BELLSOUTH TELECOMMUNICATIONS, INC.

DIRECT TESTIMONY OF W. KEITH MILNER ORIGINAL

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

DOCKET NO. 990649-TP

MAY 1, 2000

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

A. My name is W. Keith Milner. My business address is 675 West Peachtree Street, Atlanta, Georgia 30375. I am Senior Director - Interconnection Services for BellSouth. I have served in my present role since February 1996, and have been involved with the management of certain issues related to local interconnection, resale, and unbundling.

Q. PLEASE SUMMARIZE YOUR BACKGROUND AND EXPERIENCE.

A. My business career spans over 29 years and includes responsibilities in the areas of network planning, engineering, training, administration, and operations. I have held positions of responsibility with a local exchange telephone company, a long distance company, and a research and development company. I have extensive experience in all phases of telecommunications network planning, deployment, and operations (including research and development) in both the domestic and

international arenas.

I graduated from Fayetteville Technical Institute in Fayetteville, North Carolina, in 1970, with an Associate of Applied Science in Business Administration degree. I later graduated from Georgia State University in 1992 with a Master of Business Administration degree.

Q. HAVE YOU TESTIFIED PREVIOUSLY BEFORE ANY STATE PUBLIC SERVICE COMMISSION, AND IF SO, BRIEFLY DESCRIBE THE SUBJECT OF YOUR TESTIMONY?

A. I have previously testified before the state public service commissions in Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, and South Carolina, the Tennessee Regulatory Authority, and the Utilities Commission in North Carolina on the issues of technical capabilities of the switching and facilities network regarding the introduction of new service offerings, expanded calling areas, unbundling, and network interconnection.

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

A. In my testimony, I will address the technical aspects of certain network-related issues raised in this docket. These issues, in whole or in part, are issues 3, 4, and 7.

Issue 3(a): What are xDSL capable loops?

Q. PLEASE DESCRIBE BELLSOUTH'S UNBUNDLED XDSL LOOP TYPES.

A. High Bit-Rate Digital Subscriber Line (HDSL) Compatible Loop: These loops are best suited for HDSL services. The technical characteristics of a loop are screened to ensure that the loop meets stringent industry standards for Carrier Serving Area (CSA) transmission specifications to support HDSL services. The strict requirements for these loops mean that the end user must be served by a non-loaded copper pair, and the loop typically cannot be more than 12,000 feet long on 24 gauge copper wire. If 26 gauge copper wire is used, the limit is 9,000 feet or less. In either case, the loop may have up to 2,500 feet of bridged tap with no single bridged tap exceeding 2,000 feet.

Asymmetrical Digital Subscriber Line (ADSL) Compatible Loop: These copper loops are provisioned according to the Revised Resistance Design (RRD) industry standards which means they may be up to 18,000 feet long and may have up to 6,000 feet of bridged tap which is inclusive of the loop length. This means that for every foot of bridged tap, the loop length is reduced by an equal amount. Therefore, an RRD loop that has 4,000 feet of bridged tap could be no longer than 14,000 feet.

Originally the ADSL compatible loop was set to the same CSA criteria as the HDSL capable loop. However, in response to requests from ALECs, the loop was changed to the RRD standards during the first quarter of 2000.

BellSouth developed both the HDSL capable loop and the ADSL capable loop in response to the FCC's 96-325 Order and both loop types have been available to Alternative Local Exchange Carriers (ALECs) since the fourth quarter of 1996.

Unbundled Copper Loop (UCL) - These loops provide a "dry" copper pair (that is, without using electronic devices) to an end user using the Resistance Design (RD) industry standard. These loops may be up to 18,000 feet long and may have up to 6,000 feet of bridged tap, which is exclusive of the loop length. This means the loop length is not reduced by the bridged tap amount. Therefore, in some cases, the loop length may be 18,000 feet long and have up to 6,000 feet of bridged tap. BellSouth is not able to ensure that these loops will function properly for DSL service since their physical characteristics may be beyond the maximum distance for some DSL services and equipment. However, BellSouth will ensure that these loops have electrical continuity and balance relative to the tip and ring.

The UCL was developed at the request of ALECs. The UCL has been available to ALECs since the second quarter of 1999. BellSouth has also

recently developed a new variant of UCL. The UCL Long (UCL-L) unbundled loop is a copper loop that is longer than 18,000 feet. Typically applied telephony standards dictate that all copper loops longer than 18,000 feet would be loaded to properly serve dial-tone or "plain old telephone service" (POTS) type customers. Therefore, the ALEC would need to use BellSouth's Unbundled Loop Modifications (ULM) service offering to have any load coils and/or bridged tap removed from these loops in order to transform them into "dry" or "clean" copper loops. Mr. Varner addresses the issue of rates for ULM.

Q. DOES BELLSOUTH HAVE ANY ADDITIONAL XDSL LOOPS?

A. BellSouth offers its Integrated Services Digital Network (ISDN)-capable loop and is developing the Universal Digital Channel (UDC)-capable loop. These loops are not specifically categorized as xDSL-capable loops but they may support the DSL service known as Integrated Services Digital Network Digital Subscriber Line (IDSL). BellSouth provisions its ISDN-capable loops according to applicable industry standards which means they may be provisioned over copper or via a Digital Loop Carrier (DLC) system. These loops are also free of any load coils prior but are not referred to as "clean copper loops" because they may be provisioned via DLC systems which are completely compatible with ISDN service. As mentioned, BellSouth is in the process of developing a loop known as a UDC loop. This is the same as the ISDN-capable loop but is provisioned

in a manner that supports "data-only" ISDN that will better meet the needs of ALECs that want to deploy IDSL.

