COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

Review of the Federal Communications	**)**	
Commission's Triennial Review Order	**)**	**Case No. 2003-00379**
Regarding Unbundling Requirements	**)**	
for individual Network Elements	**)**	

DIRECT TESTIMONY OF JAY M. BRADBURY

ON BEHALF OF

AT&T COMMUNICATIONS OF THE SOUTH CENTRAL STATES, LLC

FEBRUARY 11, 2004

I. WITNESS QUALIFICATION AND INTRODUCTION

Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS AND POSITION TITLE.

A. My name is Jay M. Bradbury. My business address is 1200 Peachtree Street, Suite 8100, Atlanta, Georgia 30309. I am employed by AT&T Corp. ("AT&T") as a District Manager in the Law and Government Affairs Organization.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND WORK EXPERIENCE IN THE TELECOMMUNICATIONS INDUSTRY.

A. I graduated with a Bachelor of Arts degree from The Citadel in 1966. I have taken additional undergraduate and graduate courses at the University of South Carolina and North Carolina State University in Business and Economics. I earned a Masters Certificate in Project Management from the Stevens Institute of Technology in 2000.

I have been employed in the telecommunications industry for more than thirty-three years with AT&T, including fourteen (14) years with AT&T's then-subsidiary, Southern Bell. I began my AT&T career in 1970 as a Chief Operator with Southern Bell's Operator Services Department in Raleigh, North Carolina. From 1972 through 1987, I held various positions within Southern Bell's (1972 – 1984) and AT&T's (1984 – 1987) Operator Services Departments, where I was responsible for the planning, engineering, implementation and administration of personnel, processes and network equipment used to provide local and toll operator services and directory assistance services in North Carolina, South Carolina, Kentucky, Tennessee and Mississippi. In 1987, I transferred to AT&T's External Affairs Department in Atlanta, Georgia, where I was responsible for managing AT&T's needs for access network interfaces with South Central Bell, including the resolution of operational performance, financial and policy issues.

From 1989 through November 1992, I was responsible for AT&T's relationships and contract negotiations with independent telephone companies within the South Central Bell States and Florida. From November 1992 through April 1993, I was a Regulatory Affairs Manager in the Law and Government Affairs Division. In that position, I was responsible for the analysis of industry proposals before regulatory bodies in the South Central states to determine their impact on AT&T's ability to meet its customers' needs with services that are competitively priced and profitable. In April 1993, I transferred to the Access Management Organization within AT&T's Network Services Division as a Manager – Access Provisioning and Maintenance, with responsibility for ongoing management of processes and structures in place with Southwestern Bell to assure that its access provisioning and maintenance performance met the needs of AT&T's strategic business units.

In August 1995, as a Manager in the Local Infrastructure and Access Management Organization, I became responsible for negotiating and implementing operational agreements with incumbent local exchange carriers needed to support AT&T's entry into the local telecommunications market. I was transferred to the Law and Government Affairs Organization in June 1998, with the same responsibilities. One of my most important objectives was to ensure that BellSouth provided AT&T with efficient and nondiscriminatory access to BellSouth's Operations Support Systems (OSS) throughout BellSouth's nine-state region to support AT&T's market entry.

Beginning in 2002 my activities expanded to provide continuing advice to AT&T decision makers concerning industry-wide OSS, network, and operations policy, implementation, and performance impacts to AT&T's business plans.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE REGULATORY COMMISSIONS?

A. Yes, I have testified on behalf of AT&T in numerous state public utility commission proceedings regarding various network and related issues, including arbitrations, performance measures proceedings, Section 271 proceedings, and quality of service proceedings, in all nine states in the BellSouth region. I also have testified on behalf of AT&T in proceedings before the FCC regarding BellSouth's applications to provide in-region interLATA long distance service.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The critical issue of this proceeding is not whether CLECs can "deploy" their own switches. Instead, the critical issue upon which this Commission should focus is whether a CLEC can "efficiently use" its own switch to connect to the local loops of end users. The differences in the way end users' loops are connected to carriers' switches are among the most important factors that cause CLECs to face substantial operational and economic entry barriers when they seek to offer Plain Old Telephone Service ("POTS") to mass-market (residential and small business) customers using their own switches and ILEC-provided loops (i.e., *via* unbundled network element-loop or "UNE-L" facilities-based entry). Until these barriers are removed, the FCC's finding of impairment cannot be overturned.

Accordingly my testimony:

- Compares the significantly different network architectures available to an ILEC and a CLEC when each wishes to use an ILEC-owned analog voice-grade loop, also referred to as a DSO loop, to connect a mass market customer with its respective switch in order to provide POTS; and

- Provides an overview of the network architecturally-based operational and economic entry barriers to successful UNE-L facilities-based entry and identifies CLEC witnesses who will provide more detailed testimony on the impact of those barriers and the fact that until the underlying local network architecture that has created these barriers is changed, CLECs will continue to face significant practical and economic impairments.

Q. DID THE FCC MAKE ANY FINDINGS IN THE TRIENNIAL REVIEW ORDER ("TRO") REGARDING THE ISSUES YOU DISCUSS?

A. Yes. The FCC found on a national basis that CLECs are impaired in serving the mass market in the absence of unbundled ILEC switching.[1] This finding was based on an analysis that began with the simple, self-evident proposition that CLECs cannot use

[1] TRO at ¶¶ 422, 459.

their own switches, in lieu of the ILECs', unless they can connect their switches to their end-users' loops. The FCC explained:

> Competitive LECs can use their own switches to provide services only by gaining access to customers' loop facilities, which predominately, if not exclusively, are provided by the incumbent LEC. Although the record indicates that competitors can deploy duplicate switches capable of serving all customer classes, without the ability to combine those switches with customers' loops <u>in an economic manner</u>, competitors remain impaired in their ability to provide service. Accordingly, it is critical to consider competing carriers' ability to have customers' loops connected to their switches <u>in a reasonable and timely manner</u>.[2] (Emphasis added.)

To emphasize the importance of the ability of CLECs to connect their switches to the loops of their end-users, the FCC noted that no party disputed that competitors need access to the ILECs' loops to compete in the mass market.[3]

Starting from its basic premise that an <u>economic</u> connection between the local loop and a CLEC switch is a condition of non-impairment, the FCC noted the evidence in its record indicating the large disparity between the cost that CLECs incur to connect their end-users' loops to their own switches and the significantly lower cost that the ILECs incur to do the same thing.[4] The evidence demonstrated that "even using the most efficient network architecture available for entry using the UNE-L strategy, [CLECs] are at a significant cost disadvantage vis-à-vis the incumbent in all areas."[5] The FCC relied on evidence of the CLECs' "cost of backhauling the voice circuit to their switch from the customer's end office" where his/her loop terminates, and noted

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[2] TRO at ¶ 429 (emphasis added).
[3] TRO at n. 1316.
[4] TRO, at ¶¶ 479-481.
[5] TRO at ¶ 479.

that a significant cost disparity is created because the ILEC, whose switches are located where the customers' loops end, does not experience such costs.[6]

Indeed, the FCC was very specific about evidence of the additional costs faced by the CLECs. That CLECs must backhaul the circuit to their switches, *i.e.*, to extend the customer's loop beyond the point where it had connected to the ILECs switch, gives rise to "costs of collocating in the customer's serving wire center, installing equipment in the wire center in order to digitize, aggregate, and transmit the voice traffic, and paying the incumbent to transport the traffic to the competitor's switch," all costs that "put [CLECs] at a significant cost disadvantage to the incumbent."[7]

Q HOW DO THESE DIFFERENCES IMPACT THE ABILITY OF CLECS TO SERVE CONSUMERS USING UNE-L GENERALLY OR FROM EXISTING ENTERPRISE SWITCHES IN PARTICULAR?

A. The difference in the way that ILECs and CLECs connect to the ILEC loops serving end-users lies at the heart of the impairment that CLECs sustain in trying to serve mass market customers without access to unbundled switching and unbundled network element-platform ("UNE-P"). The ILECs' advantage in the way they connect their switches to the loops of their end user customers derives from their historic monopoly position. The CLECs cannot replicate the advantages resulting from the ILEC's legacy network.

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6 *Id.*, at ¶ 479.
7 *Id.*, at ¶ 480 (citations omitted).

The difference in the manner and cost of connecting loops to switches between ILECs and CLECs affects mass market customers, the consumers expecting to benefit from competition, in particular. The significant cost of the CLEC having to backhaul the loop, even after that cost is spread across all mass market customers that a CLEC can possibly serve, cannot be overcome by a CLEC being smarter or more agile in the market or by cutting corners on internal costs. It simply is too large.

Indeed, as demonstrated in the testimony of Steven E. Turner, the cost of the backhaul structure that CLECs <u>must</u> incur and that ILECs do not incur amounts to more than the total ILEC TELRIC cost of providing switching in order to serve the customer. That is why it is less expensive for CLECs to pay ILECs for the cost of unbundled switching, instead of using capacity on their own switches currently serving enterprise customers, even when the capacity is currently spare. Indeed, so great are the backhaul costs per mass market customer that CLECs could not compete with ILECs if forced to backhaul their mass market voice circuits to their enterprise switches, even if there is spare capacity on those switches. That is why the Commission cannot rely on the presence of switches used to serve enterprise customers in an area as probative of whether CLECs can serve mass market customers without access to mass market switching.

The FCC found the failure of CLECs to utilize their existing enterprise switches to be probative evidence of significant barriers making entry uneconomic.

> We found significantly more probative the evidence that in areas where competitors have their own switches for other purposes (e.g., enterprise switches), they are not converting them to serve mass market customers and instead relying on unbundled loops combined with unbundled local circuit switching. Given the fixed costs already

> invested in these switches, competitors have every incentive to spread the costs over a broader base. Their failure to do so bolsters our finding that significant barriers caused by hot cuts and other factors make such entry uneconomic.[8]
>
> We find . . . that the fact that competitors have not converted unbundled loops combined with unbundled local switching or served residential customers with existing switches only serves to demonstrate the barriers to such service.[9]

Q. FROM A NETWORK ARCHITECTURE PERSPECTIVE WHAT IS THE FUNDAMENTAL OR CENTRAL PROBLEM UNDERLYING THE FCC'S FINDING OF IMPAIRMENT?

A. As discussed in detail below, the central problem is that the ILECs' legacy network architecture was designed to support a single regulated monopoly provider, not a competitive market with multiple service providers seeking access to the ILEC's loops. This architecture allows an ILEC to efficiently connect its legacy loops to its own switches within the ILEC's wire center to provide service to end user customers. However, the legacy ILEC network architecture provides an inefficient and uneconomic means for a CLEC that tries to connect those same loops to its switch that is always remotely located from the ILEC central office where these loops terminate. This fundamental structural difference creates overwhelming operational and economic advantages for the ILEC, advantages that make it both impractical and uneconomic for CLEC competitors to compete with the ILEC to serve mass market customers using an UNE-L architecture.

Q. WHAT ARE THE KEY COMPONENTS OF THIS STRUCTURAL DISADVANTAGE?

[8] TRO, at ¶ 447, fn.1365

A. There are four key components to this structural disadvantage.

First, a CLEC must incur the time and cost to install and maintain a significant "backhaul" network infrastructure to connect its switch to the ILEC loops that terminate in the ILEC's wire center, which may also be referred to as a central office ("CO") or local serving office ("LSO"), while the ILEC has no such need for backhaul facilities. As the FCC explained in the TRO, "The need to backhaul the circuit derives from the use of a switch located in a location relatively far from the end user's premises, which effectively requires competitors to deploy much longer loops than the incumbent."[10] These CLEC backhaul costs include the non-recurring costs necessary to establish a collocation arrangement in every ILEC wire center in which the CLEC wishes to offer mass market services, the recurring costs paid to the ILEC for maintaining these collocation arrangements as well as the transport equipment and facilities necessary to extend the ILEC's loops to the remotely located CLEC switch.

