering crisis and are actively taking steps to address it, we do not believe that imposing restrictions or prohibitions on CLC service options is a proper solution to promote more efficient number utilization.

We disagree. While the California PUC sees no reason to "impos[e] restrictions or prohibitions on CLC service offerings," we see no reason why a carrier should be permitted to use scarce NXX codes for gathering interexchange traffic when there are technologically efficient methods (e.g., 800 service) to accomplish the same end, without using NXX codes.[15] The California PUC did not address whether an 800 service configuration would be a reasonable alternative for using codes for a non-dedicated FX-like arrangement.[16]

Third, and perhaps most significant, it appears that the California CLCs may actually have been offering true local exchange service (in addition to the NXX-code-based "FX-like" service) in the locations to which the NXX codes had been assigned. The California Commission stated:

> Moreover, there is no reason to conclude necessarily that a carrier will use any NXX code only to provide service to ISPs which are located outside of the assigned NXX rate center. For example, both Pac-West and WorldCom report they are actively pursuing numerous opportunities to provide profitable telecommunications services throughout their service areas. Their current subscribers include paging companies that have a significant demand for local DID

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[15]The NANPA reports that California presently has 25 area codes. 12 of which codes are in "jeopardy" and 11 of those 12 are subject to "extraordinary measures," i.e., rationing. Number Assignments; NPAs in Jeopardy (visited June 20, 2000) http://www.nanpa.com

[16]Given the California PUC's statements that the CLCs should pay ILECs that transport the call more than nothing for that transport, but should also not pay switched access rates, it should make little difference to the California CLCs whether they offer an NXX-code-based FX service based on the use of NXX codes or an 800 service.

> numbers, which they, in turn, assign to local end users who typically *are* physically located in the assigned rate centers. (emphasis in original) Customers also include banks, retail stores, and other businesses, both located *inside* and outside the assigned rate centers. (emphasis added)

California PUC *Rulemaking/Investigation Order* at 16-17.

While that reason appears to be little more than "make-weight" to the California PUC, we would consider such service to be highly significant. If Brooks actually offered local exchange service to customers located in any of the areas to which the 54 non-Portland codes have been assigned (on other than a sham basis), it would have a legitimate claim to retain the codes.

For the foregoing reasons, we disapprove the proposed terms, conditions and rates proposed by Brooks in Docket No. 99-593. Brooks is, of course, presently providing the very service it has proposed in the tariff filing, but without authority. We will require Brooks to terminate the present unauthorized service on the date that the NANPA reclaims the NXX codes assigned to Brooks that are located outside the Brooks Portland area exchange. We will, however, delay the effective date of our orders to the NANPA for a period of six months and will permit Brooks temporarily to continue to offer the present service to its currently existing customers during that period. As stated in the Part I Order in Docket No. 99-593, Brooks must file a tariff for this grandfathered service, or special contracts with the existing customers.

VI. ILEC SNS/PRI ("500") SERVICE FOR ISPs AND IXCs THAT SERVE ISPs

A. Service Description and Requirement; Rates

In the June 22 Order, we proposed that Bell Atlantic and all other ILECs (the independent telephone companies or ITCs), in their roles as providers of interexchange service in Maine, offer a special service and retail rate for ISPs that would represent a substantial discount from existing retail toll rates. The service would also provide Bell Atlantic and the other ILECs with a more appropriate level of revenue than the amounts BA-ME has "received" as "local" reciprocal compensation (which actually are payments by BA to Brooks) under Brooks's interpretation of the interconnection agreement between Brooks and Bell Atlantic. We also proposed that the service be available on a wholesale basis to other IXCs.

There are two purposes to this service: to provide affordable statewide access to the Internet and to provide an appropriate level of compensation to interexchange carriers that actually carry the traffic and to LECs that originate and terminate the traffic. Those carriers include Bell Atlantic, other ILECs that provide interexchange service or interexchange access service, and any other IXCs that might offer similar special ISP service on their own. At present, Brooks is providing affordable access, but it is needlessly wasting 54 NXX codes to provide the service and is not properly compensating Bell Atlantic and other ILECs for the use of their interexchange facilities. We have found Brooks's service to be unreasonable and unlawful. Brooks's service also has not been available statewide on a toll-free basis. Most ITCs have rated the traffic to the Brooks NXXs that are nominally assigned to areas outside Portland as toll, because the traffic actually terminates in Portland rather than in the nominally assigned locations, and at least two have blocked the traffic.

