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DIRECT TESTIMONY OF PAUL KOUROUPAS
ON BEHALF OF
TELEPORT COMMUNICATIONS GROUP INC.
DOCKET NO. 950985-TP
SEPTEMBER 1, 1995

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Paul Kouroupas. My business address is Teleport Communications Group Inc. ("TCG"), Two Teleport Drive, Staten Island, New York 10311.

Q. WHAT IS YOUR CURRENT POSITION AT TCG?

A. I am Regional Director of Regulatory Affairs for the Eastern Region, responsible for state regulatory initiatives in the region. Prior to becoming the Eastern Regional Director, I was Manager of Regulatory Affairs, responsible for the development and implementation of regulatory rules regarding the interconnections necessary for effective local exchange competition as described in TCG's "Nine Points". For the past year, I have been responsible for negotiating and implementing a comprehensive interconnection and compensation arrangement with several local exchange carriers.

Q. HAVE YOU PREVIOUSLY TESTIFIED IN OTHER PROCEEDINGS ON BEHALF OF TCG?

A. Yes. I most recently testified before the Maryland Public Service Commission in Case 8584, Phase II, specifically addressing the appropriate structure for reciprocal compensation arrangements between competing local exchange carriers. I also have testified before the Connecticut Department of Public Utility Control in Docket 94-10-02 and before the Massachusetts Department of Public Utilities in Docket No. 94-185 on the same issue. I have testified in Illinois before the Illinois Commerce Commission in Docket No. 92-0398 addressing expanded interconnection for special and switched access services and in Docket Nos. 94-0048, 94-0049, 94-0096, 94-0117, and 94-0146 concerning the interconnection and reciprocal compensation arrangements necessary for the development of local exchange competition. I testified before the Pennsylvania Public Utility Commission in Docket No. A-310203F0002 in which I also specifically addressed the significance of an

economically viable reciprocal compensation arrangement between competitors for the exchange of local telephone traffic. I have testified to these same issues before the Maryland Public Service Commission in Case No. 8587 addressing the legal, technical and economic requirements which must be in place before potential competitors can provide local exchange service.

Finally, I testified before the Florida Public Service Commission in Docket No. 921074-TP addressing expanded interconnection for special access services and just recently, I testified to the benefits of using a geographic split to alleviate telephone number shortages in Florida in Docket No. 941272-TL.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND.

A. I received a Bachelor of Arts degree in communications from Temple University. I also received a Juris Doctorate degree from the Catholic University of America and a certificate from the Communications Law

Institute of Catholic University, in recognition of my completion of a curriculum specializing in telecommunications regulation. While attending Catholic University, I worked as an intern in the General Counsel's office of the National Telecommunications and Information Administration from September 1990 to December 1990. In addition, I worked as an intern in the office of Commissioner Andrew C. Barrett of the Federal Communications Commission from June 1991 until April 1992. Since June 1992, I have been employed by TCG.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to describe the optimal interconnection and compensation arrangement which should exist between competing local exchange carriers, the primary issue on which TCG and BellSouth Telecommunications, Inc. ("BellSouth") have not been able to reach a mutually acceptable agreement. Pursuant to the petition it has filed in this docket, TCG requests that the Commission establish the arrangements I

describe below in order to make it possible for local competition to develop as envisioned by the new legislation.

Q. HAVE TCG AND BELLSOUTH REACHED AN AGREEMENT ON ISSUES OTHER THAN RECIPROCAL COMPENSATION?

A. No, TCG and BellSouth have not reached a formal agreement on issues other than mutual compensation. However, TCG is hopeful that the companies will reach such an agreement shortly so that Commission intervention on these issues is unnecessary. TCG has reserved the right to raise these issues should it be necessary to do so.

Q. DID YOU PARTICIPATE IN NEGOTIATIONS BETWEEN BELLSOUTH AND TCG?

A. Yes. In my capacity as the Regulatory Director for the Eastern Region, I presented TCG's overall requirements for interconnection at the first meeting our companies had. Since then, representatives from TCG and BellSouth have had multiple meetings to discuss the specifics regarding the implementation of these

requirements. To illustrate this process, attached to my testimony as Exhibit PK1 is a letter from me to Mr. Robert Scheye at BellSouth, dated August 7, 1995, describing, from TCG's perspective, the areas in which I believe TCG and BellSouth are in agreement. Also attached is Exhibit PK2, a letter from Wanda G. Montano, TCG Director, to Ms. Suzanne H. Detlefs at BellSouth, dated August 24, 1995, describing the companies' proposals for directory listings. I have also attached a series of letters identified as Exhibits PK3, PK4 and PK5 from Ms. Montano to Mr. Scheye addressing interexchange carrier ("IXC") connectivity, 976/audiotext calls and meet point billing arrangements.

Although BellSouth has maintained a cooperative spirit with TCG, to my knowledge, TCG has not received any written responses or confirmation concerning the issues in these letters.

INTERCONNECTION AND COMPENSATION

Q. WHAT DO YOU MEAN BY THE TERMS, "INTERCONNECTION" AND "COMPENSATION?"

A. Interconnection and compensation refer to the technical, administrative and financial arrangements which govern the exchange of traffic between competing local exchange carriers.

Q. WHY ARE THESE ISSUES SO IMPORTANT?

A. Interconnection is important because in order to avoid the situation which existed at the turn of the century where consumers often had to have two or more telephones in order to communicate with all of their neighbors, competing local exchange carriers must interconnect their networks and agree to terminate traffic originated by the other carrier. Therefore, in order to allow customers of one carrier to seamlessly place and receive calls from customers of another carrier, the competing local exchange carriers ("LECs") must develop the technical and

administrative arrangements necessary to terminate each other's traffic.

A reciprocal compensation arrangement is an agreement between two LECs outlining how they will compensate one another for traffic that originates on the network of one LEC and terminates on the network of the other LEC. Simply put, the incumbent LEC and the new LEC need to arrange to compensate one another for the use of each other's networks. Logically, compensation payments for the exchange of traffic are only an issue to the extent that the carriers disproportionately use each other's network, meaning that the traffic they exchange is unbalanced.

Q. WHAT DO YOU MEAN WHEN YOU SAY THAT COMPENSATION ARRANGEMENTS ARE AN ISSUE ONLY TO THE EXTENT THAT TRAFFIC EXCHANGED BETWEEN THE CARRIERS IS UNBALANCED?

A. To put it another way, if the traffic exchanged between competing local exchange carriers was exactly balanced, i.e., each carrier terminated

100 minutes per month for the other, then the compensation arrangement between carriers is irrelevant since the payments to each other would net out to zero. This assumes, of course, that the compensation arrangement is reciprocal.

Q. WHAT DO YOU MEAN BY THE TERM, "RECIPROCAL"?

A. By "reciprocal," I mean that carriers compensate each other equally for the exchange of traffic.

Q. IS IT YOUR EXPECTATION THAT TRAFFIC EXCHANGED BETWEEN BELLSOUTH AND TCG WILL BE BALANCED?

A. In the near term, I do not believe the traffic exchange will be balanced between TCG and BellSouth due in large measure to the fact that there exists no long-term number portability solution.

Q. WHY DOES A LACK OF LOCAL NUMBER PORTABILITY IMPACT WHETHER OR NOT TRAFFIC EXCHANGED BETWEEN TCG AND BELLSOUTH WILL BE BALANCED?

A. In order to attain a balance of traffic with BellSouth, TCG must serve the same customer mix as BellSouth does. This means that TCG must serve both customers with heavy outbound usage, as well as customers with heavy inbound usage. Without number portability, TCG's ability to serve customers with heavy inbound usage is crippled.

Q. WHY DOES A LACK OF NUMBER PORTABILITY CRIPPLE TCG'S ABILITY TO SERVE CUSTOMERS WITH HEAVY INBOUND USAGE?

A. Customers with heavy inbound usage develop a strong affinity to their telephone number, since their customers have become used to dialing that number thus generating that heavy inbound usage. If the customer must change his telephone number in order to utilize TCG's services, then the customer will likely remain with BellSouth rather than go to the trouble of re-educating its users. Customers with heavy

outbound usage are dialing other people's telephone numbers, rather than encouraging people to call them. Accordingly, they will likely attach less importance to their telephone number. Therefore, TCG will be relegated to serving customers with heavy outbound usage, requiring TCG to terminate much of this outbound traffic on BellSouth's network. This will translate into an unbalanced exchange of traffic with BellSouth.

Q. SO, BECAUSE THERE IS NO LONG TERM LOCAL NUMBER PORTABILITY SOLUTION, THE ISSUE OF RECIPROCAL COMPENSATION IS IMPORTANT TO NEW ENTRANTS?

A. Yes. When a carrier faces the prospect of completing more traffic to a carrier than that carrier completes to it, the issue of reciprocal compensation becomes absolutely critical. In fact, at this early stage of competitive entry, local exchange competitors will provide a de minimis number of subscriber lines. Even if a competitor succeeded in providing 1% of the subscriber lines in BellSouth's service territory, BellSouth will

still retain 99% of the subscriber lines. The competitor would, therefore, be required to terminate virtually all of the local calls made by its own customers on BellSouth's network. Conversely, BellSouth will only have to terminate a tiny percentage of calls made by its customers on the competitor's network. Clearly, any imbalance in the pricing of a compensation arrangement will be insignificant to BellSouth but could seriously harm the local competitor whose entire business is conditioned upon paying BellSouth to terminate calls on its network.

This situation I have described is exacerbated when there is a dominant carrier in the marketplace such as BellSouth. Through the application of excessive charges for the termination of other carriers' traffic, BellSouth can stifle the development of competition.

Q. IF ONE ASSUMES THAT TRAFFIC EXCHANGED BETWEEN TCG AND BELLSOUTH WILL BE UNBALANCED, WHAT DO YOU CONSIDER TO BE THE OPTIMAL RECIPROCAL INTER-CARRIER COMPENSATION ARRANGEMENT?

A. Reciprocal inter-carrier compensation arrangements should be developed in accordance with the following principles.

ECONOMIC VIABILITY

First and foremost, compensation arrangements must allow for economically viable local exchange competition. In order for new competitive entrants to invest hundreds of millions of dollars to deploy the network infrastructure necessary to provide consumers with local telecommunications services, these entrants must be able to deliver ubiquitous local telecommunications services in an economic manner. The inter-carrier compensation arrangement between competing carriers can, more than any other inter-carrier arrangement, greatly impact the ability of a carrier to economically deliver local telecommunications services and is therefore the most important principle to consider.

Particular attention must be paid to the retail environment in which the carriers will operate. If retail local telephone service is priced on a flat-rate monthly basis or on a message-rate basis, as it is in Florida, it is highly unlikely that a measured per minute inter-carrier compensation arrangement is economically viable.

INCENTIVES FOR INFRASTRUCTURE DEVELOPMENT

The competitive development of the nation's telecommunications infrastructure has been targeted by policy-makers at the highest-levels of government as a primary objective for this nation. Reciprocal inter-carrier compensation arrangements can greatly influence the pace and direction of this competitive development and must therefore be carefully considered in this larger aspect.

In conjunction with the principle of unbundling, inter-carrier compensation arrangements can encourage continued investment in the State's local telecommunications

infrastructure by providing carriers with an economic incentive to deploy their networks ubiquitously. For instance, by requiring carriers to pay a greater amount for terminating traffic at the tandem level of the network and a lesser amount for terminating traffic at the end office level of the network, carriers will have an economic incentive to more broadly deploy their networks.

MAXIMIZE COMPETITIVE OPPORTUNITIES

New entrants into the local telecommunications marketplace must have the freedom to develop innovative products tailored to consumer demand. New entrants must also have the freedom to develop unique service packages and pricing plans. The inter-carrier compensation arrangement which exists between carriers can greatly impact a carrier's ability to differentiate itself from the incumbent carrier.

To the extent that new entrants are tied to the incumbent LEC's existing retail pricing plan,

competitive opportunities will be minimized if the new entrant is forced to pay a disproportionate amount to the incumbent to terminate traffic on a wholesale basis. New entrants must be able to develop their own retail pricing packages, i.e. volume discounts, time of day discounts, flat-rate service, message-rate service, etc., in spite of the compensation rate they will pay.

UNBUNDLING

Inter-carrier compensation arrangements must be consistent with unbundling policies. New entrants should not be required to purchase unnecessary services from the incumbent carrier. Conversely, new entrants should be permitted, and encouraged, to provide as much of an end-to-end call as possible.

ADMINISTRATIVE EFFICIENCIES

The cost of administering an inter-carrier compensation arrangement must be minimized. It does not make sense to spend $10,000 to settle a $5,000 bill. Moreover, it would be

inefficient to require ratepayers in Florida to absorb unreasonable costs associate with the development of billing systems used for this purpose. Therefore, great attention must be paid to the administrative costs associated with reciprocal compensation arrangements.

Q. HOW CAN THE COMMISSION ENSURE THAT LOCAL COMPETITION IS ECONOMICALLY VIABLE?

A. As with any business, the provision of local exchange service requires a carrier to cover its costs. These costs can be considered in three general categories. First, a carrier must cover its own internal costs of operation. These costs are not the subject of this proceeding, nor generally subject to Commission review. Second, a carrier must be prepared to support the social policy objectives of the Commission, especially as manifested in a "universal service" policy. However, the issue of universal service and other social policy goals are currently being addressed in a separate proceeding before the Commission and

therefore should not be a subject of this proceeding.

The third major cost component of the provision of local exchange telecommunications services entails the costs associated with interconnecting with existing local exchange telecommunications carriers for the exchange of traffic. This is potentially the largest cost component of a new carrier's operations and the one over which the new carrier has the least control. It is therefore imperative for the terms and conditions of interconnection between carriers to offer the new entrant a fair opportunity to provide service.

Interconnection costs can be broken down into two general categories. First, there are the costs associated with the physical network connections between the competing carriers such as trunking facilities. Second, there are the costs associated with the termination of traffic delivered over the inter-carrier network (mutual compensation for call

completion services). It is the cost of this call completion service which is the focus of my testimony. As discussed in more detail below, the terms and conditions of mutual compensation arrangements are critical to the viability of new entrants, and the Commission should take great caution to assure that the costs imposed by incumbent carriers do not eliminate nascent competition.

Q. BASED ON THE ABOVE, WHAT IS THE OPTIMAL RECIPROCAL INTER-CARRIER COMPENSATION ARRANGEMENT?

A. TCG advocates a capacity-based reciprocal inter-carrier compensation arrangement which recognizes the costs incurred in establishing interconnection arrangements.

