ORIGINAL

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December 22, 2003

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COMMISSION CLERK

Mrs. Blanca S. Bayó
Division of the Commission Clerk and
Administrative Services
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

Re: Docket No. 030852-TP

Dear Ms. Bayó:

Enclosed are an original and fifteen copies of BellSouth Telecommunications, Inc.'s Direct Testimony of A. Wayne Gray, Shelley W. Padgett, and Dr. Aniruddah Banerjee, which we ask that you file in the captioned docket.

A copy of this letter is enclosed. Please mark it to indicate that the original was filed and return the copy to me. Copies have been served to the parties shown on the attached Certificate of Service.

Sincerely,

Nancy B. White

Nancy B. White

RECEIVED & FILED
FPSC-BUREAU OF RECORDS

Enclosure

cc: Parties of Record
Marshall M. Criser III
R. Douglas Lackey
Meredith Mays

AUS ___
CAF ___
CMP ___
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CTR ___
ECR ___
GCL 1
OPC ___
MMS 2
SEC 1
OTH ___

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Gray — DOCUMENT NUMBER-DATE 13321 DEC 22 8 FPSC-COMMISSION CLERK

Padgett — DOCUMENT NUMBER-DATE 13322 DEC 22 8 FPSC-COMMISSION CLERK

Banerjee — DOCUMENT NUMBER-DATE 13323 DEC 22 8 FPSC-COMMISSION CLERK

CERTIFICATE OF SERVICE
Docket No. 030852-TP

I HEREBY CERTIFY that a true and correct copy of the foregoing was served via Electronic Mail, Hand Delivery* and FedEx this 22nd day of December, 2003 to the following:

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Nancy B. White

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(+) signed protective agreement via Hand Delivery(*)

BELLSOUTH TELECOMMUNICATIONS, INC.

DIRECT TESTIMONY OF A. WAYNE GRAY

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

DOCKET NO. 030852

December 22, 2003

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

A. My name is A. Wayne Gray. My business address is 675 West Peachtree Street, Atlanta, Georgia 30375. My title is Director – Regional Planning and Engineering Center in the Network Planning and support organization.

Q. PLEASE SUMMARIZE YOUR BACKGROUND AND EXPERIENCE.

A. I graduated from Georgia Tech in 1979, with a Bachelor of Electrical Engineering degree. In 1992, I received a Master of Business Administration degree from Emory University. I began working for Southern Bell in 1979, in the Equipment Engineering organization in Miami, Florida. Over the course of my 24-year career with BellSouth, I have held various line and staff positions in Equipment Engineering, Traffic Engineering (Capacity Management), Infrastructure Planning and Project Management. In November 1999, I became Director-Collocation in the Network Planning and Support organization. In December 2001, my scope of responsibility was expanded and my title was changed to Director – Regional Planning and Engineering Center. In this position, I am responsible for ensuring that BellSouth provisions collocation arrangements in the timeframes established by contractual agreements and governmental mandates. I am also responsible for managing the planning and engineering of BellSouth's Advanced Intelligent Network, Common Channel Signaling Network, Link Monitoring System, Public Packet Switching Network, MemoryCall® Service platform, Pooled Internet Access Platforms, and corporate transport network. My responsibilities also include the activities performed by BellSouth's Numbering and Technology Forecasting groups. In addition, I direct all switch software upgrades and contract administration for the purchase of network technologies.

Q. **WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

A. The first part of my testimony describes the network architecture an efficient Competitive Local Exchange Carrier ("CLEC") would utilize to self provide high capacity loops over which it serves its customers. The second part of my testimony describes the network architecture an efficient CLEC would utilize to self provide high capacity interoffice transport facilities. I address Issues 4, 6, 8, 12, 13, 17 and 19 in whole or in part.

I. HIGH-CAPACITY LOOPS

Q. **WHAT DO YOU MEAN BY "HIGH CAPACITY LOOPS?"**

A. The types of loops covered in my testimony are DS1, DS3, and dark fiber. These loops are known as "high-capacity loops" because they allow transmission speeds significantly higher than the 64 Kbps of voice grade lines. High-capacity loops are typically used in corporate data networks and to provide voice service to enterprise locations requiring a large number of lines.