We note that some of the discussion below refers only to Bell Atlantic. Some refers to ILECs generally or to Bell Atlantic and other ILECs. For example, where we discuss present impacts of Brooks's service, we usually refer only to Bell Atlantic. Bell Atlantic has been the primary carrier of the traffic generated by the Brooks service. Bell Atlantic also has an interconnection agreement with Brooks, and, at least until we found that the traffic was interexchange, Bell Atlantic paid Brooks reciprocal compensation for the "local" traffic that Bell Atlantic carried over its toll network. By contrast, the other ILECs (ITCs) do not have interconnection agreements with Brooks. Most ITCs have rated the traffic to the Brooks 54 NXXs assigned to areas outside Portland as toll, with the result that there is relatively little traffic originating in ITC exchanges that terminates at Brooks's ISP customers in Portland. In addition, as explained below, Bell Atlantic will be providing the retail service and the other ILECs will be providing access service. We fully intend, however, that all ILECs will participate in providing the service, that the service will be available statewide on a toll-free basis to end-users who are customers of ISPs, and that there be reasonable compensation arrangements among Bell Atlantic, other ILECs and any other participants.

We proposed a special rate for two reasons. Both of these are related to our findings that the ISP traffic carried by Brooks (only from its switch to its ISP customers) is interexchange rather than local in nature; and that Bell Atlantic and other ILECs actually carried the traffic over their transport facilities from locations outside the Portland calling area to Brooks's Portland switch. First, we want to ensure that Internet subscribers are able to continue to subscribe to the Internet at reasonable rates, consistent with the Legislature's mandate of "affordable" Internet access in 35-A M.R.S.A. § 7101(4), even though the traffic at issue in this case is interexchange rather than local. Second, we intend that the rate will fairly compensate Bell Atlantic and other ILECs that will be carrying or providing access for this interexchange traffic. We proposed that the service would be toll-free to end-users, much like an 800 service, and that it would avoid the need to use NXX codes within the 207 area code, again much like an 800 service, which uses no 207 NXX codes.

In its comments of July 14, 1999, Bell Atlantic proposed a service (labeled Single Number Service/Hubbed Primary Rate ISDN, or SNS/PRI) essentially identical to that proposed by the Commission, except for price.[17] As under the Commission's proposal, the SNS/PRI service would use numbers that would be toll-free to end-user

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[17]The SNS/PRI service configuration uses advanced intelligent network (AIN) database capability and is therefore technically superior to circuit-switched 800 service.

customers. Each ISP could be assigned one (or more) 7-digit number within the "500" prefix.[18] There would be no need to use any NXX codes within the 207 area code.[19]

The SNS/PRI service is an interexchange service, and the rate is an interexchange rate, for traffic that the Commission has found is interexchange. It is also a *retail* service offered to ISPs. The rate to ISPs will be flat. There will be no usage component (per-minute or otherwise). The subscribers to the rate will be ISPs, not individual customers of ISPs. The service is an *inward* (called party pays) service; ISP customers would be able to call the "500" numbers without paying toll charges.

Under recent changes to the interexchange relationship between Bell Atlantic and the other ILECs (ITC), Bell Atlantic provides retail interexchange toll services to ITC customers in the local service territories of all of the ITCs, except one.[20] The ITCs provide access service to Bell Atlantic and other IXCs. The IXCs pay access charges according to rate schedules on file with the Commission. Pursuant to contract, the ITCs also bill their local exchange customers for Bell Atlantic's retail toll service, and turn over that retail revenue to Bell Atlantic. Unlike the other ITCs, Saco River Telegraph and Telephone Company provides its own interexchange service to its local exchange customers and pays Bell Atlantic and other ITCs to terminate its traffic.