Q. WHAT IS A CAPACITY-BASED RECIPROCAL INTER-CARRIER COMPENSATION ARRANGEMENT?

A. A capacity-based reciprocal inter-carrier compensation arrangement establishes a flat-monthly fee for the termination of traffic over a DS1 capacity facility. This is in contrast

to a per minute-of-use compensation arrangement as proposed by BellSouth.

Q. WHAT IS THE ADVANTAGE OF USING A CAPACITY BASED CHARGE AS OPPOSED TO A PER MINUTE OF USE CHARGE?

A. The advantages of capacity-based charges are fourfold and consistent with the principles I described above. First, capacity-based charges are the natural means of assessing call completion charges in a competitive market. Second, capacity-based charges afford carriers the retail pricing flexibility desirable in a competitive environment. Third, capacity-based charges are administratively simple. Fourth, capacity-based charges represent a good transitional vehicle to a "bill and keep" arrangement which would prevail when traffic between carriers is balanced.

Q. WHAT DO YOU MEAN THAT CAPACITY-BASED CHARGES ARE A NATURAL MEANS OF ASSESSING CALL COMPLETION CHARGES IN A COMPETITIVE MARKET?

A. By way of analogy, I will demonstrate that in a competitive market carriers would compensate each other on a capacity-basis as opposed to on a per minute of use basis.[1] For purposes of the analogy, suppose one car rental company decided that all drivers should pay for each mile driven and sets its rates as a price per mile rather than a price per day. Before customers adjusted to the changed price structure, the company could receive the same revenue with either method by simply setting the price per mile equal to the previous price per day divided by the average number of miles per day. However, that price structure could not last in a competitive market. It would cause those who drive long distances per day to pay far more than those who drive short distances. Because the real costs are related to the time the car is rented rather than to the number of miles,

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[1] This analogy was developed by Dr. Gerald W. Brock in a paper prepared for Teleport Communications Group and is attached as Exhibit PK6.

another company would offer a flat rate with unlimited miles and attract all of the long distance drivers. The company charging per mile rates would be left with only those who drive very short distances and would no longer cover its cost with the initial rates. As it raised its rate per mile in order to cover its costs, it would lose additional customers and eventually it would be forced to impose a cost related time charge in order to stay in the competitive business.

Similarly, a competitive telecommunications company would be forced to impose a cost related capacity charge rather than a minutes of use charge in order to survive in a competitive telecommunications market. I believe that the only reason capacity-based charges would not develop in Florida is the presence of a dominant carrier.

Q. WHAT DO YOU MEAN WHEN YOU SAY THAT CAPACITY-BASED CHARGES AFFORD CARRIERS MAXIMUM RETAIL PRICING FLEXIBILITY?

A. The retail local telephone market in Florida is characterized by the offering of both flat-rate and measured-rate local calling. It is extremely risky for a new entrant to offer flat-rate local calling when the entrant must pay the dominant LEC to terminate traffic on a per minute basis.

A capacity-based reciprocal inter-carrier compensation arrangement affords TCG the retail pricing flexibility to offer consumers both flat-rate and measured usage options for local calling. This is because the new entrants would not be tied into the per minute interconnection rate which BellSouth proposes to impose.

Q. ARE THERE OTHER BENEFITS OF A CAPACITY-BASED RECIPROCAL INTER-CARRIER COMPENSATION ARRANGEMENT?

A. Yes. A capacity-based reciprocal inter-carrier compensation arrangement permits all carriers to develop their own unique time-of-day and volume discounts. This would not be possible in an environment where the dominant carrier imposes per minute charges because those per minute charges would set a price floor for all carriers operating in a market.

Q. WHY DO CAPACITY-BASED CHARGES PERMIT CARRIERS TO OFFER TIME-OF-DAY AND VOLUME DISCOUNTS?

A. With capacity-based charges, carriers no longer have to price their services against a per minute charge levied by the dominant carrier. Rather, carriers have the freedom to price their services in any manner so long as at the end of the month they cover the capacity charge. This affords a much greater degree of flexibility.

A simple example relates to the time-of-day discount. Suppose that a carrier discovers an inordinately high volume of traffic occurs each day at 10:15am until 11:30am. That carrier may want to encourage its customers to place telephone calls prior to or after that time period so as to avoid having to increase network capacity. If the carrier is tied into the dominant carrier's per minute charges, the carrier may find that it is uneconomic to offer time-of-day discounts which differ from the dominant carrier's because the retail calling rate during the discounted period is less than the call completion charges imposed by the dominant carrier.

Q. WHAT DO YOU MEAN WHEN YOU SAY CAPACITY-BASED CHARGES ARE ADMINISTRATIVELY SIMPLE?

A. As stated above, the Commission must be cognizant of the costs associated with administering a reciprocal inter-carrier compensation arrangement. A capacity-based charge is administratively simple since it entails only the monthly billing of a fixed

charge. Per minute charges, on the other hand, require complex and costly measuring and billing capabilities which not all carriers currently have.

Q. WHAT DO YOU MEAN WHEN YOU SAY THAT CAPACITY-BASED CHARGES REPRESENT A GOOD TRANSITIONAL VEHICLE TO A "BILL AND KEEP" ARRANGEMENT?

A. As stated at the outset, reciprocal inter-carrier compensation arrangements are relevant to the extent that traffic exchanged between carriers is unbalanced. However, the longer carriers operate in Florida, and the sooner a long-term solution to local number portability is implemented, the more likely that traffic exchanged between TCG and BellSouth will be balanced. The capacity-based reciprocal compensation arrangement described below permits a smooth transition to this balanced situation and in fact incorporates a mechanism for determining when traffic is in balance.

Q. ARE THERE ANY DISADVANTAGES ACCRUING FROM THE IMPLEMENTATION OF Per minute OF USE CHARGES AS PROPOSED BY BELLSOUTH?

A. Yes, there are primarily three disadvantages of utilizing per minute of use charges. First, minutes of use interconnection charges would not be sustainable in a highly competitive market as demonstrated by my example of the rental car agency above.

Second, minutes of use interconnection charges fail to attain efficiency and lead to incorrect investment signals. Third, minutes of use interconnection charges have been used in the past as a convenient allocator for fully distributed costs under a regulated monopoly structure, but are not appropriate for the emerging market structure of greater competition.

Q. CAN YOU EXPLAIN WHAT YOU MEAN WHEN YOU SAY MINUTES OF USE CHARGES FAIL TO ATTAIN EFFICIENCY AND LEAD TO INCORRECT INVESTMENT SIGNALS?

A. Minutes of use pricing has been used extensively in the monopoly telecommunication industry of the past. Pricing on a minutes of use basis was mandated in the federal access charge plan. The access charge plan created in preparation for the January 1, 1984 divestiture of AT&T created a rigid structure of the prices to be paid from interexchange carriers to local exchange carriers for originating and terminating interstate traffic. Particular categories of cost determined by prescribed cost allocation procedures were required to be recovered by dividing the cost category by the forecast number of minutes and charging interexchange carriers the resulting price per minute for the access element.[2]

[2]The legal description of the access charge plan is found in Title 47 of the Code of Federal Regulations, Parts 36 (separations cost allocations) and 69 (computation of access charges).

Although the per minute access charges were sustainable because of the largely monopoly structure of the local exchange industry, they distorted both consumer and business decisions away from maximum efficiency. On the consumer side, the access charges made it expensive for long distance companies to serve off peak residential customers. Long distance companies paid the same rate per minute to local telephone companies for traffic terminated late at night as they paid for traffic terminated at the peak of the business day. Consequently, discounted consumer rate plans for night calls that were established prior to the implementation of access charges became unprofitable. Long distance companies were forced to raise their prices to night time residential callers because of the artificial access charge structure even though the night time calls (utilizing otherwise idle capacity) imposed practically no cost on either long distance or local exchange companies.

Prior to the implementation of the federal access charge plan, an interim plan for initial long distance competition imposed access charges on long distance providers based on capacity used. That plan provided incentives for carriers such as MCI and Sprint to aggressively build their residential customer base because residential calls were primarily off peak and imposed little or no cost on the companies. Once the access charge plan was implemented with its per minute charges for all traffic regardless of when it occurred, the companies found that business traffic was more profitable than residential traffic. The incentives created by the minutes of use access charges thus distorted business marketing and investment decisions away from the efficient path.

The inefficient effects of minutes of use interconnection charges can be illustrated by again considering a car rental company, functioning as a regulated monopoly. If it (or its regulator) decides that charges should be

determined by the mileage driven rather than by the time the car is rented, the resulting rate structure will be sustainable and can be designed to allow the company to recover its total revenue requirement. However, consumers will have an incentive to rent many cars for occasional short mileage driving. If the company is required to provide rental cars at the established rate to all who request them, it will be forced to make large investments in underutilized capital. It will recoup the costs of the investment by imposing very high charges on long distance drivers.

The monopoly rental company will report to its regulators that it is subsidizing short distance drivers who are being provided cars below cost. Both the company and its regulators will be concerned about any proposals for competition because competitors would "cream-skim" the profitable long distance drivers, leaving only the unprofitable short distance drivers to the regulated company and threatening its viability. However, the entire

problem is simply that the price structure does not correspond to the cost structure. The distortions and regulatory problems could be solved by shifting to a time based rental structure that matched the structure of cost in that market. Similarly, minutes of use access or interconnection charges reduce efficiency, create wrong investment incentives, and increase the difficulty of moving toward a competitive communications industry.

Q: HAVE YOU ANALYZED BELLSOUTH'S SWITCHED ACCESS RATES?

A: Yes, it is my understanding, based on BellSouth's tariff, that BellSouth charges $.04793/minute to terminate intraLATA toll traffic. As is evidenced by the table below, this rate is clearly uneconomic when one looks at BellSouth's retail rates. I would note that this is the case when considering BellSouth's claim that 460 minute of use per month is the

Average Monthly Usage for a residential customer.[3]

BellSouth's Residential Flat Monthly Rate (includes unlimited local calling)	TCG Cost of Terminating Traffic to BellSouth Based On BellSouth's Switched Access Rate of 4.793¢/minute in Comparison to BellSouth's Retail Residential Flat Rates Monthly Minutes of Use (MOU) Terminating to BellSouth			
	Monthly MOU 200	Monthly MOU 460*	Monthly MOU 600	Monthly MOU 800
$8.10	$9.59	$22.05	$28.76	$38.34
$9.80	9.59	22.05	28.76	38.44
$10.05	9.59	22.05	28.76	38.44
$10.30	9.59	22.05	28.76	38.44
$10.45	9.59	22.05	28.76	38.44
$10.65	9.59	22.05	28.76	38.44

[3] See Pre-filed Direct Testimony of BellSouth Witness Martin, Docket No. 950696-TP, at 14.

Q. BUT WON'T TCG RECEIVE COMPENSATION FROM BELLSOUTH FOR TERMINATING ITS TRAFFIC TO OFFSET THIS LOSS?

A. TCG may receive some inbound revenue from BellSouth, but as stated in my direct testimony, until a long-term solution to service provider number portability is in place, the balance of traffic between TCG and BellSouth will most likely be heavily in favor of BellSouth. Therefore, the inbound revenues received from BellSouth will be minuscule in comparison to the outbound expenses incurred by TCG.

Q. BUT WON'T TCG RECEIVE ADDITIONAL REVENUES FROM THE CUSTOMER FOR SO-CALLED VERTICAL SERVICES?

A. TCG may receive additional revenues from a customer for vertical and ancillary services, but there is no guarantee of that. Every service offered by TCG will be competitive in nature, which means that consumers can elect to take the same service TCG offers from some other carrier or vendor. For instance, many of the so-called CLASS features have customer

premises equipment ("CPE") equivalents which consumers can purchase at an electronics store.

Q. BUT WON'T TCG RECEIVE ADDITIONAL REVENUES FROM TOLL SERVICES?

A. With the implementation of intraLATA presubscription, TCG has no guarantee that it will receive any toll revenues. For this and the previous two questions, I would have to agree with the conclusions of an Administrative Law Judge with the Illinois Commerce Commission who said, "The issue is not whether a new LEC can ultimately scrape together revenues from enough sources to be able to afford Illinois Bell's switched access charges. The crucial issue is the effect of a given reciprocal compensation proposal on competition." (Hearing Examiners' Proposed Order in Docket 94-0096, January 24, 1995 at 98.)

Q. WHAT IS THE SPECIFIC CAPACITY-BASED RECIPROCAL INTER-CARRIER COMPENSATION ARRANGEMENT TCG ADVOCATES?

A. TCG's compensation proposal works as follows:

(1) Carriers will make available a DS1 capacity switch port for the termination of traffic at both the tandem-level and the end-office level of the network.[4]

(2) Carriers will price these ports on a flat monthly basis.

(3) For the exchange of all POTS traffic ("local" and "toll"), the inter-carrier network will consist of two-way trunk groups with Feature Group D technical characteristics and full SS7 signalling capabilities. Each carrier will purchase one fully equipped DS1 capacity port for each two-way trunk group.

(4) During each month, carriers will measure the peak busy hour of the month to determine the relative traffic flow over the inter-carrier network.

(5) Port charges will be allocated in accordance with the peak busy hour measurements. That is, if the peak busy

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[4] Of course the ports will be priced to reflect the differing functions between the end-office and tandem. The tandem ports perform the access-equivalent function of tandem switching, local transport and local switching, while the end-office ports perform the access-equivalent function of local switching only.

hour measurement determines that 75% of the traffic over the inter-carrier network originates from carrier 1 and 25% of the traffic originates from carrier 2, then carrier 1 will pay 75% of the port charge and carrier 2 will pay 25% of the port charge.

(6) For the inter-carrier DS1 network facility, either carrier can deploy the facility through their respective collocation arrangement. The charges for the facility will be allocated in accordance with the peak busy hour measurement and the deploying carrier's tariffed rate for the facility.

Because telephone networks are engineered for peak busy hour traffic, it makes sense to allocate the costs of the inter-carrier network according to peak busy hour usage. The major benefit of this method of cost allocation is that it recognizes that the effective incremental cost of off-peak usage is zero. Since residential traffic is generally off-peak, this will encourage

carriers to aggressively market residential service.

Q. YOUR PROPOSAL RECOMMENDS THAT CARRIERS EXCHANGE ALL TRAFFIC AT A SINGLE RATE, INCLUDING TRAFFIC TRADITIONALLY RATED AS BOTH "LOCAL" AND "TOLL". DOES THIS RAISE ANY CONCERNS REGARDING THE MAINTENANCE OF THE EXISTING ACCESS CHARGE REGIME FOR INTEREXCHANGE CARRIERS?

A. No. The interconnection and compensation proposal I have outlined applies to competing local exchange carriers only. If a carrier is acting as an interexchange carrier only, then it will continue to interconnect with BellSouth via existing tariffed access arrangements. If, on the other hand, a carrier is operating as a local exchange carrier and providing residential and Lifeline services to customers, then the interconnection and compensation arrangement I have described should apply.

