BELLSOUTH®

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December 4, 2003

VIA HAND DELIVERY

Hon. Deborah Taylor Tate, Chairman
Tennessee Regulatory Authority
460 James Robertson Parkway
Nashville, TN 37238

Re: *Implementation of the Federal Communications Commission's Triennial Review Order (Nine-month Proceeding)(Switching)*
Docket No. 03-00491

Dear Chairman Tate:

Enclosed are the original and four paper copies, along with a CD ROM, of the non-proprietary portion of BellSouth's Supplemental Response to MCI's Request for Production of Documents, Item 1. The proprietary portion of the response is being submitted under separate cover and subject to the terms of the Protective Order entered in this docket.

Copies of the enclosed are being provided to counsel of record.

Very truly yours,

Guy M. Hicks

GMH:ch

REQUEST: Please provide, a) on a statewide basis, and b) on a CLLI-code-specific basis, monthly data for each month since July 1, 2001 for your retail customer "churn" (*i.e.*, customer change from one carrier to another) on each of the following bases:

(a) number of customers changing carriers, and percentage of then-current customers changing carriers, by customer type (*e.g.*, residential, business with one to three DS-0/voice grade lines to a single customer premises; business with more than three DS-0/voice grade lines to a single customer premises);

(b) number of customers changing carriers, and percentage of then-current customers changing carriers, by service type (*i.e.*, local exchange voice service only; long distance voice service only; bundled local exchange and long distance voice services; bundled local exchange and DSL; and bundled local exchange, long distance, and DSL services);

(c) number of customers changing carriers, and percentage of then-current customers changing carriers, by customer type (*e.g.*, residential, business with one to three DS-0/voice grade lines to a single customer premises; business with more than three DS-0/voice grade lines to a single customer premises) by the following customer ages: 1) churn within the first three months after the customer's service is provisioned 2) churn within the first six months after the customer's service is provisioned.

SUPPLEMENTAL RESPONSE:

BellSouth objects to this Interrogatory on grounds that the information is not reasonably calculated to lead to the discovery of admissible evidence and it is not relevant to the subject matter of this action. BellSouth also objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to these objections, and without waiving these objections, this information is proprietary and is being provided subject to the protective agreement executed by the parties.

REQUEST: Please provide, a) on a statewide basis, and b) on a CLLI-code-specific basis, monthly data for each month since July 1, 2001 for your retail customer "churn" (*i.e.*, the number of customers changing from one carrier to another) for residential local exchange customers between each of the following service configurations: 1) BellSouth voice only 2) BellSouth voice plus DSL; 3) BellSouth DSL only; 4) CLEC UNE-P voice only; 5) CLEC switch-based voice only; 6) CLEC line sharing; 7) CLEC line splitting; 8) CLEC DSL only [e.g., BellSouth voice only to CLEC UNE-P voice only; CLEC A switch-based voice only to CLEC B switch-based voice only].

SUPPLEMENTAL RESPONSE:

BellSouth objects to this Interrogatory on grounds that the information is not reasonably calculated to lead to the discovery of admissible evidence and it is not relevant to the subject matter of this action. BellSouth also objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to these objections, and without waiving these objections, see BellSouth's Supplemental Response to MCI's First Set of Interrogatories, Item No. 1.

REQUEST: Please provide, a) on a statewide basis, and b) on a CLLI-code-specific basis, monthly data for each month since July 1, 2001 for your retail customer "churn" (*i.e.*, the number of customers changing from one carrier to another) for business local exchange voice customers with one to three lines between each of the following service configurations: 1) BellSouth voice only 2) BellSouth voice plus DSL; 3) BellSouth DSL only; 4) CLEC UNE-P voice only; 5) CLEC switch-based voice only; 6) CLEC line sharing; 7) CLEC line splitting; 8) CLEC DSL only [e.g., BellSouth voice only to CLEC UNE-P voice only; CLEC A switch-based voice only to CLEC B switch-based voice only].

SUPPLEMENTAL RESPONSE:

BellSouth objects to this Interrogatory on grounds that the information is not reasonably calculated to lead to the discovery of admissible evidence and it is not relevant to the subject matter of this action. BellSouth also objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to these objections, and without waiving these objections, see BellSouth's Supplemental Response to MCI's First Set of Interrogatories, Item No. 1.

REQUEST: Please provide, a) on a statewide basis, and b) on a CLLI-code-specific basis, monthly data for each month since July 1, 2001 for your retail customer "churn" (*i.e.*, the number of customers changing from one carrier to another) for business local exchange voice customers with more than three lines between each of the following service configurations: 1) BellSouth voice only 2) BellSouth voice plus DSL; 3) BellSouth DSL only; 4) CLEC UNE-P voice only; 5) CLEC switch-based voice only; 6) CLEC line sharing; 7) CLEC line splitting; 8) CLEC DSL only [e.g., BellSouth voice only to CLEC UNE-P voice only; CLEC A switch-based voice only to CLEC B switch-based voice only].

SUPPLEMENTAL RESPONSE:

BellSouth objects to this Interrogatory on grounds that the information is not reasonably calculated to lead to the discovery of admissible evidence and it is not relevant to the subject matter of this action. BellSouth also objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to these objections, and without waiving these objections, see BellSouth's Supplemental Response to MCI's First Set of Interrogatories, Item No. 1.

REQUEST: Please provide, on a CLLI-code-specific basis, the number of loops that BellSouth has migrated through hot cuts (i.e., individual coordinated simultaneous transfer of DS-0/voice grade loops with live customers' service transferred) since July 1, 2001 that involved manual frame (MDF and/or IDF) jumper work, reported on a daily, weekly and monthly basis, from each of the following: 1) BellSouth retail analog services; 2) CLEC UNE loops. Please provide all supporting documents or information regarding such provisioning volumes.

SUPPLEMENTAL RESPONSE:

BellSouth objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to this objection, and without waiving this objection, information responsive to this request is available via the following URL link:
http://bellsouthcorp.com/policy/triennialreview/filings/2003-12-03/
The file name format is inter_attach_.04.

RESPONSE PROVIDED BY: Ray Lee

REQUEST: For each CLLI code in Tennessee, please provide the number of individual cross connects/jumper jobs performed on (1) the MDF, and (2) any IDF(s), during each month since July 1, 2001.

SUPPLEMENTAL RESPONSE:

BellSouth objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to this objection, and without waiving this objection, data concerning jumper activity on MDFs are kept in the SWITCH database for a rolling 12-month period, although no data are available for jumper activity on the IDF(s). A program is being developed to extract data concerning jumper activity from the SWITCH system, and BellSouth will supplement its response to this Interrogatory as soon as practicable.

RESPONSE PROVIDED BY: Dan Stinson

REQUEST: With respect to the hot cuts identified in response to 0, please provide a detailed description of each work effort your personnel had to perform, the costs you incurred, and the maximum number of hot cuts that you have accomplished per day per CLLI code since July 1, 2001.

SUPPLEMENTAL RESPONSE:

BellSouth has a seamless hot cut process that ensures minimal end- user service outage. BellSouth's process provides for the following: pre-wiring and pre-testing of all wiring prior to the due date; verification of dial tone from the CLEC's switch; verification of correct telephone number from the CLEC switch using a capability referred to as Automatic Number Announcement ("ANAC"); monitoring of the line prior to actual wire transfer to ensure end-user service is not interrupted; and notification to the CLEC that the transfer has completed. In addition to these activities listed above, coordinated hot cuts (including coordinated / time specific hot cuts) also include: notification to the CLEC of CLEC wiring errors, dial tone or ANI problems; verification of end-user information with the CLEC prior to the conversion; verification with the CLEC of cut date and or time 24 – 48 hours prior to the conversion date; and joint acceptance testing, if necessary, with the CLEC to ensure the transfer is successful and number porting is complete.

The "costs" involved in performing hot cuts as calculated on a forward-looking basis consistent with the FCC's pricing rules were provided in connection with the UNE cost proceedings throughout the BellSouth region. These calculations were included in the filings in those proceedings, which are a matter of public record and are in the possession, custody or control of MCI.

There is no "maximum" number of hot cuts that BellSouth has established for any central office in any state in the BellSouth region. BellSouth's hot cut process is based on load volumes and force. BellSouth uses plan size methods to monitor staffing levels to ensure that expected hot cut volumes will be met.

RESPONSE PROVIDED BY: Ken Ainsworth

REQUEST: Please provide the name(s) of the work group(s) whose members routinely perform cross connects/jumper jobs in BellSouth central offices, and provide the following information for each:

(a) a list and description of every job classification (e.g. frame technician) within such work group(s);
(b) whether each job classification is staffed by members of a union, and whether non-union employees may perform the same job function;
(c) for each job classification, the minimum job requirements, including training, job experience, education, etc;
(d) a description of all on-the-job training required or provided for each job classification once in the position;
(e) a copy of the methods and procedures or similar documents that contain any kind of instructions specifying the steps, processes, techniques, tasks, materials, etc. for performing cross connects/jumper jobs.

SUPPLEMENTAL RESPONSE:

The Network Operations, Central Office Field Work Group performs cross connects/jumper jobs.

(a) Central Office Electronic Technician (COET) and Frame Attendant (FA). Job Descriptions for this positions are available via the following URL link:
http://www.bellsouth.com/employment/recruiting_testing_events.html

(b) Both COET and FA job titles are staffed by union and non-union employees.

(c) See BellSouth's response to subpart (a).

(d) On-The –Job-Training consists of an experienced FA or ET observing the new hires performing necessary steps to complete each assigned task, which usually takes one to three weeks for the FAs and two to six weeks for the ETs.

RESPONSE: (Cont.)

(e) The information responsive to this request consists of copyrighted material in various forms, including CD Rom and video. This information is proprietary and will be made available for inspection at a mutually convenient time subject to the protective agreement between the parties.

RESPONSE PROVIDED BY: Dan Stinson

REQUEST: Please 1) state whether BellSouth's methods, procedures, scheduling, and/or completion intervals are different in any way, 2) provide a detailed explanation of all such differences, and 3) provide all Methods and Procedures and other documents that describe the work effort required for the following types of cross connects/jumper jobs:

(a) new retail service installation to a premises with no previous telephone service;
(b) adding a second line to a premises with existing service;
(c) performing a line and station transfer ("LST") that involves cross connects/jumper jobs at the MDF on a loop with live traffic;
(d) changing loops with live traffic from one type of retail service to another (e.g., POTS to ISDN);
(e) changing loops with live traffic from one type of provider to another (e.g., UNE-P to UNE loop; one CLEC UNE loop to another CLEC UNE loop)
(f) changing loops with live traffic from one service on a loop to two services on a loop (e.g., line shared DSL and voice; line split DSL and voice);
(g) any other type of cross connect/jumper job in the BellSouth central office not covered by (a) through (f) above.

SUPPLEMENTAL RESPONSE:

There are no basic differences in BellSouth's methods, procedures, scheduling, and/or completion intervals for the types of cross connects/jumper activity referenced in this Interrogatory. To the extent work steps may vary, these variations would be described in the materials BellSouth is making available for inspection in response to MCI's 1st Set of Interrogatories, Item No. 19.

RESPONSE PROVIDED BY: Dan Stinson

REQUEST: For each type of cross connect/jumper job identified in response to MCI-20, please identify each step or task in the process (e.g., obtain work order for frame wiring, review work order, travel to central office (if required), travel to remote terminal/FDI/customer premises serving terminal (if required), locate binder posts for service to be installed, locate binder posts for service to be removed (if any), remove old jumper(s), install new jumper(s), test for dial tone/connectivity, troubleshoot lack of dial tone/connectivity, enter job completion in work force administration system and/or other record(s), etc.)

SUPPLEMENTAL RESPONSE:

Work steps and tasks are detailed in the documents provided in described in the materials BellSouth is making available for inspection in response to MCI's 1st Set of Interrogatories, Item No. 19.

RESPONSE PROVIDED BY: Dan Stinson

REQUEST: On a statewide basis and for each CLLI code, for each type of cross connect/jumper job identified in response to MCI-20, please identify the minimum, maximum and average actual work time(s) for 1) the total work effort and 2) each step or task in the work effort identified in response to MCI-21, reported monthly for each month since July 1, 2001.

SUPPLEMENTAL RESPONSE

BellSouth objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to this objection, and without waiving this objection, BellSouth does not maintain data on work times associated with individual steps of a given cross connect activity nor does BellSouth maintain data on work times associated with different cross connect activities. However, records documenting the time it takes BellSouth employees to perform coordinated hot cuts is captured via the following three performance measurements in the Service Quality Measurement ("SQM") Plan: P-7, Coordinated Customer Conversions Interval; P-7A, Coordinated Customer Conversions - Hot Cut Timeliness % Within Interval and Average Interval; P-7C, Hot Cut Conversions - % Provisioning Troubles Within 7 Days of Completed Service Order.

RESPONSE PROVIDED BY: Dan Stinson
Bill Griffin

REQUEST: On a statewide basis and for each CLLI code, for each type of cross connect/jumper job identified in response to MCI-20, please identify the minimum, maximum and average work time(s) for 1) the total work effort and 2) each step or task in the work effort identified in response to MCI-21, specified in: a) BellSouth union contracts covering workers who routinely perform cross connect/jumper jobs in the BellSouth central offices; b) BellSouth methods and procedures, guidelines, rules, regulations, specifications or any other written directive; c) employee performance evaluation criteria.

SUPPLEMENTAL RESPONSE:

BellSouth objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to this objection, and without waiving this objection, see BellSouth's Supplemental Response to MCI's First Set of Interrogatories, Item No. 22. Work times are not specified in union contracts, methods and procedures, guidelines, rules, regulations, specifications, or Employee Evaluation Plans.

RESPONSE PROVIDED BY: Dan Stinson

REQUEST: On a statewide basis and for each CLLI code, for each type of cross connect/jumper job identified in response to MCI-20, and for cross connect/jumper jobs in general, please identify the minimum, maximum and average number of such jobs that must be performed by each individual employee or worker during the time interval specified in BellSouth employee performance requirements and/or union contracts (i.e., the number of cross connect/jumper jobs that must be performed per hour, day, shift, or other time interval).

SUPPLEMENTAL RESPONSE:

BellSouth objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to this objection, and without waiving this objection, see BellSouth's Supplemental Response to MCI's First Set of Interrogatories, Item No. 23.

RESPONSE PROVIDED BY: Dan Stinson

REQUEST: Please describe how you prioritize cross connects/jumper jobs during normal working conditions (e.g., first come first served, by service type, etc.) and state whether those priorities change during strikes and other labor related work disruptions. If the priorities change, please provide a detailed description of the manner in which they change.

SUPPLEMENTAL RESPONSE:

BellSouth objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to this objection, and without waiving this objection, priorities are determined by due date requested and are established at the time of service order issuance. Business lines carry a higher priority than do residential lines. This prioritization process does not change during service disruptions.

RESPONSE PROVIDED BY: Dan Stinson

REQUEST: Please provide all time and motion studies, special studies, or other evaluations of cross connect/jumper work times and processes.

SUPPLEMENTAL RESPONSE:

BellSouth objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to this objection, and without waiving this objection, time and motion studies have not been performed on these work functions. Evaluations of cross connect/jumper work times have been conducted in connection with the UNE cost proceedings throughout the BellSouth region, and the results of such evaluations were included in the filings in those proceedings. These documents are a matter of public record and are in the possession, custody or control of MCI.