Issue 3(b): Should a cost study for xDSL-capable loops make distinctions based on loop length and/or the particular DSL technology to be deployed?

Q. WHAT IS THE IMPACT OF LOOP LENGTH AND/OR THE PARTICULAR DSL TECHNOLOGY ON COST?

A. The usefulness of BellSouth's unbundled loops for the provisioning of DSL services depends on a variety of factors, including the end user's distance from the serving wire center, as well as the length and gauge of the copper wire that serves the customer. Significantly, the same copper loops that are used to provide DSL services are also utilized to provide voice service to BellSouth's customers, as well as to other ALECs' customers.

BellSouth ensures that the unbundled loops it provides meet appropriate technical standards. As the FCC recognized: "[p]rovision of xDSL service is subject to a variety of important technical constraints. One is the length of the subscriber loop: ADSL, the most widely deployed xDSL-based service, generally requires loops of less than 18,000 feet using current technology. Another is the quality of the loop, which must be free of excessive bridged taps, loading coils, and other devices commonly used to aid in the provision of analog voice and data transmission, but which

interfere with the provision of xDSL services. 'Conditioning' loops to remove those impediments, or constructing fiber-based digital loop carrier systems to overcome loop length difficulties, can be expensive." See Third Report and Order in CC Docket No. 98-147, rel. Dec. 9, 1999, ¶ 8, n. 9.

As a result of the above and as discussed in Issue 3(a) above, it is quite evident that the cost of provisioning xDSL services is a function of both the loop length and the particular DSL technology to be deployed. As a result, it is appropriate for a cost study for xDSL-compatible loops to recognize distinctions based on loop length for the particular DSL technology to be deployed.

Issue 4(b): How should access to such sub-loop elements be provided, and how should prices be set?

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

A. BellSouth believes that access to such sub-loop elements should be provided in a similar manner as approved by this Commission in its order in Docket No. 990149-TP wherein the Commission approved BellSouth's method of providing MediaOne with access to the sub-loop element called Network Terminating Wire (NTW) in multiple dwelling units (MDU's). As I will discuss in the following paragraphs, the considerations applicable to access to a sub-loop element are the same whether the access point is at

an MDU or at some other point in the network between an end-user's premises and the serving central office. Therefore, the concept of an access terminal (as described by BellSouth in the MediaOne docket) by which an ALEC can gain access to the unbundled sub-loop element provides an appropriate level of technical security for the networks of each company involved. Mr. Varner will address pricing issues in his testimony.

Q. WHAT ARE SUB-LOOP ELEMENTS?

A. Sub-loop elements are the individual elements that make up the entire loop that extends from the BellSouth central office to the demarcation point between BellSouth's network and the inside wire at the end user customer's premises. No sub-loop elements, including those accounted for as Network Terminating Wire (NTW) and Intrabuilding Network Cable (INC), are classified as inside wire. Rather, since these sub-loop elements are on the network side of the demarcation point, sub-loop elements are all parts of BellSouth's loop facilities and, as such, are subject to unbundling per the FCC's UNE Remand Order.

Q. PLEASE GIVE A BRIEF DESCRIPTION OF THE TECHNOLOGY BELLSOUTH USES IN PROVIDING CUSTOMER LOOPS.

A. Today, BellSouth uses many types of facilities and technologies to provision loops to its customers. In some cases, the facility may be a basic architecture consisting of a pair of copper wires that extend from the

Main Distributing Frame (MDF) of the central office to the Network Interface Device (NID) at the end user's premises. In other cases, BellSouth may use a mixture of fiber optic cables, pairs of copper wires, and sophisticated electronics to provision a circuit from the central office to the end customer. As an example, Digital Loop Carrier (DLC) is one such technology that uses a mixture of facilities and electronic equipment to provide loops to end user customers. By offering these different types of provisioning options, BellSouth is able to provide optimum flexibility and cost-effectiveness during its service provisioning and maintenance processes.

Q. PLEASE DISCUSS THE SUB-LOOP ELEMENT REFERRED TO AS LOOP FEEDER.

A. In many cases BellSouth deploys a multiple circuit copper cable (for example, a 1,200 pair cable) from its central office to a remote terminal (RT) or cross-box located somewhere between the central office and the end user customer's location. Each pair within this cable can be used to carry a single voice conversation. This section of the loop is called the loop feeder. Sometimes, loop feeder has been referred to as "the first mile" of the loop in that it is the first section of cable leaving the BellSouth central office headed towards a customer's premises. This loop feeder section may also be provisioned using fiber optic cable.

The copper pairs of the loop feeder are then individually cross-connected

to pairs in smaller cables called loop distribution. The loop distribution cables are attached to the loop feeder cables and serve all the houses or businesses in a sub-section of one of the central office's serving areas.

Q. PLEASE DESCRIBE THE SUB-LOOP ELEMENT REFERRED TO AS LOOP DISTRIBUTION.

A. Loop distribution facilities have been referred to as the "last mile" because these are the facilities that go the "last mile" to the customer's premises. The loop distribution cables are used to, in effect, "fan out" the availability of the cable pairs and/or transmission channels, if electronic digital loop carrier equipment is used, from the loop feeder cables. In this regard, the cables one would see within a sub-division are generally loop distribution cables. Between the loop feeder cable and the loop distribution cable is a cabinet, above ground "hut", or below ground "controlled environment vault" within which cross-connections and/or electronics are located. These structures have been variously described as the "Feeder/Distribution Interface", the "Serving Area Interface", the "Remote Terminal" or, in its most simplistic configuration a "cross-connect box" or simply "cross-box". Any of these terms provides a reasonable description of the function of connecting a copper cable pair or fiber optic facility in the loop feeder cable to a copper cable pair in the loop distribution cable. The loop distribution facility eventually runs to the customer's building and is then connected to Intrabuilding Network Cable (INC) and/or Network Terminating Wire (NTW), or in single family dwellings, a "drop wire", which

connects the entire loop to the device called the Network Interface Device (NID).