"DS1 loop facilities" refer to digital loops having a total transmission speed of 1.544 Mbps provided over various transmission media including, but not limited to, two-wire and four-wire copper, coaxial cable, fiber optics, wireless, radio, and power line facilities. A DS1 capacity loop contains the equivalent of 24 voice-grade or DS0 channels.

"DS3 loop facilities" refer to digital loops having a total transmission speed of 44.736 Mbps provided over various transmission media including, but not limited to, fiber optics, coaxial cable, wireless, radio, and power line facilities. A DS3 capacity loop contains the equivalent of 28 DS1 channels or 672 DS0 channels.

"Dark fiber" refers to optical transmission loops without attached electronics, through which no light is transmitted and no signal is carried. There is no transmission speed associated with dark fiber since the transmission speed of the loop depends on the type of electronics used to light the fiber.

Q. PLEASE DISCUSS THE CAPACITY LEVELS ACHIEVED WHEN CARRIERS DEPLOY FIBER-OPTIC BASED TRANSMISSION SYSTEMS.

A. Carriers typically deploy fiber-optic facilities that can operate at a range of capacities determined by the electronics attached to them. For example, when laying fiber it makes sense to deploy high-capacity, "OCn" facilities so that there will always be enough bandwidth to handle the traffic on a given loop. The term "OCn" refers to Optical Carrier where "n" designates the optical carrier level. The optical carrier level "n" is directly related to the quantity of DS3 capacity units the system is capable of handling simultaneously. For example, OC48 systems provide capacity for 48 individual DS3 transmission "pipes". The carrier can then attach electronics to subdivide (or "channelize") the available capacity, activating the amount of capacity and number of channels needed along the loop. The electronics used to do this channelization of OCn facilities into DS1 or DS3 facilities are relatively inexpensive, are widely available, and can be quickly installed whenever the carrier has demand for DS1 or DS3 facilities.

Q. ONCE AN OCn FACILITY IS INSTALLED, IS IT CAPABLE OF TRANSPORTING DS1 OR DS3 LOOPS?

A. Yes. As explained in the previous answer, a carrier with channelized OCn facilities is operationally ready to provide DS1 or DS3 facilities.

Q. PLEASE DISCUSS THE COSTS A CARRIER WOULD INCUR WERE IT TO CONSTRUCT ITS OWN HIGH CAPACITY LOOP FACILITIES.

A. There are two types of cost that a carrier would incur -- the costs of extending the loop facility and the other costs of offering service (e.g., sales costs, and general and administrative costs). I will describe the first category of costs below; the second category is discussed by BellSouth witness Dr. Banerjee.

Q. WHAT COSTS ARE INCURRED FOR A COMPETITIVE CARRIER TO EXTEND A LOOP FACILITY TO A PARTICULAR CUSTOMER LOCATION?

A. Costs for network extension consist of one-time capital expenditures as well as operating expenses incurred on a recurring basis. These costs are incurred at three points in the network (see Exhibit AWG-1) – at the newly connected building, at the currently collocated wire center or building that the new location is being connected to, and at a "node" along the fiber route itself.

Moving from the left of Exhibit AWG-1, the "Off Net Building" is the one that is not connected directly to the existing fiber network. It is sometimes referred to as a "spoke" off the fiber-optic network. At that Off Net Building, one would find the equipment elements listed on the left hand side of Exhibit AGW-1. The Light Guide Cross-connect ("LGX") allows the attachment of individual fiber optic strands (via fiber optic "jumpers") to connectors that allow the fiber to be interfaced with other electronics such as the multiplexers. The fiber optic "pipe" is then channelized into smaller DS1 or DS3 transmission paths (dependent on customer demand) via plug-in electronic cards and other cross-connect panels. At the customer's premises, channel-bank equipment is utilized to convert the DS1 or DS3 pipes into individual channels (at DS0 level) via so-called D-4 channel bank equipment. The intra-building network cable and termination (INCT) provides the inside wiring required to access the entire customer location. INCT is not always required to be purchased for various reasons so I have made the conservative assumption that the CLEC requires INCT in 50% of the buildings it serves.