RESPONSE PROVIDED BY: Dan Stinson

REQUEST: For each central office in Tennessee, for each month since July 1, 2001, please state:

(a) whether the central office was staffed with one or more resident frame technician(s) (or other job classification(s) that routinely perform cross connect/jumper jobs);
(b) for each central office that was so staffed, the hours during which it was staffed;
(c) for each central office that was so staffed, the number of person hours per day or per week devoted to cross connect/jumper jobs;
(d) for each central office that was not staffed, the number of person hours per day or per week devoted to cross connect/jumper jobs.

SUPPLEMENTAL RESPONSE:

BellSouth objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to this objection, and without waiving this objection, see below:

a. Central Offices are staffed according to work load demand, not specific to cross connect/jumper jobs. Additional information responsive to this request is available via the following URL link: http://bellsouthcorp.com/policy/triennialreview/filings/2003-12-03/ The file name format is inter_attach_.01.

b. Central Offices are staffed during normal business hours based on work load demand and personnel availability.

c. BellSouth does maintain staffing data that is specifically associated with cross connect/jumper activity.

d. BellSouth does not maintain staffing data that is specifically associated with cross/connect jumper activity.

RESPONSE PROVIDED BY: Dan Stinson

REQUEST: Please provide the definition you use internally for business purposes for the following terms: (1) "mass market customer" and (2) "enterprise customer," in terms of type of customer (e.g., residential vs. business), number of lines per customer, use of analog loop facilities vs. DS-1s, or any other basis you use to distinguish these terms.

SUPPLEMENTAL RESPONSE:

BellSouth does not use the term "mass market" internally for business purposes, except to refer to small business customers that spend less than $3,000 annually. BellSouth considers business customers that bill more than $1 million annually to be an "enterprise" customer, although this is not a strict definition given that the segment can vary depending upon other factors, including locations, types of services ordered, and type of industry. For purposes of this proceeding, BellSouth accepts the FCC default delineation between "mass market" customers and "enterprise customers by which customers with three or fewer DS0 lines serving them are "mass market" customers and customers with more than three DS0 lines serving them are "enterprise" customers.

RESPONSE PROVIDED BY: John Ruscilli
Susan Callaghan

REQUEST: Please state whether you view a crossover point between mass market customers and enterprise customers set at 4 DS-0/voice grade lines per customer to have any economic, engineering, operational, or business basis from the perspective of your non-regulatory business purposes. If your response is not an unqualified "no," please explain such basis in detail and provide supporting documentation.

SUPPLEMENTAL RESPONSE:

See BellSouth's Supplemental Response to MCI's First Set of Interrogatories, Item No. 110.

RESPONSE PROVIDED BY: John Ruscilli

REQUEST: Please provide your calculation, estimate, or view of the economic crossover point , in terms of number of DS-0/voice grade lines to a single customer premises, at which you offer service at a DS-1 level rather than using a number of analog lines, and provide the basis for that crossover point (e.g., equivalency point of analog service rates and DS-1 service rates, consideration of whether the customer premises equipment can accept a DS-1 interface, etc.).

SUPPLEMENTAL RESPONSE:

See BellSouth's Supplemental Response to MCI's First Set of Interrogatories, Item No. 110.

RESPONSE PROVIDED BY: John Ruscilli

REQUEST: For cross-connects between CLEC collocation arrangements in your central offices in Tennessee, please provide:

(a) name(s) of the CLECs whose collocation arrangements are cross-connected to each other;
(b) your Methods and Procedures, guidelines, and practices relevant to, or describing cross-connects between CLEC collocation arrangements;
(c) non-recurring charges;
(d) monthly recurring charges;
(e) applicable performance measures and penalties;
(f) complaints from CLECs regarding any aspect of such cross-connects (e.g., cost, timeliness, etc.);
(g) your response to and resolution of any such complaints.

SUPPLEMENTAL RESPONSE:

(a) The primary purpose of collocation is for a telecommunications carrier to interconnect with BellSouth's network or to access BellSouth's unbundled network elements for the provision of telecommunications services. BellSouth will permit a carrier to interconnect between its virtual or physical collocation arrangement(s) and that (those) of another collocated telecommunications carrier within the same "BellSouth Premises". Both the ordering carrier's agreement and the other collocated telecommunications carrier's agreement must contain the Co-Carrier Cross Connect ("CCXC") rates, terms and conditions before BellSouth will permit the provisioning of CCXCs between the two collocated carriers. The carrier is prohibited from using the Collocation Space for the sole or primary purpose of cross-connecting to other collocated telecommunications carriers.

A carrier must contract with a BellSouth Certified Supplier to place the CCXC. The CCXC shall be provisioned using facilities owned by the ordering carrier. Such cross-connections to other collocated telecommunications carriers may be made using either electrical or optical facilities. The ordering carrier will be responsible for providing a letter of authorization ("LOA"), with the application, to BellSouth from the other collocated telecommunications carrier to which it will be cross-connecting.

RESPONSE: (Cont.)

The carrier-provisioned CCXC shall utilize BellSouth common cable support structure. There will be a recurring charge per linear foot, per cable, of common cable support structure used by the carrier to provision the CCXC to the other collocated telecommunications carrier. In those instances where the ordering carrier's equipment and the equipment of the other collocated telecommunications carrier are located in contiguous caged Collocation Space, the ordering carrier may use its own technicians to install co-carrier cross connects using either electrical or optical facilities between the equipment of both collocated telecommunications carriers by constructing a dedicated cable support structure between the two contiguous cages. The ordering carrier must deploy such electrical or optical cross-connections directly between its own facilities and the facilities of another collocated telecommunications carrier without being routed through BellSouth's equipment. The ordering carrier may not provision CCXC on any BellSouth distribution frame, POT (Point of Termination) Bay, DSX (Digital System Cross-Connect) or LGX (Light Guide Cross-Connect). The ordering carrier is responsible for ensuring the integrity of the signal.

To place an order for CCXCs, the ordering carrier must submit an Initial Application or Subsequent Application to BellSouth. If no modification to the Collocation Space were requested other than the placement of CCXCs, the Subsequent Application Fee for CCXCs would apply. If other modifications, in addition to the placement of CCXCs, are requested, either an Initial Application or Subsequent Application Fee will apply, pursuant to ordering carrier's interconnection agreement. BellSouth will bill this nonrecurring fee on the date that it provides an Application Response to the ordering carrier.

RESPONSE: (Cont.)

All of the rates, terms and conditions associated with BellSouth's Standard Interconnection Agreement, which includes BellSouth's CCXC offering (in Attachment 4 for Collocation), can be found at the following BellSouth website:

http://www.interconnection.bellsouth.com/become_a_clec/html/ics_agreement.html

(b) See BellSouth's Response to (a).

(c) See BellSouth's Response to (a).

(d) See BellSouth's Response to (a).

(e) BellSouth's responsibility is to provide common cable support structure to the ordering carrier. The ordering carrier's application will be captured by the collocation measurements C-1, Collocation Average Response Time, C-2, Collocation Average Arrangement Time, and C-3, Collocation Percent of Due Dates Missed. Measurement C-3 is a part of the SEEM penalty plan. There are no performance measurements for the placement of the cabling and the installation of the cross connects since both are the responsibility of the ordering carrier.

(f) BellSouth is unaware of any complaints from CLECs regarding any aspect of their provisioning of co-carrier cross connects in BellSouth's central offices in Tennessee. See BellSouth's Response to Item No. 107.

(g) Not Applicable

RESPONSE PROVIDED BY: Wayne Gray
Dave Coon

REQUEST: Please provide a copy of all business cases, business analysis, cost studies, or other analyses or evaluations concerning whether entry into the mass market is economically feasible without access to BellSouth's switches, including those analyses and studies that were submitted to the FCC, performed but not submitted to the FCC, and performed since February 22, 2003. Provide all supporting documentation and work papers, in electronic format if available.

SUPPLEMENTAL RESPONSE:

BellSouth objects to this Interrogatory on grounds that it is unduly burdensome, overly broad, and oppressive as written. Subject to this objection, and without waiving this objection, see BellSouth's Supplemental Response to MCI's First Request for Production of Documents, Item No. 1. Additional information responsive to this request will be provided in connection with the testimony filed in this docket.

RESPONSE PROVIDED BY: Kathy Blake

REQUEST: Please produce all documents that were identified, or that should have been identified, in response to the preceding Interrogatories.

SUPPLEMENTAL RESPONSE:

Additional documents responsive to this request are being provided.

BellSouth Telecommunications, Inc.

MCI/WorldCom's 1st Request for Production of Documents

Item No. 1

Attachment to Interrogatory Item No. 153

CLECs' Choices for Local Switching

By Charles L. Jackson

July 2002

A study prepared for BellSouth

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1 Executive Summary

Although the tasks to be performed by their switches are similar or identical, ILECs and CLECs have vastly different needs for switching capabilities. ILECs need switching equipment that is compatible with their legacy network—including cable routes and operations support systems. CLECs, lacking these legacy constraints, have more freedom when shopping for switches. CLECs, building new systems covering large areas benefit from technologies that permit easy entry with lower fixed costs than traditional systems.[1]

New microelectronic and switch technologies, along with the entry of new suppliers, have lowered the cost of switches—especially the new technology switches and the switches from new entrants—have reduced the minimum efficient size of switches, and have made it possible for switches to serve telephone lines hundreds of miles distant from the switch. All these changes expanded the alternatives available to CLECs.

In addition to the option of purchasing switching hardware, CLECs have the alternative of purchasing switching services—both CLECs and ILECs offer wholesale switching services.

Given the facts, CLECs are not competitively impaired without access to unbundled switching. Indeed, the sheer deployment of alternative switches precludes any reasonable claim of impairment. As detailed in the UNE Fact Report 2002, filed as an attachment to BellSouth's Comments in this proceeding, the number of CLEC voice switches has increased from 700 to 1,300 in the three years since the UNE Remand record was compiled, and the number of CLEC data switches has grown from 860 to 1,700.[2] (Data switches can be used both for data and, increasingly, for voice and thus substitute directly for circuit switches.) Moreover, non-ILEC alternative switches serve customers in wire centers accounting for 86 percent of all BOC switched access lines—and 97 percent of BOC switched access lines in the top 100 MSAs,[3] demonstrating effective geographic ubiquity. And these

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[1] This paper does not consider the market for packet switching, other than to note that CLECs have deployed a large number of packet switches, which may be used to switch both data and voice traffic.

[2] *UNE Fact Report 2002*, Section I, Table 1.

[3] *Id.*, at p. II-6

switches are being used to serve at least an estimated 13 million business lines and 3 million residential lines.[4] Finally, as discussed later in this paper, CLECs can and do use their switches to serve customers located in different MSAs or even different states, so that they can greatly expand their customer base without deploying a large number of new switches.

I performed a simple study that confirms the general results of the Fact Report cited above. Universal Access provides a product called C.O. Finder, which permits inquiries to a central office switch database developed by NECA. The November 1998 version of the database listed 58 switch entities serving the District of Columbia, with 49 of those associated with area code 202 in the District. The switches are listed as being owned by Bell Atlantic, Nextel, AT&T Wireless, SWB Mobile, and several other firms. The February 2002 version of the database listed 500 switch entities serving the District with 115 of them associated with area code 202. There has been a significant change in the reported data on non-ILEC switches in the District over a period of a little more than two years.

Considering CLEC access to switching in the context of the FCC's five criteria for impairment—cost, ubiquity, quality, timeliness, and operational impediments—it is clear that the CLECs would not be impaired by being required to deploy their own switches or purchase switching in the marketplace.

About the Author

I began my career as a computer programmer and worked as both a system programmer and a digital designer. I received my PhD in electrical engineering from MIT. I have worked for both the FCC and the House Commerce Committee. Currently, I work as a consultant and a professor. I have written extensively on technology and public policy. I am also an adjunct professor of electrical engineering and computer science at George Washington University, where I have taught graduate courses on mobile communications, wireless networks, and the Internet. I am a member of the FCC's Technological Advisory Council. My full biography is available at www.jacksons.net.

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[4] *Id.*, at Section II, Table 2

2 Switching Needs: CLECs versus ILECs

ILECs and CLECs have different needs for switching capabilities because their networks differ. ILECs need switching equipment that is compatible with their legacy network—including cable routes and operations support systems. Many of the ILECs have extensive operations support systems that they use to manage switch configuration. An ILEC cannot easily install a new switch if that switch is not compatible with the existing operations support system. CLECs, lacking these legacy constraints, have more freedom when shopping for switches. Start-up CLECs benefit from switching systems with lower fixed costs because their scale of operations in the first few years will be far smaller than those of most ILECs.

As a general proposition, the cost of deploying alternative switches is declining dramatically. Bob Lucky, Corporate Vice President of Applied Research at Telcordia Technologies and chairman of the FCC's Technological Advisory Committee, wrote,

> A recent study at Telcordia of the economics of packet networks showed a cost advantage of 20-40% for the equipment costs in packet technology relative to circuit technology. However, it is important to realize that this advantage is fast increasing because of the exponentially-declining costs of packet routers. While circuit switching costs are also decreasing, they are doing so at a much slower pace. *One estimate is that routers are doubling their cost effectiveness every 20 months, as compared with a very slow 80 months for circuit switches.* The point is very simple, but profound—the world is working on packet technology and not circuit technology. In technology today it is necessary to "ride the wave" of popularity, because that is where the economics will be most advantageous. Because of the growth of the Internet, that wave today is with packets.[5]

2.1 Background

Telecommunications switching lies at the heart of most local exchange carrier (LEC) services, including plain old telephone service (POTS). The basic idea of a telecommunications switch is

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[5] "NGN and the Packetizing of Telecommunications," by Robert W. Lucky, *Exchange,* Spring 1999, Telcordia Technologies. Emphasis added.

simple. Instead of running wires between every pair of houses in a town, the LEC runs wires to a central point and connects the wires together as needed. This economizes enormously on the cost of wire, but at the expense of having the central connecting point.

At first, a human operator performed the central connecting function. However, mechanization or automation of this task reduced costs. The mechanical systems that performed this function were called switches—perhaps analogous to railroad switching systems or to electrical light switches or perhaps because the earlier manual systems were called switchboards.

To implement equal access and to provide other advanced services, LECs in the United States upgraded their switches in the 1980s and 1990s to modern digital switches such as the Lucent 5ESS and Nortel DMS series switches. These switches were large, relatively expensive (up to several million dollars) systems that included a central computer controlling the system, specialized modules for connecting incoming and outgoing signals, and various auxiliary equipment. Because speech signals are represented internally as digital quantities in these switches, it is common usage in the industry to call these *digital switches*. Digital switches have the advantages of connecting efficiently to digital transmission facilities, such as long-distance fiber networks or digital loop carrier systems, and of using the latest digital electronic technologies to reduce costs. Of course, these digital switches can also connect to analog telephone lines. The connection is made using a *line card* that contains the electronics needed to convert the analog voice signal to a digital signal.[6]

Switches are often categorized as either local or toll switches (also called tandem switches). *Local switches* connect to the user's telephone and need many more capabilities, such as call forwarding and accounting features, that are not needed on toll switches. Local switches are also often called Class 5 switches.

Remote switches or remote switching modules also exist. A *remote switch* is a partial switch, with some of its control logic or administrative features located in a second switch—often called the *host switch*.