Q. PLEASE DESCRIBE THE SUB-LOOP ELEMENT REFERRED TO AS THE NETWORK INTERFACE DEVICE (NID).

A. Simply stated, the NID provides a demarcation point between BellSouth's facilities (that is, the loop) and the customer's facilities (that is, the inside wire). Thus, the NID provides a way to connect the loop to the inside wire. In some cases, the NID provides additional functions such as lightning protection and loopback testing.

Q. PLEASE DESCRIBE THE SUB-LOOP ELEMENT REFERRED TO AS INTRABUILDING NETWORK CABLE (INC).

A. In multi-story buildings, and in some campus-type properties, INC is that part of BellSouth's loop facilities extending from a cross-connect terminal at, or close to, the entrance point of the distribution cable. INC is another sub-loop element that is located on the network side of the demarcation point between BellSouth's network and the inside wire at an end user customer's premises. INC in some cases is referred to as "riser cable." Although INC may in some cases connect directly to the NID, typically it connects to NTW in a wiring closet prior to final termination at the end user's NID.

Q. PLEASE DESCRIBE THE SUB-LOOP ELEMENT REFERRED TO AS NETWORK TERMINATING WIRE (NTW).

A. NTW is another sub-loop element of the BellSouth loop. Depending on the type of building served, NTW provides a copper wire transmission path between distribution cable or INC, and "fans out" to individual customer suites or rooms within that building. In this sense, NTW is the "last" part of the loop on the network side of the demarcation point.

To summarize, loop feeder cables are connected to loop distribution cables which, in turn, are connected to INC and/or NTW, depending on the situation, either of which then extends the loop to its final termination at the customer's NID. The NID establishes the demarcation point between BellSouth's network and the inside wire at the end user customer's premises with both NTW, INC, loop distribution, and loop feeder being located on BellSouth's side of the demarcation point and, thus, comprising sub-loop elements of BellSouth's network.

Q. IS INTRABUILDING NETWORK CABLE (INC) AND NETWORK TERMINATING WIRE (NTW) PART OF BELLSOUTH'S LOOP, OR ARE THEY "INSIDE WIRE"?

A. INC (sometimes referred to as "riser cable") and NTW are sub-elements of the loop. BellSouth expects to be, and is entitled to be, compensated for the parts of BellSouth's loop used by an ALEC, including INC and

NTW. The loop, including all sub-elements, is on the network side of the demarcation point or NID. The inside wire is on the customer's side of that demarcation point. The demarcation point has clearly been established by this Commission's rule 25-4.0345-1B.

Q. WHAT IS BELLSOUTH'S BASIC POSITION REGARDING ALEC's ACCESS TO SUB-LOOP ELEMENTS LOCATED ON BELLSOUTH'S SIDE OF THE DEMARCATION POINT?

A. Because BellSouth's loop feeder, loop distribution, NTW, and INC constitute sub-loop elements, ALECs should obtain access to them in the same manner as it obtains access to any other network element -- by placing an order with BellSouth and paying a just and reasonable price for the element.

Q. DOES BELLSOUTH PROVIDE ALECS UNBUNDLED ACCESS TO SUB-LOOP ELEMENTS?

A. BellSouth offers access to all elements of its loop network through sub-loop unbundling offerings that comply with the FCC's UNE Remand Order and FCC Rule 319(a). In keeping with the full intent of the FCC's UNE Remand Order, BellSouth is, and has been, providing sub-loop unbundling at technically feasible points of access.

Q. PER THE FCC's UNE REMAND ORDER, WHAT DO TECHNICALLY

FEASIBLE POINTS OF ACCESS INCLUDE?

A. BellSouth will provide sub-loop unbundling at those technically feasible points of access per the FCC's Remand Order. However, the Order relating to access points is not entirely clear on this issue, and BellSouth has sought additional clarification from the FCC as part of a Petition For Reconsideration of the 319 Order. For example, the meaning of "access to the Minimum Point of Entry (MPOE)" is unclear since the term MPOE is generally used to define a location of the demarcation point, not a cross-connect block or some other piece of hardware. In this sense, BellSouth has no control over ALEC access to the location on a property for access to facilities that are on the customer side of the demarcation at the MPOE.

Q. IS BELLSOUTH'S POSITION CONSISTENT WITH THIS COMMISSION'S RULES REGARDING DEMARCATION POINTS?

A. Yes. BellSouth's position is entirely consistent with the rules created by this Commission's rule 25-4.0345-1B.

Q. ARE THERE ANY OTHER AREAS OF CLARIFICATION THAT NEED TO BE ADDRESSED RELATIVE TO "TECHNICALLY FEASIBLE POINTS OF ACCESS"?

A. Yes. Access to sub-loop unbundling at the Main Distributing Frame (MDF) is viable only for those network elements that normally terminate on the

MDF. One example of such a sub-loop element is loop feeder.

Q. WHAT IS YOUR UNDERSTANDING OF THE FCC'S STATEMENT THAT BELLSOUTH IS REQUIRED TO PROVIDE ALECS "ACCESS TO BELLSOUTH-OWNED INSIDE WIRING", AND WHAT IS ITS IMPACT, IF ANY?