Between the Off Net Building and the node on the CLEC's existing fiber-optic network is the fiber optic cable itself. Here, a CLEC would incur the (distance-sensitive) material cost of the fiber-optic cable, as well as construction fees and other fees paid to use another party's poles, ducts or conduits.

At the node location on the CLEC's fiber optic network, the CLEC would incur costs for the same types of equipment needed at the Off Net building (LGX bays, fiber jumpers, etc.)

The configuration of the network equipment required at the new and existing wire centers to terminate the fiber and provide DS0/DS1/DS3 loops to end-use customers is illustrated in Exhibit AWG-2. This diagram shows pictorially the relationship of the individual "piece parts" described above.

Q. WHAT ARE THE COSTS FOR THE EQUIPMENT ELEMENTS LISTED?

A. Both the capital and operating costs for each piece of equipment is listed in Exhibit AWG-3. These numbers reflect the fully installed costs of all equipment, including material, labor, all overhead, and taxes. These costs are taken directly from the cost study that BellSouth filed in the Commission's most recent UNE cost case, Docket No. 990649-TP, and which underlie the UNE rates approved by this Commission.

Q. HOW DO YOU DETERMINE THE QUANTITY OF MULTIPLEXERS AND DS1/DS3 CARDS NEEDED?

A. The quantities of network equipment needed scales with demand. We assume that one DS1 circuit equivalent to be provided for every $500 per month of revenue. After determining the number of DS1 equivalents (N) needed, the requirement of DS1/DS3 plug-ins is calculated as follows:

If N <= 28, number of DS1s = N, number of DS3s = 0

If N > 28, number of DS1s = max (28, N x 1/3), rounded up to the next integer, number of DS3s = 2/3 x N/28, rounded up to the next integer

If more than 3 muldems are needed, equipment is scaled by adding another OC3 multiplexer, as shown in Exhibit AWG-2.

II. HIGH-CAPACITY TRANSPORT

Q. WHAT IS A "ROUTE?"

A. A route is defined in the FCC's rules as "a transmission path between one of an incumbent LEC's wire centers or switches and another of the incumbent LEC's wire centers or switches" within a LATA. Furthermore, "a route between two points (*e.g.*, wire center or switch "a" and wire center or switch "z") may pass through one or more intermediate wire centers or switches (*e.g.*, wire center or switch "x"). Transmission paths between identical end points (*e.g.*, wire center or switch "a" and wire center or switch "z") are the same 'route,' irrespective of whether they pass through the same intermediate wire centers or switches, if any." 47 C.F.R. §51.319(e).

Q. IS IT REASONABLE TO ASSUME THAT A CARRIER HAS A "ROUTE" BETWEEN ANY PAIR OF INCUMBENT LEC WIRE CENTERS IN THE SAME LATA WHERE IT HAS OPERATIONAL COLLOCATION ARRANGEMENTS?

A. Yes. It is logical and reasonable to assume that a carrier can route traffic between any pair of wire centers within a LATA where it has operational collocation arrangements, i.e. that a carrier's network is fully interconnected. Although, for network and cost efficiency reasons it is unlikely that a CLEC would have a *direct* link between every ILEC wire center where it is collocated (e.g., it may instead have a "hub and spoke" layout where traffic is routed through the CLEC's point of presence), that fact is not determinative under the FCC's definition of a "route," because that definition expressly states that intermediate wire centers or interconnection points outside the ILECs' facilities (e.g., collocation hotel, data center, CLEC point of presence) may be present on the transmission path between two ILEC wire centers.

Q. IF A CARRIER HAS AN OCn TRANSPORT FACILITY TO A COLLOCATION ARRANGEMENT IN AN ILEC WIRE CENTER, CAN THAT CLEC PROVIDE DS3 TRANSPORT?