2.2 Traditional Cost Structure

Historically, local telephone switches have been expensive. The costs of traditional switches reflect several factors including (1) the fact that much of the manufacturer's costs are software development costs—so the marginal production costs are much lower than the average cost; (2) the fact that there were few competitors in the local switching market until recently; and (3) the fact that, once a carrier bought a switch from a manufacturer, that manufacturer had a monopoly on hardware and software upgrades to the switch. This last factor, the fact that the owners of current switches are locked-in to their suppliers for hardware and software needed for growth and upgrades, creates incentives for the manufacturers not to lower the price of their traditional equipment. Klemperer and Varian provide excellent discussions of these incentives.[7,8] Given these incentives, we should not expect to see the same decline in the cost of traditional switches as will be the case for new-technology switches.

2.3 ILEC and CLEC Network Architectures

Telephone outside plant—the wires, cables, conduits, and poles that carry the signals—and switches evolved together. But, as a telephone company's network became mature, the company could no longer easily trade off outside plant capabilities against switching capabilities. Rather, when the company needed a new switch to replace an existing switch, that new switch had to be compatible with the existing network of cable and wires—it would be inefficient and disruptive to replace or rework the outside wiring. Consequently, ILEC switches in urban areas tend to be in buildings that have held switches for many years, and the scale of the switches made for the ILECs reflects this pattern—an ILEC can use multiple switches, located in buildings where wires congregate, to serve

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6 All modern switching equipment can connect to analog telephone instruments—either directly through a line card or indirectly through equipment containing a line card.

7 Paul Klemperer, "Competition when Consumers Have Switching Costs: An Overview with Application to Industrial Organization, Macroeconomics, and International Trade," *Review of Economic Studies*, Vol. 62, pp. 515-539 at 519. Note, in the context of this paper, the title of Professor Klemperer's paper may be confusing—in that title *switching costs* refers to the cost to consumers of changing suppliers, not to the costs of devices that connect and route telephone calls (telephone switches).

8 Hal Varian, Raffaele Mattioli Lecture, Bocconi University, Milano, Italy, on November 15-16, 2001, revised text of December 16, 2001.

an urban area. The switch manufacturers designed their switches to meet the ILECs' need for switches fitting their networks.

In contrast, CLEC networks can take advantage of the economies made possible by modern transmission capabilities. Rather than installing many switches in an urban area, CLECs install a single switch in a city or state and then haul the calls back to the switch for processing. Before the development of low-cost optical transmission systems, it was rarely economically feasible to carry telephone calls back to remote locations for switching. The growth of optical digital transmission, however, has changed this limitation. Currently, the signal from a modern digital loop carrier can be transmitted to a switch many miles away at relatively low cost. Similarly, modern communications permits the switching function to be fragmented, with equipment at the central office performing some functions and equipment at distant locations performing other functions.

Today CLEC networks are built with only a few switching nodes—one switch serves a city or an entire region. Correspondingly, the number of switches in the ILEC networks has been falling in recent years—the number of ILEC switches reported by the FCC in its annual report *Statistics of the Common Carriers* declined from 24,000 in 1995 to 18,000 in 2000.[9] However, the size of the ILEC networks, the utility of existing plant, and the cost of rearrangement limit the rate at which ILECs can consolidate and combine switches. In fact, these restrictions minimize the opportunities for consolidation of ILEC switches. CLECs, on the other hand, are not constrained by these factors.

2.4 Modern Electronics Lowers Costs of CLECs' Next-Generation Switches

The continuing process of innovation in microelectronics has produced amazing products. Today's Intel Pentium 4 has more than 50 million transistors. A typical modern desktop computer has far more memory or processing power than a central office switching machine of a decade ago. Unfortunately, neither the hardware nor the software of a desktop system is anywhere as reliable as

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[9] FCC, Statistics of Communications Common Carriers, 1995 Table 2.10 and Statistics of Communications Common Carriers, 2000, Table 2.6. The ILECs had 7,978 full switches and 15,708 remotes in 1995 but only 6,429 full switches and 11,267 remotes at year end 2000.

the central office switch—so one cannot just load the software for a telephone switch into a new computer from Dell and have a telephone switch that costs $800.[10]

At the same time that microelectronics have progressed, the computer industry has poured enormous resources into the development and perfection of various forms of data communications equipment to support networking both in the office and in the larger Internet. One consequence of this work on data communications has been the development of new technologies that compete with the traditional voice switching technologies and new firms that compete with the traditional suppliers of central office switches. For example, Cisco—a leading data networking firm—has sales roughly the same as those of Lucent or Nortel. Investor expectations for Cisco are more optimistic than for Lucent or Nortel—Cisco's market valuation is more than three times that of Lucent and Nortel combined.[11] Cisco's leading products are called switches and routers—these products are designed to switch data traffic rather than voice traffic.

Over the last few years, products and technologies from the data communications or the Internet world have begun to appear in the telephone switching market. One feature of the new designs is that the minimum efficient scale of a switching machine is much smaller than in the traditional telecommunications world. Industry uses a mix of terminology to describe these new devices—including terms such as softswitch, media gateway, and multiservice access switch. I refer to these as *new-technology switches*—but it is important to understand that no term perfectly describes this new category of switches. A key feature of many of the new-technology switches is that the program logic controlling call setup and call features (such as call forward on busy/don't answer) runs on a general purpose computing platform—not on a special processor built only by the switch vendor. A second feature, seen in many new-technology switches, is that the voice signal is transferred using data communications technologies, such as Internet Protocol, Ethernet, or frame relay, rather than the traditional signal formats used in the telephone industry. The softswitch

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[10] There are other technical issues that make the use of a PC as a telephone switch problematic.

[11] Data taken from Yahoo Finance, February 19, 2002. Market capitalizations: Lucent $18 billion, Nortel $17.5 billion, and Cisco $122.4 billion, ratio [122.4/(18 + 17.5)] = 3.45.

industry has created its own industry association—the International Softswitch Consortium—with more than 100 member firms.[12]

A recent study by John Malone of the Eastern Management Group (EMG) titled *Trends in Switching Prices, 1996—2002* reviewed these technological changes and concluded,

> Since a voice oriented next generation Class 5 Switching System for CLECs is different than that required by ILECs, which must incorporate products into a legacy network, a CLEC's costs for switching are substantially less than that of an ILEC.

That Eastern Management Study is attached to this report as Appendix A. The following are some of its key points:

- **Technology Has Changed Since UNE Remand Order**

  At the time the UNE Remand Order took effect (November 1999), integrated multiservice access platforms did not exist. Costly digital access cross connect systems (DACS), digital loop carriers (DLC), and frame relay switches had to be individually purchased by carriers to transmit customer data traffic. Recently, manufacturers have begun to develop and sell integrated multi-service access platforms (IMAP), also referred to as aggregators or converged switches. Since the UNE Remand Order, several new firms have developed Class 5 switch products.

- **Costs for CLECs Have Declined**

  Since a voice oriented next generation Class 5 Switching System for CLECs is different than that required by ILECs, which must incorporate products into a legacy network, a CLEC's costs for switching are substantially less than that of an ILEC. Operating expenses for a Class 5 Switching System include personnel, power, air conditioning, and space. Next generation Class 5 Switching System operating expenses may be 75% less per year than those of legacy systems.

- **CLEC Network Architecture Has Evolved**

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12 For information, see their website at www.softswitch.org

Figure 1 below, taken from the Eastern Management Group study, shows the network architecture of a modern CLEC—using IMAPs for remote access, the concentration of traffic in each city, and high capacity backhaul to a switching system.

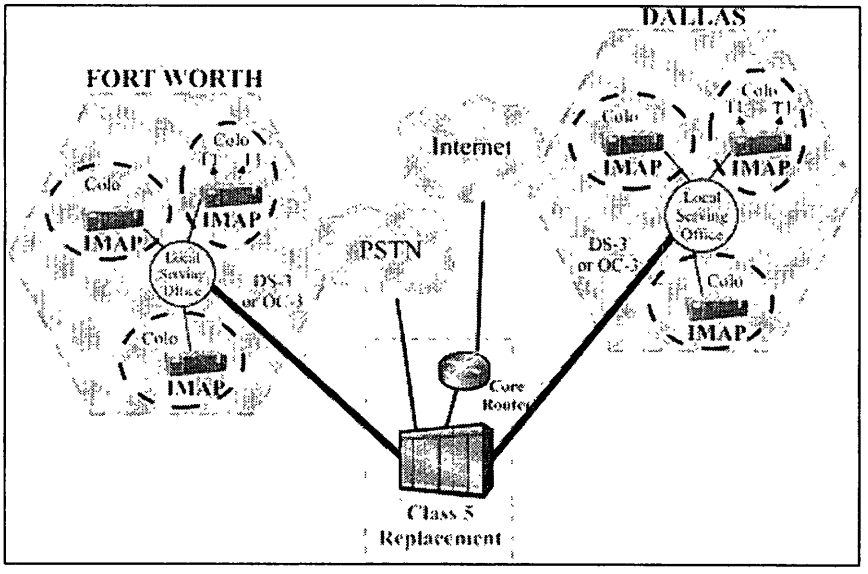

Figure 1. CLEC Network Architecture.

A filing by Taqua, Inc., a switch manufacturer, complements the EMG study.[13] Taqua, a relatively young firm, manufactures a modular central office switch—the OCX. At its smallest configuration, the Taqua OCX supports only 80 access lines. But, the same box can support up to 100,000 subscribers in a single rack.[14] Systems, such as the OCX, that are (1) designed for efficient operation even if connected to relatively few loops and (2) are manufactured using the most recent semiconductor and software technologies drastically reduce or eliminate the economies of scale in switching.

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[13] See Comments of Taqua, Inc., in CC Docket No. 01-338, CC Docket No. 96-98, and CC Docket No. 98-147, April 5, 2002.

[14] Taqua filing at p. 5.

2.5 Service Providers

The changes in industry structure have created a new source of supply of telecommunications switching—vendors of switching services. A CLEC with a 5ESS switch can sell switching capacity to other CLECs—and, as I show below, some CLECs do so. Also, at least one ILEC continues to sell unbundled switching to CLECs in situations in which the FCC's UNE switching carve-out applies and market-priced switching rates are in the interconnection agreements pertinent to the ILEC and those CLECs.

2.6 Observations and Conclusions

CLECs and ILECs use switches to perform similar functions in their networks. ILECs, however, are constrained in their choice of switching technology by their legacy networks—whereas CLECs are not constrained in the same fashion. The cost of switches, especially switches based on packet switching technologies, continues to fall and the new technology switches are economically efficient at a smaller scale than the traditional switches. Furthermore, the current generation of traditional switches can serve telephone lines many hundreds of miles from the switch.

3 Hardware Solutions

In this section, I look at the supply of local switches in more detail. I consider first the suppliers of the traditional switches and then address the softswitch suppliers.

3.1 Traditional Switches

The industry that produces the traditional local switches used by most carriers in North America reflects the history of the telephone industry. The two major producers are Lucent and Nortel.

3.1.1 Lucent

Lucent's traditional local switch offering is formally known as the 5ESS but is often called the 5E. In recent years, Lucent has developed variations on the 5ESS design. One important variation is the remote unit that allows the capabilities of a 5ESS switch to be delivered using smaller modules located at distant locations from a host 5ESS system. Figure 2, taken from Lucent marketing literature, illustrates the concept.[15]

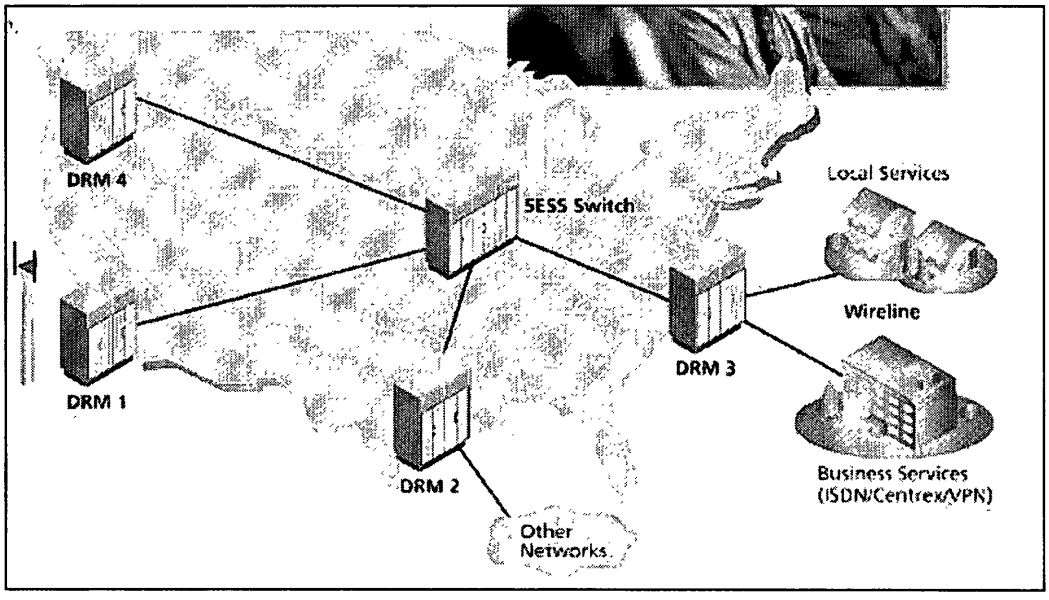

Figure 2. Lucent 5ESS Remote Capabilities

Lucent claims that the DRM remote unit illustrated here can be located up to 2,000 miles from the host 5ESS switch. CLECs use Lucent DRMs to provide service in cities hundreds of miles from their 5ESS. See, for example, the press release from Integra Telecom (a CLEC) at http://www.integratelecom.com/news/press/corp/091100_pr.shtml.

A second important variation on the traditional 5ESS design was the development of smaller versions of the 5ESS. One such smaller unit was the CDX (standing for compact digital exchange), now replaced by the VCDX (very compact digital exchange). Of course, the meaning of "very compact" depends on the context—a VCXD is 90 inches wide and about 7 feet tall. Lucent

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[15] Source, Distinctive Remote Module (DRM), Lucent, August 1999. 4 pages.

characterizes the VCDX as "the smallest configuration of the 5ESS family," but a VCDX can support up to 28,000 telephone lines.

Nevertheless, the Lucent VCXD, together with the backhaul option discussed below, provides a more reasonable scale of entry (lower fixed cost but lower capacity) for CLECs than did the older 5ESS designs. Lucent says of its VCDX,

> The VCDX provide the same dependable features of a full 5ESS® switch in a much smaller footprint, allowing your customers to offer the same broad array of services that a larger switch could offer. Ideal for residential, rural, and suburban markets, the VCDX is also fully scalable to a full 5ESS switch, letting your customers preserve their investment when their capacity demands increase.
>
> Minimum Footprint
>
> Compact size
>
> Housed in three cabinets that are 6 feet high, 29.9 inches wide, and 23.6 inches deep
>
> Ideal for locations with small-line-size applications
>
> 20,875 lines
>
> 25 Primary Rate Interfaces (PRIs)
>
> 4,080 Trunks.[16]

Lucent also manufactures several new-technology switching systems. I discuss those products below in the section on new-technology switches.