A. First, let me set out what the FCC stated. The FCC's Remand Order at ¶223 is as follows:

> We clarify that "technically feasible points" would include a point near the customer premises, such as the point of interconnection between the drop and the distribution cable, the NID, or the MPOE. Such access would give competitors unbundled access to the inside wire sub-loop element, in cases where the incumbent owns and controls wire inside the customer premises. It would also include any FDI, whether the FDI is located at a cabinet, CEV, remote terminal, utility room in a multi-dwelling unit, or any other accessible terminal. (Emphasis added).

The FCC's Remand Order at ¶182 describes more specifically "control" of inside wire as follows:

> Section 68.3 of our rules defines the demarcation point as that point on the loop where the telephone company's control of the wire ceases, and the subscriber's control (or, in the case of some multiunit premises, the landlord's control) of the wire begins. Thus,

> the demarcation point is defined by control; it is not a fixed location on the network, but rather a point where an incumbent's and a property owner's responsibilities meet. The demarcation point is often, but not always, located at the minimum point of entry (MPOE), which is the closest practicable point to where the wire crosses a property line or enters a building. In multiunit premises, there may be either a single demarcation point for the entire building or separate demarcation points for each tenant, located at any of several locations, depending on the date the inside wire was installed, the local carrier's reasonable and nondiscriminatory practices, and the property owner's preferences. Thus, depending on the circumstances, the demarcation point may be located either at the NID, outside the NID, or inside the NID.

The above paragraphs from the Order suggest to me that the FCC intended to include in the unbundling of what it refers to as "inside wire" those facilities that exist today on the network side of the demarcation point, and which are included in BellSouth's Accounts and Subsidiary Records Categories as Network Terminating Wire (NTW), and that which are defined in Part 32 of the Uniform System Of Accounting (USOA) as Intrabuilding Network Cable (INC). As defined in several previous FCC Orders, however, "inside wire" is located on the customer's side of the demarcation point and is under control of the end user or, in some cases, the landlord. In the situation of NTW and INC, ALECs should obtain access to these sub-loop elements from BellSouth in the same manner as

it obtains access to any other unbundled network element. As to access to the inside wire within the end user's premises, such access should be obtained from the end user, or building owner.

Q. WHAT IMPACT, IF ANY, WOULD DIRECT ACCESS TO SUB-LOOP UNBUNDLING HAVE ON END USER CUSTOMERS?

A. BellSouth believes that direct access by ALEC technicians could, intentionally or unintentionally, disrupt the service provided by BellSouth to end user customers, including both BellSouth's and ALECs' end user customers. The FCC requires that "each carrier must be able to retain responsibility for the management, control, and performance of its own network." (First Report and Order in Docket 96-325, ¶ 203) If allowed, direct access would render BellSouth incapable of managing and controlling its network in the provision of service to its and certain ALECs' end user customers. For reasons of network reliability and security, BellSouth believes that direct access to its network facilities by ALECs is not in the best interests of the end user customer, whether they be end user customers of BellSouth or the ALECs.

Q. HAVE ANY STATE UTILITY COMMISSIONS CONSIDERED THE APPROPRIATE METHOD FOR ALECS TO HAVE ACCESS TO BELLSOUTH'S SUB-LOOP ELEMENTS?

A. Yes. This Commission considered the issue of access to the sub-loop

element referred to as Network Terminating Wire (NTW) in the arbitration proceedings between BellSouth and MediaOne in Docket No. 990149-TP. Also, the Georgia Public Service Commission considered this same issue of access to NTW in the arbitration proceedings between BellSouth and MediaOne in Docket No. 10418-U.

This Commission denied direct access to NTW and required an access terminal to be placed between BellSouth's network and MediaOne's network. The access terminal gives MediaOne the access to NTW it desires without reducing network reliability and security. BellSouth believes the underlying issues here (that is, providing a ALEC unbundled access to the other sub-loop elements while preserving network reliability and security) are the same as were addressed in the MediaOne arbitration cited above. This Commission determined that MediaOne and others could gain access to unbundled NTW without reducing network security and reliability by adopting BellSouth's proposed form of access. A portion of that Order follows:

> "The record does not contain evidence of any case which would support a proposal where one party is seeking to use its own personnel to, in effect, modify the configuration of another party's network without the owning party being present. We find that MediaOne's proposal to physically separate BellSouth's NTW cross-connect facility from BellSouth's outside distribution cross-connect facilities is an unrealistic approach for meeting its

objectives. Therefore, BellSouth is perfectly within its rights to not allow MediaOne technicians to modify BellSouth's network.

> ... Based on the evidence presented at the hearing, we believe that it is in the best interests of the parties that the physical interconnection of MediaOne's network be achieved as proposed by BellSouth.
>
> We find from the record that at least one other ALEC in Florida and an unknown number of ALECs in other states have been able to provide service based on BellSouth's NTW proposal. Thus, we believe that MediaOne should be able to provide service using BellSouth's NTW proposal..."

The Georgia Commission likewise found that MediaOne should gain access through the use of an access terminal and BellSouth's facilities. In its Order, the Commission stated:

> "As stated in the prior section, to the extent there is not currently a single point of interconnection that can be feasibly accessed by MediaOne, consistent with the FCC's Third Report and Order, BellSouth must construct a single point of interconnection that will be fully accessible and suitable for use by multiple carriers. Such single points of interconnection shall be constructed consistent with MediaOne's proposal such that MediaOne shall provide its own

cross connect (CSX) facility in the wiring closet to connect from the building back to its network. MediaOne would then be able to connect its customers within the MDU [that is, the Multiple Dwelling Unit] by means of an 'access CSX'."