Q. WHY DO YOU MAKE A DISTINCTION BETWEEN INTEREXCHANGE CARRIERS AND LOCAL EXCHANGE CARRIERS IN THIS MANNER?

A. To the extent that existing local exchange carriers generate their own internal "subsidy" to maintain low prices for residential telephone service and to provide Lifeline services and these "subsidies" are derived from interexchange carrier access charges, new entrants must be permitted to do the same. That is, new entrants must be permitted to generate their own internal "subsidy" and should not be required to transfer that "subsidy" to the incumbent local exchange carrier through the payment of access charges. Therefore, all traffic must be terminated to the incumbent local exchange carrier at rates which do not include any "contribution". This will enable the new entrants to fulfill its universal service obligations in the same manner that the incumbent local exchange carriers do.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

Exhibit PK 1

TCG

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August 7, 1995

Mr. Robert C. Scheye
Strategic Management
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Atlanta, Georgia 30375

RE: Interconnection negotiations

Dear Mr. Scheye:

I am writing this letter as a follow up to our July 17, 1995 meeting regarding the interconnection of TCG's South Florida network to BellSouth's Florida network. I was pleased at the apparent level of agreement between our organizations regarding many of the technical, administrative, and financial issues surrounding the interconnection of our networks. It appears that TCG and BellSouth are in agreement on the following issues:

1. In order to facilitate the exchange of traffic between interexchange carriers and TCG, BellSouth will establish a meet-point trunking and billing arrangement with TCG pursuant to industry guidelines developed by the Ordering and Billing Forum (OBF).

2. In order to facilitate the delivery of intraLATA 800 traffic to BellSouth, BellSouth will order an 800 access arrangement from TCG. TCG will provide BellSouth with the billing records it requires to render bills to its customers, and will be billed by TCG for switched access MOUs and the 800 database query.

3. In order to permit TCG to participate in the State's emergency network and to ensure the continued integrity of the State's emergency network, BellSouth will interconnect TCG's facilities to BellSouth's 911 hub sites. BellSouth will further cooperate with TCG to include TCG's customer information in the State's E911 database by providing TCG with the appropriate database record format and a process for updating the database with TCG customer information.

4. In order to provide consumers with a complete directory of telephone numbers in both an electronic (Directory Assistance) and published format ("white" and "yellow" pages), BellSouth agrees to include TCG's customer listings in its directories (electronic and published) at no cost to TCG. Any enhancements to

directory listings will be purchased from BellSouth by TCG on behalf of the customer.

5. In the event that TCG utilizes its own operator service provider, each carrier will purchase Busy Line Verification and Emergency Interrupt services (BLV/BLI), from existing tariffs and/or contracts.

6. TCG will participate in the CMDS system established and maintained by the RBOCs for the processing and clearing of all interLATA collect, third-party, and credit card calls. There is still an open issue regarding the billing, clearing and settling of intraLATA collect, third-party, and credit card calls.

From our discussions, it is also apparent that TCG and BellSouth are not in agreement on the financial terms which should govern the exchange of POTS (Plain Old Telephone Service) traffic. TCG explained its need for a capacity-based reciprocal compensation arrangement whereby each carrier would purchase network capacity from the other in DS1 increments and pay a flat monthly fee for such capacity. BellSouth explained its desire to charge its existing switched access charges for the termination of all traffic.

Nor have TCG and BellSouth agreed to an appropriate division of revenues for meet point billing. BellSouth expressed its intention to bill and collect the Carrier Common Line (CCL) and Residual Interconnection Charge (RIC) rate elements, while TCG believes these are end office rate elements which are correctly billed by the party functioning as the end office.

In an effort to focus on the areas of agreement between our companies, I am providing further detail on the technical, administrative and financial arrangements necessary to effectuate the interconnection arrangements described above.

MEET-POINT BILLING

As stated above, TCG and BellSouth have not agreed on a specific division of revenues for the meet-point arrangement. Further dialogue on this issue is warranted. Wanda Montano is the TCG contact person on this issue and can be reached at (718) 355-2797. Please provide TCG with a contact person in BellSouth.

In order to establish the meet-point arrangement, TCG requires a list from BellSouth of all of the IXCs operating in South Florida including their Carrier Identification Codes, signaling type, and billing address. TCG plans to issue a letter to all of the IXCs notifying them of their opportunity to interconnect with TCG directly or via the meet-point arrangement established with BellSouth. We also need to understand if BellSouth has a technical requirement for both SS7 and MF trunks, for routing depending upon

the type of interconnection BellSouth has with a particular IXC. In addition, should a new IXC wish to interconnect to Bell South in the future, a process should be established whereby BellSouth notifies the IXC that it needs to issue a "virtual ASR" to TCG, and also notifies TCG of this carrier's presence. Your cooperation in this effort is greatly appreciated. We look forward to your identification of our BellSouth counterparts for resolution of this item.

INTRALATA 800 TRAFFIC

At our last meeting, TCG identified its requirements for delivering to BellSouth 800 calls served by BellSouth. BellSouth needs to place an order to TCG for the access arrangement and further needs to identify its requirements for the receipt of billing records from TCG for proper billing to BellSouth's 800 customers. TCG's contact for this issue is Wanda Montano and Dennis McClure who can be reached at (718) 355-2757. Please provide TCG with a BellSouth contact.

911 TRAFFIC

BellSouth needs to identify for TCG

(1) where its 911 hub sites are in South Florida;
(2) the type and quantity of trunks required for each hub site including any requirements regarding route diversity or alternative routing schemes; and
(3) the telephone numbers for the individual Public Safety Answering Points (PSAP) so that TCG's operator services provider can route 0- calls to the PSAP.

Further details on TCG's requirements for 911 service were forwarded to you under separate cover on Tuesday August 1, 1995. TCG's contacts for 911 are:

Regulatory	Andrew Burke	718.355.2367
Network Eng.	Geri Lopez	303.267.1738
Project Mgmt.	Wanda Montano.	718.355.2797
Database Mgmt.	Nancy O'Leary	718.355.2004
Database Format	Billy Boyd	718.355.2137

CLEARINGHOUSE ISSUES

TCG and BellSouth need to establish a direct means of clearing intra-LATA collect, third-party, audiotext (976, and 900-like NXXs) and credit card calls placed between our networks. InterLATA calls can be cleared through CMDS using TCG's RAO code of 112 (TCG is sponsored by SNET). One option available is If BellSouth utilizes ITORP or an ITORP-like system, intraLATA calls can be cleared using your existing system. Failing that, TCG and BellSouth will need to establish a clearing arrangement. TCG's

contact person for this issue is Wanda Montano who can be reached at (718) 355-2797 and Dennis McClure (x2757). Please provide TCG with a contact at BellSouth.

DIRECTORY LISTINGS

Suzanne Detlefs of BellSouth has contacted Wanda Montano of TCG regarding the provision of directory listings to TCG and progress is being made.

OPERATOR SERVICES

TCG is in the process of evaluating various options for operator services. TCG would like to consider BellSouth as an available option. Please consider this a request for proposal from BellSouth for the provision of 0+ and 0- operator services in South Florida. I have attached document detailing TCG's specifications. Please contact Wanda Montano for more information at (718) 355-2797.

I hope this information proves useful to you. Because this effort is being conducted in advance of (and in anticipation of) litigation before the Florida Public Service Commission (FPSC), it is important that we come to more complete understandings on the above issues before August 31, 1995. TCG would prefer to enter into a stipulation with BellSouth in order to resolve the above issues and remove them from the hearing process at the FPSC. However, if TCG is not satisfied that sufficient progress has been made, we will be forced to bring these issues to the FPSC for resolution.

I look forward to your prompt response to these matters and look forward to our next meeting.

Sincerely,

Paul Kouroupas

cc: Andrew Burke (TCG)
Dennis McClure (TCG)
Wanda Montano (TCG)
Graham Taylor (TCG)
Tony Lombardo (BellSouth)

TCG Operator Services

Operator Services include:

1. Operator Handled
   a. Hotel Paid } FGC required
   b. Coin Paid }
   c. Collect Service
   d. Third Number Billing
   e. ONI
   f. ANI Failures
   g. Calling Card Service
   h. Auto-Collect Service (Enterprise and 800 excluding 800 traffic of Interexchange carriers)
   i. Person to Person Service
   j. Time and Charge Quotation Service

2. Customer Assistance
   a. Dialing Instructions
   b. Trouble Reporting
   c. Emergency Call Handling (911/E911) –
   d. Rate Information
   e. Credit Requests
   f. Busy Line Verification
   g. Busy Line (Emergency) Interrupt
   h. Other Customer Requests as mutually agreed upon

3. Calling Cards to be served:

AT&T	Discover	MCI
Sprint	All RBOC Cards	Japanese Credit Bank
MasterCard	VISA	American Express
Carte Blanche	Diners Club	

4. Pricing
   Automated Platform - Per completed call
   Live Operator - per Operator Worksecond

5. Interconnection Methodology
   POP Locations/backhaul
   Whole and Partial NXX 's (how are these handled)

6. Branding

Billing of TCG Customer Operator Calls

TCG requires the billing records in an unrated AMA format which will indicate the originating number, terminating number and minutes of use on the call for all Local, intraLATA and 0- IXC calls.

Pricing/Billing to TCG for Service

TCG requires pricing based upon the OSP providing the automated Bong tone for 0+ calls on a per completed call basis. For Live Operator services, (0- calls) a per work second price is required. Please provide the mechanism by which TCG will be able to substantiate the bill sent from your OSP to TCG for both the Automated and Live operator portions of the bill. Please provide a sample AMA record for TCG to view and a sample bill.

The OSP should be prepared to accept, record and provide billing data for the following types of calls:

Hotel Paid	Coin Paid	Collect
Third Party	ONI/ANI	Calling Card
Auto Collect	Person to Person	Time and Charge quotation
Telecommunications Relay Service		

The OSP should be prepared to provide the following Customer Assistance responsibilities with detailed transport requirements identified including but not limited to signalling type, emergency service lines, where necessary, interconnection requirements:

a. Dialing Instructions
b. Trouble Reporting
c. Emergency Call Handling(911/E911)
d. Rate Information
e. Credit Requests
f. Busy Line Verification
g. Busy Line (Emergency) Interrupt
h. Other Customer Requests as mutually agreed upon

TCG will offer callers to the operator services platform the service of being transferred to the Directory Assistance provider in each city. Please identify the methods by which the OSP would accomplish this and the requirements for TCG to provide this service.

TCG requires that the OSP adhere to the Local Public Service Commission requirements for handling both Business (Commercial and Payphone) and Residential customers in each of the TCG cities in which your OSP is proposing to offer Local Operator Services.

Backhaul

The OSP will provide the backhaul from the OSP POP closest to the TCG switch, to its Operator Services Platform at no cost to TCG. The OSP will issue any and all trunking orders into TCG through the standard ASR process.

Testing Procedure

Please identify what your testing procedure is to ensure proper billing information and transport.

Branding

TCG requires that all 0+/0- calls into the Operator Services Platform, whether on an Automated call or Live Operator be answered with an identifier of "TCG".

Transport/Call Processing and Call type

TCG will operate as follows from each TCG switch within a city by trunking to the closest OSP POP via Feature Group C or D trunks; Two 2-Way trunk groups with diverse routing from the TCG switch to the OSPS for both incoming and outgoing traffic.

TCG will receive all Local and IntraLATA 0+/0- calls to the OSPS over the above trunk group for local and IntraLATA termination to be completed either on the TCG network or through arrangements made with the incumbent LEC. The OSP will send the associated ANI back with the call so that TCG can properly bill the Local or intraLATA usage to the customer.

TCG may also at its discretion choose to send Payphone calls from its "Smart" Public Telephones. We will utilize the same transport mechanism for Payphone traffic as we are using for commercial traffic.

Exhibit PK2

TCG

Teleport Communications Group
One Teleport Drive
Staten Island, NY 10311-1004
Tel: 718.983.2000
Fax: 718.983.2147

August 24, 1995

Direct Dial: 718.355.2797
Fax: 718.355.4418

Ms. Suzanne H. Detlefs
Vice President - Marketing and Development
Bell South Advertising and Publishing
59 Executive Park South, NE
Room 465
P.O. Box 95807
Atlanta, Georgia 30347

Re: **Directory Listings**

Dear Suzanne:

It was good to meet you, Jan and Deb yesterday to discuss Bell South's proposal for Directory Listings. This letter confirms our discussions.

Basic White Pages, Basic Yellow Pages will be provided free of charge to TCG's subscribers. Delivery of directories to TCG subscribers will be provided on an intermediate basis (upon service turn-up) and with the annual publication. The directories will be available to TCG and its subscribers free of charge. Up to 10 directories will be free. Additional copies and foreign directories will be available at Bell South's prevailing rates. Bell South will provide TCG with a list of the available directories and a price list for the South Florida LATA.

In return for the above, TCG agrees to permit Bell South to market its white and yellow pages advertising to TCG customers and to directly bill those customers for BSAPS products. We also discussed TCG's concerns about the regulated operating companies having access to this data for its use in sales.

TCG also requested that Bell South respond to our request to publish TCG customer information pages in the front of its directories and to also consider including TCG's logo on the front cover of the directories.

Thank you for your time on Tuesday. TCG looks forward to our continued work on this subject.

Sincerely,

Wanda Montano

Wanda G. Montano
Director, Competitive Local Exchange Carrier Services

cc: Graham Taylor, Paul Kouroupas, Rich Dender

Exhibit PKS

TCG

Teleport Communications Group
One Teleport Drive
Staten Island, NY 10311-1006
Tel: 718.983.2000
Fax: 718.983.2147

August 31, 1995

Direct Dial: *718.355.2797*
Fax: *718.355.4418*

Mr. Bob Scheye
Strategic Management
BellSouth Telecommunications
Room 11A15 Southern Bell Center
675 W. Peachtree Street, N.E.
Atlanta, GA 30375

RE: IXC Connectivity

Dear Bob:

This letter follows up on our meeting of August 22, 1995. First, thank you for having Jo Ana Hoyle provide TCG with the list of Interexchange Carriers (IXCs) which are connected to the three BellSouth access tandems in the South Florida LATA. As we discussed, TCG has some concerns about the interworking of SS7 with carriers who are connected to BellSouth on an MF basis. To facilitate our implementation of meet point trunks, TCG needs to have the list provided by Ms. Hoyle revised to indicate which of these carriers utilize SS7 connections and which use MF. A handwritten indication on the existing list of carriers would be acceptable.

TCG looks forward to the receipt of this updated list.