Some questions have been raised about the participation of the independent ILECs, specifically about "concurrence" by those companies in Bell Atlantic's interexchange rate schedules. Historically, the independent telephone companies (ITCs) have concurred in those schedules. Under that concurrence (and the now abandoned settlements process), Bell Atlantic and the ITCs provided interexchange services jointly. Although some ITCs may still "concur," we view concurrence, or the lack thereof, as irrelevant under the present arrangement between Bell Atlantic and the ITCs, where Bell Atlantic provides interexchange service to retail customers located in ITC local service territories and the ITCs provide interexchange access services to Bell Atlantic.

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[18]Brooks's exceptions claim that Bell Atlantic cannot use "500" numbers for the proposed service. If Brooks is correct, we expect Bell Atlantic to obtain another prefix that it may use for the service.

[19]Great Works Internet (GWI), a customer of Brooks, states, somewhat misleadingly, that the proposed SNS/PRI service would require "20,000 internet users to change their numbers." The service would not require any of these users to change their home or business telephone numbers. They would only have to change the number that they dial to access internet service. The vast majority of these users would have to make a one-time change to the number in their computer software that provides access to the Internet. That software automatically dials the number.

[20]Other IXCs, such as AT&T, Spring and WorldCom, also provide interexchange service to local service customers of ITCs.

In response to a set of questions filed by the ITCs, Bell Atlantic stated that the ITCs will offer the SNS/PRI services only if they specifically concur or independently establish their own rate schedules for these services and agree upon compensation with Bell Atlantic. Bell Atlantic also stated that the tariff it is preparing will not include provisions "for the exchange of traffic for this service between BA-ME and the ITCs, in either the originating (i.e., ITC originated to BA-ME's ISP terminating subscriber) or terminating (i.e., BA-ME originated to ITC's terminating ISP subscriber) direction."

Consistent with the description above concerning toll services generally, we will require Bell Atlantic to offer the retail SNS/PRI service to ISP customers located in ITC local exchange service areas, and to allow customers of ITCs to call ISPs located in Bell Atlantic local exchange territory.[21] We also will require the ITCs to provide access service to Bell Atlantic and other IXCs. Rate schedule concurrence is not necessary. ITCs will also provide (sometimes jointly with Bell Atlantic) any necessary dedicated facilities (local distribution channels) to ISPs located in their territory. In response to the question asked by the Telephone Association of Maine (TAM) in its exceptions, concerning whether we are requiring BA to offer "toll plans statewide," including areas served by ITCs, the answer for the SNS/PRI service is yes.

B. <u>Retail Pricing</u>

BA proposed rates that would be "non-usage sensitive and non-distance sensitive and will probably fall in the range of $500-$600 per month, per SNS/PRI facility." In its March 24, 2000 filing, it stated that the rate for such a facility would be "approximately $500." A retail ISP subscriber must obtain a minimum of two SNS/PRI facilities, one in each of the two "sector hubs" for the service, located in Portland and one in Bangor. In addition, an ISP would need "appropriately sized Local Distribution Channels to connect the ISP's location to a single interconnection point on BA-ME's network," at flat-rated prices equal to special access prices, which are distance sensitive.

Bell Atlantic characterized these rates as "affordable" (the statutory standard) rather than based on a possible pricing standard mentioned in the Commission's Order, long run marginal cost.

No party objected to BA's proposed pricing for the retail service, either in earlier comments or in exceptions. The earlier comments filed by Brooks claimed that the proposed Bell Atlantic retail rate would not allow Brooks to "compete." Brooks did not state the reason for this claim, beyond the further conclusory statement that the proposed rate includes a "discriminatory rate structure that will make this service

[21]In the case of 800 service, 800 service customers located in BA-ME territory are able to receive calls from *all* locations in Maine including calls originated by ITC end-users. A BA-ME 800 service customer does not have to subscribe to an ITC service to receive those calls from end-users whose exchange service is provided by an ITC. We expect the same to be true with this SNS/PRI (500) service.

uneconomical for CLECs [sic] to provide."[22] Nothing precludes Brooks from offering a similar retail service using its own facilities and ILEC access services or through resale of the Bell Atlantic service. As proposed in the Commission's June 22, 1999 Order and in Bell Atlantic's proposal, the retail rate would be available at a wholesale discount so that other IXCs would be able to resell it. Bell Atlantic states that the discount in Maine is presently 18-20%.