A. Yes. As described above for loops, carriers typically deploy fiber-optic facilities that can operate at a range of capacities determined by the electronics attached to them. For example, when laying fiber it makes sense to deploy high-capacity, OCn facilities so that there will be enough bandwidth to handle all traffic on a given route and leave additional capacity available for growth. The carrier can then attach electronics to subdivide (or "channelize") the available capacity, activating the amount of capacity and number of channels needed along the route. The electronics used to do this channelization of OCn facilities into DS1 or DS3 facilities are relatively inexpensive, are widely available, and can be quickly installed whenever the carrier has demand for DS3 transport facilities. The fact that the capacity of the facility itself is at the OCn level is therefore independent of the carrier's ability to provide a dedicated DS1 or DS3 transport route over that facility.

Q. WHEN CARRIERS CONSTRUCT FIBER OPTIC TRANSMISSION SYSTEMS, IS IT COMMON TO INCLUDE AN ALLOWANCE FOR SPARE (SOMETIMES REFERRED TO AS "UNLIT") FIBER OPTIC STRANDS?

A. Yes, for network engineering reasons and based on the cost structure of fiber cables, it is common to place additional spare fiber strands in anticipation of future needs. Since the cost of deploying a fiber cable is mostly fixed (e.g., digging up the streets, attaching cable to poles, and deploying the fiber) and only slightly correlated with the number of fiber strands in the cable, carriers almost always choose to deploy a considerable larger number of strands than what they need for their immediate transmission needs. In fact, although generally four (4) fibers are enough to support OCn circuits that can provide enough capacity for any route (e.g., an OC192 has capacity for 192 DS3s, or 129,024 simultaneous voice conversation, and this capacity can be multiplied several times over with the use of Dense Wave Division Multiplexing ("DWDM") technology), CLECs typically deploy 144 fiber strands or more when extending a cable to large commercial buildings or ILEC wire centers.

Q. **WHAT FACTORS INFLUENCE A CARRIER'S COSTS TO EXTEND THE CARRIER'S NETWORK TO AN ADDITIONAL WIRE CENTER?**

A. A competitive carrier's network is typically fully interconnected. That is, transport can be provided between all of a carrier's collocated wire centers in a LATA. It follows that to add a new wire center to its network, all a carrier has to do is extend its fiber from any location where it is currently present to the new wire center. This will allow it to connect the new wire center with all its others in the LATA. To determine the costs of making such an extension, one must first identify the nearest location, then determine what expenses will be incurred in laying the new fiber and adding equipment to make the fiber operationally ready to provide transport.

Q. **HOW DO YOU DETERMINE THE COST TO EXTEND THE CARRIER'S NETWORK TO AN ADDITIONAL WIRE CENTER?**

A. Costs for network extension consist of one-time capital expenditures as well as operating expenses incurred on a recurring basis. These costs are incurred at three points in the network (see Exhibit AWG-4) – at the newly connected wire center, at the currently collocated wire center or building that the new location is being connected to, and along the fiber route itself.

As is shown starting on the left side of the diagram in Exhibit AWG-4, the network equipment required at the new (the so-called "Off Net" central office) and existing central office to terminate the fiber and provide DS1/DS3 facilities is depicted. Those devices are functionally similar to those used in the context of providing high capacity loops to a new customer location that I described earlier in this testimony. For the sake of brevity, I will not repeat that discussion here. Exhibit AWG-5 shows the physical and functional interaction between those devices. CLECs also have to pay BellSouth nonrecurring and recurring collocation charges at the new central office, which vary based on the equipment deployed and the amount of space occupied. Additional costs are incurred in constructing fiber cable to the new wire center. This cost is a function of the distance, and – depending on the geography – a combination of aerial, buried and underground fiber may need to be deployed. There are additional pole and conduit costs associated with aerial and underground fiber, respectively.

Q. WHAT ARE THE COSTS FOR THE EQUIPMENT ELEMENTS LISTED?

A. Both the capital and operating costs for each piece of equipment is listed in Exhibit AWG-6. These numbers reflect the fully installed costs of all equipment, including material, labor, all overhead, and taxes. These costs are taken directly from the cost study that BellSouth filed in August 2000, in the Commission's most recent UNE cost case, Docket No. 990649-TP, and which underlie the UNE rates approved by this Commission.