Sincerely,

Wanda G. Montano
Director, Competitive Local Exchange Carrier Services

cc: Graham Taylor, Rich Dender, Jodie Donovan, Paul Kouroupas, Dennis McClure

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Exhibit PK4

TCG

Teleport Communications Group
One Teleport Drive
Staten Island, NY 10311-1049
Tel 718.983.2000
Fax 718.983.2147

August 31, 1995

Direct Dial: *718.355.2797*
Fax: *718.355.4418*

Mr. Bob Scheye
BellSouth Telecommunications
Room 11A15 Southern Bell Center
675 W. Peachtree Street, N.E.
Atlanta, GA 30375

RE: 976/Audiotext Calls

Dear Bob:

The purpose of this letter is to follow up on our August 22, 1995 discussion of intra-LATA audiotext (976 and 976-like) services. At that time, TCG requested confirmation from BellSouth that 976 is the only NXX code being used for audiotext services.

TCG further requested that discussions be initiated as to how TCG can obtain the correct billing rates for these calls. Our proposal is that TCG would provide unrated EMR records (BELLCORE format) to BellSouth, which BellSouth would rate and return to TCG for billing to its customers. We were also advised that Florida has a maximum 90 day window for customer billing, so that the process for exchange of rated and unrated data must be timely and efficient.

In addition, TCG and BellSouth must agree on a rate for billing and collection of these calls on behalf of BellSouth and its information service provider customers. We must also establish a rate for transport of these calls to the BellSouth network, and understand to what access tandem or end office the calls should be delivered. TCG hereby proposes a rate of $0.45 per call for billing and collection of these calls. TCG also proposes that the transport for these calls will be billed as intra-LATA switched access minutes of use, and that the facilities for the transport of these calls will be ordered via the ASR process by BellSouth.

TCG looks forward to further discussion of this subject and would appreciate BellSouth's response to our proposal no later than September 13, 1995.

Sincerely,

Wanda G. Montano
Director, Competitive Local Exchange Carrier Services

cc: Graham Taylor, Rich Dender, Jodie Donovan, Paul Kouroupas, Dennis McClure

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Exhibit PK5

TCG

Teleport Communication Group
One Teleport Drive
Staten Island, NY 10311-1000
Tel 718.983.2000
Fax 718.983.2147

August 31, 1995

Direct Dial: *718.355.2797*
Fax: *718.355.4418*

Mr. Bob Scheye
Strategic Management
BellSouth Telecommunications
Room 11A15 Southern Bell Center
675 W. Peachtree Street, N.E.
Atlanta, GA 30375

RE: Meet Point Arrangements

Dear Bob:

This letter follows up on our meeting of August 22, 1995. At that meeting, we discussed the meet point trunking and billing proposal which TCG had submitted to BellSouth via fax on August 15, 1995. As we discussed, additional clarification of the Local Transport rate element was needed, and I have added language to our proposal which I trust reflects our discussion. In addition, we need to finalize the local transport proportional splits once we determine TCG's points of interconnection to the three access tandems in South Florida. Attached is the revised documentation.

TCG believes we have now agreed to the Meet Point arrangements and looks forward to the installation, testing and implementation of these trunk groups in accordance with the ASR in-service dates, once TCG actually orders the trunking.

If this assumption is incorrect, please advise TCG in writing no later than September 8, 1995.

Sincerely,

Wanda G. Montano
Director, Competitive Local Exchange Carrier Services

cc: Graham Taylor, Rich Dender, Jodie Donovan, Paul Kouroupas, Dennis McClure

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MEET POINT OVERVIEW

Meet point trunking arrangements shall be established between TCG and Pacific Bell. These trunks will be used by Pacific Bell to terminate calls to TCG subscribers from Interexchange Carriers (IXCs) who have Feature Group arrangements with Pacific Bell.

TCG will use these trunks to originate calls to Interexchange Carriers who are not directly connected to TCG's switches. Call types which may be routed include:

1+ PICed traffic	10XXX calls
500, 700, 900 calls	950 calls
800/888 inter-LATA calls	00+, 00- calls

Should TCG act as a tandem for an IXC, TCG may also route calls destined to Pacific Bell subscribers from IXCs on these facilities.

TCG proposes a multi-bill, multi-tariff environment, wherein the Company functioning as the End Office also functions as the Initial Billing Company (IBC). Tandem bills as the Subsequent Billing Company (SBC).

TCG proposes the following billing structure:

(1) TCG's rates will mirror the Bell South rates, both in structure and charge.

(2) The Company acting as the End Office will bill:

Local Switching
Carrier Common Line
Local Transport in proportion to the amount of transport provided.

If the End Office Company is collocated in the Serving Wire Center to which the IXC is connected, the EO Company bills 100% of the Local Transport. This assumes the Serving Wire Center is also the Access Tandem or End Office in which the company acting as the End Office is collocated. Otherwise, the companies will agree on a proportionate split, to be reviewed in an annual audit.

(3) The Company functioning as the Tandem will bill the following:

Entrance Facility
Tandem Switching
Tandem Transport
Residual Interconnection Charge (RIC)

The IBC will issue summary records to the SBC, in accordance with OBF Guidelines.

Exhibit PK6

The Economics of Interconnection

by

Gerald W. Brock

April 1995

TCG

Teleport Communications Group
Two Teleport Drive, Staten Island, New York, 10311

Contents:

Preface

The three papers by Gerald W. Brock compiled herein are a clear, concise analysis of the economics of interconnection. Mr. Brock, former Chief, Common Carrier Bureau, U.S. Federal Communications Commission and now professor of telecommunication and Director, Graduate Telecommunication Program, the George Washington University, Washington, DC, goes to the heart of local telecommunications competition: compensation for the exchange of traffic among interconnected local networks, some of which retain market power. Mr. Brock explains how compensation arrangements that are administratively simple, economically correct and consistent with maximum network efficiency would arise in fully competitive markets. He explains why a market in transition to competition needs regulatory controls on compensation for interconnection, and why such regulatory controls must limit compensation to the actual cost of service. He explains why zero-priced interconnection ("sender keep all"), such as has been agreed to by commercial service providers on the Internet, meets these economic requirements. And he shows that "sender keep all" is a logical compensation arrangement in light of the fact that the incremental cost of providing necessary capacity for terminating traffic-- the only theoretically correct basis for calculating a call completion charge -- is trivial.

The Economics of Interconnection

by Gerald Brock

Introduction

The issues of interconnection rights and the compensation to be paid for traffic exchanged among interconnected companies have played a crucial role in the development of competitive alternatives throughout the history of the telecommunication industry. Interconnection disputes began with the early efforts to expand market power in the mid-nineteenth century telegraph industry and have continued to the present.[1] Although the long history of interconnection controversies provides several models of possible solutions to interconnection issues, the problems have not all been solved.

The emerging local competition requires an interconnection policy that will allow the efficient development of a "network of networks" in which customers have access to any combination of private and multiple public communications networks. The interconnection rules to and from monopoly networks should not be dependent on technology and should apply to both wireline and wireless services. This problem is more complex than past ones because there are no clear stationary boundaries across which interconnection must occur and because there will be a need for interconnection among companies with different and changing degrees of market power.

One important goal of regulation is to bring the results of a monopolized or partially monopolized market closer to what would occur under competitive conditions. Thus in considering the desirable price structure for regulated interconnection, the expected price structure under full competition is a useful guide.

The best existing example of interconnection under competitive conditions without regulation is the interconnection of commercial providers of Internet services. Because the Internet consists of many interconnected networks with relatively easy entry conditions and no regulation, it provides an example of a competitive network of networks. The growth of commercial services on the Internet and limitations on commercial products on the backbone network controlled by the National Science

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[1]A brief summary of FCC efforts to devise appropriate interconnection policies for customer premises equipment, long distance service, and international service is contained in the appendix to this paper. For a more complete account see generally Gerald Brock, The Telecommunications Industry: The Dynamics of Market Structure (Harvard University Press, 1981) and Telecommunication Policy for the Information Age: From Monopoly to Competition (Harvard University Press, 1994).

4

Foundation led to the formation of the Commercial Internet Exchange (CIX) in August 1991. Commercial Internet service providers agreed that interchange of traffic among them was of mutual benefit and that each should accept traffic from the other without settlements payments or interconnection charges. The CIX members therefore agreed to exchange traffic on a "sender keep all" basis in which each provider charges its own customers for originating traffic and agrees to terminate traffic for other providers without charge.[2]

The Internet example suggests that "sender keep all" interconnection arrangements are likely to develop in competitive communications markets as the compensation method for mutually beneficial interconnection arrangements. However, most telecommunication markets are not fully competitive. Incumbent telephone companies with market power have an incentive to use interconnection prices as a method of limiting competitive entry.

In November 1994, the European Commission released a study that it commissioned from a prestigious group of European and American telecommunication experts regarding issues of interconnection in an increasingly competitive telecommunication industry.[3] The study found that continued regulatory oversight of interconnection conditions would be necessary in order to allow effective competition to flourish. It recommended that interconnection rates be based on cost and set as a capacity charge. The European Commission study's conclusions that telephone company incumbents will set interconnection prices too high without regulatory controls and that interconnection charges should be based on the incremental cost of capacity required by the interconnector are directly relevant to the development of competition in the United States. The principles developed in that study are designed to promote a dynamic and efficient telecommunication market and are applicable to the U.S. telecommunication market as well as the European telecommunication market.

In order to apply the principle of setting interconnection charges at the incremental cost of capacity required to terminate the traffic, it is necessary to estimate that cost. The most comprehensive public engineering study of incremental cost was done by the Incremental Cost Task Force with members from GTE, Pacific Bell, the California Public Utilities Commission, and the RAND Corporation.[4] The Task Force had access to data for telephone companies in California and performed a detailed

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[2]Padmanabhan Srinagesh, "Internet Cost Structures and Interconnection Agreements," in Gerald Brock, ed. Toward a Competitive Telecommunication Industry: Selected Papers from the 1994 Telecommunications Policy Research Conference (Hillsdale, N.J.: Lawrence Erlbaum, in press).

[3]J. Arnbak, B. Mitchell, W. Neu, K. Neumann, and I. Vogelsang, Network Interconnection in the Domain of ONP: Study for DG XII of the European Commission (Brussels: European Commission, 1994).

[4]Bridger M. Mitchell, Incremental Costs of Telephone Access and Local Use, (Santa Monica, CA: The Rand Corporation, 1990); reprinted in William Pollard, ed., Marginal Cost Techniques for Telephone Services: Symposium Proceedings (Columbus, Ohio: National Regulatory Research Institute, 1991) (NRRI 91-6).

engineering cost study for various output measures of local telephone service. Individual components were priced based on 1988 prices and costs were computed for switch investment, switch maintenance, interoffice transport, and call attempts. All costs were computed for calls during the busiest hour of the year because the investment and associated expenses are related entirely to capacity cost.

The task force computed a cost of $6.00 to $11.00 per year to provide the capacity for 100 call seconds of local usage during the busiest hour of the year, plus a cost of $.30 to $.90 per year to provide the capacity for an additional call attempt during the busiest hour of the year. Using reasonable assumptions regarding the distribution of traffic, those capacity costs translate into an average cost of supplying additional local usage capacity of approximately 0.2 cents per minute. Because the actual cost is higher than the average during the peak periods and because the actual cost is zero during non-peak periods, it is more efficient to charge based on the maximum capacity required than to charge at the average cost per minute for each minute of use.

The three attached papers discuss the interconnection issues in detail. The first focuses on the importance of using capacity measures for interconnection rather than charges per minute of use. The second reviews previous studies of the incremental cost of local usage. The third examines the implications of various interconnection policies and shows that mutual compensation without control of the actual rates for interconnection does not limit monopoly power.

The analysis in the three papers leads to the following conclusions:

(1) If there are no regulatory controls on compensation for interconnection, the monopolist of part of the market can extend its monopoly power to the entire market;
(2) A compensation policy for the mutual exchange of local traffic without limits on the level of rates does not limit market power;
(3) The interconnection of two communications networks provides a benefit to customers of both networks;
(4) The commercial providers of competitive non-regulated Internet service have recognized the mutual benefits of interconnection by agreeing to interconnect on a "sender keep all" basis, terminating traffic originated by others in exchange for having their originating traffic terminated by others;
(5) Minutes of use interconnection charges would not be sustainable in a highly competitive market;
(6) Minutes of use interconnection charges fail to attain maximum efficiency and lead to incorrect investment signals;
(7) Minutes of use interconnection charges have been used in the past as a convenient allocator for fully distributed cost under regulated monopoly, but are not appropriate in the emerging market structure of greater local competition;

(8) In order to facilitate the transition to a competitive local communications market, regulators should emulate the competitive market outcome by setting interconnection prices determined by the cost of providing the necessary capacity for terminating traffic;

(9) A reasonable estimate of the average incremental cost of terminating traffic received from a competitor using digital technology is 0.2 cents per minute, but the actual cost is determined only by the maximum capacity required and not by the total number of minutes terminated;

(10) "Sender keep all" is an administratively simple mutual compensation scheme with zero prices for terminating service. It is an attractive approximation to the theoretically correct policy of cost based prices when the incremental cost of terminating service is low.

Price Structure Issues in Interconnection Fees

Gerald W. Brock
March 30, 1995
(Prepared for Teleport Communications Group)

Summary

The interconnection of two communication networks provides a benefit to the customers of both networks by allowing customers of one network to communicate with customers of the other network. If traffic is roughly equal in both directions between the two networks, there is no need for either network to pay the other for interconnection. Each network can bill its own customers for their communications, and can terminate traffic received from the other network in exchange for the privilege of having its originating traffic terminated on the other network, an arrangement known as "sender keep all".

If traffic is primarily one way, it may be necessary for the company that is terminating the traffic to impose interconnection charges as compensation for the service it provides to the other company. If interconnection charges are imposed, they should be assessed at the long run incremental cost of adding capacity. The price structure should be a capacity charge per unit of time (as in private lines), not a minutes of use charge. A minutes of use charge causes inefficient calling choices and investment decisions and it would not occur in a competitive market.

I. Introduction

One important goal of regulation is to bring the results of a monopolized or partially monopolized market closer to what would occur under competitive conditions. Thus in considering the desirable price structure for regulated interconnection, the expected price structure under full competition is a useful guide.