BellSouth believes the use of access terminals as ordered by the Florida Commission and the Georgia Commission gives ALECs the requisite access to unbundled sub-loop elements while still maintaining network reliability and security. Such access should apply to all sub-loop elements.

Q. WHAT IS YOUR UNDERSTANDING OF THE TERM "SPOI" AS USED BY THE FCC IN ITS 319 REMAND ORDER?

A. The term "SPOI" refers to a single point of interconnection at multi-unit premises that is suitable for use by multiple telecommunications carriers. I believe the SPOI to be conceptually identical to the serving arrangement approved by this Commission in the MediaOne Docket discussed above except that it is intended for use by multiple carriers rather than by a single carrier. Further, if the SPOI were established following the form of access this Commission ordered for access to NTW in the previously mentioned MediaOne arbitration proceeding, I believe that the resulting SPOI would be compliant with this Commission's rule 25-4.0345-1B.

Q. HAVE YOU PREPARED AN EXHIBIT WHICH ILLUSTRATES AN

EXAMPLE OF BELLSOUTH'S PROPOSAL REGARDING SUB-LOOP UNBUNDLING?

A. Yes. Exhibit WKM-1, which is attached to this testimony, contains four (4) pages that I hope will aid in understanding this issue. Page 1 shows the typical access to unbundled NTW in a "garden" apartment. The apartments on page 1 could as easily be envisioned as separate floors in a multi-story building. The point to be made here is that the access terminal is cross-connected by tie cable pairs with the terminals of both BellSouth and the ALEC thus allowing an ALEC access while preserving network reliability and security. The access terminal in this scenario could also function as a SPOI for UNTW access. Page 2 shows a typical serving arrangement in multi-story buildings for which BellSouth is, at present, the sole provider of telephone service. Page 3 shows BellSouth's proposed form of access for an ALEC to the sub-loop elements NTW and INC. BellSouth proposes the use of an access terminal or connecting block on the cross-connect panel that is cross-connected by tie cable with the terminals of both BellSouth and the ALEC. The cross-connect panel for INC and the access terminal for UNTW access could also be serve as a SPOI for use by multiple carriers. Page 4 shows access to the sub-loop element Loop Distribution. In this instance only, an access terminal is usually not appropriate because of severe space limitations within the "cross-box" or similar structure. Rather, direct connections are made on behalf of the ALEC at the "cross-box", provided there is space, by BellSouth technicians.

Issue 7: What are the appropriate assumptions and inputs for the following items to be used in the forward-looking recurring UNE cost studies?

(i) fiber cable (material and placement costs)

(j) copper cable (material and placement costs)

(m) digital loop carrier costs

Q. PLEASE PROVIDE THE NETWORK TECHNOLOGY ASSUMPTIONS USED IN DEVELOPING THE UNE LOOP COST STUDY?

A. The network infrastructure design in the loop cost methodology starts with two basic assumptions. First, loops up to 12,000 feet from the central office are designed using copper. Second, loops longer than 12,000 feet are provided service using fiber feeder facilities and Next Generation Digital Loop Carrier (NGDLC).

Q. PLEASE EXPLAIN WHY FIBER FEEDER FACILITIES ARE USED RATHER THAN COPPER FOR LOOPS LONGER THAN 12,000 FEET.

A. The Total Element Long Run Incremental Cost (TELRIC) cost study methodology requires the use of the most economic architecture for the service for which costs are being developed. As explained by Ms. Caldwell in her testimony regarding the development of the loop costs, the primary consideration was for voice grade (or "narrowband") services. Costs were developed for loops of increasing length using both copper

cable and fiber fed digital loop carrier. Depending on the type of construction (aerial versus buried cable) and the volume of demand (cable size or NGDLC size), the economics of provisioning begin to indicate the use of fiber fed NGDLC rather than copper cable at approximately 10,000 feet of total loop length. Therefore, the economic crossover distance for loop studies for voice grade services is approximately 12,000 feet.

It should be noted that, in actual network design, voice grade services are mixed with demand for other types of service such as DS-1 and higher bandwidth services. In selecting the infrastructure design for a network to meet all of these demands, new copper cable is rarely the facility of choice for the feeder network. Instead, fiber cable with fiber optic multiplexers and NGDLC are used to meet the combined demand on the cable route.

Q. WHERE FIBER FED NGDLC IS PROVISIONED, PLEASE EXPLAIN WHAT DESIGN CRITERIA ARE USED TO DETERMINE THE DESIGN OF THE CABLE PLANT EXTENDING FROM THE NGDLC TO THE CUSTOMER LOCATION?

A. Carrier Serving Area (CSA) design provides the rules for provisioning the cable plant extending from the NGDLC to the customer location. These design rules limit the total loop length from the NGDLC site to the customer to 12,000 feet. Included in this 12,000 feet may be a maximum of 2,500 feet of bridged tap. No single bridged tap may be longer than 2,000 feet.

Q. PLEASE EXPLAIN THE BENEFIT OF USING THE CARRIER SERVING AREA DESIGN.

A. The economics that limit copper cable deployment distances from the central office to the customer location are the same as those that limit copper cable deployment from the NGDLC to the customer location. In addition to the economics of the design itself, the 12,000 foot maximum copper cable length makes copper loops compatible with many of the digital subscriber line (DSL) technologies used today in providing advanced services.

Q. IN YOUR TESTIMONY SO FAR, ONLY NGDLC HAS BEEN MENTIONED. WHAT IS THE DIFFERENCE BETWEEN NGDLC AND OTHER FORMS OF DIGITAL LOOP CARRIER (DLC)?