Second, as the FCC found, a UNE-L CLEC must aggregate traffic from many locations in order to achieve the same switch economies of scale realized by an ILEC at a single location. This forces the CLEC to incur its backhaul cost disadvantage in many wire centers in order to achieve the type of switch scale economies that the ILEC achieves at a single wire center.

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[9] TRO, at ¶ 449, fn.1371 (citations omitted)

[10] TRO at ¶ 480 (citations omitted); see also TRO at ¶ 464, n. 1406, TRO, at ¶ 424, n. 1298 , and TRO at ¶ 429.

Third, the CLEC must pay exorbitant charges to the ILEC for transferring loops from the ILEC switch to a CLEC collocation facility, or from one CLEC to another. This transfer process also forces the CLEC's customers to suffer an inferior experience in converting to the CLEC's service compared with the treatment they can receive using UNE-P, or that interexchange carriers -- including the ILECs -- can offer customers using the Primary Interexchange Carrier ("PIC") change process for allowing customers to change their long distance service provider.

Finally, the CLEC is precluded from serving an entire segment of retail customers, those whose loops are currently served by integrated digital loop carrier (IDLC) systems, unless the ILEC has the spare non-IDLC loop plant in place to replace these customer's lines so that they are eligible for a UNE-L migration to a CLEC. This is described in more detail in Section V.

Because these significant economic and operational barriers are rooted in the ILECs' network design, a UNE-L market entry strategy to serve the mass market cannot be sustained unless there are significant modifications to the ILECs' existing network architecture.

Q. PLEASE DESCRIBE HOW THE REMAINDER OF YOUR TESTIMONY IS ORGANIZED.

A. Section II provides a historical overview of how the ILECs' networks developed and the principles underlying their evolution in a monopoly environment.

Section III describes how end-user locations are connected to ILEC switches and why that service configuration has serious implications for mass-market competition.

Section IV describes CLEC networks and how the incumbents' closed and integrated network architecture causes quantifiable and significant cost disadvantages for a new entrant.

Section V briefly describes the impairment created by the ILECs' increasing deployment of integrated digital loop carrier ("IDLC") technology and the impairment resulting from differences in call termination capabilities.

Section VI provides my concluding thoughts.

II. PRINCIPLES UNDERLYING THE HISTORICAL DEVELOPMENT OF ILEC NETWORKS

Q. CAN YOU PROVIDE AN OVERVIEW OF THE PRINCIPLES UNDERLYING THE HISTORICAL DEVELOPMENT OF ILEC NETWORKS?

A. Yes. The essence of the telephone network is *connecting* one party to another, whether they are physically located near each other or separated by considerable distance. There is value in merely being *able* to call any party on the network, or likewise being *able* to receive calls from any party on the network. In theory, the more parties that can be reached, the greater the value of the network. The nature of voice communication is that even brief conversations, such as emergency calls, can be of great value. Telephone networks are predominantly designed to facilitate relatively short, private, one-to-one, bilateral communications. The telephone network must stand ready to complete any particular call (or tens of millions of calls) at any time customers want to call, but stand partly idle when customers do not wish to use it.

Because of the high fixed cost required to maintain the ability to make direct connections between all customers and the relatively small proportion of time that those connections are required (coupled with the practical impossibility of directly connecting every customer to every other customer), the goal of an efficient telephone network is to balance the callers' ability to connect to any other customer with the cost of making the connection. This is accomplished by minimizing the proportion of assets dedicated to any particular customer and by creating "on-demand" connections whenever practical.

Q. HOW IS THE NEED FOR DEDICATED CONNECTIONS TO SERVE CUSTOMERS REDUCED?

A. Switching reduces the need for dedicated connections. In fact, a single switch in the ILEC's network permits any customer terminated on that switch to connect with any other customer terminating on that same switch without the need for any transport facilities. Depending on population density, these "intra-switch" calls can account for a very large percentage of all of the ILEC's traffic. By connecting switches to each other using efficient transport and tandem switching, all customers on those switches can connect with each other.

For example, assume that we wish to interconnect eight different customers for a two-way conversation between any two of the customers. (See Exhibit JMB- 1) If we count all of the transmission paths between any two of the eight customers, we find that a total of 28 such paths are required.

The maximum number of simultaneous connections that may exist, obviously, is four -- half of the subscribers talking to the other half. Furthermore, if a traffic study were made over a period of time, it would probably show that the occasions on which more than two links were in use would be quite rare. Clearly, maintaining 28 dedicated transmission paths is an inefficient arrangement.

Taking this example a step further, assume instead we have 1,000 customers that we wish to connect. It would be impossible to lay out the required 499,500 dedicated transmission paths necessary to allow these customers to communicate with each other. Thus, the central office was established as a point where all the transmission paths to the individual customers were terminated for switching. The original switches in these central offices were manual switchboards. All of today's switches are, of course, fully automated.

Q. BECAUSE A SINGLE SWITCH OBVIOUSLY CANNOT BE USED TO SERVE ALL CUSTOMERS, HOW DID THE INDUSTRY RESOLVE THIS PROBLEM?

A. Once central offices were established, two more questions rapidly came upon the industry: how many switches are needed to serve a given geographic area and how to connect customers in one switch to those in another?

The decision to invest in more switches was an economic trade off among: (1) the cost of an additional switch in a territory, (2) the cost of building long customer loops, or (3) deciding not to provide service, avoid the cost, and forego the additional revenue.

A typical copper loop without any enhancement can provide adequate telephone service out to a distance of about 18,000 feet (3.4 miles) from a switch. Thus in the early days of the industry, there were a lot of areas and customers without telephone service. Over time loop design and enhancement capabilities improved, making it possible, <u>at a cost</u>, to provide telephone service up to 160,000 feet (30.3 miles) from a switch, although such costly extreme loop lengths are rare. For decades, telephone companies extended service, grew and added switches by comparing the economics of long loops versus additional switches. In urbanized areas, bigger switches became located closer to the customers they served. In rural areas, with lower population densities, smaller switches with longer average loop lengths are more common.

Connecting all individual switches to each other with dedicated facilities may at first seem to create the same problem discussed above caused by connecting end-users with dedicated facilities; however, the connections between switches, known as "trunks" and "trunk groups" are much more efficient than loops. Loops are dedicated to individual customers; trunks, however, are used by multiple customers on an as needed basis. As a result, a key characteristic of trunks is that they carry "concentrated" traffic. Concentration, or over-subscription, is possible because it is unlikely that all potential users will want to make calls simultaneously. This permits the sharing of facilities by more users than could be accommodated if all users sought service at the same time. Concentration is limited by the level of service blockage probability that is deemed acceptable.

Trunk facilities are also less costly than individual loop facilities because trunks can be "multiplexed" – several trunks can be placed on the same facility. Multiplexing is the encoding and compacting of communications so that they take up less "space" on a communication facility. No blocking is introduced by multiplexing, although the degree to which the communications are compressed and the sophistication of the encoding may affect the ultimate service quality.

Further, "switching between switches", known as "tandem switching." can also be used, eliminating the need to build individual trunk groups from any one switch to all the other switches in the network until it is economical to do so. Such an individual trunk group would be built only when the volume of calling between any two switches warrants such a direct trunk group connection. By connecting one switch to another using efficient transport (including tandem switching), all customers of those switches can connect with each other.

Q. WHAT IS THE SITUATION TODAY RELATIVE TO LOOPS SERVING MASS MARKET CUSTOMERS?

A. The connection between a customer premises and the first point of switching – or the local loop – remains fundamentally a dedicated connection with little opportunity for cost sharing through multiplexing or concentration. The use of digital loop carrier (DLC), which only began to be deployed in the loop plant within the last two decades, provides some opportunity for cost sharing. Depending upon the type and vintage of the DLC, both multiplexing and concentration may occur. However, as I will discuss below, in Sections IV and V, the deployment of DLC in the loop plant creates additional sources of impairment. Loops were originally a simple copper cable pair between the customer's premise and the local switch, and for the mass market that remains prominently the case today, over 100 years later. The loop plant represents a high fixed cost infrastructure with little opportunity to share costs.

This is the very infrastructure the FCC found that incumbents must unbundle because competitors cannot duplicate or replace it. As the FCC explained:

> No party seriously asserts that competitive LECs are self-deploying copper loops to provide telecommunication services to the mass market.[11]
>
> When the incumbent LECs installed most of their loop plant, they had exclusive franchises and, as such, the record shows that they secured right-of-way at preferential terms and at minimal costs. By contrast, [the] record shows that new entrants have no such advantage.[12]

III. ILEC NETWORKS

Q. PLEASE DESCRIBE HOW LOOPS SERVING MASS MARKET CUSTOMERS ARE CONNECTED TO THE ILEC'S NETWORK.

A. In order to use an analog loop to provision traditional retail local voice service (*i.e.*, POTS), a local exchange carrier must connect that loop to a local circuit switch. The local loop is typically a copper transmission facility that originates at the customer's

[11] TRO at ¶ 226
[12] TRO at ¶ 238

premise and terminates on a Main Distribution Frame ("MDF") in the incumbent LEC's wire center (see diagram at Exhibit JMB- 2).

When an ILEC provides POTS to a retail customer, the customer's loop must be connected to a port on the ILEC's switch. The switch port recognizes when a customer wishes to make a call (*i.e.*, goes "off-hook"), indicates to the customer that a call may be placed (*i.e.*, provides dial tone) and receives the dialed digits necessary to make the call. Similarly, the switch port notifies the customer when someone is calling (initiates ringing for incoming calls). For mass-market customers served by analog voice-grade loops, the switch port connection is generally accomplished using a "jumper" wire pair at the MDF in the ILEC central office. The MDF is a large metal framework that serves the simple purpose of terminating cable pairs in a manner that permits a cable pair on one side of the frame to be connected to a specific piece of central office equipment on the other side of the frame. (See Exhibit JMB-3.) In order to make the connection, an ILEC frame technician runs a pair of wires from one side of the frame to the other in order to make a continuous path between the customer's loop and the switch port.

Individual loops enter the ILEC central office as part of a large cable that collects many loops from a particular neighborhood. The cable typically runs through an underground cable vault and then into the building within a pre-designated infrastructure (cable ducts) to the MDF. The individual loops within the cable are then "fanned out" onto wiring blocks on the "customer facing" side of the MDF. Twisted pairs of insulated wire, commonly referred to as "jumper wires," are used to cross-connect customer loops, which appear on the customer facing side of the MDF, to wiring blocks on the "network facing" side of the frame. The latter contain the wiring blocks onto which cables from the ILEC's local switch ports are terminated. Using this technique, customer loops can be assigned to a specific analog switch port on the ILEC's circuit switch by placing or repositioning the jumper wire on the MDF. Exhibit JMB-3 depicts a generic MDF cross-connect arrangement.

In order to provide POTS service, each customer's individual loop must be connected to an assigned switch port. Currently, the vast majority of end-user loops are serviced by the ILEC, so the vast majority of end-user loops already terminate onto the ILEC's circuit switch by way of the MDF. This is true whether or not service is currently active on the particular loop. When a customer terminates service, *e.g.*, when he or she moves from a location, the ILEC typically does not remove the jumper wires that connect that loop to the ILEC switch. Rather than disrupting the physical connection to the premises, the loop is typically placed in an "inactive" status by software commands issued to the switch's software table. In such cases, no physical work is required to restore full service when a new customer requests it. Instead, the switch software table is merely updated through the use of keystrokes from a computer workstation to show the line is no longer "inactive." This practice of leaving the ILEC loop connected to the ILEC switch port is commonly known in the industry as "dedicated inside plant" and "dedicated outside plant". Other terms for this include "connect through" and "ready access".

Q. OBVIOUSLY THIS ASSOCIATION OF LOOPS AND SWITCH PORTS THROUGH THE USE OF FRAME CROSS CONNECTIONS OR JUMPERS

REPRESENTS AN ECONOMIC AND EFFICIENT METHOD FOR THE ILEC; ARE THERE OTHER EFFICIENCIES IN THE ILEC NETWORK?