Q. HOW DO YOU DETERMINE THE QUANTITY OF MULTIPLEXERS AND DS1/DS3 CARDS NEEDED?

A. The quantities of network equipment needed scales with demand. The number of OC12 and OC48 multiplexers is determined by the number of corresponding circuits demanded.

The number of OC3 multiplexers is determined by adding the number of OC3 circuits demanded and the OC3 multiplexers needed to handle the demand for DS1 and DS3 circuits. The requirement of DS1s and DS3s cards is calculated by adding the DS1/DS3 cards needed to handle demand for these circuits, and the DS1/DS3 cards needed for 100% utilization of OC3, 90% utilization of OC12, and 80% utilization of OC48 multiplexers, assuming equal share of DS1 and DS3 muldems.

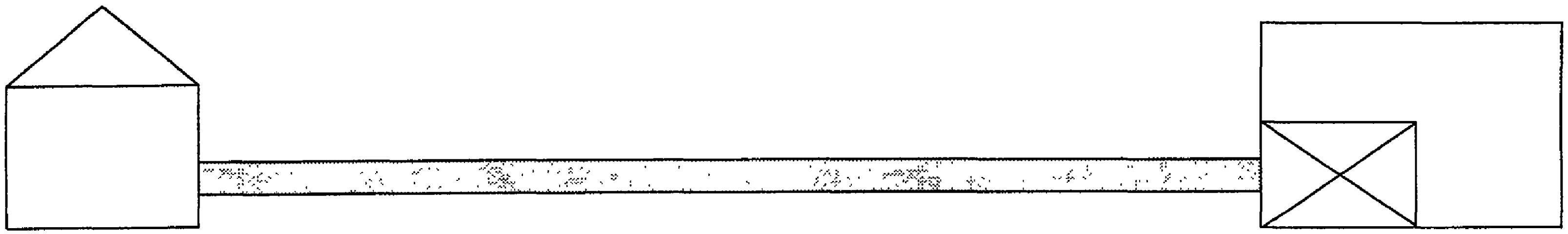
Q. **ISSUES 8, 12, AND 17 RELATED TO TRANSPORT WHOLESALING BY CLECS RAISE THE QUESTION OF WHETHER CROSS-CONNECTS ARE AVAILABLE. CAN YOU ADDRESS THIS ISSUE?**

A. The availability of cross-connects is discussed in the testimony of BellSouth witness Mr. John Ruscilli in Docket No. 030851-TP, and I adopt his testimony regarding the availability of cross-connects.

Q. **DOES THAT CONCLUDE YOUR TESTIMONY?**

A. Yes.

COST ELEMENTS FOR NETWORK EXTENSION (HIGH CAPACITY LOOPS)



"Off Net" building

- LGX
- Fiber jumpers
- OC3 multiplexer(s) depending on demand (commons + hardwire)
- DS1/DS3 plug-ins
- DS1/DS3 cross connect panels
- D-4 channel bank with plug-ins
- Intrabuilding Network Cable and Termination (INCT)

Other costs include:

- COGS**
- SG&A

CLEC fiber extension (distance sensitive)