A. NGDLC describes a version of digital loop carrier equipment that provides many enhanced services and cost-reducing features that are not available on the older DLC systems. NGDLC systems are designed to support a larger capacity of lines, up to 2,016, from a single common equipment set than older vintages of DLC. For example, the larger capacity of NGDLC is a significant improvement over the 96-line capacity of the older vintage DLC referred to as "SLC-96", manufactured by Lucent Technologies.

Older vintage DLC cannot mix switched and non-switched provisioning within a 96-line group economically and can only use integrated central office alternatives economically when the 96-line group consists almost entirely of switched service. In contrast, NGDLC remote terminals can be configured on a circuit by circuit basis using integrated or universal central office alternatives to provide switched and non-switched services.

In providing switched services, NGDLC can be integrated with the local digital switch. In this mode of operation, traffic from the remote NGDLC site to the central office can be concentrated onto only the number of circuits required by the types of services provisioned from that site. Typically, residential services can be concentrated at a 4:1 ratio. This means that, on average, only one (1) line of capacity is required from the NGDLC site to the switch for each four (4) residential lines served from the NGDLC. For business services the typical concentration ratio is closer to 3:1.

In the older DLC systems, when DLC is integrated with the switch, it can be configured with either no concentration or with 2:1 concentration. In either circumstance, DLC uses more feeder capacity per line than does NGDLC.

In providing non-switched services, NGDLC has the capability, on a line by line basis, to provision remote NGDLC lines through the universal capacity of the NGDLC central office terminal. This allows non-switched

services to be routed around the central office switch to connect with the other customer locations of the non-switched services or to interconnect with another telecommunications carrier's facilities. Since these services are not switched, concentration is not feasible.

Q. WHY IS NGDLC ASSUMED IN THE LOOP COST METHODOLOGY?

A. The technical reasons I have described above provide the most forward looking architecture to provide for voice grade loop requirements. These technical advantages also offer economic advantages over older vintages of DLC. Larger line capacity on the NGDLC system achieves economies of scale, producing lower overall equipment costs. The capability to mix switched and non-switched services on the same system eliminates wasted capacity which adds economic benefit. Finally, the combination of larger line capacity and greater concentration capability reduces loop feeder capacity requirements resulting in lower overall costs.

Q. IN DISCUSSING OLDER VINTAGE DLC AND NGDLC, YOU MENTION INTEGRATION WITH THE CENTRAL OFFICE SWITCH. PLEASE DESCRIBE THE REQUIREMENTS THAT ARE FOLLOWED TO MAKE INTERFACING WITH THE SWITCH POSSIBLE.

A. Two technical documents provide descriptions of digital loop carrier systems and how they interface with local digital switches in the integrated configurations. The first document to be issued was Technical Reference-

008 (TR-008). This document, authored by Bell Communications Research, Inc. or "Bellcore" (the forerunner of Telecordia), described the SLC-96 digital loop carrier system manufactured by AT&T before divestiture and the document was jointly owned by AT&T and the Regional Bell Operating Companies (RBOCs) at divestiture. The major portion of that description still in use today is the portion describing the interface that allows remote NGDLC/DLC to connect directly to a local digital switch at the DS-1 level in what is referred to as an integrated configuration.

This configuration allows lines to be provisioned with channelization circuit packs at the remote NGDLC/DLC but without per line circuit packs at the central office switch. TR-008 describes two alternatives for this integrated capability.

TR-008 Mode I is a non-concentrated alternative that requires feeder capacity for every line on a full time basis. When this alternative is used, four DS-1s (each with 24 channels for a total of 96 channels) are required for each 96-line capacity TR-008 remote NGDLC/DLC system. This configuration is used when high usage lines are to be served from the remote NGDLC/DLC system. TR-008 Mode II is a concentrated alternative that provides 2:1 concentration. When this alternative is used, two DS-1s (each with 24 channels for a total of 48 channels) are required for each 96-line capacity TR-008 remote NGDLC/DLC system.