A. Yes. As discussed above, the evolution of the ILEC loop and switch architecture under monopoly protection has resulted in an effective and efficient arrangement in which both loop and switching costs have been optimized.

As a result of the volume of traffic and the resulting economies of scale that the ILEC enjoys, it is able to connect its switches for the completion of inter-switch calls for its customers by an efficient and economical inter-office transport network. The ILEC will engineer this network with direct switch-to-switch trunk groups in all cases where traffic volumes warrant such a connection. In cases where traffic volumes between two switches are not sufficient to justify a direct connection or in cases where there is overflow traffic that cannot be supported by the direct trunk group, the ILEC utilizes an efficient tandem switching and transport network to handle such traffic. This low cost network design allows the ILEC to complete its inter-switch calling using the minimum amount of trunk connections possible to complete a call between two switches. (See Exhibit JMB-4)

The ILECs were able to attain the necessary scale because, as the historic monopoly suppliers of all telecommunications services, they could count on serving the entire population located near their switches. ILECs were also able to attain switch scale economies through the use of "host – remote" switching arrangements. A moderate to large size switch in one wire center can "host" smaller "remote" switches (actually modules of the host switch) miles away in other wire centers Such remote switches are significantly less expensive than stand alone switches of the same line size. In sum, the ILECs efficiently use their ubiquitous legacy copper loop plant that employs relatively short loops and are able to maintain quality transmission for the analog signals carried over those loops. The ability to use short loops resulted from the monopoly franchise guarantee that there would be significant numbers of end-users within close proximity of a switch, such that the ILECs could attain the scale economies necessary to make their local switches economical.

CLECs, however, cannot benefit from the ILECs' ability to maximize the joint economies of *both* switching and loop facilities. Rather, as described below, CLECs must access the ILECs' loops where they terminate (i.e. in the ILEC's wire centers) and then do their best to survive in an environment in which they are subject to substantial costs and operational impediments not faced by the ILECs.

IV. CLEC NETWORKS

Q. HOW DO CLEC NETWORKS DIFFER FROM THE EFFICIENT AND ECONOMIC ILEC NETWORK YOU HAVE DESCRIBED?

A. In contrast to the incumbents, new entrants do not have the opportunity to achieve scale economies for their switches *and at the same time* minimize loop distances and costs by locating their switches where these loops terminate. The FCC summarized the problem as follows: "The [CLECs'] need to backhaul the circuit . . . effectively requires competitors to deploy much longer loops than the incumbent".[13] The FCC's

[13] TRO at ¶ 480

rules do not permit a CLEC to place a circuit switch in a collocation.[14] And in all events, even if a new entrant were allowed to place a circuit switch in every local serving office, it could not achieve the same scale economies as the ILEC unless it possessed the same market share as the incumbent did in that particular office. This situation is, of course, a practical impossibility. Facing such market uncertainties, CLECs can at best expect to be able to serve only a fraction of the total end-users in any ILEC wire center.

Thus, CLECs must deploy individual switches to serve much larger areas than the ILEC, because that is the only way they could possibly achieve switching scale economies comparable to those enjoyed by the ILECs. The FCC recognized this problem in the TRO, noting that "[The RBOCs' cost studies] suggest that it would be uneconomic for a competing carrier to serve customers in smaller wire centers. All the studies found that in such wire centers, entry would be much more expensive for the competitive LEC than for the incumbent, or simply would be uneconomic"; and "[I]n smaller wire centers, where the competitors' customer base is likely to be smaller and they are unable to take advantage of scale economies, the cost disadvantage due to backhaul is much larger" .[15]

Accordingly, CLECs cannot use the same kind of connections, *i.e.*, the MDF jumper wire pairs used by ILECs, to link their customers' loops to their distant switches. Rather, CLECs must deploy an extensive *backhaul network* that extends the existing

[14] 47 CFR 51.323 (ILEC may refuse to permit collocation of equipment not necessary for access to UNEs or interconnection).
[15] *See* TRO at ¶ 484 *see also* TRO at ¶ 480 (citations omitted).

customer loops – all of which terminate at ILEC wire centers– to a distant CLEC switching location. In Kentucky, there are 190 BellSouth wire centers from which CLECs must "backhaul" end-user loops if they want to use their own switching to serve customers in all of the incumbent LECs' wire centers.

Q. WHAT MUST A CLEC DO IN ORDER TO "BACKHAUL" ITS CUSTOMER'S TRAFFIC TO ITS OWN SWITCH?

A. In order for a CLEC to "backhaul" its customers' traffic to its own switch, the CLEC must first create an overlay network infrastructure that is largely dedicated to the subset of customers won from the incumbent in a specific wire center. In essence, the CLEC must add a very long, costly and dedicated "extension cord" in order to connect its end-users' loops to its switches. This requires the CLEC to:

(1) establish and maintain collocations at ILEC wire centers, where customers' loops are "collected;"

(2) install and maintain the equipment necessary to digitize and, using concentration and multiplexing techniques, aggregate the traffic on those loops to permit connections to the CLEC's switch at acceptable quality levels; and

(3) establish the necessary transport facilities that provide the physical path connecting the CLEC's collocations and its switch.

Only after all of this infrastructure and these functionalities are in place and operational in each ILEC wire center in which it wishes to compete can a switch-based CLEC begin to offer service to customers in those incumbent's wire centers. Thereafter, for each individual customer line it seeks to serve, the CLEC must then arrange and pay for a manual, volume limited, and costly "hot cut" process to have the customer's loop connection transferred to its collocation, and the customer's telephone number ported to the CLEC's switch.

In sum, due to the underlying integrated, and effectively closed, design of the incumbents' local network architecture, competitors must invest in and deploy all of the functionalities described above in order to replace a simple jumper pair across the incumbent's MDF. That is why the FCC correctly found that the barriers CLECs face in attempting to provide a UNE-L based service

> are *directly associated with incumbent LECs' historical local monopoly*, and thus go beyond the burdens usually associated with competitive entry. Specifically, the ***incumbent LECs' networks were designed for use in a single carrier, non-competitive environment*** and, as a result, the incumbent LEC connection between most voice-grade loops and the incumbent LEC switch consists of a pair of wires that is generally only a few feet long and hardwired to the incumbent LEC switch.[16] (Emphasis added)

These barriers generate very significant costs for the CLECs, costs that ILECs do not incur. This, in turn, makes it impractical and uneconomic even for "efficient" competitors to provide service *via* UNE-L to the low volume (and low margin[17]) communications users typically found in the mass-market.

[16] TRO at ¶ 465 (emphasis added) (citations omitted).
[17] TRO at ¶ 474 (the mass market is "characterized by low margins").

The following subsections describe in greater detail the general infrastructure and equipment that a CLEC must install and operate in order to provide service to mass market customers using analog voice grade loops (*i.e.*, collocation, collocation equipment, transport, and hot-cuts).

A. Collocation

Q. WHAT IS THE FUNCTION OF A COLLOCATION AND WHY ARE THEY PROBLEMATIC?

A. A CLEC cannot provide any telecommunications service employing a UNE-L architecture until the retail customer is physically connected to its network switch. In order to provide POTS service, as explained above, a CLEC must deploy the equipment required to digitize, encode, multiplex and concentrate its customers' traffic so that the unbundled loops terminating in the ILEC's wire center can be extended to the CLEC's switch. In order to do so, *i.e.*, to make an ILEC loop useable at a CLEC switch, the CLEC must rent space to establish a collocation in the ILEC's wire center. (See Exhibit JMB-5)

Establishing a collocation involves a number of activities and costs that will vary depending on the type of collocation established. The ILECs offer various collocation arrangements including physical collocation in which the CLECs equipment can either be secured in a "caged" space or unsecured in a "cageless": space and virtual collocation in which the CLEC's equipment is leased to the ILEC and is installed and maintained by the ILEC on the CLEC's behalf.

In general, the activities required to establish a collocation include: (1) obtaining the necessary space in the wire center, which is predicated upon the ILEC having sufficient collocation space in its central office;[18] (2) engineering the collocation; (3) arranging construction (for physical caged collocations); (4) cabling the CLEC interface frames for its collocated equipment to cross-connection frames in the incumbent's space and (5) installing the required equipment in the collocated space.

Because the CLEC's equipment in the collocated space requires electric power, the CLEC must also pay the incumbent for delivery of direct current ("DC") power and emergency power to operate the collocated equipment. In some instances, the CLEC may opt to invest in additional equipment to deploy power distribution, i.e., a battery distribution fuse bay ("BDFB") within its own collocation to provide for more flexibility and to minimize the need for a subsequent (and generally very costly) power augment. In general terms, the collocation power charges are driven by the charges for redundant power feeds (sized for the maximum demand in the collocation) and the necessary HVAC for the collocated equipment.

A CLEC's collocation costs can be highly influenced by the incumbent's minimum requirements for collocation purchases. For example, while a CLEC may only require 25 square feet of floor space for its equipment in a given LSO, the ILEC may have a minimum size for caged collocation of 50 or 100 square feet. Similarly, while the CLEC's equipment may only require 40 amps of power the ILEC may have a minimum power feed requirement of 60 DC amps and/or the power may be billed based on fused rather than drawn power.

[18] *See* TRO, at ¶ 477

Such minimum space/power requirements serve to needlessly inflate a CLEC's collocation expenses, particularly for locations where the CLEC may only win a small quantity of lines. Accordingly, the average cost of collocation under such conditions may become prohibitive, because the equipment deployed actually requires substantially less space and/or power than the minimum space required or power charged for by the ILEC. Similarly, the incumbent sometimes applies large up-front one-time charges for the collocation application, cage engineering (whether for space or power) or administrative fees (such as project management, space availability reports, etc.), which may prove unrecoverable depending upon the market share achieved in the specific area served by the collocation facility.

As discussed in the testimony of Steven E. Turner, the unit collocation costs for an efficient CLEC seeking to serve the mass market in Kentucky are significant.

B. Collocation Electronics

Q. CAN YOU DESCRIBE THE KEY ELECTRONIC COMPONENTS NECESSARY?

A. Yes. Obviously having an empty collocation space does not by itself provide the CLEC with any of the functionality necessary to connect customers on ILEC loops to the CLEC's switch. Additional equipment is necessary to make the loop connection work. (See Exhibit JMB-6) For example, analog voice signals degrade and unwanted noise increases as the length of a copper facility increases. Thus, the longer a copper loop, the less a voice signal can be distinguished from noise on the line. This is known as "signal loss". The incumbent's loop plant is designed so that voice grade loops consume all but a "safety margin" of the allowable signal loss on the conductor. Therefore, once the analog loop is delivered to the CLEC collocation cage, the analog telecommunication signals on the loop cannot travel much farther and still retain acceptable voice and analog modem quality levels.

Accordingly, in order for a CLEC's mass-market customers' communications to transit back and forth between the customer's premises and the CLEC's remotely located switch at an acceptable level of quality, the CLEC must install digital loop carrier ("DLC") transmission equipment. While this DLC equipment is absolutely mandatory for the CLEC, it is not required for the ILEC when serving the same customers.

The CLEC's DLC equipment must be placed in the collocation arrangement that is located in the wire center where the end-user loops terminate. The equipment digitizes, encodes, concentrates and multiplexes the analog signals received from the customer so that the CLEC can extend the loop signal back to its remote switch in a manner that (1) provides service quality that will meet customer expectations and (2) minimizes the CLEC's costs to transport its customers' traffic back and forth from its switch. This equipment includes the cross-connection frame (also known as a POTS bay) between the incumbent's MDF where the loops terminate and the DLC equipment, the DLC equipment itself, and high capacity digital cross-connection frames ("DSX-1" or "DSX-3") necessary to cross-connect the digital output from the DLC to the transmission facilities that ultimately connect to the CLEC's remotely located switch. In addition, test access and monitoring equipment must be deployed in the collocation to allow the CLEC to operate its equipment as efficiently as possible.