The rate proposed for this service by Bell Atlantic is acceptable. It represents a substantial discount from the toll rates for the calling volumes directed to ISPs. It satisfies the criterion of 35-A M.R.S.A. § 7101(4), which requires "affordable access" to computer-based information services. Although not required to do so, competitive IXCs may also offer a similar service. In order to facilitate such offerings by IXCs, Bell Atlantic shall also offer a discounted wholesale rate as required by 47 U.S.C. § 251(c)(4). That requirement applies to "any telecommunications service that the carrier [any ILEC] provides at retail to subscribers who are not telecommunications carriers." The requirement does not make any distinction between local exchange and interexchange service. The amount of the discount represents billing and other costs that the ILECs avoid by providing the service on a wholesale basis to IXCs rather than on a retail basis to ISPs.

The Examiner's Report proposed to require Bell Atlantic to provide an additional rate for wholesale customers (IXCs) that would equal the wholesale rate described above, but that would be broken down into separate components of switching, transport and a remaining "common line" amount, similar to the current structure for access rates. The Examiner and advisors apparently believed that a carrier providing service to an ISP could use its own switching, for example, and purchase only transport and the common line component from Bell Atlantic or other ILECs, thereby avoiding the ILEC switching charge. According to Bell Atlantic's exceptions, that assumption is not correct:

[22]Because the service is interexchange, Brooks's statement quoted above should be read as applying to the ability of *IXCs* to provide the service.

Brooks's exceptions provide a little more specificity to its objection. We discuss that objection below.

> SNS/PRI uses select network facilities to extend a wide-area calling area to an ISP's end users from the PRI hub locations. This investment includes hub switching, direct interoffice transport (where available), Advanced Intelligent Network (AIN) database capability and dedicated terminating facilities to the ISP end user. All of these network components must be in place to efficiently route calls under the SNS/PRI service.
>
> As a consequence, a competing carrier wishing to provide a service comparable to SNS/PRI on a facilities basis cannot own only a terminating switch, as the Examiner apparently envisions. Instead, a competing facilities-based provider must obtain all of the foregoing network facilities which enable BA-ME to provide SNS/PRI. There is no way for BA-ME to "break down" its retail service architecture into a wholesale access rate structure, as the switched access rate categories of common line, switching, and transport do not correspond to the investment in SNS/PRI-related facilities.

Brooks made a similar argument, claiming in effect that the "bundled" service "excludes" competition for what it refers to as the "local service component," i.e., the local distribution channel. Brooks apparently views the "local distribution channel" as a "local component" in part because of its name and its location in Bell Atlantic's tariff. A "local distribution channel" is a facility that runs between a switching facility and a customer. Such a facility is dedicated to that customer's exclusive use and, depending on purpose, may also be called a "local loop" or "special access." The facility, whatever it is called, is capable of carrying both interexchange and local traffic. The service that Bell Atlantic's and the ITCs will offer is an integrated interexchange service that carries interexchange traffic. Brooks apparently agrees with Bell Atlantic's claim that the service is an integrated one and cannot feasibly be broken down into components. Accordingly, we will not require Bell Atlantic and the ILECs to offer services consisting of the three components individually as suggested by the Examiner's Report.

Brooks, in its earlier comments, also complained that if the Commission ordered the proposed service, it would not be permitted to collect anything for traffic that originates on another carrier's network and that terminates at Brooks's facilities. The problem for Brooks is not whether it may collect compensation for terminating traffic, but whether there will be any terminating traffic, once its present unauthorized "FX-like" service ceases. The Bell Atlantic-ILEC SNS-PRI service will be provided directly to ISPs that subscribe to the service. That traffic will be carried directly to a subscribing ISP by Bell Atlantic (and, if the ISP is located in ITC territory, locally by the ITC). Unless Brooks (as an IXC) establishes a competing similar interexchange service, which it is obviously free to do, none of the present "FX-like" traffic will terminate on Brooks's facilities. The question of compensation for nonexistent traffic is therefore academic.[23]