3.1.2 Nortel

Nortel's pioneering digital switch line, the DMS series, began shipping in 1980—two years ahead of Lucent's 5ESS. The early availability of the DMS product line, together with the changes in the U.S. telephone industry at divestiture, led to widespread use of the DMS switching products in the United States. The Nortel DMS product line encompasses a range of products—the DMS-10, DMS 100/200, DMS 250, and DMS-500. The DMS 100/200 is a traditional local switch; the DMS 10 is a

small local switch, somewhat comparable to the Lucent VCDX; the DMS 250 is a long-distance switch; and the DMS-500 is a combined local/long distance switch. Nortel promotes its DMS-10 to the CLEC market emphasizing the DMS-10's low initial cost and support for remote modules.[17]

The DMS family of switches supports remote units. The DMS remote units include a single cabinet version for start-up applications. Figure 3, taken from Nortel marketing materials, shows the size and capabilities of a standard DMS remote unit.[18] These DMS remotes can be separated from the host switch by as much as 650 miles.

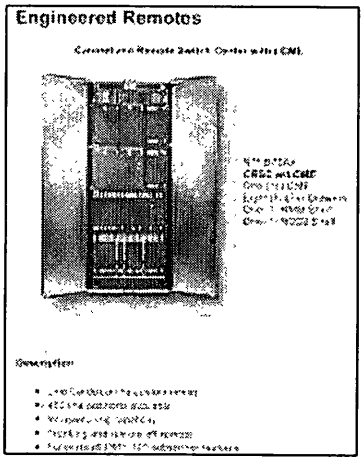

Figure 3. DMS Remote

3.1.3 Others

Lucent and Nortel are not the only switch manufacturers—Alcatel, Ericsson, Siemens, and NEC also manufacture local switches. However, relatively few of their switches have been installed in the networks of the LECs in the United States. In terms of competitive impact in the United States, these firms are more important as sources of proven knowledge and expertise on telecommunications switching—resources that can be used to support the development of new technology switches—rather than as suppliers of traditional switches.

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16 http://www.lucent.com.au/intl/au/en/products/solution/0,,CTID+2003-STID+10055-SOID+563-LOCL+1,00.html

17 "DMS-10 CLEC Switching Solutions," Nortel Product Brief, May 1999.

18 http://www.nortelnetworks.com/products/01/ndc/ntnb70.html.

3.2 Remote Switching and Backhaul

Carriers use two methods to provide switching efficiently at distant locations. The first is to locate a small switching unit at the distant location. These switching units are called *remotes* or *remote switches*. Remotes depend on some of the capabilities of a *host switch* to provide the full spectrum of call processing capabilities. Above, I provided a description of some of the remote capabilities of the Lucent and Nortel switches.

The second method is simply to haul the calls from the remote location back to the switch; process the calls at the switch; and, if necessary, haul the traffic back to the original location for termination. Until recently, such backhaul would have been uneconomical in most circumstances. However, the cost of transmission over modern fiber optic facilities has fallen so low that backhaul can now be economical in many situations. In many cases, carriers haul traffic hundreds of miles to switches. Backhaul is not just a theoretical possibility but rather is a market reality.

In traditional backhaul, the standard voice signal (a 64,000 bit-per-second stream of bits) is carried over traditional telephone transmission facilities, such as DS-1 or OC-1 circuits. Of course, the backhaul need not be done over traditional telecommunications networks. Data communications technologies, such as networks based upon the Internet's IP protocol, can also be used to do the backhaul. For example, Lucent sells a product, the *i*Merge CFG, that provides such a backhaul capability over IP networks.[19] Use of this box requires use of an access gateway to connect to analog phones.[20]

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[19] The *i*Merge is manufactured by AG Communications Systems, a Lucent subsidiary.

[20] An access gateway converts the analog phone signal to an IP packet, and vice versa. Access gateways are made by many firms, including Lucent, Cisco, and Nortel.

Figure 4 shows the use of an *i*Merge box to extend the functions of a local switch to a remote access gateway.

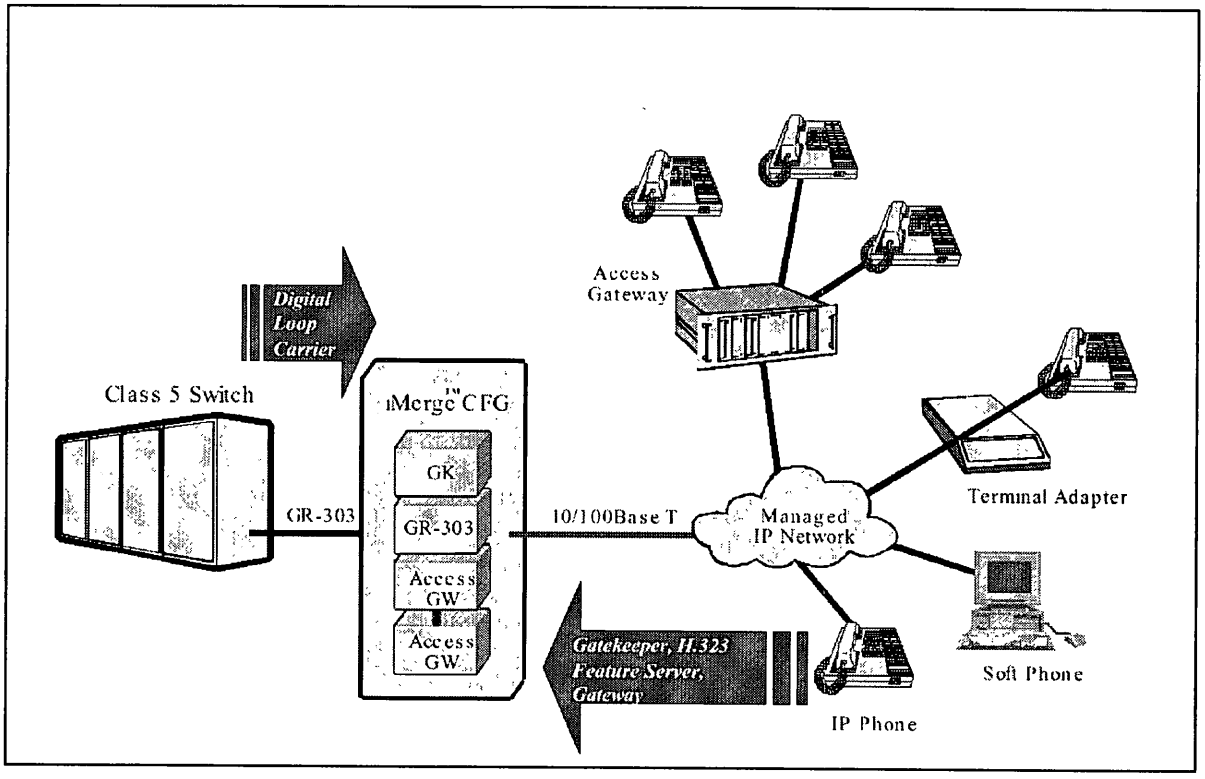

Figure 4. Lucent *i*Merge Remote Capability

Lucent is not the only firm that supplies a unit that permits traditional local switches to connect to remote loop terminations using an IP-based network—CopperCom, CableCom, General Bandwidth, Terayon, and others offer systems with similar capabilities.

3.3 New-Technology Voice Switches

Probably the most interesting switches for LECs are the switches built around data communications technologies. These systems can provide the same services as do traditional switches, but the new-technology switches do so in a quite different fashion. In traditional switches, a voice signal is represented as a stream of bits flowing at an even rate. The new-technology systems break a voice signal up into packets and send the packets over a packet-switching network—in same fashion that packets are used to carry web pages or radio broadcasts over the Internet.

The remote units described above illustrate one element of such network switching solutions. But, in those systems, the telephone calls are converted to packets at a gateway, carried back to a unit such as the Lucent *i*Merge over a packet network, converted by the IMerge box to a traditional telephone bit stream, and passed on to a traditional telephone switch for switching. But, of course, the middleman of the traditional switch is not necessary. The packetized voice signal could be sent over the data network directly to a second gateway connected to the telephone terminating the call or even to a telephone with built-in packet voice capabilities—an alternative sometimes called *pure IP telephony*.

Such a pure IP telephony arrangement might be useful inside an organization today, but most telephone calls must terminate on more traditional telephones—either analog wireline instruments or wireless phones. Thus, systems such as the *i*Merge and other forms of gateways between the analog telephones and the packet network will be needed for some time to come.

New-technology switches have been evolving over the last few years. One evolutionary path has been from telecommunications applications. Capability-limited, but low-cost switches, based on computers with cards that can connect the computer to T1 lines, were developed for applications such as international callback and office PBXs. Over time, the manufacturers have added additional capabilities, both hardware and software, to these systems. I believe that this path will ultimately turn out to be a dead end because of the likely success of the alternative approach described next.

A second evolutionary path grew from the Internet and data communications world. The original Arpanet/Internet researchers were always aware that telephone calls were one possible type of traffic that could go over the systems they were designing. The Department of Defense's Advanced Research Projects Agency (ARPA) sponsored research and experiments involving packet voice in the 1970s. Indeed, in 1978, Larry Roberts, now acknowledged as an Internet pioneer, wrote,

> In short, packet switching seems ideally suited to both voice and data transmissions. The transition to packet switching for the public data network has taken a decade, and still is not complete; many PTT's and carriers have not accepted its viability. Given the huge fixed investment in voice equipment in place today, the transition to voice switching may be

> considerably slower and more difficult. There is no way, however, to stop it from happening.[21]

Over the last few years, packet voice has moved from specialty market applications to moderately widespread use—widespread in the sense that there are millions of devices capable of generating packet voice installed, although not always carrying voice traffic. Packet voice, often called voice over internet protocol (VoIP), has become an object of intense research and product development. Last summer, the Office of Engineering and Technology (OET) sponsored a tutorial on this subject.[22] The speaker at that tutorial, Niel Ransom of Alcatel, described three trends for VoIP—first, bypassing the traditional telephone network; second, replacing the traditional telephone network; and third, enabling new applications.[23]

I believe that Roberts and Ransom are correct and that as VoIP and similar technologies evolve, they will supplant the traditional telephone network architecture.

3.4 New Technology Vendors and Products

The market for equipment capable of transmitting and switching voice over data networks is changing rapidly and is far from settled. Unlike the situation for traditional central office switches, there are dozens—perhaps hundreds—of suppliers fighting to define exactly what the products will be and to claim market share. A good discussion of the impact—or disruption as the author calls it—that the new technology switches will have on the switch manufacturing industry is given in Frank Ohrtman's master's thesis.[24] He identifies the "ability to scale down rather than up" to be "of great advantage in the converging market."[25] A recent study for investors reached much the same conclusion, saying,

> The deployments of Voice over Packet (VoP) technologies are quickly reaching an inflection point. The industry has moved from low-scale toll bypass deployments to large-scale competitive carrier deployments.

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21 "The Evolution of Packet Switching," by Lawrence G. Roberts, *Proceedings of the IEEE*, November 1978.

22 Available at http://www.fcc.gov/oet/tutorial/tutorial.html.

23 Ransom tutorial, slide 14.

24 Supra, note 1.

25 Ibid, p. 42.

> Within the next year, we expect to see large-scale deployment by incumbents worldwide.[26]

A comprehensive survey of the new-technology switch market would be far too large for this paper. The International Softswitch Consortium lists 141 members on their website. Several of those, such as Time Warner Telecom and Verizon, are carriers but most appear to be equipment manufacturers.

Below, I briefly discuss a few new-technology switch suppliers that together illustrate the nature of the industry. These firms are:

- Cisco,
- Nortel and Lucent,
- Sonus, and
- Telcordia.

Cisco is the giant of computer networking, with 38,000 employees and sales of about $20 billion per year. Cisco sells several products that permit voice communications over data networks including telephone instruments, gateways that convert analog voice signals into data packets, systems for controlling telephone call setup over data networks, and its traditional data switching and routing products.

Nortel has developed a softswitch that it offers as an alternative to its traditional switches. Qwest has used the Nortel switch to carry live ILEC traffic.[27]

Lucent's strength in the telecommunications industry is, of course, its traditional switching product line the 5ESS. However, Lucent also has a variety of new-technology voice communications products. To build its expertise in this area, Lucent acquired Ascend and Excel, two firms in the

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[26] See "The Metamorphosis of the Telephony Network," by Michael R. Brown and Stephanie Roscoe, RBC Capital Markets, December 10, 2001, at p. 1.

[27] See, "Nortel Networks Deploying Voice, Data Network for Qwest Using Internet Technology—Qwest First Local Carrier to Serve Customers Using Voice Over Packet Network Architecture," Nortel press release, October 11, 2001.

new-technology switch industry. The Ascend EXS switch is now the Lucent EXS switch. Lucent states,

> Lucent's new EXS® Converged Services Platform is an "any-gen" platform designed to seamlessly and cost-effectively bridge the gap between revenue-generating network services in today's Public Switched Telephone Network (PSTN) environment and packet-based network solutions of the future. From unified messaging and automatic speech recognition to web-initiated voice services and voice portal solutions, the EXS® Converged Services Platform is the ideal solution for your carrier-class needs.[28]

Previously, I described Lucent's *i*Merge product that extends the reach of a traditional switch over a data network.

Lucent is a significant competitor in the new-technology voice systems marketplace. Figure 5—taken from a recent Lucent presentation to investors—shows Lucent with the largest market share for universal port cards (cards that are installed in devices such as the EXS and that can support either telephone or data dial in—that is, they combine a voice digitizing function with a modem function).[29]

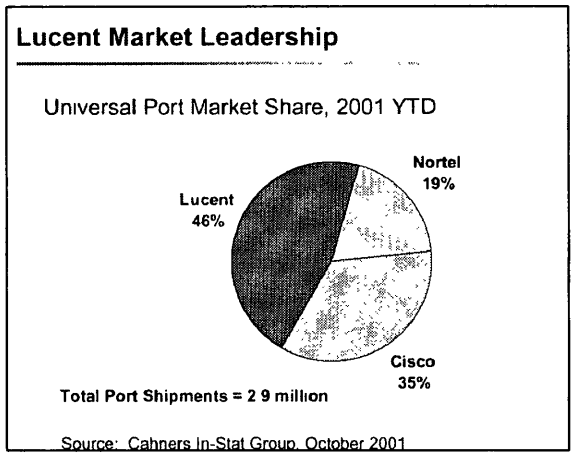

Figure 5. Universal Port Sales in 2001

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[28] http://www.lucent.com/products/solution/0,,CTID+2002-STID+10153-SOID+1022-LOCL+1,00.html

[29] Presentation by Joe Sigrist, Lucent, "Voice-over-Packet Solutions," CSFB Annual Technology Conference, November 2001, slide 15.

With respect to market share, Sonus lies at the opposite pole from Lucent. Sonus was founded in late 1998 and had its initial public offering at the end of May 2000. Yahoo reports that a diverse range of carriers, including BellSouth, Time Warner Telecom, Level 3, Touch America (Montana Power), Qwest, China Netcom, and Fusion Communications Corporation (Japan), use Sonus switches in their networks.[30] Sonus's newest product is the Insignus Softswitch. Sonus emphasizes that their product can be economically used for small installations. They claim:

> **Seamless Scalability**
>
> The Insignus Softswitch can scale from the smallest single Point of Presence (POP) to the largest global configuration. The Insignus Softswitch and appropriate gateways can be deployed as a one-rack next-generation local switch. However, each module can also work with multiple gateways or other softswitch elements, allowing you to optimize network operation by sharing resources.[31]

Telcordia (formerly Bellcore) is not a hardware manufacturer but is a major provider of software for ILECs. Telcordia has developed a software package for new-technology switching (Telcordia calls its product *Call Agent*) and Telcordia sells that software package to both carriers and equipment suppliers.