As noted above, the CLEC DLC equipment, which is not required in the ILEC's network, receives the analog communications from the loop and digitizes, concentrates and multiplexes the communications on the CLEC customers' loops so that the connecting transport facility can be used efficiently. The DLC also interoperates with the CLEC's switch to provide and receive the signaling necessary for call supervision, including the provision of dial tone and ringing current, digit reception and related functions. Thus, when using this architecture arrangement, the DLC equipment is not only needed to extend the CLEC's loops, it is also essential to provide electrical current for the ringing and dial-tone necessary for POTS service, functions that are performed by the ILEC's switch port as described in Section III above.

Additional equipment is needed to take the output of the DLC and place it on transport facilities for transmission out of the retail customer's wire center. The digital cross connection frame (or DSX equipment) provides for this functionality by permitting the DLC to be efficiently cross-connected to the backhaul transport facility. DSX-1 equipment allows for connections to DS-1 transport facilities. DSX-3 equipment allows for connections at the DS-3 level. The volume of traffic that will be served from the wire center dictates the type of equipment used at a particular location. As described in greater detail in the Transport section below, when transport is leased from the incumbent, the DSX equipment cross-connects DLC transmissions from the CLEC's collocation to the ILEC's transport facilities. In cases where the CLEC provides its own transport to its switches, connections from the DLC are typically to an optical multiplexer which, in turn, is connected to the CLEC's metropolitan fiber ring. (See Exhibit JMB-7)

Q. CAN DLC EQUIPMENT AND DSX EQUIPMENT BE INSTALLED IN A MANNER THAT GROWS SMOOTHLY WITH THE GROWTH OF CLEC CUSTOMERS IN AN AREA SERVED FROM A COLLOCATION?

A. No. DLC equipment is not designed to, and therefore cannot, scale precisely with the level of demand (or number of lines) served in a wire center. Rather, there is a minimum amount of DLC equipment that must be purchased and installed. Accordingly, DLC investment is very "lumpy". The first module of collocated DLC typically includes equipment that manages the interface with both the transmission facility and the sub-modules of DLC equipment where the lines physically terminate.

For example, common equipment in the LiteSpan 2000 product, manufactured by Alcatel, can serve up to 2,016 POTS lines. Additional equipment, which is frequently referred to as a channel bank assembly, manages the interface between the analog lines and the digital switch port and provides for the sharing (concentration of lines) of the transmission facility. The channel bank assembly for the LiteSpan 2000 product handles up to 224 POTS lines. Finally, individual POTS lines terminate on electronic devices called line cards. Line cards terminate the loop and provide the electrical interface to the DLC channel bank assembly. For the LiteSpan 2000 product, 4 POTS lines can terminate on a single line card. In the LiteSpan example, in order to serve a single POTS line, a CLEC would need one line card capable of serving up to four lines, one channel bank assembly capable of serving up to 224 lines and one DLC common unit capable of serving up to 2,016 lines. No additional investment would be needed until the fifth line is served, when a second line card would be required. A new channel bank would be required when the 225th line is added, and when the 10th channel bank assembly is required (*i.e.*, when the 2,017th line is added) the whole process would start again with new common unit, a new channel bank assembly and a new line card.

Additionally, because the many collocated DLCs that subtend a CLEC's switch are so widely dispersed over a large geographic area, it is uneconomic to incur the travel expense to add small increments of equipment. Accordingly, CLECs are forced in practice to install extra capacity rather than dispatch a technician each time a new line card or channel bank assembly is needed. Thus, the CLEC must install an inordinate amount of spare equipment and suffer a sub-optimal equipment utilization rate.

The digital cross connection frame (whether a DSX-1 or DSX-3) takes the output of the DLC as a digital electrical signal and connects it to either a DS1 or a DS3 transport facility that extends the loops from the CLEC's collocation to the CLEC switch. DSX equipment is also not designed to scale smoothly with growth. A typical DSX 3 panel can terminate 24 DS-3 transport circuits. Each DS-3 is equivalent to 672 DS-0 (voice grade) channels, and DLCs typically permit 4 lines to share a single channel through the unit's concentration capabilities. A single DSX-3 panel when used in conjunction with DLCs, therefore, has capacity to handle more than 64,000 (24 x 672 x 4 = 64,512) POTS lines – approximately the equivalent capacity of a large incumbent LEC wire center.

C. Transport

Q. PLEASE DESCRIBE HOW THE TRANSPORT FUNCTION IS ACCOMPLISHED.

A. What I have described so far brings the loop into the collocation space and prepares it to be extended, along with numerous other loops, to the CLEC's distant switch. Once a CLEC customers' signals have been prepared for transport to the CLEC switch, the CLEC must arrange for transmission capability to deliver traffic from the collocation to its remotely located switch. Here again, this transport requirement does not exist in the ILEC's network.

In some cases, a CLEC's collocation will be connected to another collocation through the purchase of ILEC transport facilities (*e.g.*, DS1 and DS3 capacity facilities) as the CLEC traffic volumes at most incumbent wire centers are typically too low to justify CLEC construction and use of owned transport facilities. (See Exhibit JMB-8) When used, this second CLEC collocation typically serves as a "hub" location to aggregate loops from several sub-tending collocations in the area and subsequently transport the loops to the CLEC's switching location, either over higher capacity leased facilities or using self-provided CLEC transport. The FCC commented on this type of arrangement in the TRO: "Competing carriers generally use interoffice transport as a means to aggregate end-user traffic to achieve economies of scale. They do so by using dedicated transport to carry traffic from their end users' loops, often terminating at incumbent LEC central offices, through other central offices to a point of aggregation." [19]

Self-provided transport between ILEC wire centers is the exception rather than the rule for mass-market service. Indeed, POTS volumes from a single wire center alone could not justify a CLEC's deployment of its own transmission facility. This is corroborated by the FCC's finding of national impairment when a CLEC requires 12 or fewer DS3s of capacity. [20] Twelve DS3s are equivalent to 32,256 POTS lines, with a four-to-one DLC concentration ratio. However, the average sized ILEC wire center has under 15,000 POTS lines.

In other cases, rather then linking two collocations together, single collocations will be equipped to extend the loops collected directly to the CLEC's switch location. (See Exhibit JMB-5.)

In either case, regardless of which carrier provides it, a CLEC must procure transport facilities between its collocations and switching locations in order to backhaul customers' loops to its switch. Ironically, when the transmission capability is procured from the ILEC rather than self-provisioned, the CLEC's transport cost has potentially increased as a result of the TRO. In the TRO, the FCC determined for the first time that ILECs are no longer required to unbundle transport facilities for requesting CLECs when such facilities are used to backhaul traffic from the CLEC

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[19] *See* TRO at ¶ 361. *See also* TRO at ¶ 370.
[20] TRO at ¶ 388.

end user loops to their switches.[21] As a result, CLECs may now be required to pay above cost special access rates to ILECs for such transport.

D. Physical Transfer Of Loops

Q. ONCE THE CLEC HAS PURCHASED, INSTALLED AND ACTIVATED ALL OF THE COLLOCATION SPACE, EQUIPMENT ELEMENTS AND TRANSPORT ARRANGEMENTS, WHAT ELSE MUST OCCUR FOR CLECS TO PROVIDE SERVICE TO CUSTOMERS USING UNE-L LOOPS?

A. Once the necessary network infrastructure described above is in place, the CLEC is finally in a position to transfer individual customer loops from the incumbent's network to its collocation and ultimately to its switch. In order to accomplish this, the CLEC must arrange for what is typically referred to as a hot cut. The hot-cut process, which is described in detail in the testimony of Mark Van de Water, involves multiple manual steps and coordinated activities of both CLEC and ILEC personnel.

These include, among other things: (1) interrupting the customer's service while changing the customer's loop cross-connection at the MDF from a terminal pair connected to the incumbent's switch port to a terminal pair that connects to a pair of terminals in the CLEC collocation and (2) coordinating the porting of the customer's telephone number to the CLEC's switch so that calls dialed to the customer's number can be properly completed. Once the hot-cut has been successfully completed, a CLEC can finally provide service to its end-user using its own switch. In contrast, as discussed above, the ILEC can provide service to that same customer on the same

[21] TRO, at ¶¶ 365-369.

loop through a software change command. Because of all of the physical work and manual touch points and the associated human error involved with a hot cut, the process is inadequate to service mass market customers.

As the FCC noted, the shortcomings of the hot cut process also stem from the ILECs legacy network created for a monopoly environment:

> The barriers associated with the manual hot cut process are directly associated with incumbent LECs' historical local monopoly, and thus go beyond the burdens usually associated with competitive entry. Specifically, the incumbent LECs' networks were designed for use in a single carrier, non-competitive environment and, as a result, the incumbent LEC connection between most voice-grade loops and the incumbent LEC switch consists of a pair of wires that is generally only a few feet long and hardwired to the incumbent LEC switch. Accordingly, for the incumbent, connecting or disconnecting a customer is generally merely a matter of a software change. In contrast, a competitive carrier must overcome the operational and economic barriers associated with manual hot cuts. Our finding concerning operational and economic barriers associated with loop access reflects these significant differences between how the incumbent LEC provides service and how competitive LECs provide service using their own or third-party switches.[22]

E. Issues of Scale

Q. DO ALL OF THE ADDITIONAL SPACE, EQUIPMENT AND FACILITIES YOU HAVE BEEN DESCRIBING THAT ARE NOT REQUIRED IN THE ILEC'S NETWORK ADD SIGNIFICANT COSTS TO THE CLEC NETWORK?

A. Yes. Each of the collocation and backhaul costs that a CLEC must incur to connect a customer's ILEC loop to the CLEC's remote switch is a cost that the ILEC does not

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[22] TRO at ¶ 465 (citations omitted).

incur to serve the same customer, because the ILEC's switch is located in the same wire center where its customers' loops terminate. The CLEC's cost disadvantage, however, is multiplied because the ILEC also significantly benefits from what economists might describe as "first mover advantages" that translate into scale advantages.

Because of its status as the incumbent, monopoly provider, the ILEC starts with all the customers in a wire center, and each of them are already served by its switch and generating revenue. Thus, the ILEC does not have to expend resources attempting to persuade customers to change carriers in order to acquire their business and revenues. Unlike competitive carriers, the ILEC does not need to "acquire" large numbers of customers. It only needs to hold its existing customers while offering attractive win-back offers to entice customers who left for a competitor to return.

These scale or share disadvantages multiply the backhaul cost disadvantage described above. Switches are expensive, fixed cost investments and are thus subject to substantial economies of scale. Put simply, switches must be filled with the lines and traffic of paying customers in order to generate the revenues needed to recover the cost of these high fixed-cost investments. However, in order for a CLEC to achieve the same switch scale economies that an ILEC achieves for a single switch at a single wire center, that CLEC must aggregate substantial quantities of loops from multiple central offices and bring the traffic from each of them back to its own switch. To do so, it must build and pay for multiple collocation and "backhaul" arrangements in order to achieve the same scale efficiencies that the ILEC achieves at a single location.

For example, assume an ILEC has 40,000 mass market voice grade lines terminating in its wire center and a switch in that wire center with the capacity to handle the quantity of traffic generated by these lines. Assume, also, the ILEC will likely retain 80% of the customer lines while the CLEC community splits the remaining 20%. If a CLEC expected to serve 10% of the lines out of that wire center (or 50% of the aggregate CLEC market share), the CLEC would expect to serve 4,000 customer lines out of the wire center while the ILEC would have the traffic and revenues from 32,000 lines to fill its switch and recover its costs.

In order for the CLEC to achieve the same 32,000 mass market lines on its (distantly located) switch, it would have to aggregate a similar percentage of the analog lines from approximately 8 ILEC central offices of equal size. (Alternatively, the CLEC would have to fill its switch by accessing loops from a larger number of smaller ILEC wire centers resulting in further increased backhaul costs.) To achieve this degree of switch usage (32,000 lines), the CLEC would need to have 8 collocations and 8 backhaul arrangements, all just to have the same switch scale economies as the ILEC in one single wire center.