The best existing example of interconnection under competitive conditions without regulation is the interconnection of commercial providers of Internet services. Because the Internet consists of many interconnected networks with relatively easy entry conditions and no regulation, it provides an example of a competitive network of networks. The growth of commercial services on the Internet and limitations on commercial products on the backbone network controlled by the National Science Foundation led to the formation of the Commercial Internet Exchange (CIX) in August 1991. Commercial Internet service providers agreed that interchange of traffic among them was of mutual benefit and that each should accept traffic from the other without settlements payments or interconnection charges. The CIX members therefore agreed

8

to exchange traffic on a "sender keep all" basis in which each provider charges its own customers for originating traffic and agrees to terminate traffic for other providers without charge.[1]

The Internet example suggests that "sender keep all" interconnection arrangements are likely to develop in competitive communications markets as the compensation method for mutually beneficial interconnection arrangements. However, most telecommunication markets are not fully competitive. Incumbent telephone companies with market power have an incentive to use interconnection prices as a method of limiting competitive entry. Interconnection arrangements and prices have consequently been a major regulatory issue in the United States and other countries that have allowed competition in communications markets. Interconnection arrangements continue to be a critical factor in the viability of communications competition.

In November 1994, the European Commission released a study that it commissioned from a prestigious group of European and American telecommunication experts regarding issues of interconnection in an increasingly competitive telecommunication industry.[2] The study found that continued regulatory oversight of interconnection conditions would be necessary in order to allow effective competition to flourish. It recommended that interconnection rates be based on cost and set as a capacity charge. Specifically, the study concluded:

1. "If left to themselves, markets for interconnection services are likely to reflect either collusive arrangements or monopoly power of incumbent TOs [Telecommunication Operators]. In either case, interconnection prices are likely to be too high relative to prices that would emerge under competitive conditions."[3]

2. "We call for cost-based interconnection charges (based on MC_{IX} or AIC_{IX}) [marginal cost of interconnection or average incremental cost of interconnection].[4]

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[1]Padmanabhan Srinagesh, "Internet Cost Structures and Interconnection Agreements," in Gerald Brock, ed. Toward a Competitive Telecommunication Industry: Selected Papers from the 1994 Telecommunications Policy Research Conference (Hillsdale, N.J.: Lawrence Erlbaum, in press).

[2] J. Arnbak, B. Mitchell, W. Neu, K. Neumann, and I. Vogelsang, Network Interconnection in the Domain of ONP: Study for DG XII of the European Commission (Brussels: European Commission, 1994).

[3]Ibid., p. 69.

[4]Ibid., p. 84.

3. "The main costs associated with interconnection are for long-lived capacity. They therefore represent capital costs that are the sum of financing costs and loss in value of the capital goods over time. ...We consider capacity-based interconnection charges to be the optimal approach for interconnection between a sophisticated TO [Telecommunication Operator] and a sophisticated interconnector."[5]

The European Commission study's conclusions that telephone company incumbents will set interconnection prices too high without regulatory controls and that interconnection charges should be based on the incremental cost of capacity required by the interconnector are directly relevant to the development of competition in the United States. The principles developed in that study are designed to promote a dynamic and efficient telecommunication market and are applicable to the U.S. telecommunication market as well as the European telecommunication market.

This paper focuses on the importance of using capacity measures for interconnection rather than charges per minute of use. Specific conclusions with regard to the price structure for interconnection charges include:

(1) Minutes of use interconnection charges would not be sustainable in a highly competitive market;

(2) Minutes of use interconnection charges fail to attain efficiency and lead to incorrect investment signals;

(3) Minutes of use interconnection charges have been used in the past as a convenient allocator for fully distributed cost under regulated monopoly, but are not appropriate for the emerging market structure of greater competition.

II. Competition and Interconnection Charges

We should expect to see "sender keep all" arrangements develop in a competitive communications market if <u>either</u> of two conditions are met:

(1) Traffic flows are very roughly balanced among the companies so that each sees a clear benefit for its customers in both sending and receiving traffic from other companies; OR

[5]Ibid., p. 92, 94.

(2) The cost to a company of terminating traffic is low in relationship to the transactions costs of measuring and charging for traffic so that even with unbalanced traffic companies find the simple "sender keep all" approach superior to efforts to develop appropriate cost-based terminating charges.

In a competitive communications market, we should only expect to see interconnection charges when traffic is largely one way so that the receiving company is disadvantaged by "sender keep all" and when the costs of terminating traffic are substantial in relationship to the transactions cost of developing and collecting interconnection charges. Under those conditions, we should expect to see interconnection charges based on the cost of the capacity required to terminate traffic.

The most comprehensive public engineering study of the incremental cost of local telephone usage (and therefore of the cost of terminating telephone traffic for competitors) was done by the Incremental Cost Task Force with members from GTE, Pacific Bell, the California Public Utilities Commission, and the RAND Corporation.[6] The Task Force had access to data for telephone companies in California and performed a detailed engineering cost study for various output measures of local telephone service. Individual components were priced based on 1988 prices and costs were computed for switch investment, switch maintenance, interoffice transport, and call attempt costs. All costs were computed for calls during the busiest hour of the year because the investment and associated expenses are related entirely to capacity cost. The Task Force computed the following usage costs for each hundred call seconds (CCS) during the busiest hour of the year for "average" and "larger urban" exchanges:

switch investment	$5.00	- $ 10.00 per year
switch maintenance	.20	- .50 per year
interoffice calling	.50	- .60 per year
Total	$6.00	- $11.00 per year

In addition, the task force computed a cost of $.30 to $.90 per year for each call attempt during the busiest hour of the year and estimated approximately 1.25 busy hour attempts per busy hour CCS.[7]

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[6]Bridger M. Mitchell, Incremental Costs of Telephone Access and Local Use, (Santa Monica, CA: The Rand Corporation, 1990); reprinted in William Pollard, ed., Marginal Cost Techniques for Telephone Services: Symposium Proceedings Columbus, Ohio: National Regulatory Research Institute,1991) (NRRI 91-6).

[7]Ibid., p. 249, 250.

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The task force found that all costs were related to the capacity of the facilities used and could best be expressed as costs per year for capacity, rather than as costs per minute or per call. Using reasonable assumptions regarding the distribution of traffic, the costs determined by the Incremental Cost Task Force translate into an average of approximately 0.2 cents per minute, but most of the minutes during a year impose no incremental cost on the local exchange because they occur at off peak times.

A simple but useful way of analyzing the competitive interconnection issues is to consider two separate communities, A and B.[8] Each is served by a single telephone company, but entry and exit are easy ("contestable markets" in economic terms). The cost for each company of terminating traffic for the other is the cost of building a channel of adequate capacity for the peak terminating load between the two companys' switches. The size of the channel is a proxy for all of the capacity related costs in terminating traffic. As discussed above, if the traffic is reasonably balanced or if the costs of providing terminating service are low in relationship to transactions costs, it is likely that both companies will find it in their mutual interest to provide terminating service for the other and will provide it on a "sender keep all" basis without explicit terminating charges.

Consider the case in which terminating cost (the cost of the channel between A and B) is substantial and the terminating traffic is all one way from A to B. That is, customers of A wish to terminate traffic in B, but customers of B have no desire to terminate traffic in A. In that case, A will have to pay the cost of termination because B is not getting a reciprocal benefit. There are two ways to manage the termination:

(1) A could build the channel to B if that were technically feasible.[9] Then the cost of termination for A would be the capacity cost for the peak termination load.

(2) B could build the channel to A (add necessary capacity to its local facilities) and charge A for using it.

If B offers a long term contract based on the cost of providing a given capacity, then the price structure will be similar to the cost structure that A would incur by building the capacity itself. Either ownership method would create an effective rental

[8]They are not necessarily physically distinct communities but are communities connected to particular communication networks.

[9]A simple channel would obviously be technically feasible, but the more realistic case in which terminating traffic requires an increase in capacity of B's switches, interoffice transport, and so forth might not be technically feasible.

price per time unit based on the capacity of the channel without regard to the actual number of minutes passing through it. However, suppose that B builds the necessary capacity to A and then decides to cover the cost with a charge per minute. Assume that the price per minute is determined by dividing the annual cost of the channel by the forecast number of minutes, so that B just covers its total cost. The price per minute will be higher than the true cost for off-peak usage and lower than the true cost for on-peak usage. That price structure would not be sustainable in a contestable market because a new entrant that offered prices more closely aligned with cost would attract all of the off-peak traffic. As the incumbent loses the off-peak traffic, its average price will no longer cover its cost and it will be forced to raise prices for the remaining traffic. The only sustainable price structure will be a cost-based charge related to the capacity of the facilities used to provide terminating service.

The reason why only capacity based charges would be sustainable in a competitive market can be clarified by considering the competitive market for rental automobiles. The cost of providing rental automobiles is more closely related to the time the car is rented than to the number of miles driven. Consequently, most rental companies charge by the time rented (day, week, or month) rather than by the number of miles driven. Charging by time for rental automobiles corresponds to capacity charges for interconnection while charging by miles driven corresponds to charges per minute of use for interconnection.

Suppose one rental company decided that all drivers should pay for each mile driven and set its rates as a price per mile rather than a price per day. Before customers adjusted to the changed price structure, the company could receive the same revenue with either method by simply setting the price per mile equal to the previous price per day divided by the average number of miles per day. However, that price structure could not last in a competitive market. It would cause those who drive long distances per day to pay far more than those who drive short distances. Because the real costs are related to the time the car is rented rather than to the number of miles, another company would offer a flat rate with unlimited miles and attract all of the long distance drivers. The company charging per mile rates would be left with only those who drive very short distances and would no longer cover its cost with the initial rates. As it raised its rates per mile in order to covers its cost, it would lose additional customers and eventually it would be forced to impose a cost related time charge in order to stay in the competitive business. Similarly, a competitive communications company would be forced to impose a cost related capacity charge rather than a minutes of use charge in order to survive in a competitive communications market.

III. Monopoly and Interconnection Charges

If the company providing interconnection services has a monopoly, then interconnection charges per minute of use will be sustainable because there is no competitive pressure to price in accordance with cost. However, interconnection prices based on minutes of use will not lead to maximum efficiency. They will distort both consumer decisions and investment decisions because they provide the wrong price signals.

Minutes of use pricing has been used extensively in the monopoly telecommunication industry of the past. Pricing on a minutes of use basis was mandated in the federal access charge plan. The access charge plan created in preparation for the January 1, 1984 divestiture of AT&T created a rigid structure of the prices to be paid from interexchange carriers to local exchange carriers for originating and terminating interstate traffic. Particular categories of cost determined by prescribed cost allocation procedures were required to be recovered by dividing the cost category by the forecast number of minutes and charging interexchange carriers the resulting price per minute for the access element.[10]

Although the per minute access charges were sustainable because of the largely monopoly structure of the local exchange industry, they distorted both consumer and business decisions away from maximum efficiency. On the consumer side, the access charges made it expensive for long distance companies to serve off peak residential customers. Long distance companies paid the same rate per minute to local telephone companies for traffic terminated late at night as they paid for traffic terminated at the peak of the business day. Consequently, discounted consumer rate plans for night calls that were established prior to the implementation of access charges became unprofitable. Long distance companies were forced to raise their prices to night time residential callers because of the artificial access charge structure even though the night time calls (utilizing otherwise idle capacity) imposed practically no cost on either long distance or local exchange companies.

Prior to the implementation of the federal access charge plan, an interim plan for initial long distance competition imposed access charges on long distance providers based on capacity used. That plan provided incentives for carriers such as MCI and Sprint to aggressively develop their residential customer base because residential calls were

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[10]The legal description of the access charge plan is found in Title 47 of the Code of Federal Regulations, Parts 36 (separations cost allocations) and 69 (computation of access charges). An account of the political and economic issues related to access charges is contained in Gerald Brock, Telecommunication Policy for the Information Age: From Monopoly to Competition (Cambridge, MA: Harvard University Press, 1994),chapters 10 and 11.

primarily off peak and imposed little or no cost on the companies. Once the access charge plan was implemented with its per minute charges for all traffic regardless of when it occurred, the companies found that business traffic was more profitable than residential traffic. The incentives created by the minutes of use access charges thus distorted business marketing and investment decisions away from the efficient path.

The pernicious efficiency and investment effects of minutes of use interconnection charges can be illustrated by considering a regulated monopoly automobile rental company. If it (or its regulator) decides that charges should be determined by the mileage driven rather than by the time the automobile is rented, the resulting rate structure will be sustainable and can be designed to allow the company to recover its total revenue requirement. However, consumers will have an incentive to rent many cars for occasional short mileage driving. If the company is required to provide rental cars at the established rate to all who request them, it will be forced to make large investments in underutilized capital. It will recoup the costs of the investment by imposing very high charges on the long distance drivers.

The monopoly rental company will report to its regulators that it is subsidizing short distance drivers who are being provided cars below cost. Both the company and its regulators will be concerned about any proposals for competition because competitors would "cream-skim" the profitable long distance drivers, leaving only the unprofitable short distance drivers to the regulated company and threatening its viability. However, the entire problem is simply that the price structure does not correspond to the cost structure. The distortions and regulatory problems could be solved by shifting to a time based rental structure that matched the structure of cost in that market. Similarly, minutes of use access or interconnection charges reduce efficiency, create wrong investment incentives, and increase the difficulty of moving toward a competitive communications industry.

IV. Conclusion

Several conclusions can be drawn from this analysis:

(1) The interconnection of two communications networks provides a benefit to customers of both networks;

(2) The commercial providers of competitive non-regulated Internet service have recognized the mutual benefits of interconnection by agreeing to interconnect on a "sender keep all" basis, terminating traffic originated by others in exchange for having their originating traffic terminated by others. This is a useful model for

interconnection of competing local exchange networks;

(3) Minutes of use interconnection charges would not be sustainable in a highly competitive market;

(4) Minutes of use interconnection charges fail to attain maximum efficiency and lead to incorrect investment signals;

(5) Minutes of use interconnection charges have been used in the past as a convenient allocator for fully distributed cost under regulated monopoly, but are not appropriate in the emerging market structure of greater competition;

(6) In order to facilitate the transition to a competitive communications market, regulators should emulate the competitive market outcome by setting interconnection prices (if "sender keep all" is not acceptable) determined by the cost of providing the necessary capacity for terminating traffic.

Interconnection And Mutual Compensation With Partial Competition

Gerald W. Brock
(Prepared for Comcast Corporation)

I. Introduction

This paper examines the economic characteristics of various interconnection compensation policies when there are different levels of market power among the participants. The conclusions of the analysis are:

(1) If there are no regulatory controls on compensation for interconnection, the monopolist of part of the market can extend its monopoly power to the entire market;
(2) A mutual compensation policy without limits on the level of rates does not limit market power;
(3) The level of rates under a mutual compensation policy is unimportant if and only if the level of incoming and outgoing traffic is exactly balanced. Because traffic levels will rarely, if ever, be exactly balanced, the level of rates will be an important factor in the viability of competition;
(4) A mutual compensation policy with prices limited to the cost of service is the theoretically correct compensation policy. Mutual compensation with prices limited to the cost of service prevents the monopolist of part of the market from extending its market power to potentially competitive sectors of the market;
(5) Capacity charges rather than per minute charges allow attention to be focused on the cost of service at the peak load which is generally the real cost of service;
(6) "Sender keep all" is an administratively simple mutual compensation scheme with zero prices for terminating service. It is an attractive approximation to the theoretically correct policy of cost based prices when the incremental cost of terminating service is low.