Like the other vendors, Telcordia makes strong claims for its product:

> **The Call Agent's features make it the most advanced softswitch in the industry.**
>
> The Call Agent provides primary line VoIP without the need for a Class 5 circuit switch. The Call Agent is a "softswitch" that works with our associate-provided IP or ATM gateways to perform call control functions and deliver revenue-generating services running over IP and ATM networks. In addition, the Call Agent is based on an open architecture that eliminates dependence on switch suppliers for new products, services, and proprietary software upgrades. Telcordia has engineered the Call Agent to include:
>
> **CLASS(sm) Features** - revenue-driving services such as Call Waiting, Caller ID, and Call Forwarding

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30 http://yahoo.marketguide.com, checked February 26, 2002.

31 "**Insignus ™ Softswitch** *An Open Services Architecture™ Component,"* Sonus Corporation brochure, 4 pages, 2002.

Regulatory Features - all the features necessary to become a licensed carrier, including 411, 911, Wiretap/Calea, and Telecommunications Relay Service (TRS)

Platform Features - features that support 24x7 operation of the Call Agent, including live system retrofits, live system growth, and overload detection (e.g., guaranteed 911 service); the Call Agent handles network congestion situations both with Automatic Congestion Control (ACC) procedures and alternate routing when trunk groups no longer have available trunks

Telcordia™ Accounting Gateway - a billing interface that converts IP billing records to the Automatic Message Accounting (AMA) format

Telcordia™ Announcement Server - a server that routes network announcements (e.g., "the phone line has been disconnected") to specified destinations

Highly Available Platform - the ability to run on commercially available computing platforms with an "n+1" redundancy scheme; it allows the Call Agent to handle thousands of simultaneous calls without ever going down

Scalability - the Call Agent brings next-generation call management to both small and large, single-site configurations as well as configurations that link Call Agent sites to networks of unlimited size

Network-Independent Architecture - its open architecture allows the Call Agent to function over virtually all access mediums and networks, including copper pair, fiber, Hybrid Fiber Coax (HFC), and IP and ATM networks.[32]

Telcordia's Call Agent runs on Sun computers, and Telcordia claims that Call Agent was the first product in its class to switch live traffic. Telcordia also states that Call Agent is being used by both cable companies and CLECs.[33]

4 Service Provider Solutions

Another important alternative supply of switching for LECs is to buy switching services from other carriers. As described previously, modern switches are flexible systems that can economically provide switching services to locations many hundreds of miles away. Thus, a carrier with a switch

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32 http://www.telcordia.com/products_services/networksystems/softswitch/description.html

33 http://www.telcordia.com/products_services/networksystems/softswitch/references.html

in Miami could provide switching services for a start-up carrier in Orlando as well as to other providers in Miami.

In fact, carriers do buy and sell switching services as a normal part of doing business. Some CLECs advertise that they offer wholesale services. For example, Grande Communications in Texas offers wholesale CLEC services. The table below, taken from their website, shows how Grande Communications promotes its wholesale services.[34]

> WHOLESALE CLEC
>
> Grande Networks provides telephony services that enable CLECs to compete against local telephone providers.
>
> Our core service consists of the following components:
>
> - Local Dial Tone and Long Distance Service
> - 911 Database Update
> - Telephone Number Assignment
> - Local Number Portability
> - Local Telephone Features
> - Directory Listing Services
> - Calling Card
> - National Directory Assistance .

Grande Communications website also contains a map showing the location of their switching centers—reproduced below as Figure 6.

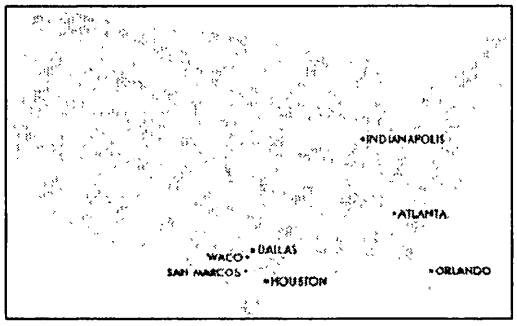

Figure 6. Grande Communications National Switching Network

Grande offers switching services to other carriers in Atlanta from the Grande switch in Atlanta—indeed, the Grande switch in Atlanta can provide service to carriers throughout the state of Georgia

and probably to some of the carriers in adjacent states. Grande says, "Grande's wholesale service division, Grande Networks, serves the integrated communications needs of other service providers and carriers by providing the underlying network products, services and professional support staff for carriers, ISPs, CLECs, VoIPs, ESPs and ASPs through Grande's ATM, voice and data switching platforms and SONET/fiber networks."[35]

KMCTelecom, also a CLEC, promotes its offering of port wholesale services that they call ClearPort.[36] KMCTelecom claims to actively market to CLECs.[37]

CLECs also actively search for wholesale switching suppliers. For example, the following message appeared on an Internet mailing list:

> I have a cable client with about 80,000 subs in various locations, with plant already largely configured for 2-way service that wants to explore using that plant as telephone loop plant. They are already doing this in at least one location so they know that it technically works.
>
> However, they don't want to buy their own switches for their various systems if they don't have to; instead, it seems to them (and to me) that a CLEC with a switch that has excess capacity should be interested in selling some of that capacity to my cable op client.
>
> States of particular interest: Georgia Alabama Florida Tennessee Louisiana Texas Oklahoma Wyoming
>
> Any CLECs out there who might want to make a few bucks on the side selling switching capacity, respond privately to me at <<address omitted>>[38]

Carrier hotels provide more evidence of such sales of switching capacity. Carrier hotels are locations where many carriers have located their switching and transmission facilities—thus permitting easy interconnection. Probably the most well-known carrier hotel in the industry is 60 Hudson Street in New York City—formerly the site of Western Union's headquarters. Switch and

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34 Source: http://www.grandecom.com/ProductsServices/wholesale_clec.jsp.

35 "Grande Communications Receives Franchises to Offer Bundled Internet, Phone and Cable Services in Four New Central Texas Cities," press release, Grande Communications, Austin, TX, November 29, 2001. http://www.grandecom.com/About/pressroom_release.jsp?PR_ID=_PR215.

36 See http://www.kmctelecom.com/services/carrierhotel.cfm.

37 See http://www.kmctelecom.com/investor/MSDW_files/frame.htm, slide 14.

Data, a firm in that market, actively promotes the benefits of capacity sales among the carriers located in its space, saying,

> As Switch and Data's locations populate, a marketplace forms that yields an instant synergy. We encourage business-to-business within our sites, and by assuring our customers that we won't compete with them, this marketplace becomes an important reason to do business with Switch and Data.[39]

According to BellSouth, CLECs continue to purchase unbundled switching when serving customers that meet the current FCC UNE switching carve-out criteria—evidence of a wholesale market for ILEC switching at market (i.e., not TELRIC) prices.

5 eBay

And, as with most other products, eBay is also a possible source. More generally, the used equipment market can supply products needed by a firm interested in small-scale entry. Below are two pages that I took off of eBay. The first is for a traditional Nortel DMS switch—which had not received any bids at the time I downloaded the page. The second is for a Cisco gateway device that can be used to connect analog telephones to an IP network. Not only is the Cisco unit cheaper and capable of supporting far fewer lines, but bidding has passed any reserve price.

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38 http://lists.robotics.net/archives/cleclist/1999-July/000445.html

39 http://www.switchanddata.com/products/marketplace.html

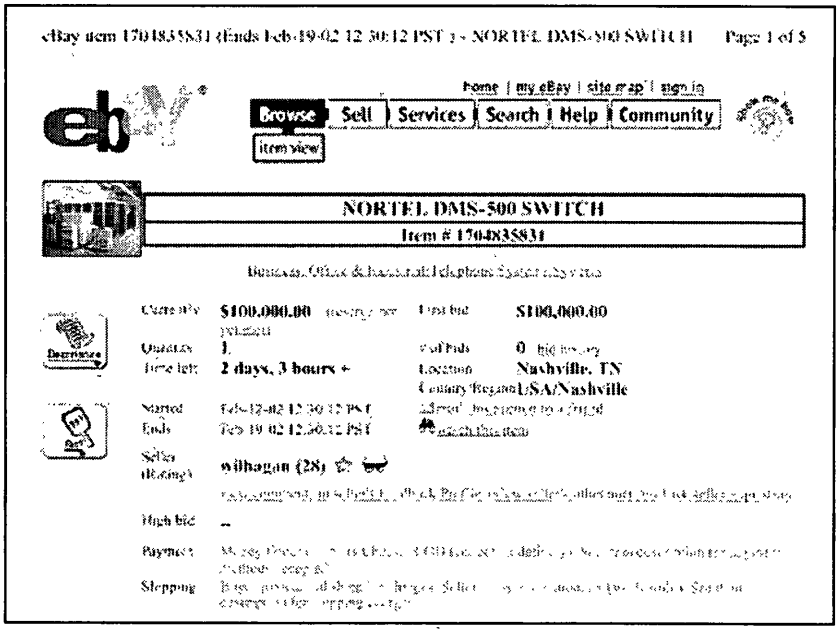

Figure 7. eBay auction of Nortel DMS 500.

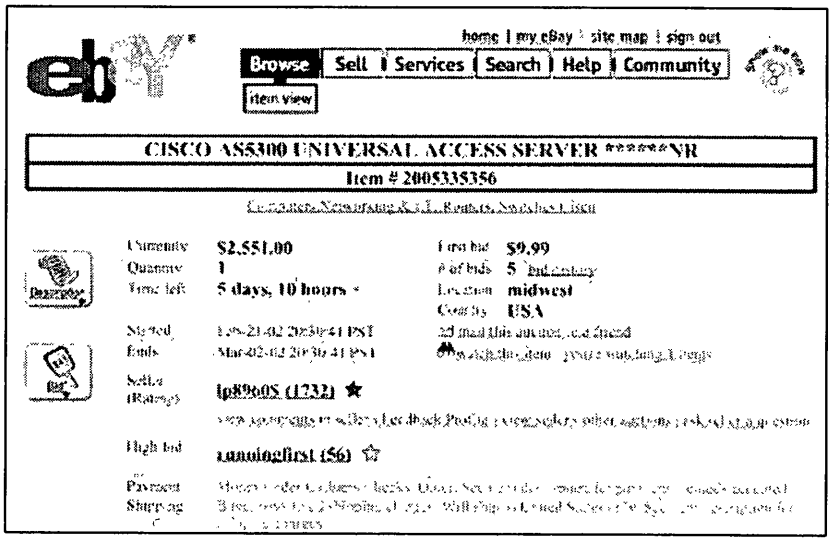

Figure 8. Cisco Gateway on eBay

These eBay examples are offered slightly tongue-in-cheek. But, the eBay offerings demonstrate an important truth: as wireless usage expands and other local alternatives substitute for traditional telephone lines, the ILECs will see a decline in the number of access lines they sell. In fact, ILECs

have already begun to report such declines. The Common Carrier Bureau's Industry Analysis Division reported that the number of ILEC switched access lines went from 179.8 million in June 2000 to 174.5 million in June 2001—a decline of 5.3 million lines. This decline frees up equipment, such as line-cards and other switch subassemblies, which the ILEC can resell. Of course, such sales by the ILECs will put downward pressure on the price of switching equipment generally, including the switching equipment available to CLECs.

6 Switching in Context

The 1996 Act requires the FCC to consider whether requesting carriers would be impaired without access to a particular network element. The FCC's UNE Remand Order set forth five criteria that the FCC would consider in determining that lack of access to a network element would impair a CLEC— cost, ubiquity, quality, timeliness, and operational impediments.[40] Without conceding that these criteria are properly employed in the impairment analysis, it is clear that, even if they are, CLECs are not impaired without unbundled access to ILEC switching.

Cost—both new-technology switches and backhaul arrangements are cost effective.

Ubiquity—backhaul is a ubiquitous option in the contiguous 48 states. Furthermore, the smaller minimum efficient scale of new-technology switches and the separation of switch functions in new-technology switches between gateway functions and call control functions also make a ubiquitous presence easier to achieve.

Timeliness—historically, the lead time for procurement of traditional switches has been fairly long. However, the lead time for backhaul arrangements should be short and the smaller, new-technology switches can be deployed quickly. Thus, timeliness should not be an issue with the alternatives to ILEC switching.

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[40] In the Matter of Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, Third Report and Order and Fourth Further Notice of Proposed Rulemaking in CC Docket 96-98, FCC 99-238, at para. 23.

Quality—backhaul to traditional switches will provide the same service features as those switches have always provided. The fact that established ILECs, such as Qwest, use new-technology switches to carry live traffic shows that such switches provide quality equivalent to that of traditional ILEC switches.[41]

Operational Impediments—using a switch owned and controlled by the CLEC would provide better operational control and flexibility. Such a switch can be integrated into the CLEC's operations support systems. The CLEC can reconfigure and upgrade such a switch on its own timetable.

In summary, examining the backhaul and new-technology switch options for CLECs in the context of the FCC's five criteria for impairment demonstrates that these two technological options meet the criteria. Further, the other alternatives that I have discussed, that is, the purchase of switching at market prices from ILECs or other CLECs, appear to meet all five of the FCC's aforementioned criteria based on the fact that some CLECs have elected to utilize these options in the provision of service to their customers.

7 Conclusions

CLECs have multiple alternative sources of supply for switching. Those alternatives are affordable, are available, and have the necessary technical features. These alternatives are not theoretical. CLECs are using both the old-technology and the new-technology switches. CLECs buy switching capacity from ILECs and from other CLECs.

Two important factors that expanded the supply of switching alternatives to CLECs are (1) the availability of switches with small minimum efficient scale and (2) the economic and technical feasibility of backhaul. A key feature of the new-technology switches is that they have been packaged for smaller scale firms—they are economically efficient at far smaller line counts than are

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[41] Indeed, unbundled access to an ILEC switch might well be access to a new-technology switch.

the old-technology switches. Backhaul and remote switching capabilities allow a switch to provide service in cities hundreds of miles away.

Given these facts, access to unbundled switching elements is not necessary to the operation of any CLEC with a reasonable business plan. Considering CLEC access to switching in the context of the FCC's five criteria for impairment—cost, ubiquity, quality, timeliness, and operational impediments—it is clear that the CLECs would not be impaired by being required to purchase switching in the marketplace.[42] The wireless and competitive long-distance industry did not have access to unbundled switching, but they grew relatively rapidly.

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[42] There is one possible exception to this conclusion: fiber networks do not extend everywhere, and my analysis may not apply as strongly outside the 48 contiguous states. Conditions in Alaska and some of the more isolated islands within the FCC's jurisdiction may be sufficiently different that backhaul is uneconomic, and thus, the support for my conclusion would be weaker in those situations.

Appendix A: Eastern Management Group Study

The EMG STUDY GOES HERE !

BELLSOUTH

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January 30, 2003

EX PARTE

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
The Portals
445 12th St. SW
Washington, D.C. 20554

Re: WC Docket 01-338

Dear Ms. Dortch:

On January 29, 2003, BellSouth met with William Maher, Jeffery Carlisle and Scott Bergmann of the Wireline Competition Bureau in reference to the proceeding identified above. Attending this meeting on behalf of BellSouth were Pete Martin, Lisa Brooks, Bob Blau, Jon Banks and Glenn Reynolds. The attached presentation was discussed during this meeting. In addition, BellSouth urged the staff not to modify the existing use restrictions in a manner that would result in detrimental impact to the existing competitive market for special access.