Exhibit JMB-9 provides an overview of the CLEC network architecture required to collect and extend customer's loops from the ILEC wire center to the CLEC switch. The contrast with what is required for the ILEC to perform the same function, shown in Exhibits JMB-2 and JMB-3, cross connect a loop to a switch port using a jumper on the MDF, is clear.

V. IMPACT OF ENHANCED LOOP TECHNOLOGY DEPLOYMENT AND CALL TERMINATION

Q. ARE THERE ADDITIONAL IMPAIRMENTS THAT RESULT FROM THE ILECS DEPLOYMENT OF ENHANCED LOOP TECHNOLOGY?

A. Yes. CLECs are further impaired in offering service to mass market customers because the incumbent has placed a large and growing portion of these customers' loops on integrated DLC ("IDLC") equipment. As described in the testimony of Mark Van de Water, IDLC loop arrangements, where alternative spare capacity is not available, can practically foreclose CLEC access to the retail customer.

Increased deployment of IDLC can significantly limit CLECs' ability to provide competing service if they are denied access to UNE-P. This is so because the IDLC equipment multiplexes multiple customers' traffic onto a single loop "feeder" facility that feeds directly into the ILEC's switch, and there is no simple way to segregate (or access) the traffic of a particular customer served with an IDLC loop. As a result, additional steps must be taken to segregate and access the traffic of a customer that desires to take service from a CLEC.

The steps required are dependent upon a number of factors within the LEC's control, including the accuracy of its records (as to which loops are served by IDLC) and the existence of spare loop plant of the appropriate type in the ILEC's network that would allow a competitor to provide a comparable level of service to the ILEC's service. For example, if the ILEC's database does not reveal the presence of IDLC before a conversion date is committed to the customer, the CLEC must negotiate a new date with that customer, which of course makes a negative impression.

Where the presence of IDLC is identified before the confirmation of the conversion date, the customer must be transferred to alternative facilities, provided such facilities are available and provided acceptable service quality is possible. But even then, the process to transfer the customer will require a field dispatch to the remote end of the IDLC facility so that the customer's loop may be re-wired to spare copper or UDLC facilities. In cases where acceptable spare loop plant is not available, other customers who are not otherwise involved in the hot cut may be affected. In these cases the ILEC might "swap-out" a retail customer's non-IDLC loop facilities with the IDLC facilities of the customer who wishes to change his/her local service provider. Overall, the process to accommodate access to IDLC loops is resource intensive, costly, customer affecting and difficult to coordinate, even when compared to the "ordinary" hot cut process. Additionally, as competition increases, the CLECs may find situations where the ILEC has neither spare facilities nor retail customers with non-IDLC facilities that can be used for a swap-out. In these cases the CLEC will be precluded from offering a competitive choice to these customers.

Additionally, except when the IDLC served customer can be placed on a copper loop less than 18,000 feet in length, CLECs are denied the capability of providing DSL services to their customers. In contrast, BellSouth can provide its retail DSL service, known as FastAccess, to the vast majority of its customers in Kentucky despite loop lengths that preclude CLEC DSL service. While I do not have data specific to Kentucky, I know that in Florida and Georgia FastAccess is available to over 86% of BellSouth's customers.

Q. IN SECTION III ABOVE YOU DISCUSSED THE EFFICIENT AND ECONOMIC NETWORK AVAILABLE TO ILECS, AND CLECS USING UNE-P, TO TERMINATE CALLS. DO CLECS FORCED TO USE UNE-L HAVE ACCESS TO THE SAME EFFICIENCIES AND ECONOMIES?

A. No. CLECs will also be impaired when trying to serve the mass market with unbundled loops by an inability to exchange traffic with the ILEC at a switch-to-switch level. As explained earlier, because the CLEC does not have the economies of scale to direct connect its switch with efficient inter-office trunk groups to each of the ILEC's local switches, the CLEC will be more reliant on the ILEC's tandem network for the exchange of traffic. This reliance will put the CLECs at a cost disadvantage because of the additional tandem switching costs and transport facilities that will be needed to complete each of its calls. Additionally, because the CLEC will route a large percentage of its traffic to the ILEC's tandem switch it will face the potential for greater call blocking as a result of tandem congestion and/or inadequate subtending trunking from the ILEC's tandems to its end offices. (See Exhibit JMB-10)

VI. CONCLUSION

Q. HOW HAS THE MONOPOLISTIC HISTORY OF THE ILEC IMPACTED

THE EVOLUTION OF THE LOCAL NETWORK OVER THE LONG RUN AND IN THE YEARS SINCE THE PASSAGE OF THE TELECOMMUNICATIONS ACT OF 1996 ("the ACT")?

A. Incumbent LEC networks were designed in a manner that enables them -- and no one else -- to maximize the efficiencies of both their loop and switching assets. This design provides them with substantially higher quality and lower costs compared to their potential competitors. Specifically, ILECs can connect their analog voice grade loops to their switches by using a simple jumper wire pair across the MDF in the customer's local serving office. ILECs were able to construct this type of network architecture because, as the historic monopolists, they supplied local telecommunications to all customers in their serving areas.

Until the passage of the Act in 1996, the network evolved for the exclusive use of a single user, the ILEC. Since the passage of the Act, the ILECs have resisted opening that network for use by their competitors, doing so only when and as specifically ordered by the FCC and various states.

Q. BECAUSE OF THE SINGLE USER NATURE OF THE ILEC'S NETWORK, WHAT ARE THE BARRIERS FACING CLECS WANTING TO USE THE LOOPS IN THAT NETWORK TO PROVIDE LOCAL SERVICE USING THEIR OWN SWITCHES?

A. CLECs cannot maximize the combined efficiencies of both the ILEC loop plant and their own network infrastructure. Rather, in order to compete, they must take the ILEC loop plant as it exists and extend all of their customers' loops to their own switches, which are typically located a significant distance from the customer's serving office, a network architecture that is expensive and necessary. Accordingly, before a CLEC can provide POTS service using its own switch and ILEC analog voice grade loops, it must:

(1) engineer, establish and maintain a collocation, including the associated HVAC and power;

(2) install and maintain digitization, concentration, and multiplexing equipment at its collocations, as well as related monitoring/testing and power distribution equipment; and

(3) arrange for and provide transport between its collocation and its switch.

Each of these activities imposes additional costs and operational barriers on CLECs, costs that ILECs do not incur to offer the same service. As noted above and demonstrated in the testimony of Steven E. Turner, the additional cost per line in Kentucky that such activities impose on CLECs represents significant, real costs not faced by incumbents that effectively foreclose CLECs from serving mass-market customers through the use of their own switches.

Q. GIVEN THE SIGNIFICANT BARRIERS FACING CLECS DESIRING TO ENTER THE LOCAL MARKET USING UNE-L, HOW HAS COMPETITION FOR MASS MARKET CUSTOMERS ACTUALLY DEVELOPED IN THE SEVEN YEARS SINCE THE PASSAGE OF THE ACT?

A. A number of CLECs did attempt to enter the market using UNE-L. Most are now in bankruptcy, and those who are not serve only business customers. A number of other CLECs attempted to enter the market using total services resale ("TSR"). TSR quickly proved to be financially untenable except as a niche product to serve groups of customers on a pre-paid basis that could not otherwise obtain local service.

After a delayed start, caused by ILEC regulatory opposition at the state level, UNE-P has emerged as the entry method capable of and actually bringing competition to the mass market. As Mr. Joseph Gillan notes in his testimony for CompSouth, UNE-P works, and furthermore, benefits not only CLECs, but also the ILECs, and <u>most importantly, the consumer,</u> when compared to forced use of UNE-L.

UNE-P is an electronic service provisioning system that extends to the CLECs many of the same efficiencies and economies available in the ILEC network. UNE-L is not and cannot be made so through the implementation of "batch" hot cut processes and a pairing with "rolling access" neither of which, individually or collectively, eliminates any of the fundamental characteristics of the existing single user ILEC network.

Q. CAN THE FUNDAMENTAL CHARACTERISTICS OF THE EXISTING SINGLE USE ILEC NETWORK BE MITIGATED WITHOUT TECHNOLOGICAL CHANGE?

A. No. Until the underlying local network architecture that has created these impairments is changed, CLECs will continue to face significant practical and economic impairments in serving mass market end-users on ILEC loops *via* their own switches—impairments that make UNE-P the only viable entry method for serving the mass market.

Q. CAN THE FUNDAMENTAL CHARACTERISTICS OF ACCESS TO LOOPS BE CHANGED IN A MANNER THAT BENEFITS CONSUMERS BY EXPANDING THE DEVELOPMENT OF MASS MARKET COMPETITION?

A. Yes. There is a means available that uses currently available technology and allows the provisioning of loops to be operationally and competitively neutral, making it the local service counterpart of "equal access" in the long distance market. This is a process that AT&T has generically referred to as "electronic loop provisioning" ("ELP"). Exhibit MDV-4, attached to the testimony of Mark Van de Water, is a videotape that concludes with an overview and demonstration of ELP and is directly related to my testimony here.

As discussed in Section IV above, the underlying single user local network architecture and technology that ILECs deployed over the decades, and have resisted changing since the passage of the Act, impose on CLECs the burdens of a vast investment in backhaul infrastructure (e.g., collocation, collocation electronics, and transport facilities) and of an inefficient and costly loop migration process (*e.g.*, hot cuts) that ILECs do not have to incur in order to serve end-users. The "batch" hot cut process and use of UNE-P based "rolling access" do not erase any of these problems that make the use of UNE-L for the mass market infeasible. Change is required and possible and, in fact, many of the components necessary to make the change are already in use in the ILEC network.

Competitively neutral, efficient access to customer loops is required for mass-market competition to develop and be sustainable in a UNE-L environment. This means that customer transfers among competing networks must be fast, inexpensive and non-disruptive for the customer choosing a CLEC as its carrier. No carrier should be advantaged or disadvantaged with regard to how customers are physically connected to competing networks. The ILECs' current network was designed to accommodate a single firm operating as a monopoly. It cannot functionally support a competitive, multi-carrier environment without significant modification. Fortunately, however, modern technology has opened new opportunities for responsibly converting the ILEC network into an efficient multi-carrier network.

The characteristics of such a network are fairly easy to define. Loops should be readily accessible at a few centralized locations, and the interface to the loops should be electronic, as it is today in the ILECs' network and when UNE-P is used. Centralized availability of digital, packetized customer signals (rather than dispersed access to physical, analog loops) would address and resolve many of the problems. First, transmitting voice signals in a digital and packet format eliminates the need for CLECs, and only CLECs, to deploy costly electronics that do not augment the types of services that may be deployed. Centralized access, highly feasible with a packet-based network infrastructure, can significantly reduce the need for, and the cost of, collocation. Equally important, packetized signals are readily redirected by software commands. This feature offers the speed, cost structure, capacity and ease of change fundamental to unconstrained competition. It removes the manual hot cut process from consideration and replaces it with electronic provisioning that is equal to that which exists for UNE-P and in the long distance marketplace. Lastly, a packet-based loop architecture would eliminate the need for competitors to adopt a circuit-switched infrastructure and permit the introduction of new services that leverage the computer controlled and higher bandwidth features of a packet-based network.

The technology and equipment necessary to realize non-discriminatory digital, centralized and packet-based loops are available today. Indeed, the digitization and packetization of voice communications can be seen as a logical extension of equipment and technology already in use by the ILECs in association with their deployment of DSL. The three major components necessary to support the necessary changes are already in service, Next Generation Digital Loop Carriers ("NGDLC"), Asynchronous Transmission Mode ("ATM") modules, and ATM-compatible equipment known as "voice gateways" or "VoATM Gateways".