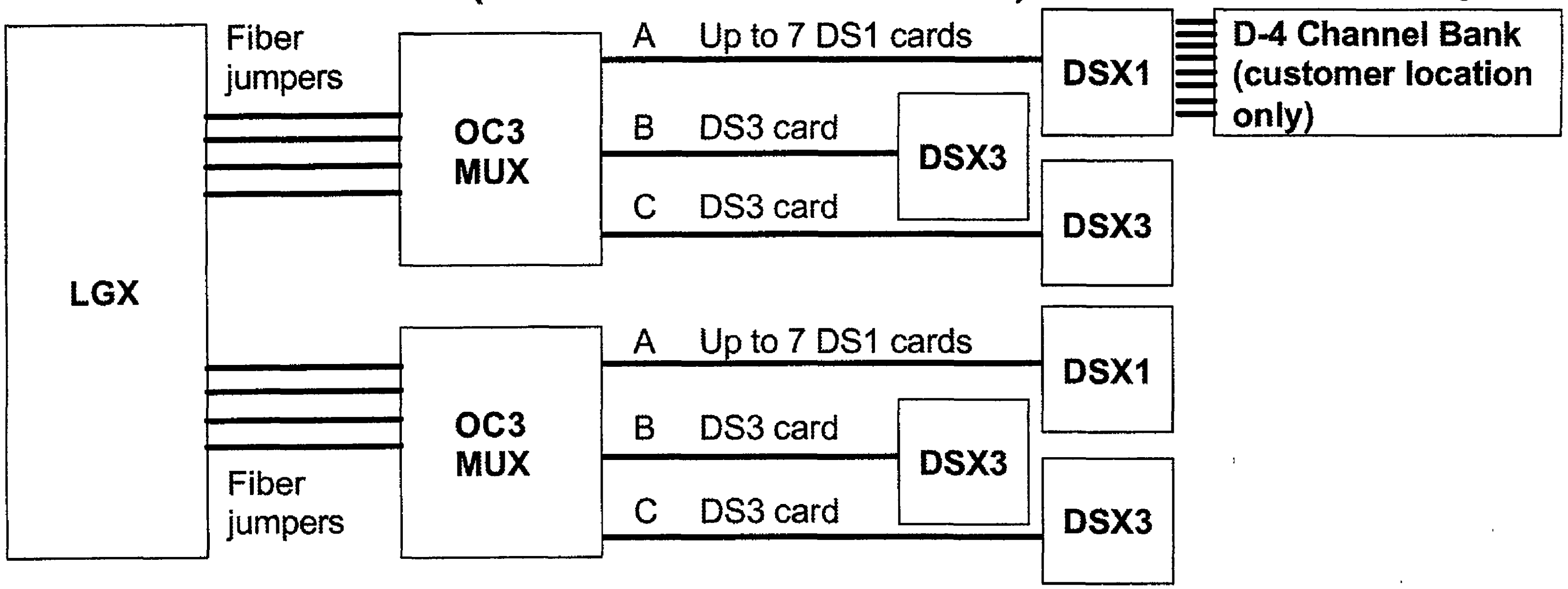
- Right-of-way fees
- Installed investment for aerial, buried, and underground fiber
- Associated pole and conduit costs

CLEC existing node

- LGX
- Fiber jumpers
- OC3 multiplexer(s) depending on demand (commons + hardwire)
- DS1/DS3 plug-ins
- DS1/DS3 cross connect panels

*Includes Ad Valorem and other taxes
**Includes all non-loop costs and some depreciation for equipment in other parts of the network, e.g., switch for local voice

NETWORK ARCHITECTURE/EQUIPMENT NEEDED FOR FIBER EXTENSION (HIGH CAPACITY LOOPS)



Notes

- Same equipment is installed at both ends, except the channel bank which is located only at the customer location
- Network equipment scales with demand, as follows
  - Number of DS1 circuits are forecast based on potential revenue
  - For N DS1 circuits required, the number of DS1s and DS3s are calculated as follows
    - If N <= 28, number of DS1s = N, number of DS3s = 0
    - If N > 28, number of DS1s = max (28, N x 1/3), rounded up to the next integer, number of DS3s = 2/3 x N/28, rounded up to the next integer
- Equipment is scaled by adding another OC3 MUX if more than 3 muldems are needed

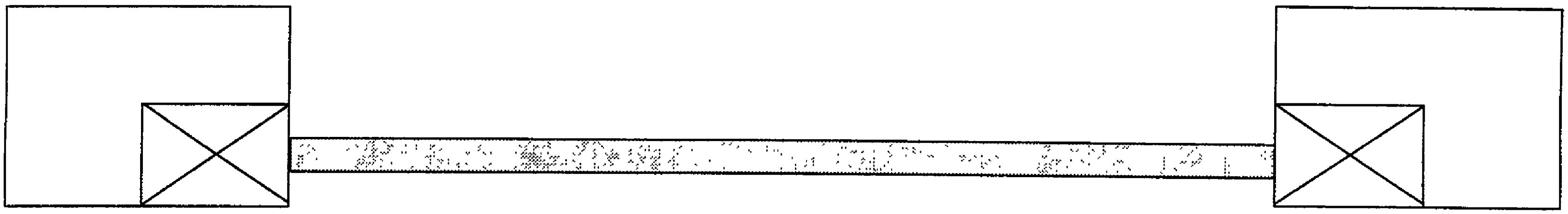
Cost elements for network extension (High capacity loops)