The issues of interconnection rights and the compensation to be paid for traffic exchanged among interconnected companies have played a crucial role in the development of competitive alternatives throughout the history of the telecommunication industry. Interconnection disputes began with the early efforts to expand market power in the mid-nineteenth century telegraph industry and have continued to the present.[1]

[1]A brief summary of FCC efforts to devise appropriate interconnection policies for customer premises equipment, long distance service, and international service is contained in the appendix to this paper. For a more complete account see generally Gerald Brock, The Telecommunications Industry: The Dynamics of Market

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Although the long history of interconnection controversies provides several models of possible solutions to interconnection issues, the problems have not all been solved. Past interconnection controversies have led to three different kinds of solutions:

(1) The customer premises equipment (CPE) model of zero interconnection charges;
(2) The long distance model of substantial one-way per minute interconnection charges;
(3) The international model of two-way per minute interconnection charges.

The emerging local competition requires an interconnection policy that will allow the efficient development of a "network of networks" in which customers have access to any combination of private and multiple public communications networks. The interconnection rules to and from monopoly networks should not be dependent on technology and should apply to both wireline and wireless services. This problem is more complex than past ones because there are no clear stationary boundaries across which interconnection must occur and because there will be a need for interconnection among companies with different and changing degrees of market power.

Both the CPE interconnection rules and the long distance provider access charge rules were developed in a context in which competitors were seeking interconnection with a monopoly public network. The international model provides a closer analogy to the emerging competition in which there may not be a clearly defined monopoly public network. Traditionally, international service has been provided jointly by the national carriers with neither national carrier allowed to provide service directly into the other carrier's country. The international accounting rate and settlement rate system is a mutual compensation arrangement in which the level of payment is negotiated by the carrier pairs and that level of payment is generally used for traffic in either direction. Whatever level of payment is chosen for carrier A to compensate carrier B for terminating traffic received from A is generally the same level used for carrier B to compensate carrier A for terminating traffic received from B.

The mutual benefit and mutual compensation aspects of the international model make it appealing as a framework for interconnection of a wide variety of networks in the future. However, even the increasingly competitive future situation is likely to retain areas of monopoly power, and the international model has encountered difficulties in dealing with different levels of market power among the participants in the bargain.

Structure (Harvard University Press, 1981) and Telecommunication Policy for the Information Age: From Monopoly to Competition (Harvard University Press, 1994).

With the mutual compensation approach, the actual level of payments makes no difference so long as traffic is exactly balanced in both directions. For example, suppose carriers A and B each originate 100 minutes of traffic to be terminated by the other. If the compensation rate for termination is $1, each pays the other $100, while if the compensation rate is $10, each pays the other $1000. In either case the payments exactly cancel out.

If traffic is unbalanced, the compensation rate does matter. If the more competitive carrier originates more traffic than it terminates (as has been the typical pattern in international communications), then a high mutual compensation rate favors the monopolist. For example, suppose low prices in competitive market B cause companies to originate 100 minutes while high prices in monopolized market A cause companies to only originate 50 minutes. Then a compensation rate for termination of $1 causes a net payment from B to A of $50, while a compensation rate of $10 causes a net payment from B to A of $500. Evan Kwerel's analysis of the international market concluded that with a net traffic outflow toward the monopolist, the mutual compensation principle does not limit the monopolist's ability to extract profit from the more competitive partner: "When the net traffic flow is out of the U.S., as with international MTS, ... U.S. carriers are making net payments to the PTT. The PTT can extract the same total revenue from U.S. carriers regardless of the terms for dividing the accounting rate by demanding a sufficiently high accounting rate."[2]

Because lower prices for calls originating in the competitive U.S. market than for calls originating in the generally monopolized foreign markets have created a net traffic outflow from the U.S., compensation rates above cost have created an increasingly large balance of payments deficit. Net outflow from U.S. carriers to foreign carriers increased by a factor of 10 between 1980 and 1992, rising from $347 million in 1980 to $3,344 million in 1992.[3] The rising balance of payments deficit due to compensation rates above cost has led to extensive consideration at the FCC and other U.S. government agencies of ways to attain the "objective of promoting lower, more economically efficient, cost-based international accounting rates and calling prices."[4]

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[2]Evan Kwerel, "Promoting Competition Piecemeal in International Telecommunications," FCC, OPP Working Paper 13 (December 1984), p. 49.

[3]FCC, Industry Analysis Division, "Trends in Telephone Service," (May 1994), Table 31, p. 48.

[4]"In the Matter of Regulation of International Accounting Rates," CC Docket 90-337, 6 FCC Rcd. 3552 (1991) at 3552.

II. A Framework for Analyzing Interconnection Issues

Today's communications marketplace is a hybrid with market segments of robust competition (no barriers to entry) and market segments of little or no competition (extensive barriers to entry). The problem is to create an interconnection policy that will be feasible across a wide range of situations, including different cost situations, different technologies such as wired and wireless, and different degrees of market power. The interconnection arrangements should be flexible enough to meet changing circumstances rather than having the rigidity of the existing prescribed access charge structure.

The interconnection and compensation arrangements are critical for the development of competitive benefits when there are some market segments with market power and other market segments subject to potential competition. Assume that customers can be divided into two groups: a set A for which entry is very difficult and a set B for which entry is easy. The division of the customers into two classes creates four different types of traffic:

(1) traffic among the customers in A, designated AA traffic.
(2) traffic originating from a customer in A and terminating in a customer of B, designated AB traffic.
(3) traffic originating from a customer in B and terminating in a customer of A, designated BA traffic.
(4) traffic among the customers in set B, designated BB traffic.

The significance of interconnection policy depends upon the relative sizes of AB and BA traffic compared to AA and BB traffic. If, for example, A and B represent very different kinds of customers with no desire to communicate between the groups, then AB and BA would be very small and interconnection policy would be largely irrelevant. In that specialized case, there could be one system serving A customers and a completely separate system serving B customers with no loss in efficiency. However, in the more normal case, the division of customers between A and B is a function of geography and customer characteristics that do not affect their desire to communicate with each other. Thus AB and BA represent substantial streams of traffic and it is necessary to have interconnection among the systems in order to promote efficiency.

A second factor that affects the importance of interconnection policy is the existence of fixed costs per subscriber compared to costs per unit of traffic. If there are no fixed costs per subscriber (any number of subscribers can be served at the same total cost so long as the total traffic carried is the same), then interconnection policy is less important than when there are fixed costs per subscriber. With no fixed costs per subscriber, it may be efficient to serve the different traffic streams with different systems

(one system for BB traffic and another for BA traffic, for example). With fixed costs per subscriber, the subscriber must choose the system that best fits that subscriber's needs. Limitations on AB and BA traffic may make a separate system for BB traffic infeasible with fixed costs per subscriber, but not with only usage costs.

The remainder of this paper examines some of the interconnection issues with a "toy model" consisting of a total universe of six subscribers who desire to communicate with each other. The simplified model allows explicit solutions to be worked out in a way that is more obvious than either more realistic simulation models or mathematical formulations. However, the results are quite general and not dependent upon the specific characteristics of the simple model presented.

Assume there are six individuals, designated 1 through 6. Each person i has a linear demand curve for communication with each of the other five individuals shown in Figure 1. Each person demands 3 calls per time period with each other person when the price is zero per call, 2 calls per time period when the price is $1 per call, 1 call per time period when the price is $2 per call, and at a price of $3 per call is priced out of the market. If all six people are connected in a network, the total demand of person i for communication with the other five individuals is simply the sum of i's demand for communication with each of the individuals as shown in Figure 2; person i has a demand for 10 calls per time period to the entire network at a price of $1 per call because person i desires to make two calls to each of the other five people at that price.

Assume that the cost of providing each call is $0.5 for each call originated and $0.5 for each call terminated. Thus the usage cost per call is $1 for each call carried entirely over one network and is $.5 for each call originated or terminated on the network. There are no interconnection costs for multiple networks. That is, the real interconnection cost (but not necessarily the price) of interconnection is zero, though there is a real cost to the networks of terminating traffic provided by other networks.

With a cost of $1 per complete call, the competitive price is $1 yielding a quantity demanded of 2 per person-pair or of 10 calls per person to the other people on the network. The pure monopoly price is $2 per complete call yielding a quantity demanded of 1 per person-pair or 5 calls per person to the other people on the network, as illustrated in Figures 1 and 2.[5] The monopoly price of $2 per call yields a monopoly profit of $1 per person-pair, while the competitive price of $1 per call is equal to the

[5]The person-pair inverse demand curve is $P = 3 - Q_{ij}$ where P is the price per call and Q_{ij} is the number of calls from person i to person j. The corresponding marginal revenue curve is $MR = 3 - 2Q_{ij}$. Using the monopoly profit maximizing condition of marginal revenue equals marginal cost when marginal cost equals 1 yields a quantity of 1 and corresponding price of 2 for each person pair.

FIGURE 1

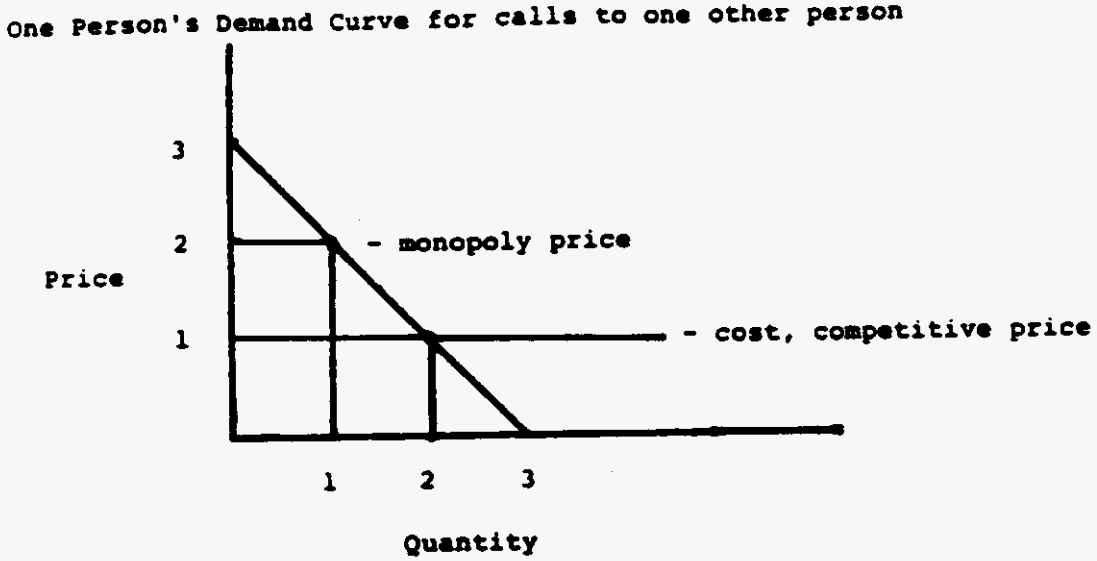
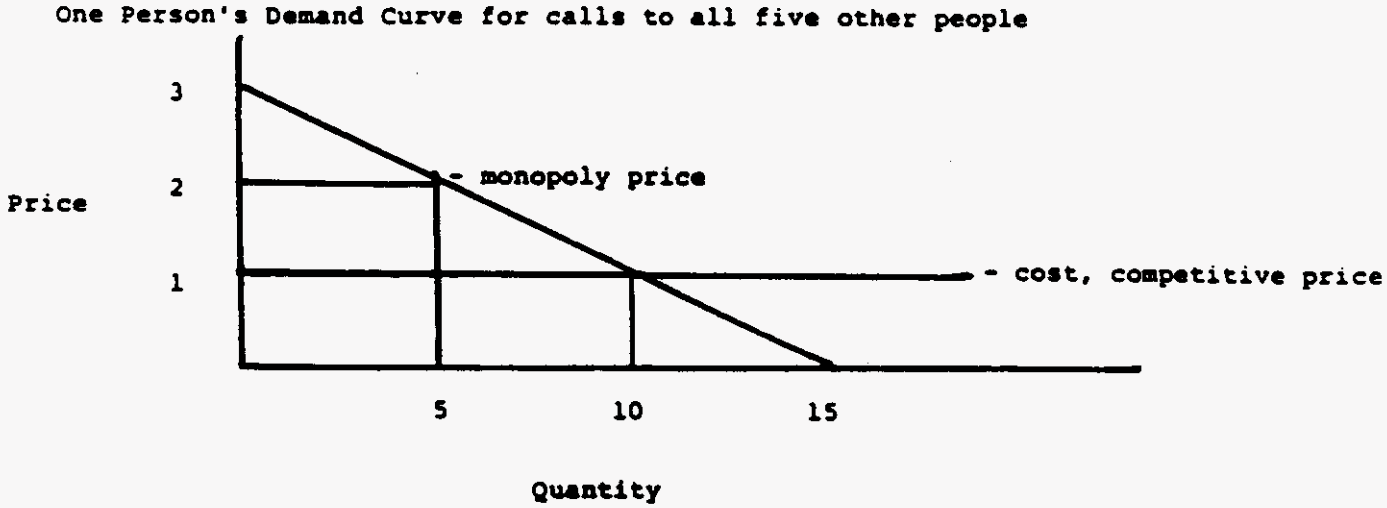


FIGURE 2



costs and yields no net economic profit. With no fixed costs per subscriber, the potential monopoly profit from the network is $30 (6 subscribers each making one call per time period to 5 other subscribers and generating a monopoly profit of $1 per call).

Assume that the incumbent is the only possible provider of service to the first three subscribers while anyone can serve the remaining three subscribers. That is, subscribers 1, 2, and 3 are in the set A of monopolized subscribers while subscribers 4, 5, and 6 are in the set B of competitive subscribers. There is no regulation of the prices that the monopolist can charge its own customers. In a standard market with no network externalities, these conditions would allow the monopolist of the A customers to extract monopoly profits from them, but would not allow the monopolist to extend its monopoly power to the B customers. The network nature of telephone service makes it possible for the monopolist to extend its power to the B customers through control of interconnection conditions. The best that an interconnection policy can do is to restrict the monopoly power to the set A. That is, a good interconnection policy will reduce potential monopoly profits from $30 (the level at which all customers pay monopoly prices) to $15 (the level at which A customers pay monopoly prices and B customers pay competitive prices). No interconnection policy in itself can reduce the monopoly power over A customers, but a poorly functioning interconnection policy can allow the monopoly to be extended to part or all of the calls from the potentially competitive B customers as well. The monopoly extension occurs because a poorly functioning interconnection policy limits the ability of carriers in B to terminate calls on A's monopoly network and may make competition in B infeasible.