In accordance with Commission rules, I am filing copies of this notice and attachment and request that they be included in the record of the proceeding identified above.

Sincerely,

Glenn T. Reynolds

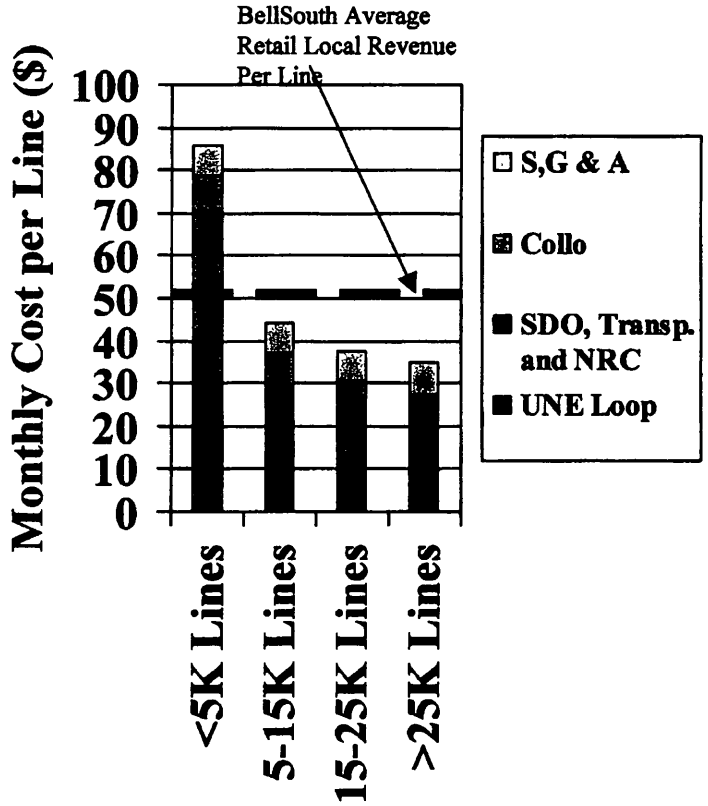
cc: William Maher
Jeffery Carlisle
Scott Bergman
Michelle Carey
Tom Navin
Jeremy Miller

CLECs NOT IMPAIRED IN USING UNE LOOPS TO COMPETE

BellSouth Corporation

January 29, 2003

WorldCom's Cost Model Shows That CLECs Are Not Impaired In Serving Wire Centers with > 5,000 Lines

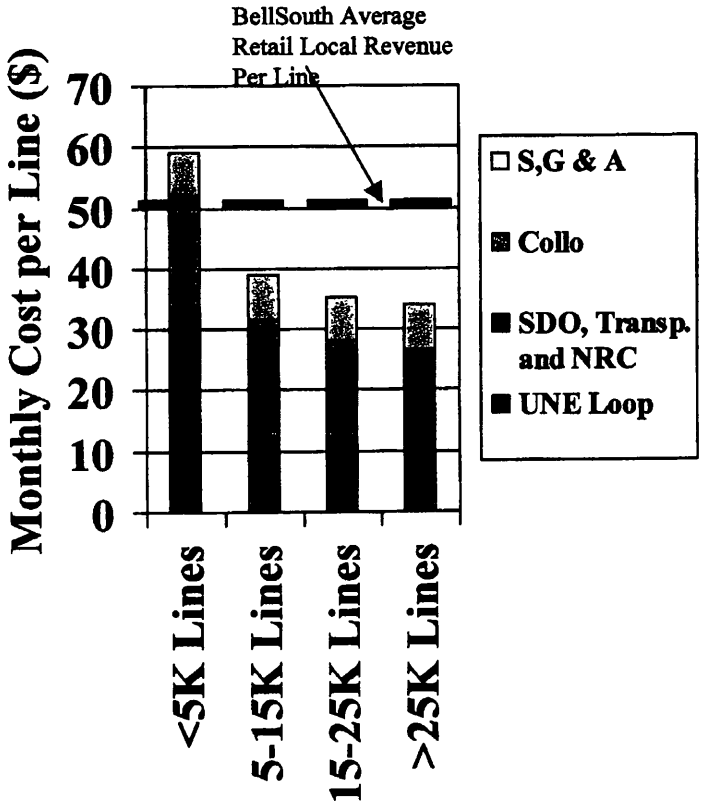


BellSouth's Scenario 1

- WorldCom's 1/08/03 ex parte used as the source for Collocation and "Switching, Digitizing and OSS" (SDO), Transport and Nonrecurring costs
- S,G&A cost taken from FCC Synthesis Model
- UNE Loop rate represents average rate for BST region
- Assumed an average of $50 average retail local revenue per line (which correlates with BellSouth actual revenues per line)

Key Point: Without UNE-P, CLECs can profitably serve wire centers with greater than 5000 lines based on WorldCom's own analysis

Correcting for WorldCom's Overstated Collocation Costs Makes the Case for No Impairment Even Stronger

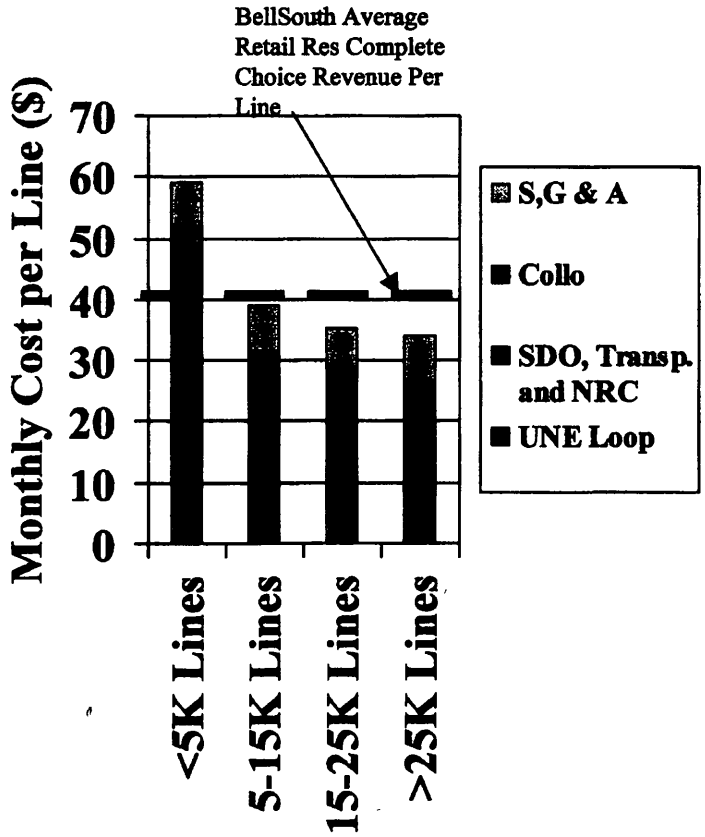


- WorldCom used collocation costs that are totally out of line with current rates
- Replacing WorldCom's overstated collocation costs with current actual collocation rates provides a more accurate picture of the margin available to facility based CLECs
- No changes made to WorldCom's calculation of SDO, transport and NRC costs

Key Point: Correcting for WorldCom's overstated collocation costs makes it even more apparent that CLECs can profitably serve wire centers with greater than 5000 lines

BellSouth's Scenario 2

View with Corrected Collocation Costs and Retail Residential Complete Choice Service

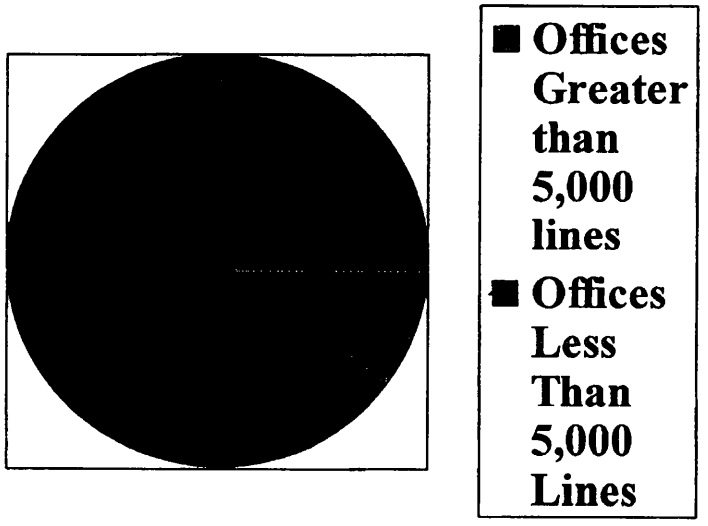


- Average Retail Revenue consists of Residence Complete Choice Service ($31.64), SLC ($6) and SWA ($3.92)
- WorldCom and AT&T are currently targeting high revenue residential customers as evidenced by their pricing plans

Key Point: CLECs can profitably serve residential customers in wire centers with greater than 5000 lines

BellSouth's Scenario 3

Most Wire Centers Located Outside of an MSA Have Less Than 5,000 Lines



Outside of an MSA Breakdown

- Within BellSouth's serving area, 65% of the wire centers located outside of an MSA have less than 5,000 lines. Within MSAs, 27% of wire centers have less than 5,000 lines.
- 44% of BellSouth's total wire centers have less than 5,000 total lines
- An initial trigger based on 5,000 total lines in the wire center would thus ensure that many "rural" areas continue to have UNE-P available.

Overview of Analysis Using WorldCom Cost Study

- WorldCom provided a cost study in its ex parte of January 8, 2003. BellSouth used the costs provided by WorldCom to determine whether a CLEC could profitably serve an area given those costs. BellSouth used WorldCom's costs for "Switching, Digitization and OSS" (SDO), Transport and Nonrecurring. BellSouth also used WorldCom's cost for collocation in Scenario 1.
- BellSouth used WorldCom's costs from its Case 2 analysis, with a 5% market-share. This was a conservative view, as use of higher market-share assumptions (WorldCom also modeled 7% and 10%) would lower the CLEC's cost per line.
- To the above costs, BellSouth added the cost of an average UNE loop. This cost is based on a weighted average from BellSouth's 9 state operating region. BellSouth then calculated an average revenue per line based on average business revenues per line and average revenue for BellSouth's Complete Choice residential customers (Complete Choice provides customers a combination of basic service and switch based vertical services). This number was rounded to $50.00 for use in Scenario 1. SBC provides additional documentation to support a $50.00 revenue figure in its 1/14/03 ex parte. The difference between cost and retail revenue per line provides the gross margin per line. BellSouth also added in Selling, General and Administrative costs (SG&A), taken from the FCC's Synthesis Model, to arrive at a net margin per line.
- BellSouth then corrected WorldCom's collocation costs to reflect current collocation rates (See Scenario 2). WorldCom apparently used overstated collocation costs in it original analysis. To correct the collocation costs, BellSouth used actual rates from its Georgia SGAT. Those calculations are shown in detail on the following pages. It should be noted that BellSouth made the conservative assumption that WorldCom would use caged collocation. If rates for cageless collocation were used, the collocation rates would be even lower.
- BellSouth then compared these costs to BellSouth's Average Residence Complete Choice revenue, (Scenario 3).

BellSouth's Analysis showing that CLECs can profitably serve customers in wire centers with > 5,000 lines

Scenarios 1 and 2

5% Market Share - WorldCom's Case 2: UNE - Avg Retail Local Revenue

Scenario 1	SDO *	Trans	NRC	Total SDO, Trans & NRC	Collo	UNE Loop	Total CLEC Cost	Avg Retail Local Rev **	Gross Margin	% Gross Margin	SG&A	Net Margin	% Net Margin	COs	Lines	Lines per CO	5% share
Lines >25k	$4.76	$0.85	$2.50	$8.11	$2.89	$16.61	$27.61	$50.00	$22.39	45%	$7.32	***$15.07***	***30%***	619	23,647,711	38,203	1,910
25K>Lines>15K	$5.14	$0.99	$2.50	$8.63	$5.16	$16.61	$30.40	$50.00	$19.60	39%	$7.32	***$12.28***	***25%***	490	9,604,473	19,601	980
15K>Lines>5K	$6 02	$1.36	$2.50	$9.88	$10.59	$16.61	$37.08	$50.00	$12.92	26%	$7.32	***$5.60***	***11%***	1,079	9,756,196	9,042	452
Lines<5K	$10.09	$2.86	$2.50	$15.45	$46.50	$16.61	$78.56	$50.00	-$28.56	-57%	$7.32	-$35.88	-72%	2,155	4,240,193	1,968	98

* Switching, digitization and OSS

** Approximation of BellSouth's average retail local revenue. Does not include revenues from long distance, memory call or inside wire. Supported by SBC's 1/14/03 ex parte.

5% Market Share - WorldCom's Case 2: UNE w/corrected collocation costs - Avg Retail Local Revenue

Scenario 2	SDO *	Trans	NRC	Total SDO, Trans & NRC	Correct-ed Collo	UNE Loop	Total CLEC Cost	Avg Retail Local Rev **	Gross Margin	% Gross Margin	SG&A	Net Margin	% Net Margin	COs	Lines	Lines per CO	5% share
Lines >25k	$4.76	$0.85	$2.50	$8.11	$1.97	$16.61	$26.69	$50.00	$23.31	47%	$7.32	***$15.99***	***32%***	619	23,647,711	38,203	1,910
25K>Lines>15K	$5.14	$0.99	$2.50	$8.63	$2.89	$16.61	$28.13	$50.00	$21.87	44%	$7.32	***$14.55***	***29%***	490	9,604,473	19,601	980
15K>Lines>5K	$6.02	$1.36	$2.50	$9.88	$5.11	$16.61	$31.60	$50.00	$18.40	37%	$7.32	***$11.08***	***22%***	1,079	9,756,196	9,042	452
Lines<5K	$10.09	$2.86	$2.50	$15.45	$19.87	$16.61	$51.93	$50.00	-$1.93	-4%	$7.32	-$9.25	-19%	2,155	4,240,193	1,968	98

* Switching, digitization and OSS

** Approximation of BellSouth's average retail local revenue. Does not include revenues from long distance, memory call or inside wire. Supported by SBC's 1/14/03 ex parte.

*** Corrected collocation costs based on GA SGAT rates

BellSouth's Analysis showing that CLECs can profitably serve residence customers in wire centers with > 5,000 lines

Scenarios 3 and 4

5% Market Share - WorldCom's Case 2: UNE w/corrected collocation costs - Res Complete Choice Revenue

Scenario 3	SDO *	Trans	NRC	Total SDO, Trans & NRC	Corrected Collo	UNE Loop	Total CLEC Cost	Res Comp Choice Rev **	Gross Margin	% Gross Margin	SG&A	Net Margin	% Net Margin	COs	Lines	Lines per CO	5% share
Lines >25k	$4.76	$0.85	$2.50	$8.11	$1.97	$16.61	$26.69	$41.56	$14.87	36%	$7.32	***$7.55***	***18%***	619	23,647,711	38,203	1,910
25K>Lines>15K	$5 14	$0.99	$2.50	$8.63	$2.89	$16.61	$28.13	$41.56	$13.43	32%	$7.32	***$6.11***	***15%***	490	9,604,473	19,601	980
15K>Lines>5K	$6.02	$1.36	$2.50	$9.88	$5.11	$16.61	$31.60	$41.56	$9.96	24%	$7.32	***$2.64***	***6%***	1,079	9,756,196	9,042	452
Lines<5K	$10.09	$2.86	$2.50	$15.45	$19.87	$16.61	$51.93	$41.56	-$10.37	-25%	$7.32	-$17.69	-43%	2,155	4,240,193	1,968	98

* Switching, digitization and OSS

** Average of BellSouth's Residential Complete Choice rates across the nine states. Also includes Subscriber Line Charge of $6.00 and average SWA revenue of $3.92 per line. Does not include revenues from long distance, memory call or inside wire.