	Initial Cost (Year 0)	Ongoing Costs (Year 1+)
NetworkCosts (at customer premises)		
LGX	$149.80	$3.83
Fiber jumpers	$123.12	$3.15
OC3 multiplexer (commons + hardwire)	$11,721.46	$300.07
DS1 plug-in	$1,333.82	$34.15
DS3 plug-in	$1,303.52	$33.37
DS1 cross connect panel	$2,633.76	$67.42
DS3 cross connect panel	$10,536.91	$269.74
D4 channel bank (commons + hardwire)	$7,742.55	$198.21
Channel bank plug-ins (2 Data, 2 ISDN, 12 VG)	$772.14	$19.77
DS0 INCT first / additional	$51.84 / $13.44	$3.96
DS1 INCT first / additional	$55.91 / $17.51	$9.37
Network Costs (at node)		
LGX	$149.80	$3.83
Fiber jumpers	$123.12	$3.15
OC3 multiplexer (commons + hardwire)	$11,774.29	$301.43
DS1 plug-in	$1,339.83	$34.30
DS3 plug-in	$1,309.40	$33.52
DS1 cross connect panel	$2,645.64	$67.73
DS3 cross connect panel	$10,584.40	$270.96
Fiber Extension Costs (per foot for 100-strand fiber)		
Total installed investment	$4.92	$0.07
Pole factor	$0.14	$0.00
Conduit factor	$2.35	$0.03
Total per foot costs	***$7.41***	***$0.10***

ASSUMPTIONS:

- Number of fiber strands 100
- Aerial Fiber 10.1%
- Buried fiber 25.2%
- Underground fiber 64.7%

COST ELEMENTS FOR NETWORK EXTENSION (DEDICATED TRANSPORT)



"Off Net"**
Central Office

- LGX
- Fiber jumpers
- OC3/OC12/OC48 multiplexer(s) depending on demand (commons + hardwire)
- DS1/DS3 plug-ins
- DS1/DS3 cross connect panels

CLEC fiber extension
(distance sensitive)

- Right-of-way fees
- Installed investment for aerial, buried, and underground fiber
- Associated pole and conduit costs