The following examples assume for simplicity that only linear pricing (a specified charge per call) may be used, though the price may be different for different classes of customers. Allowing more complex pricing plans (such as multiple combinations of fixed and usage charges) would produce different numbers but would not yield different conclusions.

III. No Fixed Costs per Subscriber

With no fixed costs per subscriber, the monopolist of A sets a price of $2 for AA calls (originating and terminating among customers of A), while the competitors that serve B set a price of $1 (equal to cost) for BB calls. The interconnection conditions determine the prices for AB and BA calls.

A. No Required Interconnection

If there is no interconnection requirement, A can monopolize the AB and the BA calls along with the AA calls, but cannot monopolize the BB calls in the absence of fixed costs. The monopolist of A can guarantee itself access to the customers of B either by purchasing access from a current supplier or by establishing its own affiliate to serve B. Competition in B means that no one can charge more than $.50 (the cost of termination) for terminating calls from A; otherwise, another competitor would offer to do it more cheaply. A will maximize profits from its monopoly by charging a price of $2.00 for AB calls (yielding a net profit of $1 per call after paying its own expenses of $.50 for originating and the competitive termination fee of $.50), and charging an access fee of $1.50 for BA calls. Because B is competitive and the cost of originating calls is $.50, the B competitors will charge $2.00 for BA calls, just equal to their total cost of $.50 for origination and $1.50 for termination.

Under these conditions, the equilibrium is full monopoly pricing of $2.00 per call for AA, AB, and BA calls (each yielding a net profit above cost of $1.00 per call) and competitive pricing of $1.00 per call for BB calls (equal to the cost of service and thus yielding a net profit above cost of zero). The monopolist of A will make a profit of $24 ($1 each on the 24 total calls made at a price of $2.00 for AA, AB, and BA calls). There will be 12 BB calls at a price of $1.00 each, yielding a net profit of zero. If there had been a complete monopoly of both A and B, the potential profits in this situation would have been $30 (including the $24 realized profits and the $6 unrealized profits that would have come from pricing BB calls at the monopoly level of $2.00 each). The monopolist of half of the subscribers makes 80 percent of the total possible monopoly profits because of its control of interconnection conditions. In other words, bringing competition to half of the subscribers only reduced monopoly power by 20 percent.

B. Required interconnection with mutual compensation

In this situation, companies are required to provide interconnection with each other, and are required to charge and receive the same rate. That is, whatever one company charges for terminating calls must be the same rate it pays the other company for terminating calls. As in the first case, the monopolized AA calls will be charged at the pure monopoly rate of $2.00 and the competitive BB calls charged at the cost-based rate of $1.00 each. Now, however, the situation above in which A charges $1.50 for terminating calls received from B and pays $.50 to B for B's service in terminating calls received from A is disallowed because the rates must be the same.

While this case appears to reduce A's monopoly power, it generally does not affect it at all. Only in the very specialized case of exactly balanced traffic does mutual

compensation without control of rates limit A's monopoly power. More generally, A can use its control of the actual compensation rate together with traffic imbalances to maintain its monopoly power. Because anyone can enter the service of B, the monopolist of A can establish an affiliate that serves B. The monopolist of A can then set a compensation rate that allows it to maximize profits in both the A and B market segments while making it infeasible for competitors in B to serve traffic from B to A. For example, the monopolist of A could set a compensation rate of $2.00 for terminating any traffic received from A and also agree to pay $2.00 for any traffic delivered either to its own affiliate or to other competitors in B. For a carrier in B that is not affiliated with the monopolist of A, the competitive price for traffic from B to A is then $2.50 ($.50 cost of originating the traffic plus $2.00 paid to the monopolist of A for terminating the traffic). However, the affiliate of A will set a price of $2.00 for B to A traffic because that is the profit maximizing price for the total company. The difference in pricing comes because the non-affiliated company sees the $2.00 payment to the monopolist of A as a real cost that must be recovered in the price charged, whereas the affiliated company sees the $2.00 payment as an internal company transfer that does not affect the real cost of doing business. For the affiliated company, the size of the payment affects which entity reports the profits, but it does not affect the total profit of the combined enterprise.

Because the affiliated company prices B to A traffic at $2.00 while the non-affiliated companies price the same traffic at $2.50, customers will choose the affiliated company. Once the affiliated company monopolizes the B to A traffic, it will naturally receive the A to B traffic as well. The profit maximizing solution for the monopolist of A and its affiliate in B is consequently to set a high compensation rate (any rate above $1.50) and to price all traffic at the monopoly price of $2.00, even though some of the traffic will show high profits and some will show losses if the specified compensation rates are taken into account. The total profits of the monopolist of A and its affiliate remain at $24 or 80 percent of the total potential just as in the case of no required interconnection. Customers pay the same prices as in the case of no required interconnection. The requirement for mutual compensation has not reduced the monopoly power at all.

This case illustrates the problem with relying only on a structural solution such as mutual compensation without control of the actual rates paid. Consider, for example, the case of a local exchange company interconnecting with a wireless services provider. Assume that the local exchange company is the only service provider for some customers but that the wireless service can be provided on a competitive basis. If the local exchange company has a wireless affiliate, it can maximize the total profits of its enterprise by setting a high mutual compensation rate. Payments to the local exchange company from the wireless companies are an internal transfer for the affiliated company

but a real cost for the unaffiliated company. So long as the competitive wireless companies send more traffic to the local exchange company than they receive from it (as is generally the case), then a high mutual compensation rate disadvantages the non-affiliated carriers and could make it impossible for them to compete with the affiliated carrier. Thus if the monopolist of part of the market is not restricted in its ability to enter potentially competitive sectors of the market, mutual compensation without control of rates fails to provide the consumer benefits of competition.

C. Mutual Compensation at Cost

In this case, each party must compensate the other at identical rates, but the rates are limited to the actual cost of providing terminating service. Using the model developed above, the compensation rate for termination service in this case would be $.50 per call.

The competitors of B will provide BB traffic at the competitive price of $1.00. They will also provide BA traffic at the competitive price of $1.00, composed of $.50 incurred as their own cost for originating traffic and $.50 incurred as an access payment for terminating traffic. The monopolized customers of A will pay the monopoly price of $2.00 per call for AA traffic and will pay the monopoly price of $2.00 per call for AB traffic.

With cost-based interconnection charges, the opening up of 50 percent of the customers to potential competition reduces monopoly power by 50 percent. This contrasts with the case of mutual compensation without control of rates in which the monopoly power was only reduced by 20 percent. The cost-based interconnection effectively eliminates the network externality and makes the telephone network similar to a standard market. The two "products" of service to A and service to B can be sold separately in accordance with their respective market conditions. The cost based interconnection effectively severs the tie between the products, and removes it from the context of network externalities, vertical integration, or tightly complementary products.

The use of cost based interconnection also makes the monopoly power and actions of A very visible. In the preceding case, the customers of A and B were charged the same price, leaving some potential doubt as to whether A was truly exerting its monopoly power. In this case, the customers of A are charged twice the rate of the customers of B even for the same physical call and therefore the monopoly actions of A are clear.

IV. Fixed costs per subscriber

Assume a fixed cost of $2 per subscriber. That is, any company that chooses to serve a particular subscriber incurs a cost of $2 even with no traffic, and incurs the same costs as above ($.50 originating and $.50 terminating) for each call carried. Fixed costs per subscriber have been a standard part of telecommunication history, and many of the existing universal service provisions are concerned with defraying the fixed costs per subscriber. In telephone language, the previous section assumes non traffic sensitive (NTS) costs are zero and this section assumes NTS costs are significant.

A. No Required Interconnection

With no required interconnection, a company choosing to serve the potentially competitive customers in set B can only be certain of the BB traffic (the traffic among customers of B). A separate network to serve only BB calls at a price of $1 per call as in the previous section is no longer viable because of the fixed cost per subscriber. A company desiring to serve only BB traffic must charge enough to pay the fixed cost of $2 per subscriber as well as the usage cost of $1 per call. The only way to do that with linear pricing is to charge the BB customers the monopoly usage price of $2 per call, yielding a profit above usage costs of $2 per person which is just enough to cover the fixed cost of serving the person. That provides no advantage to customers of BB compared to accepting service from the monopoly and therefore the separate network for BB customers alone is not feasible.

So long as interconnection is not required and the monopolist of A recognizes that service to BB alone is not viable, the monopolist of A will refuse connections. That allows A to monopolize the entire market. A's ability to extend its monopoly power from AA and AB traffic to include BA traffic in the case of no fixed costs now allows A to extend its market power to BB traffic as well.

Alternatively, A can accomplish the same thing as refusing to interconnect by setting a high fee for interconnection. If A charges $1.50 for traffic terminating on its network, customers of B are indifferent between taking service from A or from B and A makes a profit of $1 per call either directly from the customer or from the interconnection fees charged to B. The difference from the previous case is that A can now also make a profit of $1 per call from BB calls because it is infeasible to pay the additional fixed cost of having a separate network only for BB calls. The combination of fixed costs and no interconnection requirements means that the potential competition for half of the customers does not reduce total monopoly power at all. The customers pay full monopoly prices for all calls, just as if there were no possibility of entry for any customers. Total potential monopoly profits are less in this case than before because of

the fixed cost per subscriber. The potential monopoly profits of $30 in the previous case are reduced by $12 (fixed cost of $2 per subscriber times 6 subscribers) to $18. However, the monopolist of A now makes 100 percent of the potential monopoly profits rather than 80 percent as in the previous case.

B. Required interconnection with mutual compensation

A will demand a high rate (above $1.50 per call) as a termination fee for any traffic received from B and will agree to pay the same rate for any traffic sent to a company serving B. However, A will also establish an affiliate in B and will send as much traffic as possible to its own affiliate. As in the case of no fixed cost, this transfers profit from the monopolist of A to A's affiliate serving B customers, but it does not reduce prices for customers or reduce total monopoly power. Because of the fixed costs per subscriber, no company independent of the monopolist of A will find it profitable to serve any part of the B market. The interconnection fee established by A makes it unprofitable to serve B customers without return traffic, and unaffiliated companies serving B cannot be certain of the amount of return traffic they will receive. The fact that unaffiliated companies see the interconnection fee as a real cost while the affiliated company only sees it as a transfer payment among parts of the company allows A to manipulate the fee to disadvantage its competitors. Thus even with half of the market open to competition and required interconnection with mutual compensation, A can monopolize the entire market by controlling the level of the interconnection fee.

As in the case of no fixed costs, the key issue in this case is that A is able to establish an affiliate to serve B, but competitors in B are not able to establish an affiliate to serve A. Consequently, A and its affiliate can pay any necessary fee to each other and recognize the profit in whichever place is convenient. So long as A can establish an affiliate in B, there is no difference between the case of required interconnection with mutual compensation and the case of no required interconnection. In both cases, the monopolist of A can entirely monopolize the market.

C. Mutual Compensation at Cost

With cost-based mutual compensation, the monopolist of A is no longer able to extend its monopoly power into the B market. As in the case of no fixed cost, cost-based mutual compensation allows the customers of BB and BA to enjoy competitive prices. The monopolist of A cannot artificially raise the price of BB or BA traffic by setting a high mutual compensation rate and transferring profits to an affiliate. Cost-based mutual compensation achieves the theoretical ideal of restricting monopoly power to the set of

customers for which there are no alternatives and preventing the extension of monopoly power to potentially competitive markets through manipulation of interconnection compensation. With cost-based mutual interconnection, the opportunity for competition among half of the customers reduces total monopoly power in half. That contrasts with the case of mutual compensation without restrictions on the rate charged in which the opportunity for competition among half of the customers did not reduce monopoly power at all.

V. Practical Considerations in Designing an Interconnection Policy

Both existing policy toward international settlement rates and theoretical analysis support the goal of cost based compensation rates for jointly provided services. In the above examples, cost was a simple constant rate per minute. Unfortunately, the real world is not so simple and the actual definition and measurement of cost require care. For example, most telecommunication equipment is engineered for peak period usage. Because most of the cost of service is related to the capacity of the plant rather than the actual number of minutes used, the true cost for peak period usage is much greater than the cost for off peak usage. The cost of carrying off-peak traffic may be very near zero. Any interconnection policy should provide feasible administrative and measurement mechanisms and should provide maximum freedom for innovations in service and pricing. Two practical approaches to the general principle of cost based mutual compensation should be considered.

A. Sender keep all

A particularly simple approach to mutual compensation is sender keep all. Under this arrangement, each company is obligated to terminate traffic for other companies and is entitled to have its traffic terminated by other companies. Each company bills its customers for its originating traffic and pays no compensation to any other company for terminating service.

Sender keep all is mutual compensation with the price of terminating service set at zero. It is economically efficient so long as the real cost of providing terminating service is low. The incentives for manipulation are reversed in this case compared to the previous cases of above-cost terminating rates. Under sender keep all, each company has an incentive to increase the efficiency of its operations in order to reduce its costs and to maximize its outgoing traffic relative to its incoming traffic because outgoing traffic is the most profitable.

Although sender keep all departs from the theoretical goal of cost based compensation by setting a below cost price for terminating service, there is less

opportunity for manipulation than with the price of terminating service above cost. If traffic is balanced, the price is irrelevant. Decreasing the incentives for traffic manipulation will tend to increase the balance of the traffic and reduce the significance of the difference between cost and the zero compensation rate. With mutual compensation rates above cost, the monopolist has an incentive to send as much traffic as possible to its own affiliate and as little traffic as possible to the competitors of its affiliate. With sender keep all, the monopolist has no incentive to send traffic to an affiliate. The monopolist does have an incentive to refuse to accept terminating traffic, but the interconnection requirement implies an obligation to terminate any traffic that is presented.

B. Peak Usage Measurement

The recent NYNEX-Teleport interconnection arrangement provides an example of a combination of usage charges and sender keep all arrangements. The general form of the agreement is to establish a particular charge for a two-way channel of given capacity between the two companies. Traffic is measured at the busy hour each month and the relative measurements are used as an allocation factor for the established channel rate. If traffic is exactly balanced, the payments to each company cancel out and the level of the established rate is irrelevant. If traffic is not balanced, and if Teleport, for example, sends more traffic to NYNEX than it receives from NYNEX at the busy hour, that imbalance is used to compute a net payment from Teleport to NYNEX.