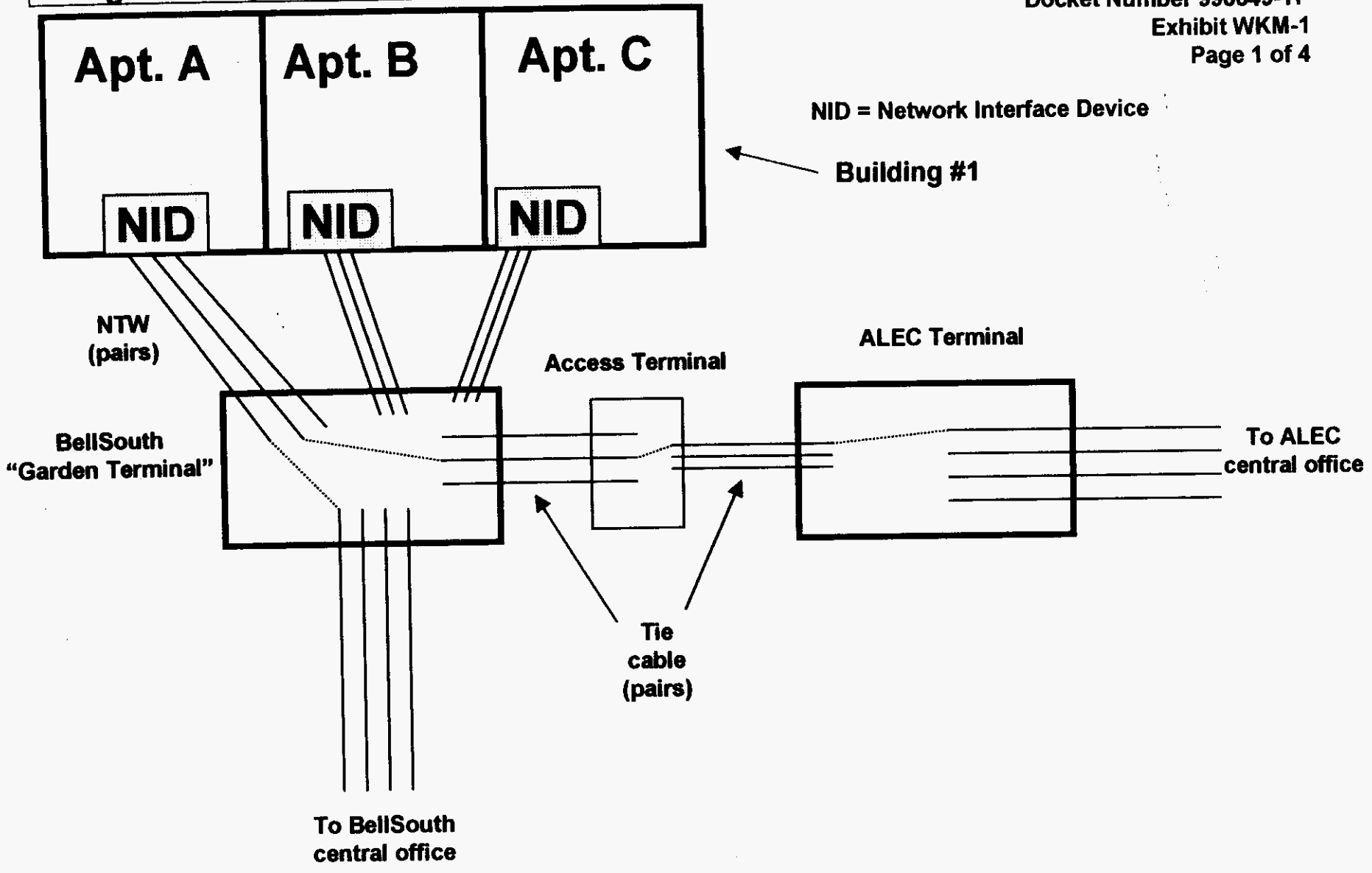
Generic Requirement 303 (GR-303) (authored by Bellcore) provides a set of generic requirements that describe more flexible NGDLC system types and a more flexible interface to a local digital switch. The GR-303 interfaces for integrating NGDLC with a local digital switch can vary in line capacity from 48 lines to 2,016 lines. The concentration allowed over these interfaces is variable and can be matched to the services being made available from the remote NGDLC site to allow the most economic concentration ratio consistent with the service being provided. Typically, residential services can be concentrated at a 4:1 ratio. This means that, on average, only one line of capacity is required from the NGDLC site to the switch for each 4 residential lines provided from the NGDLC to the customer location. For business services the typical concentration ratio is closer to 3:1.

While there are many variables that impact the decision of which switch termination type to use for the interface between a remote NGDLC site and the local digital switch, generally the most economic configurations are provided by using GR-303 for sites with more than 150 lines in the three to five year planning period. TR-008 is used for smaller remote NGDLC sites.

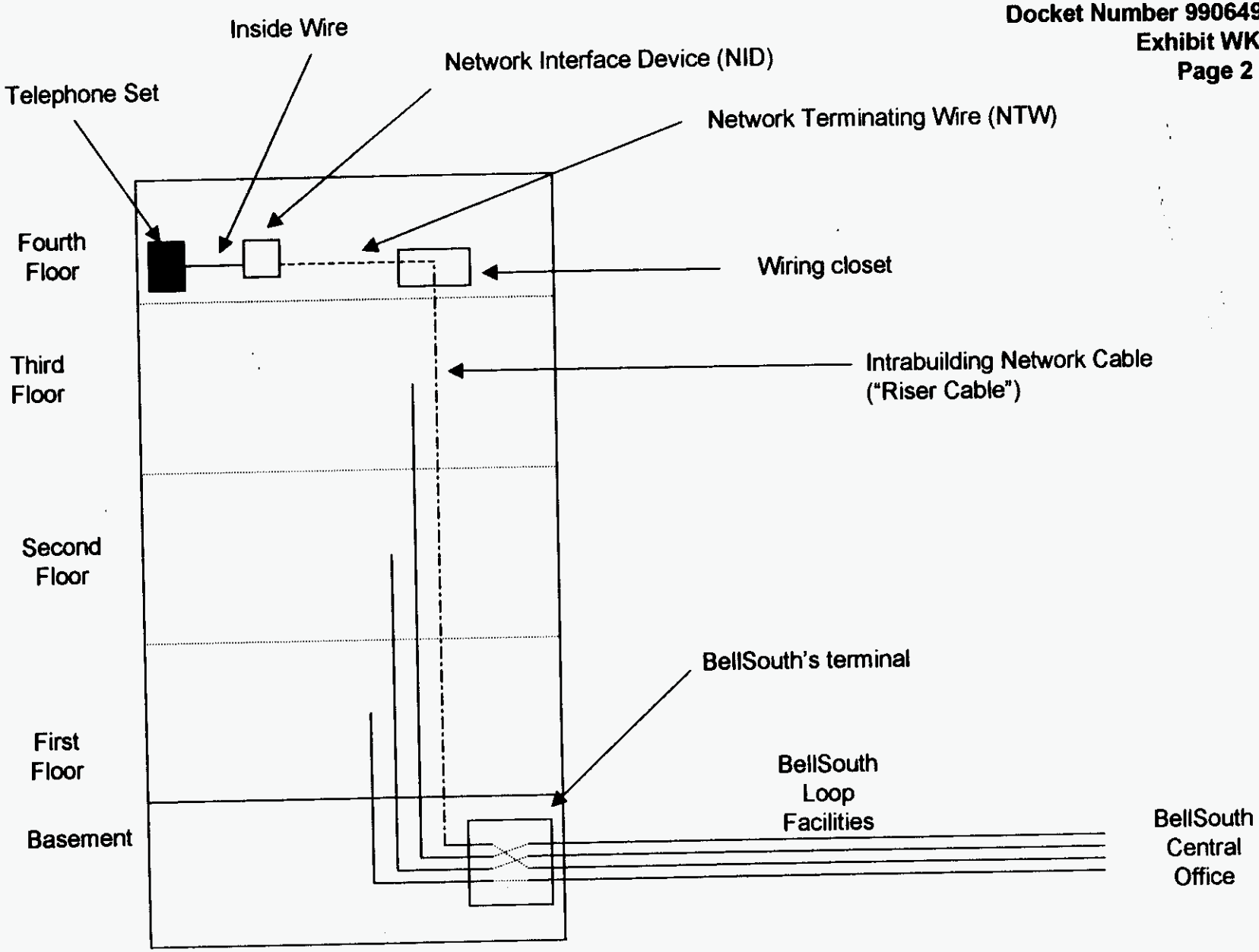
Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