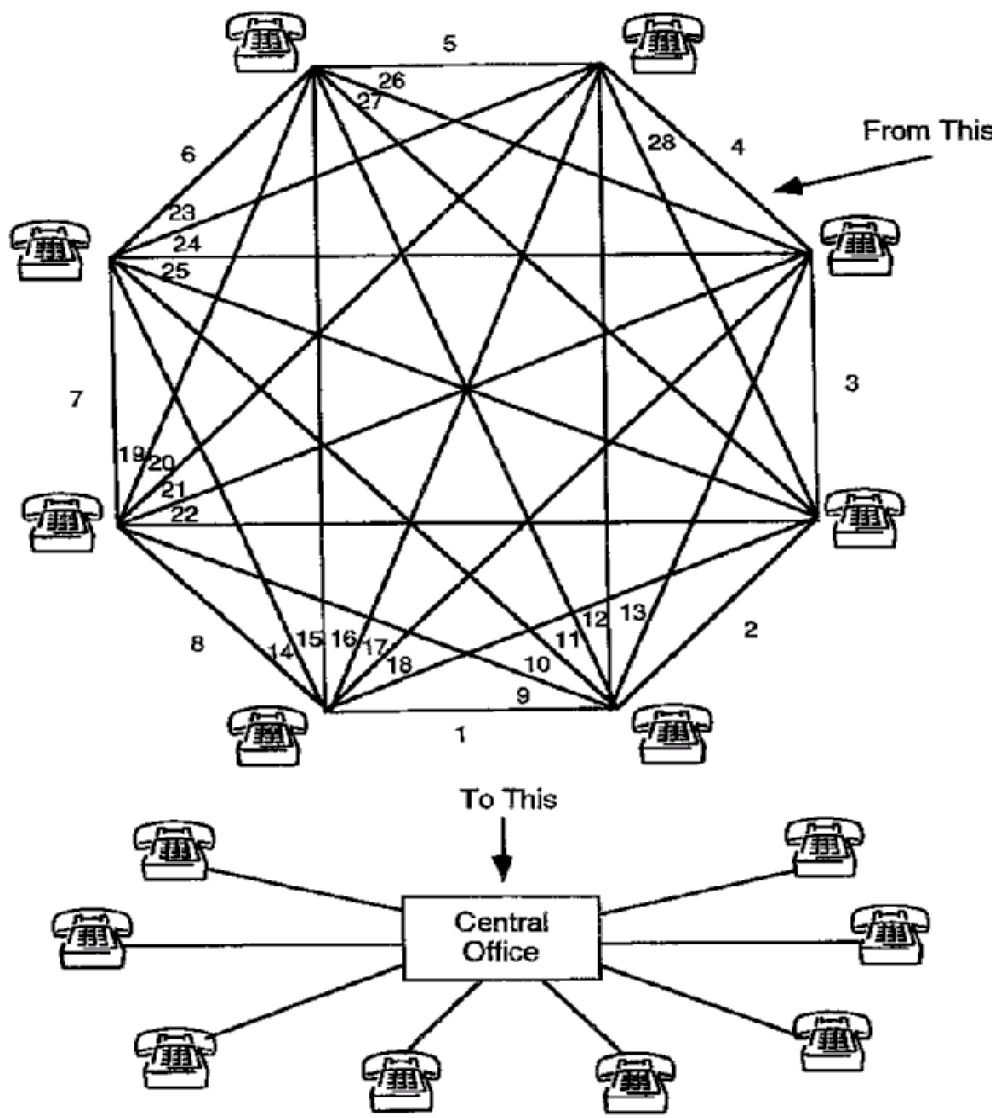
Q. PLEASE SUMMARIZE THE CRITICAL ISSUE YOU DISCUSS IN YOUR TESTIMONY.

A. The critical issue of this proceeding is not whether CLECs can "deploy" their own switches. Instead, the critical issue upon which this Commission should focus is whether a CLEC can "efficiently use" its own switch to connect to the local loops of end users. The differences in the way end users' loops are connected to carriers' switches are among the most important factors that cause CLECs to face substantial operational and economic entry barrier when they seek to offer POTS to mass-market (residential and small business) customers using their own switches and ILEC-provided loops (i.e., UNE-L facilities-based entry). Without fundamental changes to the way in which the ILECs permit CLECs to gain access to the consumers' loops, the impairment found by the FCC will continue.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

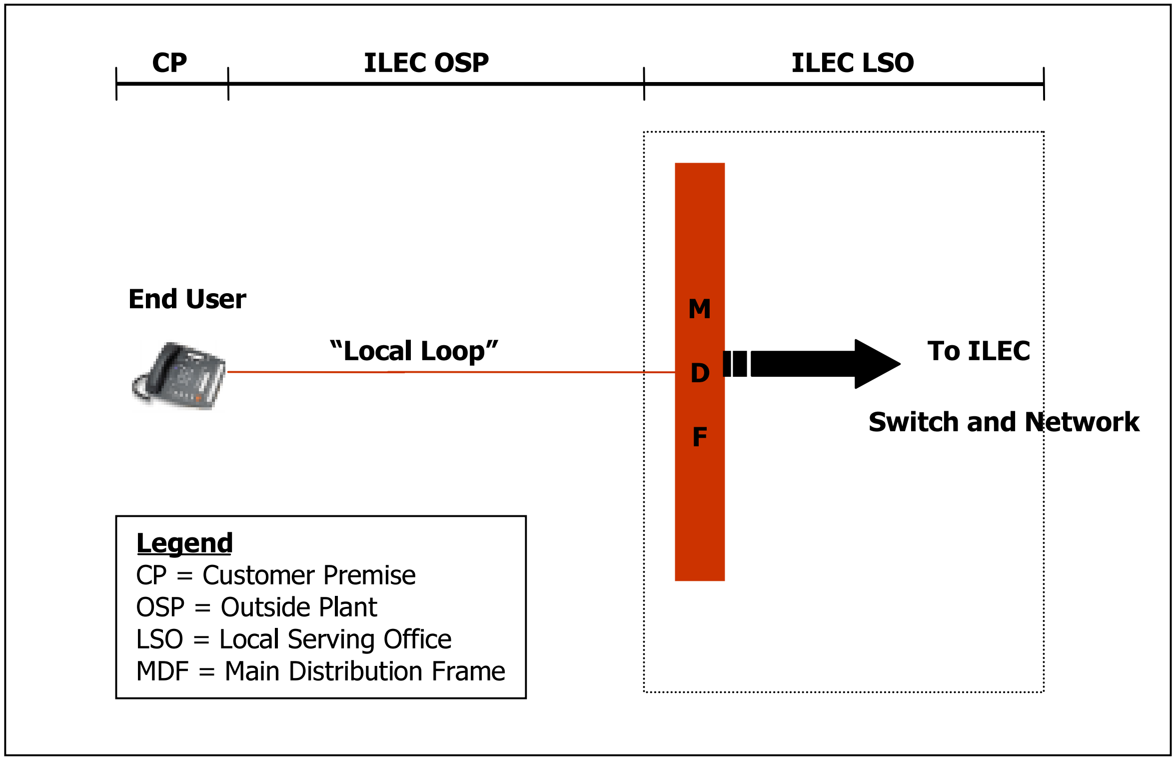
A. Yes, at this time.

The Need for Centralized Switching



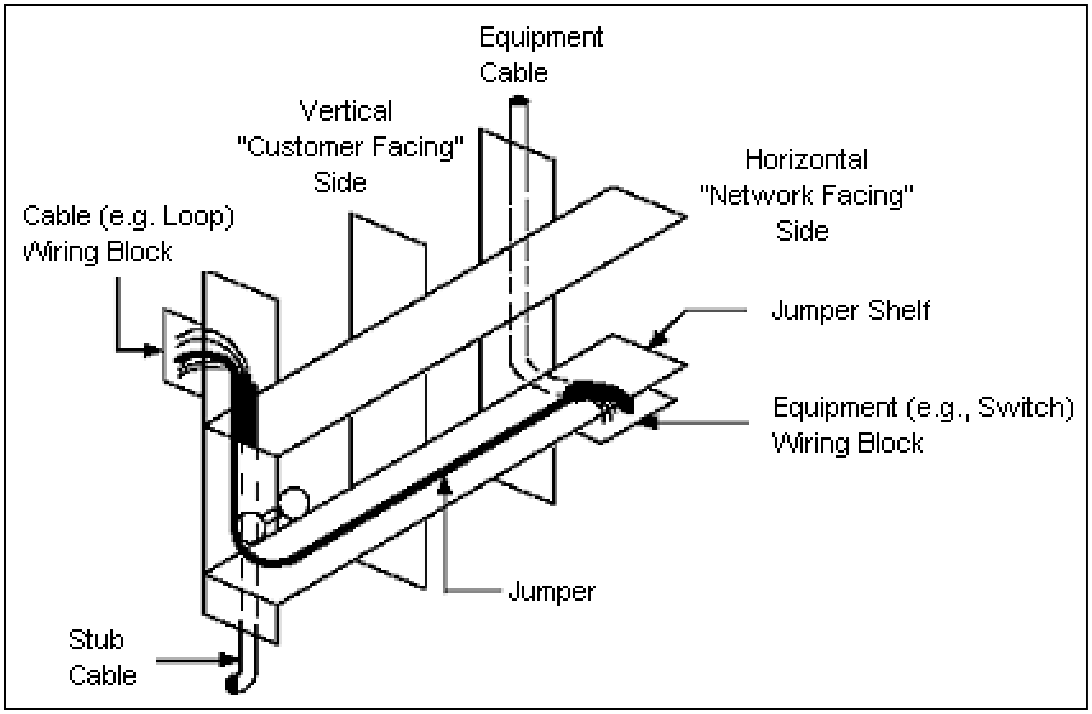
KPSC Case No. 2003-00379
Jay M. Bradbury
Exhibit: JMB-1

The Local Loop



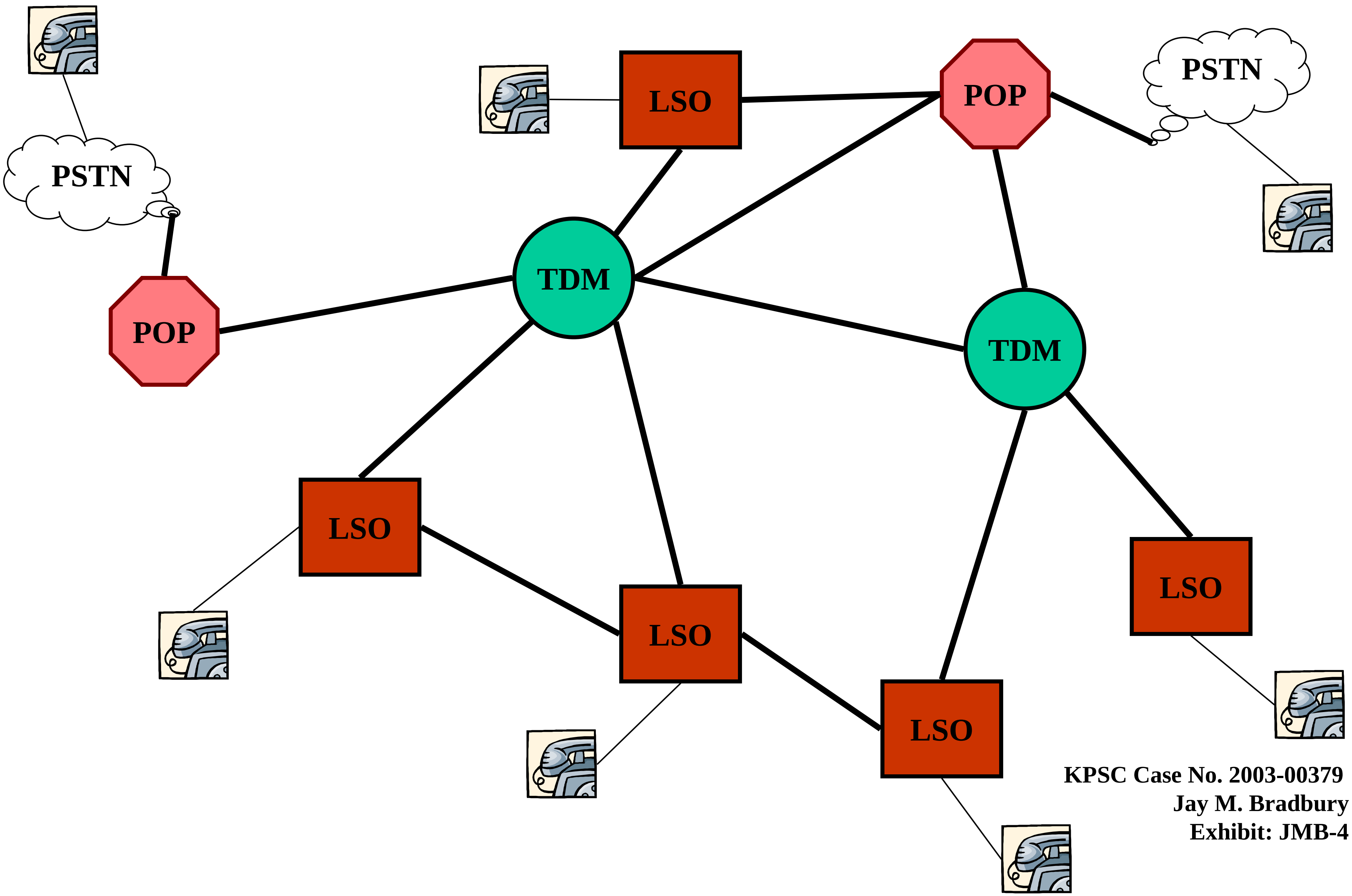
KPSC Case No. 2003-00379
Jay M. Bradbury
Exhibit: JMB-2