Central office***
with CLEC fiber and collocation

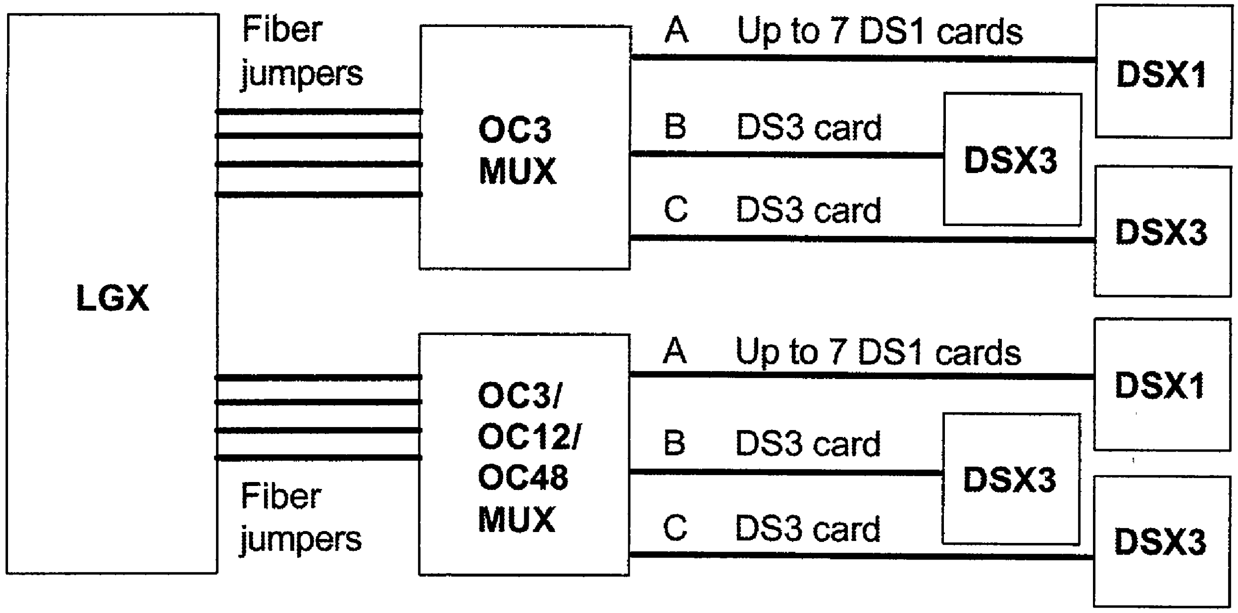
- LGX
- Fiber jumpers
- OC3/OC12/OC48 multiplexer(s) depending on demand (commons + hardwire)
- DS1/DS3 plug-ins
- DS1/DS3 cross connect panels

Other costs include:

- Collocation expense

*Includes Ad Valorem and other taxes
**BLS central office where CLEC has not built fiber
***Fiber may pass through an existing node before reaching here

NETWORK ARCHITECTURE/EQUIPMENT NEEDED FOR FIBER EXTENSION (DEDICATED TRANSPORT)



Notes

- Same equipment is installed at both ends
- Network equipment scales with demand, as follows:
  - Number of OC12 and OC48 multiplexers is determined by the number of corresponding circuits demanded
  - Number of OC3 multiplexers is determined by adding the number of OC3 circuits demanded and the OC3 multiplexers needed to handle the demand for DS1 and DS3 circuits.
  - The requirement of DS1s and DS3s cards is calculated by adding:
    - DS1 and DS3 cards needed to handle demand for DS1 and DS3 circuits
    - DS1 and DS3 cards needed for 100% utilization of OC3, 90% utilization of OC12, and 80% utilization of OC48 multiplexers, assuming equal share of DS1 and DS3 muldems

Cost elements for network extension (Dedicated Transport)

	Initial cost (Year 0)	Ongoing costs (Year 1+)
Network Costs (at new CO)		
LGX	$149.80	$3.83
Fiber jumpers	$123.12	$3.15
OC3 multiplexer (commons + hardwire)	$12,878.88	$250.74
OC12 multiplexer	$36,165.27	$824.56
OC48 multiplexer	$85,599.85	$1,951.68
DS1 plug-in	$1,391.27	$31.72
DS3 plug-in	$1,359.68	$31.00
DS1 cross connect panel	$4,205.92	$95.90
DS3 cross connect panel	$16,826.64	$383.65
Collocation expense (for 100 sq. ft)	$5,962.66	$22,831.20
Network Costs (at CO currently on network)		
LGX	$149.80	$3.83
Fiber jumpers	$123.12	$3.15
OC3 multiplexer	$12,668.05	$288.83
OC12 multiplexer	$35,573.25	$811.07
OC48 multiplexer	$84,198.58	$1,919.73
DS1 plug-in	$1,368.50	$31.20
DS3 plug-in	$1,337.42	$30.49
DS1 cross connect panel	$4,137.07	$94.33
DS3 cross connect panel	$16,551.19	$377.37
Fiber Extension Costs (per foot for 100-strand fiber)		
Total installed investment	$4.92	$0.07
Pole factor	$0.14	$0.00
Conduit factor	$2.35	$0.03
Total per foot costs	***$7.41***	***$0.10***

ASSUMPTIONS:

• Quantity of fiber strands	100
• Aerial Fiber	10.1%
• Buried fiber	25.2%
• Underground fiber	64.7%