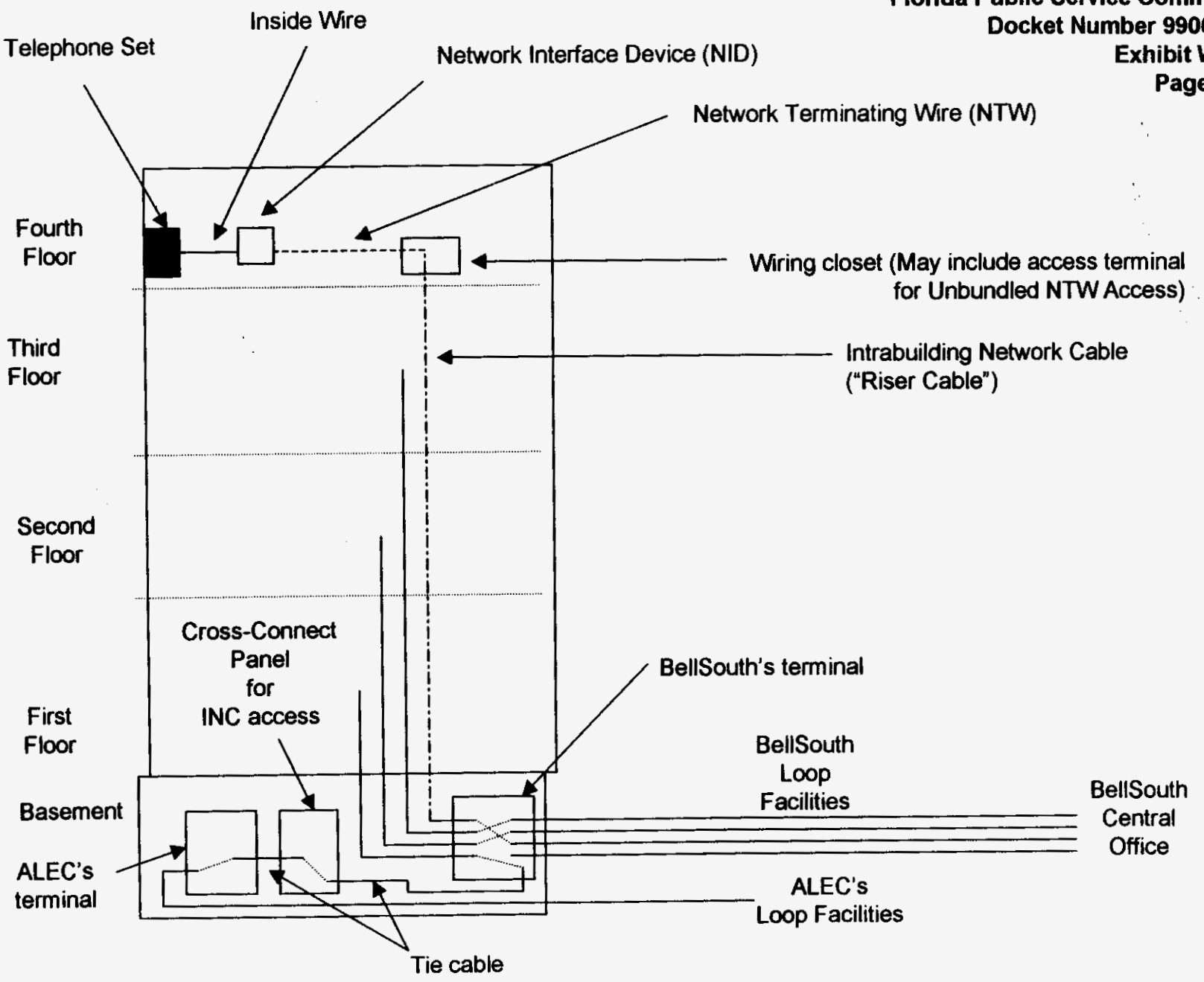
Typical access to unbundled network terminating wire in "garden" apartment



Typical existing serving arrangement



BellSouth's proposed form of access



Access to the Sub-loop Element Loop Distribution