A Distribution Frame



KPSC Case No. 2003-00379
Jay M. Bradbury
Exhibit: JMB-3

The ILEC network architecture provides efficient call termination.



KPSC Case No. 2003-00379
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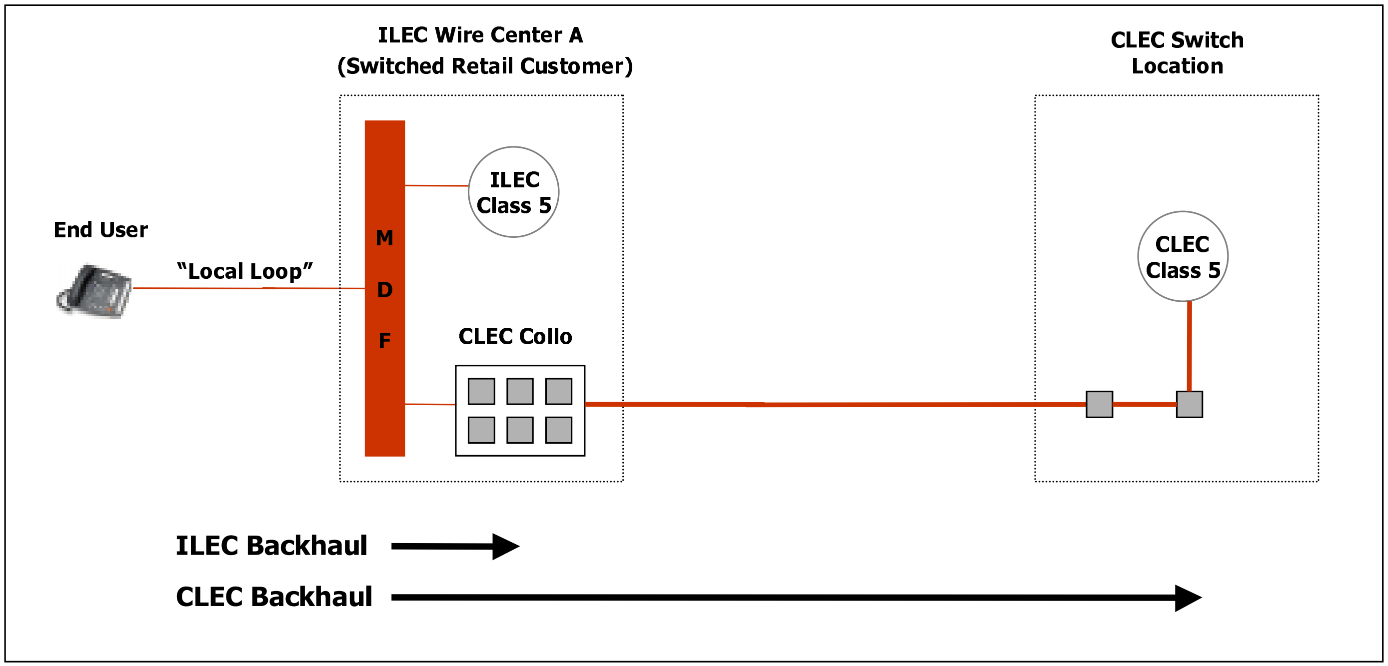
Exhibit: JMB-4

Collocation and Backhaul



KPSC Case No. 2003-00379
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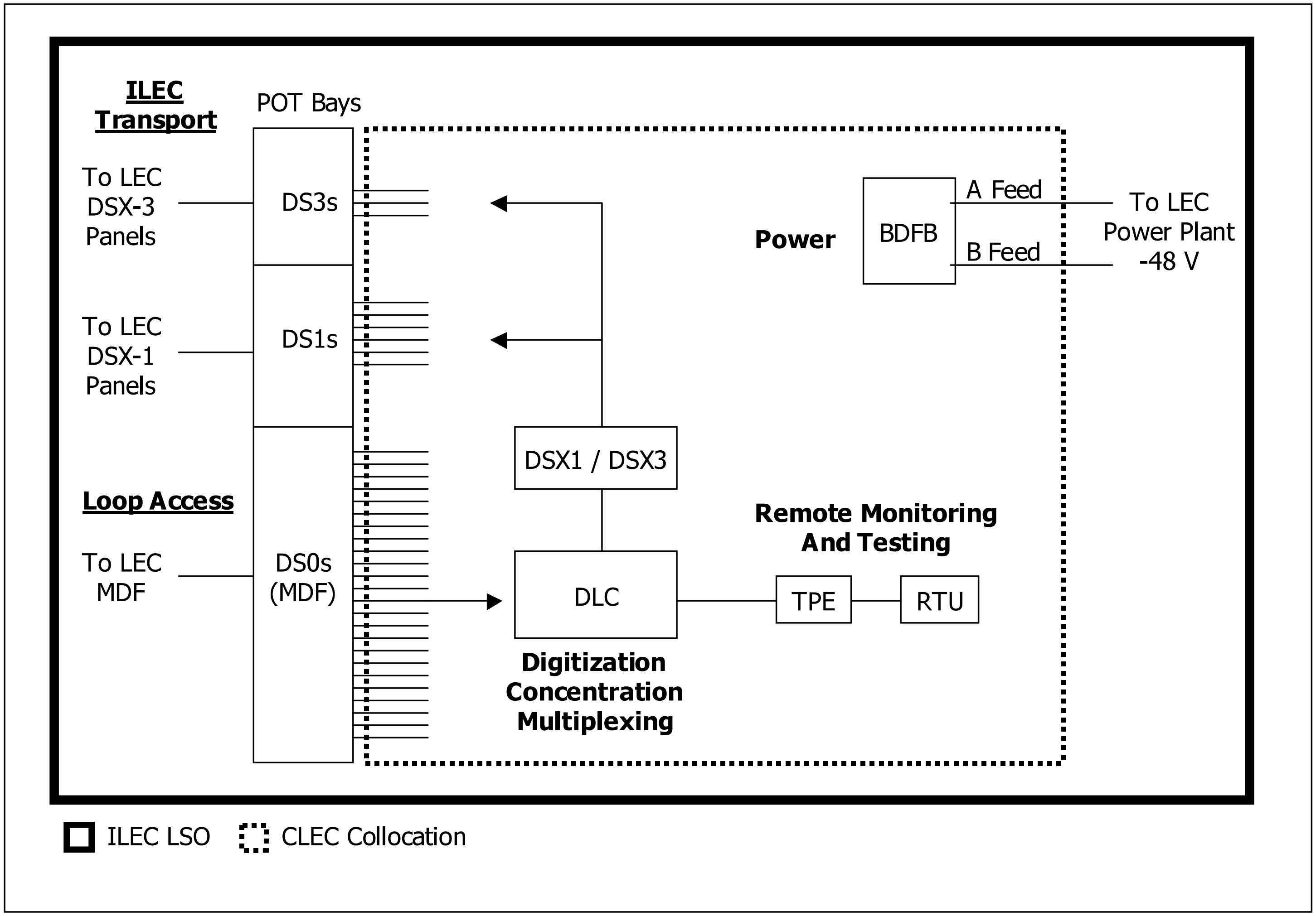
Exhibit: JMB-5