C. Compensation Among ILECs

Many, and perhaps most, ISPs are located in Bell Atlantic territory.[24] Under the SNS/PRI service, if an end user who is located in independent telephone company (ITC) territory places a 500-NXX-XXXX call to one of the ISPs located in BA territory, the ITC is entitled a "terminating" access payment from Bell Atlantic.[25] Conversely, when an ISP is located in ITC territory, and a Bell Atlantic customer dials a 500 number assigned to that ISP, the ITC is entitled to an "originating" access payments. In its Response, Bell Atlantic stated that because the SNS/PRI service was heavily discounted, it would not pay the ITCs their standard access rates. Bell Atlantic stated:

> [T]he proposed tariff does not cover the terms and conditions for the exchange of traffic for this service between BA-ME and the ITCs, in either the originating (i.e., ITC originated to BA-ME's ISP terminating subscriber) or terminating (i.e., BA-ME originated to ITC's terminating ISP subscriber) direction. The specific terms and conditions for the exchange of this traffic would have to be negotiated in arrangements between BA-ME and the ITCs because existing agreements for the exchange of toll and local traffic between BA-ME and the ITCs do not cover the special class of traffic created by the Commission in this docket and served by this new SNS/PRI offering.

It also stated:

> An ITC would need to determine for itself whether it desired to offer this service to its subscribers by concurring

[23]Even if Brooks were somehow able to retain the ISP customers (other than in a resale capacity), so that it still had terminating traffic, the traffic would be interexchange, not local. The BA-Brooks interconnection agreement requires that regular access charges apply to interexchange traffic. BA would not pay reciprocal compensation to Brooks.

[24]At the time the Commission made its factual findings in the Order issued on June 22, 1999, all of the ISPs that are customers of Brooks were located in Portland. Bell Atlantic is the ILEC that serves Portland.

[25]As in the case of 800 service, because it is an inward service (the called party pays), "originating" and "terminating" access designations are reversed.

> in BA-ME's filed tariff terms and conditions.[26] The terms and conditions (including cost recovery) for the exchange of traffic originating or terminating on an ITC's network would need to be negotiated between BA-ME and the ITCs, most likely on the basis of an equitable division of the retail rate permitted by the Commission to be charged to the ISP subscriber.
>
> The origination of a call by an ITC subscriber to a BA-ME "500" or "555" ISP subscriber is not traditional access service by the ITC because the Commission has determined that BA-ME's provision of the interoffice transport and delivery of this traffic is not to be considered or rated as traditional toll service. The Commission, in this docket, has created an entirely separate class of service for Internet-bound traffic only.

The Telephone Association of Maine (TAM) strongly urges us in its exceptions to address the matter of inter-company compensation. The Examiner's Report had suggested that under 35-A M.R.S.A. § 7901 jurisdiction over inter-company compensation issues may be limited to occasions where the companies cannot agree. Subsection 2 of section 7901 does indeed address dispute resolution. Subsection 1, however, makes clear that the Commission has direct jurisdiction over "rates, tolls or charges" for the "transfer of messages or conversations" over lines that are connected between carriers without regard to the existence of a dispute. In addition, we have ample authority under 35-A M.R.S.A. § 1303 to investigate a matter such as inter-company compensation, and that issue surely is reasonably now within the scope of this case, which is an investigation under section 1303.

At least initially, BA, the ITCs and the Commission staff shall address the question of inter-company compensation in a collaborative manner pursuant to a schedule to be established by the Examiner. For that reason, as noted in Part V, we will allow BA and the ITCs a period of up to six months to address compensation issues, as well as any administrative matters that may arise.[27]

In addressing the compensation issues, BA, the ITCs and the Advisory Staff should be aware of the following considerations:

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[26]We have addressed the "need" for ITCs to "concur" at Part VI.A above.

[27]As noted in Part V, Brooks may continue to offer the unauthorized NXX-based "FX-like" service to existing customers only for the full 6 months.