The agreement is essentially a sender keep all arrangement for non-peak traffic. Because relative traffic is only measured at the peak hour, either company can increase its traffic to the other at non-peak times without affecting the charges due. For peak traffic, the agreement is essentially a per minute compensation scheme. An increase in peak period traffic from NYNEX to Teleport, for example, without a corresponding increase in the other direction, changes the financial flows between the companies in the same way that a per minute charge for peak terminating traffic would do.

The distinction between peak and off-peak traffic is beneficial for administrative simplicity and for economic efficiency. Costs are generally associated with peak traffic and therefore the effectively zero charge for terminating off-peak traffic is cost based.

While the structure of the NYNEX-Teleport agreement is beneficial for equating termination charges to cost during the off-peak period, it does not in itself solve the problem of increasing market power through high charges discussed in the previous sections. If the established price for a channel of given capacity is set far above cost, then the company with market power could engage in the same kind of manipulation discussed above. For example, with a very high priced channel, NYNEX could choose

to not terminate traffic through Teleport during the peak hour while Teleport would have little choice but to terminate traffic through NYNEX. That could cause Teleport to pay rates for termination that were high enough to reduce the benefits of competition.

If the established price for a channel of given capacity is near the real cost, then the NYNEX-Teleport arrangement provides an attractive model for general interconnection issues. It would approach a cost-based interconnection fee for both peak and off peak traffic, leading to economic efficiency and opportunities for pricing innovations.

VI. Conclusion

When the market is composed of segments that are monopolized and segments subject to competition, interconnection and compensation arrangements are critical to the development of effective competition. A good interconnection policy will allow effective competition in the potentially competitive segments of the market while a poor interconnection policy will allow the monopolist of part of the market to extend its monopoly into potentially competitive sectors of the market. This paper has shown that the theoretically correct policy is mutual compensation at cost based rates and that mutual compensation alone is insufficient to limit monopoly power. A desirable interconnection policy should be closely related to the theoretically correct policy and also take account of the practical problems of administrative feasibility and of the definition and measurement of cost.

Several specific conclusions can be drawn from the analysis of this paper:

(1) If there are no regulatory controls on compensation for interconnection, the monopolist of part of the market can extend its monopoly power to the entire market;

(2) A mutual compensation policy without limits on the level of rates does not limit market power;

(3) The level of rates under a mutual compensation policy is unimportant if and only if the level of incoming and outgoing traffic is exactly balanced. Because traffic levels will rarely, if ever, be exactly balanced, the level of rates will be an important factor in the viability of competition;

(4) A mutual compensation policy with prices limited to the cost of service is the theoretically correct compensation policy. Mutual compensation with prices limited to the cost of service prevents the monopolist of part of the market from extending its market power to potentially competitive sectors of the market;

(5) Capacity charges rather than per minute charges allow attention to be focused on the cost of service at the peak load which is generally the real cost of service;

(6) "Sender keep all" is an administratively simple mutual compensation scheme with zero prices for terminating service. It is an attractive approximation to the theoretically correct policy of cost based prices when the incremental cost of terminating service is low.

APPENDIX

Brief Summary of Past Interconnection Compensation Efforts

Interconnection issues have played a crucial role in competitive viability and in pricing policy throughout the history of the telecommunication industry. Interconnection disputes began with the early efforts to expand market power in the telegraph industry through limits on interconnection rights and continued through the Bell companies' early twentieth century denial of interconnection to independent telephone companies, the development of legal rights to interconnection, the private line and CPE interconnection controversies of the 1970's, and the development and implementation of the access charge system during the 1980's.

The 1980 Computer II decision to remove CPE from Title II regulation included the decision to eliminate the support flows that had previously gone from CPE to other parts of the industry. Customers gained the right to interconnect any amount of CPE (so long as it met specified technical standards) to the public network with no specific interconnection charge. Customers still had to pay the tariffed local rates for service, but CPE was "carved off" from the public network. That decision was made in the context of a monopoly public network and a potentially competitive CPE component. Without the interconnection requirements, the monopoly local network provider could also monopolize the CPE, but with the requirements, the CPE market could develop in a competitive way independently of the actions of the monopoly local network providers.

It would have been possible to apply the CPE model to long distance interconnection (allowing the competitors to interconnect at ordinary local rates as MCI originally requested in its Execunet service), but that would have eliminated the established system of revenue flows from long distance to local service. The decision first to allow AT&T to impose the ENFIA tariff rather than local rates for long distance interconnection, and then the development of the access charge system, implied a desire to maintain the system of revenue flows from long distance to local service. The access charge system together with the MFJ restrictions on BOC participation in long distance service allowed the long distance market to develop competitively without interference from the local exchange companies, but did not force prices to the true cost of service as normally happens in a competitive market.

Both the CPE and long distance controversies occurred in a market structure in which one party (the local exchange) was assumed to have monopoly power and the other party (the CPE user or long distance provider) was assumed to operate in a competitive market. Thus the policy concern was to ensure that the competitor could receive access to the monopolized market at an appropriate price. The international model provides

a more equal example in which both parties are assumed to have market power. So long as AT&T was the only U.S. carrier for international telephone traffic, it could bargain over the compensation scheme with monopoly entities in foreign countries on an equal basis. However, the beginning of competition in the U.S. for international calls increased the bargaining power of the foreign carriers. The foreign carrier was no longer restricted to dealing with AT&T for U.S. traffic but could agree to send traffic to the U.S. carrier that offered the foreign monopoly carrier the most favorable terms. This possibility created considerable concern at the FCC over whether the beginning of international competition in the U.S. would only benefit foreign carriers and not U.S. customers. Evan Kwerel's 1984 analysis of the international market concluded:

> This paper raises serious questions about the wisdom of deregulating U.S. international telecommunications without considering whether this will increase the market power of foreign telecommunications authorities. Increased competition among U.S. suppliers of international telecommunications services is likely to result in a reduction in the U.S.'s share of the benefits from such services unless the U.S. government takes appropriate countermeasures.[6]

The concerns raised in Kwerel's 1984 paper later developed into extensive FCC efforts to prevent monopoly foreign carriers from taking advantage of their unequal bargaining position with competitive U.S. carriers. The Commission found that equal payment in each direction was inadequate protection against manipulation for a monopolist of one side and sought to bring the rates paid for international terminating service down to the level of cost.

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[6]Evan Kwerel, "Promoting Competition Piecemeal in International Telecommunications," FCC, OPP Working Paper 13 (December 1984), p. 49.

Incremental Cost Of Local Usage

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(Prepared for Cox Enterprises)

Summary

A reasonable estimate of the average incremental cost of local usage (and therefore the cost of terminating traffic received from a competitor) using digital technology is 0.2 cents per minute. That estimate is based on studies done by or supported by telephone companies. The cost is determined by peak period capacity and therefore the true cost is considerably higher than the 0.2 cents per minute average during the peak period and is zero during the non-peak period.

I. Introduction

In a separate paper prepared for Comcast, I have argued that the theoretically correct interconnection charge is cost based mutual compensation. However, cost can have many different meanings and in a regulatory context, cost based requirements can lead to interminable regulatory proceedings and disputes. Policy makers have consequently frequently sought structural methods of solving problems that do not require detailed oversight of cost rules.

One proposed structural rule is mutual compensation without oversight of actual rates, but as shown in the Comcast paper that approach is inadequate to limit the exercise of monopoly power. An alternative approach that dispenses with direct control of cost is the policy of "sender keep all" or "bill and keep" in which each party agrees to terminate traffic for the other without payment for terminating service. That is equivalent to mutual compensation with a zero price for compensation. It will be economically efficient if either of two conditions are met:

(1) Traffic is approximately balanced in each direction;
(2) The actual costs are very low so that there is little difference between a cost based rate and a zero rate.

Existing publicly available studies suggest that the incremental cost of local usage (and therefore the cost of terminating traffic from a competitor) is on average approximately 0.2 cents/minute. The actual cost is considerably higher during the peak period and zero during the off peak period. Thus it would not be efficient or desirable

to charge at 0.2 cents/minute on a usage basis. However, the very low average number compared to the price currently charged by local exchange companies suggests that far greater distortions are likely from mutual compensation without control of rates than from sender keep all approaches.

There are two basic methods for estimating cost:

(1) engineering studies of the forward looking cost to supply a particular service;
(2) econometric (statistical) studies of the relationship between observed cost and observed outputs.

Both engineering and econometric studies provide useful information on cost. The engineering study allows one to focus on best practice technology and compute the incremental cost of adding capacity to provide a particular function. Econometric studies provide a reality check by using observed output and cost data rather than projections of expected cost. However, econometric studies may produce less precise estimates of the incremental cost of a particular service than engineering studies because they are measuring the correlation between variations in the total cost of different telephone companies and variations in the quantities of particular services provided by those companies. The cost data include costs for different embedded technologies used by the companies and are not precise enough to provide detailed estimates of the incremental costs of particular services with particular types of technology.

II. Engineering Estimate

The most comprehensive public engineering study of incremental cost was done by the Incremental Cost Task Force with members from GTE, Pacific Bell, the California Public Utilities Commission, and the RAND Corporation.[1] The Task Force had access to data for telephone companies in California and performed a detailed engineering cost study for various output measures of local telephone service. Individual components were priced based on 1988 prices and costs were computed for switch investment, switch maintenance, interoffice transport, and call attempt costs. All costs were computed for calls during the busiest hour of the year because the investment and associated expenses are related entirely to capacity cost. The Task Force computed the following usage costs for each hundred call seconds (CCS) during the busiest hour of the year for "average" and "larger urban" exchanges:

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[1]Bridger M. Mitchell, Incremental Costs of Telephone Access and Local Use,(Santa Monica, CA: The Rand Corporation, 1990); reprinted in William Pollard, ed., Marginal Cost Techniques forTelephone Services: Symposium Proceedings (Columbus, Ohio: National Regulatory Research Institute, 1991) (NRRI 91-6).

switch investment	$5.00 - $10.00 per year
switch maintenance	.20 - .50 per year
interoffice calling	.50 - .60 per year
Total	$6.00 - $11.00 per year

In addition, the task force computed a cost of $.30 to $.90 per year for each call attempt during the busiest hour of the year and estimated approximately 1.25 busy hour attempts per busy hour CCS.[2]

There are 8766 hours per year and the ratio of the peak usage rate to the average usage rate is approximately 3.[3] That implies that one busy hour CCS is approximately equal to 2922 CCS per year (8766/3). Because one CCS is equal to 1.67 minutes, costs per busy hour CCS can be converted into average costs per minute by dividing by 4880 (2922 total year CCS times 1.67 minutes/CCS). Thus the $6.00 - $11.00 cost per year per CCS during the busiest hour of the year translates into $.0012 - $.0023 per minute. The busy hour attempt cost adds $.375 - $1.125 per busy hour CCS (1.25 busy hour attempts per buy hour CCS and $.30 to $.90 annual cost per busy hour attempt), raising the total cost, including busy hour attempts, to $6.375 - $12.125, and the per minute cost to $.0013 - $.0025. Taking the middle of the estimated range gives a cost of $.0019 per minute, or approximately 0.2 cents/minute.

Because the cost is determined by the use peak capacity, the actual cost per minute is much higher at the peak and is zero at the off-peak. If, for example, one assumes that an equal size peak occurs for one hour in each business day (260 hours per year of peak usage and 8506 hours of non-peak usage), then the average cost per minute would be 2.1 cents for the 8.9 percent of the traffic that occurs during the 260 peak hours each year and the average cost per minute would be zero for the 91.1 percent of the traffic that occurs during the 8506 non-peak hours.

A variety of other engineering studies have been done for specific regulatory purposes and submitted to various state regulatory commissions. For example, New England Telephone prepared an engineering study for the Massachusetts PUC that found an incremental cost of 0.2 cents per minute for local usage served by electronic switches,

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[2]Ibid., p. 249, 250.

[3]Rolla E. Park, Incremental Costs and Efficient Prices with Lumpy Capacity: TheTwo Product Case, (Santa Monica, CA: The Rand Corporation, 1994). p.5.

the same as the Incremental Cost Task Force conclusion using California data.[4]

III. Econometric Estimate

Many econometric cost studies of telecommunications have been done, but the procedures used in most of them do not allow an estimate of the incremental cost of local service. One good econometric cost study that does provide an estimate of the marginal cost of local exchange service is the one performed in 1989 by Louis Perl and Jonathan Falk of NERA, using data from 39 companies (24 Bell and 15 non-Bell) over the years 1984-1987. They developed a statistical relationship between the total cost of the individual companies and the access lines, local usage, and toll usage provided by the companies.

Four different models were used for the statistical estimation. In two of the models, the data for each company was averaged over the four year period to eliminate the effects of minor year to year fluctuations and to provide a pure cross section estimate. In the other two models, observations were used for each company in each of the four years creating a mixture of time series and cross section observations. In two of the models, calls were used as the unit of usage measurement and in the other two calls minutes were used as the unit of usage measurement.

The estimated marginal costs for the local minutes ranged from 0.2 cents per minute to 1.3 cents per minute. The costs per call developed in the models using number of calls as the usage unit were divided by the average holding time to produce estimates of cost per minute comparable to those from the models using number of minutes as the usage unit. The lowest estimate came from the model with only cross section observations averaged over the four years. The highest estimate came from the model using all observations in a pooled cross section and time series and using calls as the unit of usage measurement. All four models had good statistical properties. Although there are various advantages and disadvantages of each of the four models, none of the four can be identified as either the clearly correct approach or an approach to be discarded.

The statistical form used by Perl and Falk generates marginal cost numbers approximately equal to average cost numbers. Thus it should be expected that their estimates will be somewhat higher than the engineering estimates of marginal or incremental cost. Furthermore, the engineering estimates generated by the Incremental Cost Task Force were developed based on digital switching technology while the Perl and Falk estimate for local minutes served by electronic switches was based on the embedded

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[4]Reported in Lewis J. Perl and Jonathan Falk, "The Use of Econometric Analysisin Estimating Marginal Cost," in Pollard, Marginal Cost Techniques., op cit.

technology in 1984-1987 which was primarily analog. It is likely that the incremental costs of usage capacity for analog switching are higher than the incremental costs of usage capacity for digital switching.

IV. Conclusion

A reasonable estimate of the average incremental cost of terminating traffic using digital switches is 0.2 cents per minute. That estimate is supported by the engineering studies done with data for California and for Massachusetts and by one of the econometric models developed by Perl and Falk. Other reasonable econometric models using embedded cost data produce somewhat higher cost estimates. The cost is determined by peak period capacity and therefore the true cost is considerably higher than the 0.2 cents/minute average during the peak period and is zero during the non-peak period.

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