Collocation with ILEC Transport



KPSC Case No. 2003-00379
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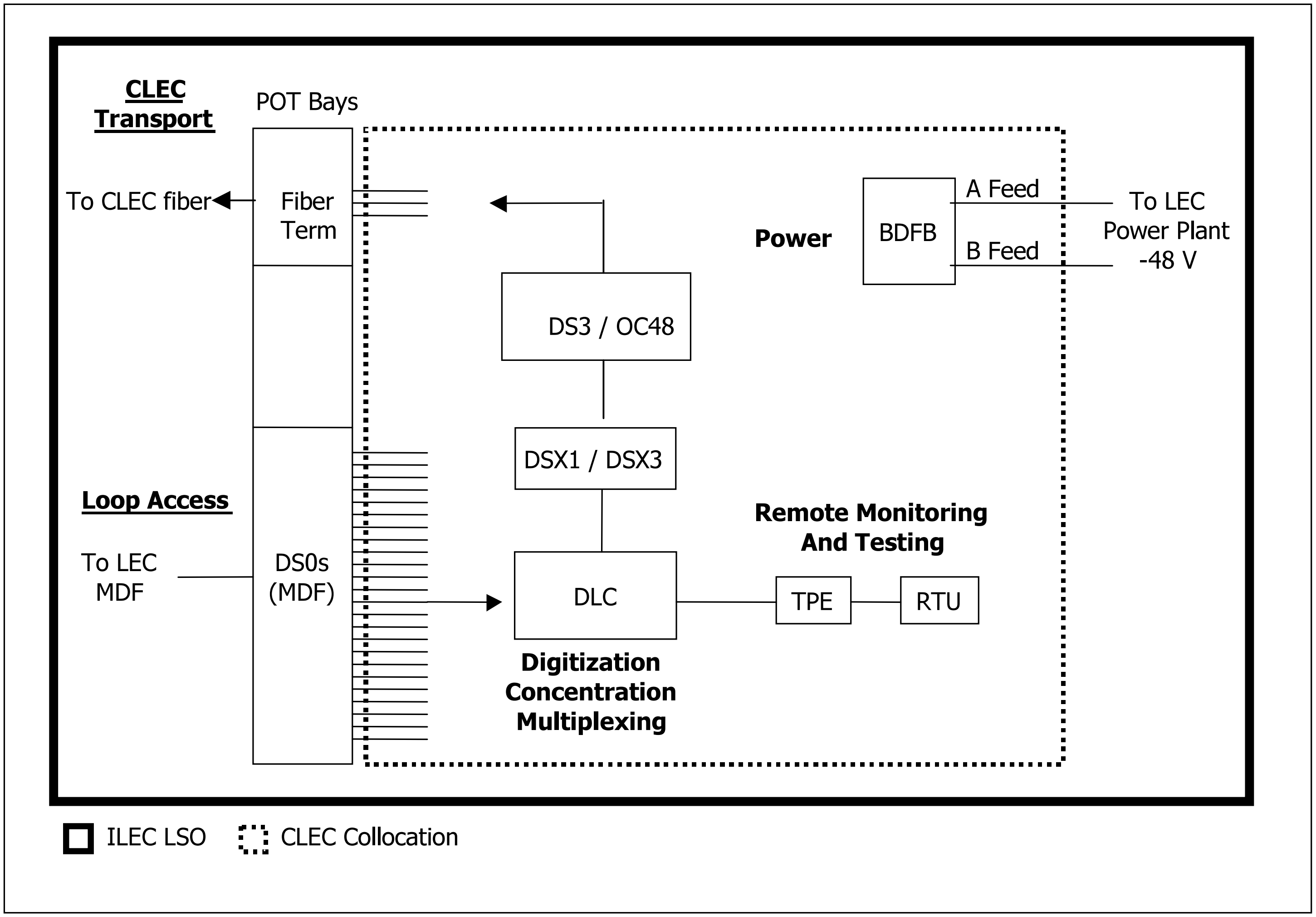
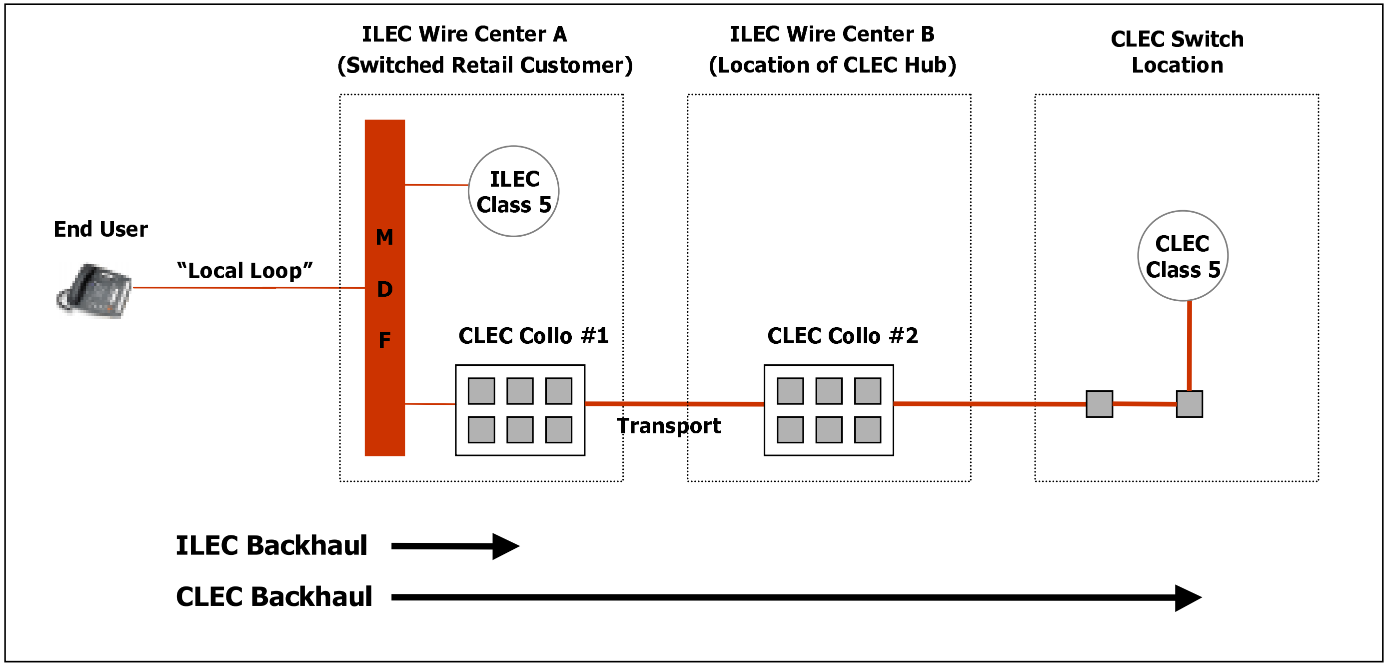
Exhibit: JMB-6

Collocation with CLEC Backhaul

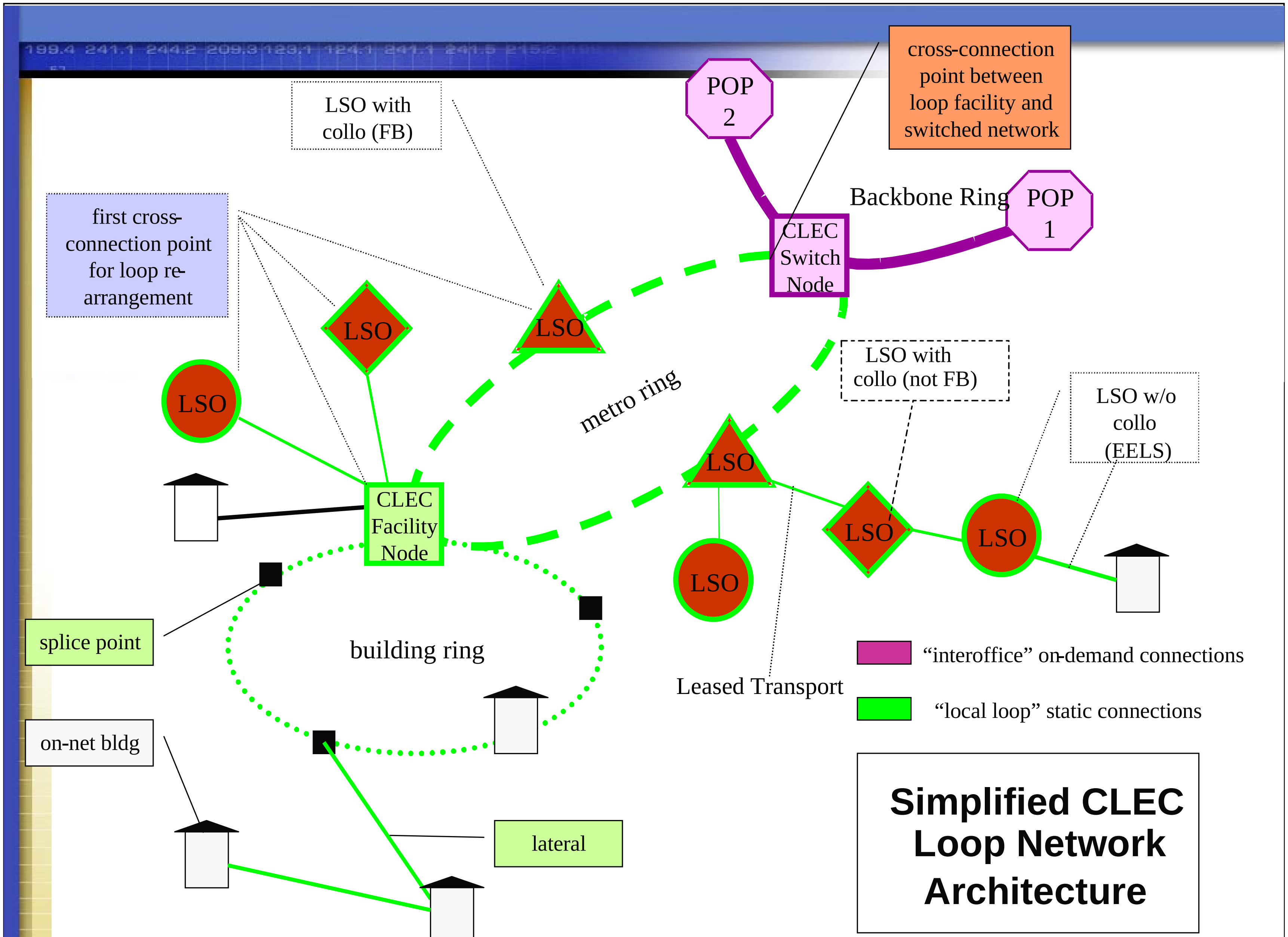


KPSC Case No. 2003-00379
Jay M. Bradbury
Exhibit: JMB-7

Collocation Hubbing and Backhaul



KPSC Case No. 2003-00379
Jay M. Bradbury
Exhibit: JMB-8



KPSC Case No. 2003-00379
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Exhibit: JMB-9

The CLEC call termination requirements span multiple ILEC local calling areas, must use the ILEC network and can not duplicate the ILEC call termination efficiencies.

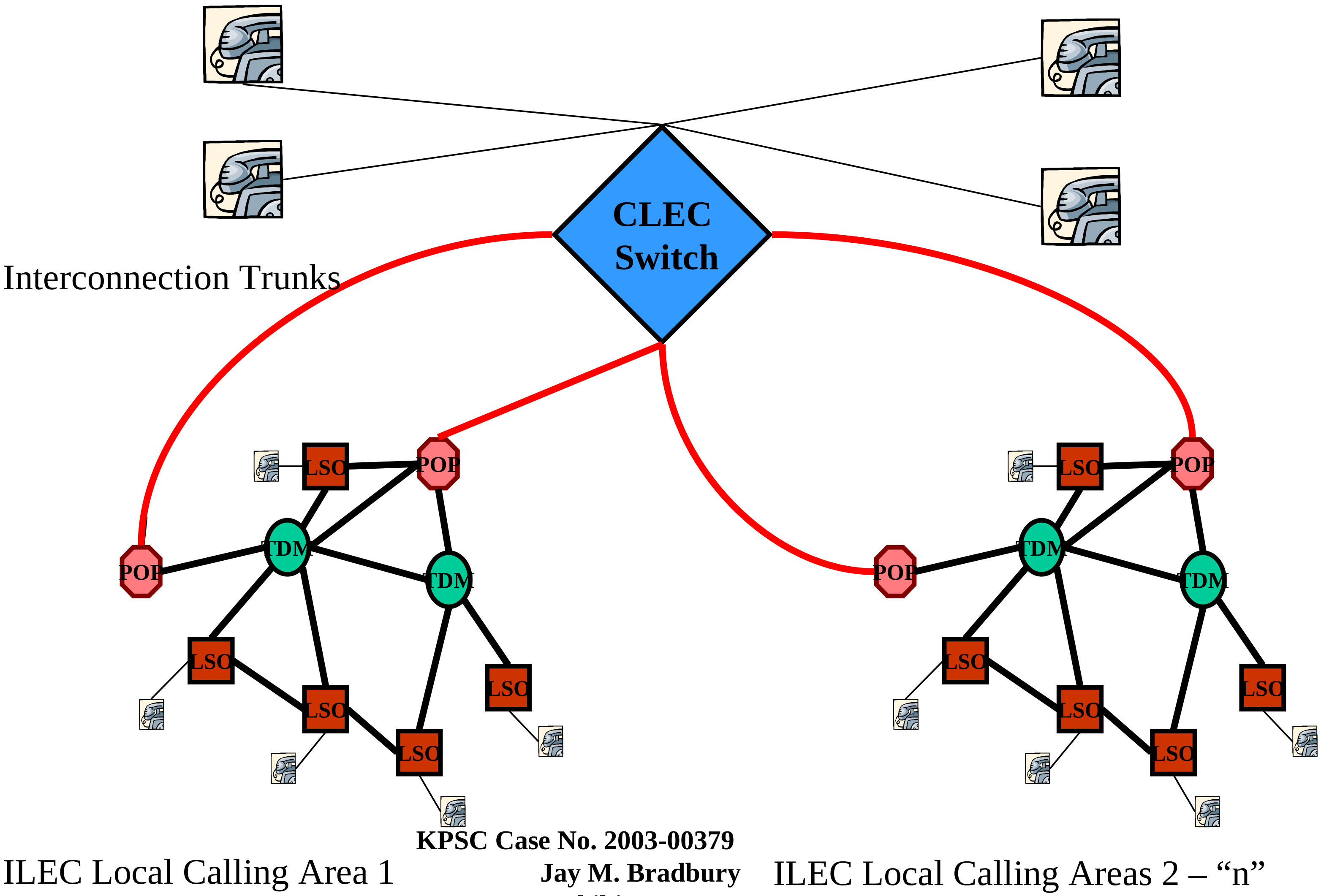

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Exhibit: JMB-10