1. It is not entirely clear (contrary to Bell Atlantic's assertions) that "existing agreements for the exchange of toll and local traffic between BA-ME and the ITCs do not cover the special class of traffic . . . ." It is not clear that existing access tariffs or contractual arrangements between the Bell Atlantic and the ITCs exclude any specific class or type of interexchange traffic from existing access tariffs or compensation arrangements.

2. As claimed by Bell Atlantic, the Commission has established a special category of interexchange toll service for Internet traffic, to be priced substantially below existing toll rates. Bell Atlantic asserts that "BA-ME's provision of the interoffice transport and delivery of this traffic is not to be considered or rated as traditional toll service." The Commission, however, has not made any finding at this time concerning whether special compensation arrangements are necessary for the SNS/PRI service.

3. If the ITCs charged their existing access rates for the origination of this traffic, Bell Atlantic most likely would be paying more to the ITCs than it would be collecting from its retail customers, the ISPs. We also note, however, that in the recent past, there has been no direct relationship between access revenue billed as a result of calling by a particular customer and the amount of retail revenue obtained from that same customer. Access rates are the same for all minutes and no longer vary according to calling volumes (as they did under versions of Chapter 280 of the Commission's rules prior to the enactment of 35-A M.R.S.A. § 7101-B) Retail rates vary considerably, however.

4. A substantial amount of the Internet traffic originating in ITC territory that will terminate in Bell Atlantic territory will be incremental. At least two ILECs block the traffic that would otherwise be directed to ISP customers of Brooks. Most ITCs charge regular toll rates for that traffic. Accordingly, the ITCs presently are not receiving a significant amount of access revenue for that traffic because blocking prevents, and per-minute toll rates deter, end users from subscribing to ISPs that are located in Bell Atlantic territory.

D. Other Issues

The exceptions of the Telephone Association of Maine (TAM)[28] state that some ITCs have switches that are not currently capable of providing PRIs. We will request the ILECs to address this matter in the collaborative process that we require in Part VI.C above.

[28] The ITCs and Bell Atlantic are all members of TAM, but at least on the issues addressed in this Part VI, it is clear that TAM represents the interests of the ITCs.

TAM's exceptions also note that the June 22, 1999 Order stated that "the rate would not be available to ISPs that offer voice services over the Internet." TAM states that it:

> believes this to mean that no customer subscribing to the service may do so for the purpose of carrying voice traffic. TAM is not aware of anything in the proposal that would prevent a company other than an ISP from subscribing to this service.

TAM then asks whether the Commission intends that the service should only be used by ISPs.

We do intend that the service be available only to ISPs. That limitation should appear in Bell Atlantic's terms and conditions. 35-A M.R.S.A. § 7101(4) justifies a special rate for connecting to the Internet. It does not justify a similar special rate for ordinary toll traffic.

TAM then raises questions about the enforceability of the limitation. We agree that enforceability may be a difficult problem, and we expect the parties to address this in the collaborative process that also will address compensation. We believe that a reasonable policy as a starting point is that ISPs that offer Voice over Internet Protocol (VoIP) should not be permitted to subscribe to the SNS/PRI service and rate. By "offering," we mean marketing and/or providing software for VoIP. If it is feasible to segregate VoIP traffic, we could alter that policy. We doubt if it is possible to enforce such a policy against end users who, on their own, obtain and use VoIP software.

VII. CONCLUSION

We reaffirm our findings in prior orders that Brooks's use of the 54 NXX Codes outside its Portland area exchange is for interexchange purposes, not local, and that Brooks is not providing facilities-based local exchange service or any other facilities-based service in those exchanges. The "FX-like" service that Brooks is currently offering without authority is unreasonable and will not be approved. Accordingly, Brooks has no legitimate need for the 54 codes, and, as authorized by the FCC Delegation Order; we order the NANPA to reclaim them six months after the date of this Order.

Within 30 days following this Order, Bell Atlantic shall file rates, terms and conditions for the retail, wholesale combined, and wholesale components services described in Part IV above.