**** Corrected collocation costs based on GA SGAT rates

Calculation of Collocation Costs Based on Actual Rates

Collocation					
	Georgia - SGAT				
	NRC	Recurring			
Space Availability Report	$2,148 00	$0.00			
Application Fee per Collo (initial)	$3,850.00	$0.00			
Space preparation - firm order processing	$1,187.00	$0.00			
Space preparation - CO mod per sq ft	$0.00	$2.02			
Space preparation - Common Sys mod per cage	$0 00	$95.23			
Cable records, per request	$1,706.00	$0.00			
Cable installation, per cable	$2,750.00	$0.00			
Cable support structure, per entrance cable	$0.00	$13.35			
Floor Space per sq ft	$0.00	$7.50			
Power, per Fused Amp	$0.00	$8.06			
Welded Wire Cage - First 100 sq ft	$0.00	$161.27			
Welded Wire Cage - Each additional 50 sq ft	$0.00	$15.82			
Security System per sq ft	$0.00	$0.0172			
Security Access System per card	$46.20	$0.0607			
Collocation Build-out	$16,281.80				
Monthly Recurring Charges		$1,720.76			
Assumptions:					
Amps used		60			
Square Feet		100			
Security Cards		4			
Requests for Cable Records		2			
Cable Support Structures		2			
Nonrecurring Charge per 2-Wire Cross Connect	$12.60				
Monthly Recurring Charge per 2-Wire Cross Connect		$0.30			
Case 2: UNEs and 5% market share	Avg Lines in CO per MCI	5% share of avg lines in CO			
Lines>25k	38,203	1,910			
25k>Lines>15k	19,601	980			
15k>Lines>5k	9,042	452			
Lines<5k	1,968	98			
Case 2: UNEs and 5% market share	Collo NRC per line *	Collo Recurring per line	2-W cross connect NRC per line **	2-W cross connect Recurring per line	**Collo Total per line**
Lines>25k	$0.07	$0.90	$0.70	$0.30	**$1.97**
25k>Lines>15k	$0.14	$1.76	$0.70	$0.30	**$2.89**
15k>Lines>5k	$0.30	$3.81	$0.70	$0.30	**$5.11**
Lines<5k	$1.38	$17.49	$0.70	$0.30	**$19.87**
* Collocation Build-out costs amortized over 10 years and divided by 5% share of lines in CO					
** 2-W Cross Connect NRC amortized over 18 months customer life					

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General Attorney

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January 30, 2003

CC 01-338
CC 96-98
CC 98-147

EX PARTE

Ms Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Dear Ms. Dortch:

On January 30, 2003, Herschel Abbott sent the attached letter to Commissioner Kevin Martin. The letter provides information on competition to provide Internet access services to businesses and discusses the ability of CLBC's to compete using UNE Loops.

I am filing this notice in the dockets identified above, as required by Section 1.1206(b)(2) of the Commission's rules, and request that you associate this notice with the record of those proceedings.

Sincerely,

Jon Banks

Attachment
Cc: Christopher Libertelli
Matt Brill
Jordan Goldstein
Lisa Zaina
Rich Lerner
Bill Maher
Jeffrey Carlisle
Scott Bergman
Michelle Carey
Tom Navin

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Suite 900
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herschel.abbott@bellsouth.com

Herschel L. Abbott, Jr.
Vice President -
Governmental Affairs

202 463 4101
Fax 202 463 4141

Dear Commissioner Martin:

This letter supplies the additional information we promised to provide you during our recent meeting. This information relates to competition and market shares in supplying Internet access to businesses and to the average revenues used in our analysis of UNE loop-based competition.

Business Internet Access Services

There are many firms that compete to provide Internet access services to business customers. The attached chart provides shares as of 2001. The principal supplier of that service is WorldCom. The Bell companies have relatively small shares.

Cable companies have also entered into this market, and are concentrating principally on smaller businesses. In general, while measuring competition in the provision of high-speed data services to smaller businesses has proven difficult, at least one market research firm has concluded that cable has enjoyed considerable success at providing a truly facilties-based competitor. A second chart that depicts those results is attached.

Revenue Data

Earlier this month, WorldCom filed its view of the costs of competing for residential customers using UNE loops instead of the UNE-Platform.[1] WorldCom calculated the monthly cost of serving customers using UNE loops, and broke down the results of its cost modeling by wire center size.[2] BellSouth has taken WorldCom's per-line cost analysis and compared it to revenues per line. This common sense comparison shows that CLECs would not suffer any meaningful overall economic impairment in moving

[1] Letter from Gil Strobel, Lawler, Metzger & Milkman, LLC, to Marlene H. Dortch, Secretary, FCC, January 8, 2003

[2] WorldCom then compared this cost calculation to the TELRIC costs of using the UNE-P to serve customers. WorldCom's suggestion that the Commission calculate impairment by focusing solely on whether a CLEC's costs may exceed purely hypothetical TELRIC costs cannot provide the basis for any real world finding of impairment.

BellSouth package of local service and features called Complete Choice. The revenue included access and subscriber line charges.[4]

BellSouth believes that the $50 figure is the most appropriate revenue figure to use. Including business revenues is correct because when a competitor analyzes whether to compete for customers served out of a particular wire center, it would not ignore the revenue opportunity provided by high margin business customers. In particular, once a carrier deploys its own facility it makes no economic sense not to go after every customer that can be served profitably from that facility (let alone the most profitable ones) in order to maximize the utilization of that facility. All the market evidence to-date is that CLECs focus on winning business customers, not ignoring them, and that they have been very successful at winning these high margin customers.

In addition to being economically irrational, excluding revenues from business customers in any assessment of possible economic impairment would likely run afoul of the D.C. Circuit's USTA decision. As the court pointed out, much residential service (the court cites support for 40%) is provided by incumbents at prices below the costs of providing service. Higher margin business customers traditionally support the provision of service to these customers. Because CLECs have no duty to provide "underpriced service to rural and/or residential customers," and '[c]ompetitors will presumably not be drawn to markets where customers are already charged below cost" an impairment finding built on residential revenues of customers that CLECs have not and will not serve would be very unlikely to pass muster with the court. *USTA v. FCC*, 290 F.3d 415, 422-23 (D.C. Cir. 2002).

BellSouth's analysis already includes revenues from residential customers that purchase local service bundled with features. Out of the broad universe of residential customers, CLECs have focused on this subset. WorldCom currently offers residential service bundles that range in price from about $50 to about $70 per month plus a $6.00 subscriber line charge.[5] The average revenue from customers that purchase BellSouth's Complete Choice package of local service and features is $41.56.[6]

The three attached charts summarize BellSouth's analysis. The first accepts WorldCom's calculation of the costs of competing using UNE loops, and adds in the average cost of a UNE loop in BellSouth's region and SG&A costs from the FCC's Synthesis Model. Those costs are compared against BellSouth's average revenue from business customers and residential customers that purchase the Complete Choice bundle of local service and features. WorldCom's price for its bundle of local service is substantially higher. Even accepting WorldCom's bloated cost calculations, only in wire centers with fewer than 5,000 lines do costs exceed revenues.

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[4] Id. at p.#21.

[5] See www.theneighborhood.com.

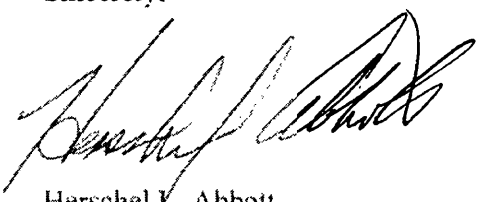
[6] This figure includes Complete Choice revenue plus a $6.00 subscriber line charge and average switched access revenue of $3.92.

The second attached chart corrects some basic errors in WorldCom's calculation of physical collocation costs. At least by comparison to collocation costs assessed by Bell South, WorldCom's calculation, far overstates the actual cost of physical collocation.[7] It also ignores the various other options open to CLECs, including shared and virtual collocation. The second chart displays a more accurate picture of costs. This chart further underscores the absence of any economic impairment in wire centers with more than 5,000 lines.

The third chart compares WorldCom's costs corrected to reflect realistic actual collocation costs against the average revenue BellSouth receives from residential customers that purchase a bundledof service and features. I emphasize that BellSouth does not believe that using purely residential revenues provides an appropriate basis for comparison. WorldCom, for instance, is a very successful competitor for business lines and revenues in BellSouth's region. As noted above, it would be economically irrational to decline serving high-margin business customers from a collocated switch once it is deployed by a CLEC. Ignoring the revenues from these customers, and the fact that the costs WorldCom has calculated for collocation, switching, digitizing and OSS would be (and are already) spread over these business customers as well as residential customers would produce a nonsensical analysis.

We appreciate your attention and would be happy to answer any questions on the attached materials.

Sincerely.



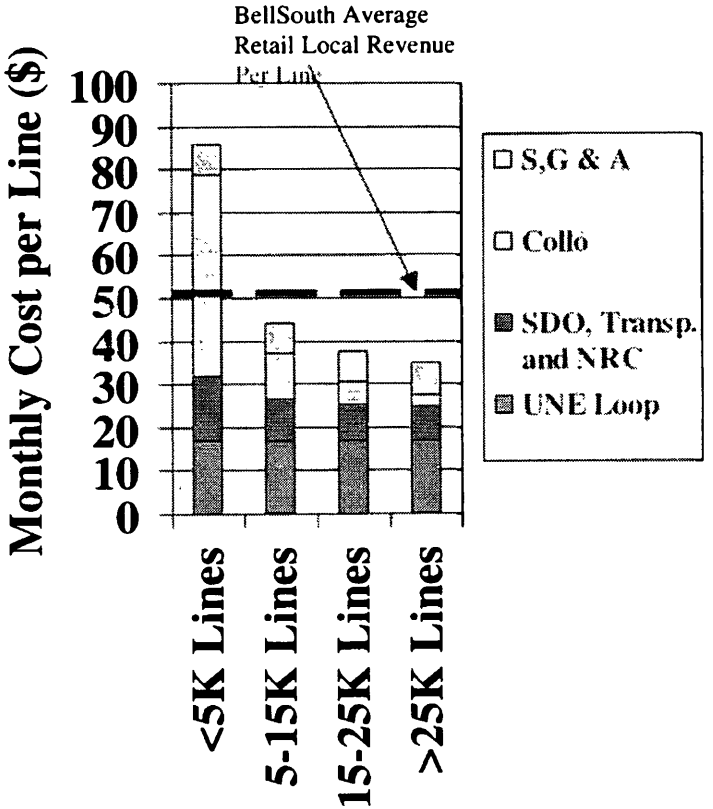
Herschel L. Abbott

Attachments

Cc: Dan Gonzales

[7] The backup for BellSouth's calculation of actual physical collocation costs based on current rates in BellSouth's Statement of Generally Available Terms and Conditions is attached.

WorldCom's Cost Model Shows That CLECs Are Not Impaired In Serving Wire Centers with > 5,000 Lines

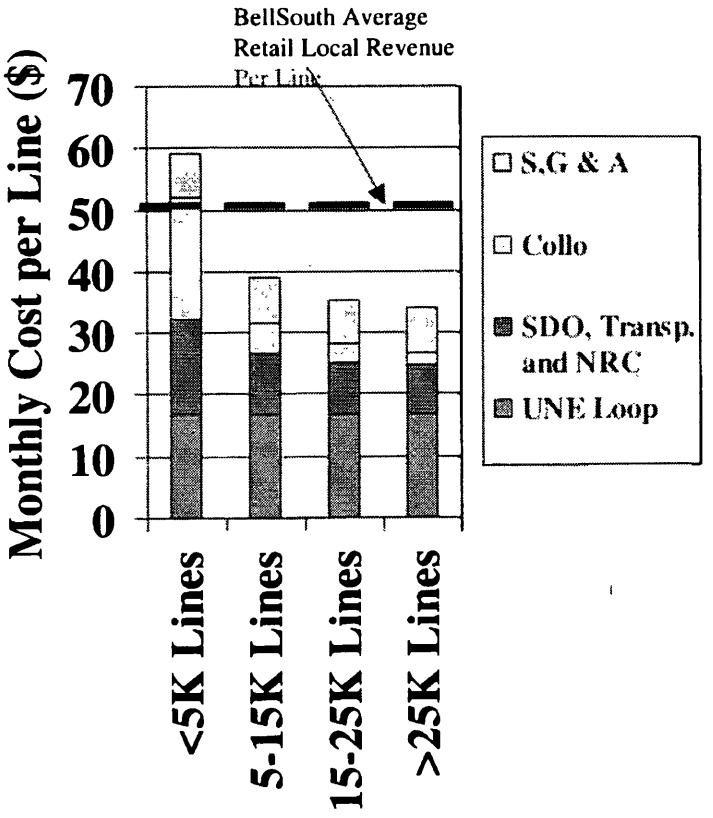


BellSouth's Scenario 1

- WorldCom's 1/08/03 ex parte used as the source for Collocation and "Switching, Digitizing and OSS" (SDO), Transport and Nonrecurring costs
- S,G&A cost taken from FCC Synthesis Model
- UNE Loop rate represents average rate for BST region
- Assumed an average of $50 average retail local revenue per line (which correlates with BellSouth actual revenues per line)

Key Point: Without UNE-P, CLECs can profitably serve wire centers with greater than 5000 lines based on WorldCom's own analysis

Correcting for WorldCom's Overstated Collocation Costs Makes the Case for No Impairment Even Stronger

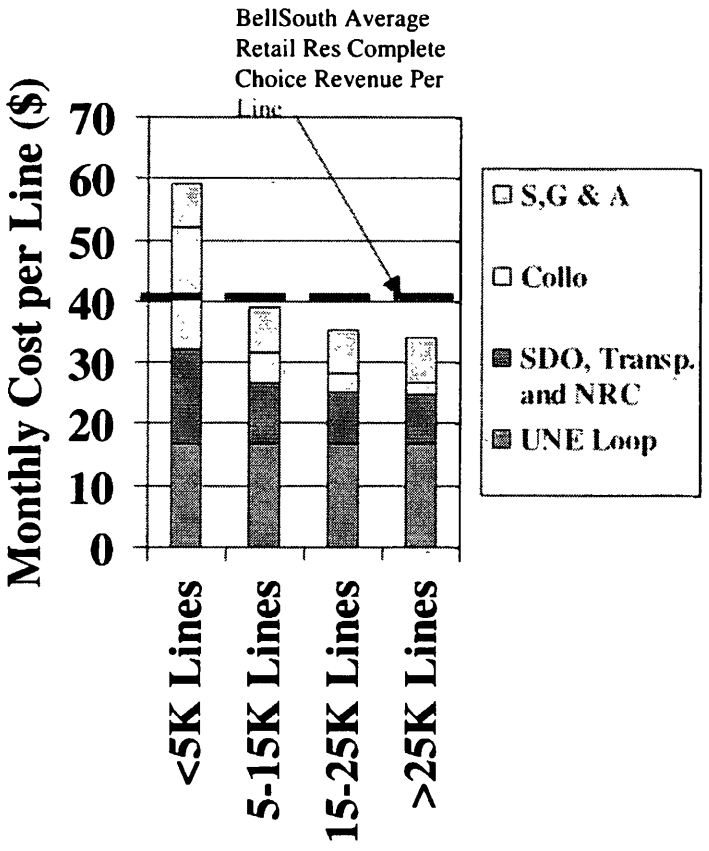


BellSouth's Scenario 2

- WorldCom used collocation costs that are totally out of line with current rates
- Replacing WorldCom's overstated collocation costs with current actual collocation rates provides a more accurate picture of the margin available to facility based CLECs
- No changes made to WorldCom's calculation of SDO, transport and NRC costs

Key Point: Correcting for WorldCom's overstated collocation costs makes it even more apparent that CLECs can profitably serve wire centers with greater than 5000 lines

View with Corrected Collocation Costs and Retail Residential Complete Choice Service



- Average Retail Revenue consists of Residence Complete Choice Service ($31.64), SLC ($6) and SWA ($3.92)
- WorldCom and AT&T are currently targeting high revenue residential customers as evidenced by their pricing plans

Key Point: CLECs can profitably serve residential customers in wire centers with greater than 5000 lines

BellSouth's Scenario 3

Calculation of Collocation Costs Based on Actual Rates

Collocation

	Georgia - SGAT	
	NRC	Recurring
Space Availability Report	$2,148.00	$0.00
Application Fee per Collo (initial)	$3,850.00	$0.00
Space preparation - firm order processing	$1,187.00	$0.00
Space preparation - CO mod per sq ft	$0.00	$2.02
Space preparation - Common Sys mod per cage	$0.00	$95.23
Cable records, per request	$1,706.00	$0.00
Cable installation, per cable	$2,750.00	$0.00
Cable support structure, per entrance cable	$0.00	$13.35
Floor Space per sq ft	$0.00	$7.50
Power, per Fused Amp	$0.00	$8.06
Welded Wire Cage - First 100 sq ft	$0.00	$161.27
Welded Wire Cage - Each additional 50 sq ft	$0.00	$15.82
Security System per sq ft	$0.00	$0.0172
Security Access System per card	$46.20	$0.0607

Collocation Build-out	$16,281.80	
Monthly Recurring Charges		$1,720.76

Assumptions:

Amps used	60
Square Feet	100
Security Cards	4
Requests for Cable Records	2
Cable Support Structures	2

Nonrecurring Charge per 2-Wire Cross Connect	$12.60	
Monthly Recurring Charge per 2-Wire Cross Connect		$0.30

Case 2: UNEs and 5% market share	Avg Lines in CO per MCI	5% share of avg lines in CO
Lines>25k	38,203	1,910
25k>Lines>15k	19,601	980
15k>Lines>5k	9,042	452
Lines<5k	1,968	98

Case 2: UNEs and 5% market share	Collo NRC per line *	Collo Recurring per line	2-W cross connect NRC per line **	2-W cross connect Recurring per line	**Collo Total per line**
Lines>25k	$0.07	$0.90	$0.70	$0.30	**$1.97**
25k>Lines>15k	$0.14	$1.76	$0.70	$0.30	**$2.89**
15k>Lines>5k	$0.30	$3.81	$0.70	$0.30	**$5.11**
Lines<5k	$1.38	$17.49	$0.70	$0.30	**$19.87**

* Collocation Build-out costs amortized over 10 years and divided by 5% share of lines in CO

** 2-W Cross Connect NRC amortized over 18 months customer life

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February 6, 2003

William F. Maher, Chief, Wireline Competition Bureau
Federal Communications Commission
The Portals, 445 12th Street, SW
Room TW-A325
Washington, DC 20554

EX PARTE

Re: CC Docket No. 01-338
Critique of WorldCom "MiCRA Model"

Dear Mr. Maher:

BellSouth is filing this letter in response to WorldCom's filing of January 23, 2003, wherein WorldCom purported to address "SBC's and BellSouth's critiques of MiCRA's model and WorldCom's cost-based impairment analysis."[1]

Costs versus Revenue

WorldCom contends that recent filings by WorldCom, SBC and AT&T "all show that competing carriers using UNE-L to serve residential customers have higher costs than incumbent LECs." WorldCom provides no support for this contention. Indeed, none of the filings referenced by WorldCom even attempt to set forth the actual costs that an ILEC incurs to serve residential customers. According to WorldCom's *ex parte*, "MiCRA used UNE-P rates as a surrogate for the ILEC's costs to serving their retail customers." Of course, UNE-P rates cannot be used as a representation of the ILECs' actual cost of providing service. At best, UNE-P rates represent the costs associated with a forward-looking, most efficient, hypothetical network. At worst, UNE-P rates do not even cover the costs of this hypothetical network, much less an actual network, due to the downward adjustments made by the state commissions.

[1] Letter from Ruth Milkman, Counsel for Worldcom, to Marlene H. Dortch, Secretary, Federal Communications Commission (Jan. 23, 2003).

BellSouth's recent *ex parte* demonstrates that, based on WorldCom's own analysis, CLECs can profitably serve both residential and business customers in wire centers with greater than 5,000 total lines.[2] Of course, as BellSouth discussed in its presentations, the appropriate comparison is cost to potential revenue, not cost to UNE-P rate. That is, the margin between the cost of providing local service and the revenue available to the CLEC determines whether a CLEC can economically enter a market to provide local service.

In its January 23, 2002 written *ex parte* submission WorldCom includes a slide entitled "Costs, not Margins, Are Relevant to Impairment Analysis," that juxtaposes *dicta* from *USTA v. FCC*[3] to suggest that an analysis of margins is inappropriate both as a matter of fact and as a matter of law.[4] If this is what WorldCom intended to convey, it is simply incorrect on both counts. In the first case, Professor Shelanski has already demonstrated why it is relevant in an impairment analysis to consider whether, under current retail rates, UNE-L would provide positive margins for CLECs.[5] WorldCom, in its "Costs, not Margins" slide, continues to argue that incumbents are in a position to "lower retail prices because it has lower costs" and that they "face the real risk of price cuts by incumbents whose costs are much lower than theirs."[6] However, these unsupported statements do not answer the critique of Professor Shelanski:

> WorldCom devotes much of its analysis to arguing that UNE-L would impose higher costs than UNE-P on CLECs. Only by the circular logic of equating UNE-P with ILEC costs, and moreover by ignoring actual empirical evidence of entry by means other than UNE-P, does that comparison possibly say anything about competitive impairment. WorldCom never undertakes another calculation that would be useful to making competitive predictions: whether, under current retail rates, UNE-L would provide positive margins for CLECs. WorldCom's implicit answer is that current retail rates do not matter because the ILEC will use its alleged cost advantage to lower retail prices. But even if one assumes a material cost disparity to exist, one cannot simply assume the real-world feasibility of downward pricing by the ILECs, especially in the residential context to which WorldCom restricts its analysis. Indeed, such assumptions of downward pricing responses are particularly unwarranted where they are based on a TELRIC proxy that likely understates ILEC costs and therefore overstates the margins available to be decreased.[7]

Nor can the *dicta* excerpted out of context from the *USTA* case in any way be construed to support WorldCom's assertions as a matter of law. The statement was merely a generalization that the Court of Appeals used to begin its discussion of the "kinds of cost disparities" that are appropriate for a section 251 impairment analysis in light of the U. S. Supreme Court's vacating

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2 Letter from Robert T. Blau to Marlene H. Dortch (Jan. 17, 2003).

3 290 F.3d 415 (D.C. Cir. 2002) ("*USTA*").

4 WorldCom *ex parte, supra* n.1 at 3.

5 *See* Letter from Howard A. Shelanski, submitted with SBC memorandum of *ex parte* communication (Jan. 14, 2003) ("Shelanski Rebuttal").

6 *Supra,* n.4.

7 Shelanski Rebuttal at 4.

the Commission's first set unbundling for use of an overbroad impairment standard based on cost assumptions that were inconsistent with the statute,[8] and the Commission's subsequent promulgation of a new set of rules that were again alleged to be unsupported by a cost analysis consistent with the statute. The Court of Appeals went on to observe that the Commission's second set of unbundling rules relied on cost assumptions that "are universal as between new entrants and incumbents" and that ignored the "costs" associated with unbundling – including "the disincentive to invest in innovation and creating complex issues of managing shared facilities."[9] Rhetorically, after conducting its analysis, the court concluded where it started – while, "[of] course, any cognizable 'impairment' would necessarily be traceable to some kind of disparity in cost,"[10] the "Commission's concept of 'impairing' cost disparities [in the *UNE Remand Order*] is so broad and unrooted in any analysis of the competing values at stake in implementation of the Act" [11] that the Court was unable to uphold any of the UNE mandates.

WorldCom's use of this language from *USTA* cannot properly be construed to demonstrate that that case stands for the proposition, as a matter of law, margins are irrelevant in an impairment analysis. Indeed, in the context of its discussion about costs in its decision vacating the Commission's first set of unbundling mandates, the United States Supreme Court specifically addressed profits:

> An entrant whose anticipated annual profits from the proposed service are reduced from 100%of investment to 99% of investment has perhaps been "impaired" in its ability to amass earnings, but it has not *ipso facto* been "impaired . . . in its ability to provide the services it seeks to offer"; and it cannot realistically be said that the network enabling it to raise its profits to 100% is "necessary."[12]

Margins are highly relevant in a statutorily grounded impairment analysis, indeed, as Professor Shelanski explains, it is only by using "the circular logic of equating UNE-P with ILEC costs, and moreover by ignoring actual empirical evidence of entry by means of entry other than UNE-P," assumptions that have been clearly rejected by the United States Supreme Court,[13] that WorldCom "possibly" says "anything about competitive impairment."[14] But even based on a shaky and illegal foundation, this only gets WorldCom to a starting point – cost disparities may exist as between ILECs and CLECs. WorldCom never shows why these are not the "kinds of cost disparities" that are "faced by virtually any new entrant in any sector of the economy, no

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8 *AT&T v. Iowa Utils. Bd.*, 525 U.S. 366, 389-92 (1999).

9 *USTA*, 290 F.3d at 427.

10 *Id.* at 426.

11 *Id.* at 428.

12 *Iowa Utils. Bd.*, 525 U.S. at 390 (Scalia, J., expressly disagreeing with Justice Souter's contention that "a business can be impaired in its *ability* to provide services – even impaired in that ability "in an ordinary, weak sense of impairment," . . . when the business receives a handsome profit but is denied an even handsomer one")(emphasis in original).

13 *Id.* at 389-92 (vacating unbundling rules for failure to consider availability of elements outside the incumbent's network).

14 Shelanski Rebuttal at 4.

matter how competitive the sector."[15] The fact that the Court of Appeals acknowledged that "any cognizable competitive 'impairment'" is necessarily "traceable to some kind of disparity in cost" does not meant that whenever WorldCom alleges the existence of cost disparities it has thus, in the words of the Supreme Court, "*ipso facto* been 'impaired . . . in its ability to provide the services it seeks to offer.'"[16]

WorldCom's Estimation of Costs

With regard to OSS,[17] Transport and Digitization costs, although BellSouth does not necessarily endorse WorldCom's estimated costs, in order to simplify the analysis, BellSouth assumed those costs in its analysis. WorldCom points out that SBC's analysis assumed virtual collocation, which is less expensive than physical collocation. BellSouth's analysis assumed physical collocation; however, it assumed actual rates that would be charged to any CLEC requesting physical caged collocation in Georgia.[18] BellSouth's January 15 -17 *ex parte* presentations included information showing how the collocation costs were calculated. Assuming that WorldCom requested every possible element associated with obtaining physical collocation, the nonrecurring charges would be approximately $17,000 (substantially less than the $120,000 price assumed by WorldCom) and the monthly recurring charges would be approximately $1,700 (compared to WorldCom's estimate of $2,500 per month).

BellSouth's analysis used WorldCom's cost estimations for each element except collocation. BellSouth also included an estimate of overhead expenses and an average cost for the UNE-L. It is clear from BellSouth's analysis that, when costs are appropriately compared to revenue, CLECs can economically serve customers in wire centers with more than 5,000 total lines.

Unbundled Loop Provisioning and Hot Cuts

BellSouth's processes and performance related to UNE-L provisioning and hot cuts are reliable. Indeed, data that BellSouth provided in its December 23, 2002, *ex parte* presentation shows excellent performance.[19] In addition, the state commissions in BellSouth's serving area have established a broad set of loop provisioning measures and standards, including meaningful penalties. Due to the availability of the UNE-P, BellSouth is not currently provisioning tens of thousands of UNE-Ls each month. Prior to the ramp-up of UNE-Ps, however, BellSouth provisioned approximately 734,000 UNE-Ls. BellSouth has reviewed its processes and its current workforce and has determined that it can successfully meet significantly increased

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15 *USTA*, 290 F.3d at 426.

16 *Iowa Utilities Board*, 525 U.S. at 390.

17 WorldCom laments yet again that it has not built OSS for UNE-L. Of course, unlike many other CLECs, WorldCom chose not to compete in the local residential market until UNE-P was available. Obviously, other CLECs built OSS for UNE-L, and certainly WorldCom can do so in order to purchase unbundled loops.

18 Collocation rates in Georgia are among the highest in BellSouth's region.

19 Letter from Robert T. Blau to Marlene H. Dortch, (Dec. 24, 2002).

demand for UNE-Ls. All of the factual evidence in the record of this proceeding demonstrates that ILECs have met every challenge to date in providing exceedingly high-performance on hot cuts and that they have the capability to do so on an increased scale, as necessary. On the other side of the coin, there is simply nothing in the voluminous record of this proceeding – other than conjecture – to support the allegations that ILECs could not meet anticipated demand.

Collocation Intervals

In its January 8, 2003, *ex parte*, WorldCom stated that "obtaining the collocation space, constructing the cage and making sure the collocation is ready to accept new lines will take about 14 months." In its January 23, 2003, *ex parte*, on page 7 under the heading Collocation Interval, WorldCom cryptically stated that the "[t]imeframe for SBC would be four months assuming leased transport." It is not clear whether WorldCom is now contending that collocation intervals are 4 months rather than 14 months. Nonetheless, BellSouth consistently meets intervals of 3 months for new sites and 2 months for augments to existing sites.

Conclusion

In its January 23, 2003, *ex parte*, WorldCom does not provide any meaningful response to BellSouth's correction of WorldCom's flawed analysis presented in WorldCom's January 8, 2003, *ex parte*. WorldCom contends that margins are not relevant to the impairment analysis; however, as explained above, WorldCom is incorrect. Rather, it is any comparison of CLEC costs with rates set by state commissions based upon – or more typically, below – a hypothetical TELRIC network that simply has no economic basis. Once that point is understood, WorldCom's analysis simply affirms BellSouth's position that CLECs are not "impaired," within the meaning of the statute, without access to local switching on an unbundled basis in wire centers with greater than 5,000 total lines.

Sincerely,

Glenn T. Reynolds

cc: Christopher Libertelli
Matthew Brill
Jordan Goldstein
Dan Gonzalez
Lisa Zaina
Jeffrey Carlisle
Scott Bergmann
Michelle Carey
Thomas Navin
Brent Olson
Tamara Preiss

CERTIFICATE OF SERVICE

I hereby certify that on December 4, 2003, a copy of the foregoing document was served on the parties of record, via the method indicated:

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