Ordering Paragraphs

Accordingly, we

1. FIND, in Docket No. 99-593, pursuant to 35-A M.R.S.A. § 310, that the proposed changes to the rate schedules and terms and conditions of the New England Fiber Communications L.L.C. contained in Maine PUC Tariff No. 1:

5th Revised Page 1.1 (cancels 4th Revised Page 1.1)
2nd Revised Page 12.1 (cancels 1st Revised Page 12.1)
1st Revised Page 12.4 (cancels Original 12.4)
1st Revised Page 12.5 (cancels Original 12.5)
1st Revised Page 12.6 (cancels Original Page 12.6)
Original Page 12.7

are UNJUST AND UNREASONABLE and we ORDER that they will not become effective;

2. ORDER New England Fiber Communications L.L.C. to file special contracts, for approval under 35-A M.R.S.A. § 703(3-A), or rate schedules and terms and conditions, for a limited continuation of its existing service that is similar to the disapproved service, as described in the body of this Order;

3. ORDER New England Fiber Communications L.L.C. to make the filing or filings described in paragraph 2 on or before July 18, 2000;

4. ORDER the North American Numbering Plan Administrator (NANPA), effective six months from the date of this Order, to reclaim the 45 central office (NXX) codes in the State of Maine that are assigned to New England Fiber Communications d/b/a Brooks Fiber, and that are outside New England Fiber Communications' Portland area exchange (consisting of the municipalities of Portland, South Portland and Westbrook, Maine);

5. ORDER New England Telephone and Telegraph Company d/b/a Bell Atlantic-Maine to file a schedule of rates, and terms and conditions for the Single Number Service/Hubbed Primary Rate ISDN (SNS/PRI) service described in Part VI of this Order. Bell Atlantic shall make that filing within 30 days of the date of this Order; and

6. ORDER New England Telephone and Telegraph Company d/b/a Bell Atlantic-Maine, the independent incumbent local exchange carriers of Maine IXCs that are parties to the case that intend to offer SNS/PRI or similar service, and the Commission Advisory Staff assigned to this case to engage in a collaborative process for resolution of questions having to do with compensation between Bell Atlantic and the independent ILECs, the question of whether there are technical problems in offering the service at some independent ILEC switches, and the question of restricting such service

to uses other than Voice over Internet Protocol. For the latter purpose, the Advisors may request information from other parties in this case and from outside persons. The Hearing Examiner shall establish a schedule for the collaborative process, which shall not exceed six months.

Dated at Augusta, Maine, this 30th day of June, 2000.

BY ORDER OF THE COMMISSION

Dennis L. Keschl
Administrative Director

COMMISSIONERS VOTING FOR: Welch
Nugent
Diamond

THIS DOCUMENT HAS BEEN DESIGNATED FOR PUBLICATION

NOTICE OF RIGHTS TO REVIEW OR APPEAL

5 M.R.S.A. § 9061 requires the Public Utilities Commission to give each party to an adjudicatory proceeding written notice of the party's rights to review or appeal of its decision made at the conclusion of the adjudicatory proceeding. The methods of review or appeal of PUC decisions at the conclusion of an adjudicatory proceeding are as follows:

1. Reconsideration of the Commission's Order may be requested under Section 1004 of the Commission's Rules of Practice and Procedure (65-407 C.M.R.110) within 20 days of the date of the Order by filing a petition with the Commission stating the grounds upon which reconsideration is sought.

2. Appeal of a final decision of the Commission may be taken to the Law Court by filing, within 30 days of the date of the Order, a Notice of Appeal with the Administrative Director of the Commission, pursuant to 35-A M.R.S.A. § 1320(1)-(4) and the Maine Rules of Civil Procedure, Rule 73, et seq.

3. Additional court review of constitutional issues or issues involving the justness or reasonableness of rates may be had by the filing of an appeal with the Law Court, pursuant to 35-A M.R.S.A. § 1320(5).

Note: The attachment of this Notice to a document does not indicate the Commission's view that the particular document may be subject to review or appeal. Similarly, the failure of the Commission to attach a copy of this Notice to a document does not indicate the Commission's view that the document is not subject to review or appeal.