Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Implementation of the Local Competition Provisions of the Telecommunications Act of 1996	)))	**CC Docket No. 96-98**

DECLARATION OF EDWIN A. FLEMING
ON BEHALF OF WORLDCOM, INC.

1. My name is Edwin A. Fleming. My business address is One Tower Lane, Suite 1600, Oakbrook Terrace, IL 60181. I have a Bachelor of Science degree in Business and am a Certified Public Accountant.

2. I am employed by WorldCom, Inc. (WorldCom), and I serve as a Senior Manager of Strategic Business Planning. My responsibilities include evaluating and managing building additions to WorldCom's local network and planning local network expansions.

I. Purpose and Summary

3. The purpose of this declaration is to describe the process that WorldCom uses to extend its local network to additional buildings or to additional LEC central offices. I also discuss the analysis contained in the Reply Declaration of Robert W. Crandall (Crandall Declaration), filed on April 30, 2001 with the Reply Comments of the United States Telecom Association (USTA).

4. In Parts II and III below, I show that the construction of high-capacity loop and transport facilities is time-consuming and requires significant levels of capital investment. In Part IV below, I show that the Crandall Declaration underestimates the cost of extending a CLEC network to a new building.

II. The "Building Add" Process

5. The "building add" process involves the construction of a "lateral" from an existing WorldCom local network to a new customer building. In some cases, especially if the lateral is short or mainly traverses private property, the lateral may consist of only a single path. But for customers whose requirements demand a high level of reliability, and for longer laterals that primarily use streets or other public rights-of-way (where there is a higher risk of cable cuts), WorldCom often uses "diverse routing," i.e., two separate paths, between the WorldCom ring and the customer building.

6. If the building in question is more than a mile from WorldCom's local network, it is not evaluated using the building add process. Buildings that are more than a mile from the existing ring would only be added as part of new subnetwork construction, which is typically a multimillion dollar project.

7. The addition of a building to WorldCom's local network incurs outside plant costs (including rights-of-way, trenching, labor, and conduits and fiber); the cost of building access (including the building access agreement and the cost of preparing the "POP space"); and the cost of transmission electronics at the customer premises and at WorldCom's local network node.

8. Building adds are extremely expensive. The cost of WorldCom's recent building adds, most of which have involved short laterals of a few hundred feet or less, has averaged $250,000.

9. Building adds are also time-consuming. Building adds generally take between six to nine months, but can often take substantially longer. In general, the most time consuming part of the process is not the construction itself, but the negotiation of rights-of-way and building access agreements

10. If projected WorldCom customer demand in a building is a DS-3 or less, the building is generally not even considered for a building add. In WorldCom's experience, it is more cost-effective to serve customers in these buildings using ILEC special access services. For larger buildings where WorldCom projects WorldCom customer demand of several DS-3s or optical level circuits, the building add decision is made using a screening process that compares projected revenues to the cost of the building add and that also takes into account the risk that revenues will be lower than projected. Because building adds are so expensive, WorldCom is able to add only a limited number of buildings to its local network each year.

III. Construction of Transport Facilities

11. When WorldCom extends its network to an additional ILEC central office, it uses a diversely-routed architecture, constructing a ring that connects existing WorldCom network facilities to the ILEC central office. Because WorldCom uses a diversely-routed architecture, the trenching that is required will be substantially

greater than the line-of-sight distance between existing network facilities and the ILEC central office.

12. Adding a central office to WorldCom's network incurs outside plant costs (including rights-of-way, trenching, and conduits and fiber); the cost of collocation; and the cost of transmission electronics at the customer premises and at WorldCom's local network node.

13. The extension of WorldCom's local network to an ILEC central office is extremely expensive. In WorldCom's experience, the extension of WorldCom's local network to an ILEC central office generally incurs an expenditure of at least $1 million, even for a central office that is close to existing WorldCom network facilities.

14. In most cases, however, costs are substantially higher. Typically, the extension of WorldCom's local network to an ILEC central office requires several miles of outside plant construction, at a cost of between $200,000 and $400,000 or more per mile. For example, I estimate that the extension of WorldCom's local network to the two largest "offnet" central offices in Seattle would require 7.5 miles and 7.0 miles of outside plant construction.

IV. Crandall Declaration

15. I have been asked to review the Crandall Declaration and the associated cost study prepared by the Cambridge Strategic Management Group (CSMG). I have the following observations.

16. First, CSMG inappropriately assumes that the length of the lateral is equal to the shortest path between the CLEC network and the target building. As I discuss

above, laterals are often diversely-routed. Where diverse routing is used, WorldCom local network engineers assume, as a rule of thumb, that the length of the lateral will be 2.5 times the "line-of-sight" distance.

17. Even if diverse routing is not required, it is unrealistic to assume that the length of the lateral will be equal to the "line-of-sight" distance. Streets and other available rights-of-way rarely follow the shortest path. By failing to recognize this constraint, CSMG has underestimated the outside plant construction cost by a significant amount.

18. Second, CSMG appears to have underestimated the trenching costs. While CSMG's estimate of $17 to $30 per foot is perhaps a reasonable estimate of trenching costs for a "building add" in suburban areas, trenching costs in the central business district of major cities are often much higher, at least $70 to $100 per foot. Costs are higher in these areas because trenching requires digging up and then repairing streets and sidewalks.

19. Third, the CLEC network maps appear to be inaccurate. To the extent that I can discern the claimed path of WorldCom's network on the maps in the Crandall Declaration, it appears that some of the routes shown on the map include WorldCom conduit that is generally not used for its local network; include long haul fiber routes; or are otherwise inaccurate. Because Worldcom's long haul network is designed for transport between cites, the use of a small section of the fiber pair for a building addition generally makes the remainder of that fiber pair running between the cities unusable. Accordingly, the use of long haul fiber for building additions is normally not economically feasible. In addition, WorldCom's

long haul fiber routes often do not even have spare fibers that could be used for building adds. As a result, WorldCom rarely extends fiber from its long haul network to customer buildings.

20. Fourth, I note that the costs of outside plant construction in the six cities studied in the Crandall Declaration are substantially lower than construction costs in top-10 MSAs such as New York, Washington, DC, Los Angeles, and San Francisco.

I declare, under penalty of perjury, that the foregoing is true and correct to the best of my knowledge and belief.

Edwin A. Fleming

Edwin A. Fleming

June 11, 2001

ATTACHMENT D
KELLEY/CHANDLER DECLARATION

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
Implementation of the Local Competition Provisions of the Telecommunications Act Of 1996	)	CC Docket No. 96-98
	)	
Joint Petition of BellSouth, SBC, and Verizon For Elimination of Mandatory Unbundling of High-Capacity Loops and Dedicated Transport	)	

Declaration of A. Daniel Kelley and Richard A. Chandler

1. We have been asked by WorldCom, Inc. ("WCOM") to explain the economic and technical basis for Incumbent Local Telephone ("ILEC") economies of density, connectivity and scale in the provision of dedicated high-capacity services. We find that the ILECs possess substantial cost advantages relative to the CLECs. Therefore, we conclude that competitive local exchange carriers ("CLECs") would be impaired if ILECs are allowed to refuse to provide dedicated high-capacity services to CLECs.

2. The 1996 Act eliminated legal barriers to competition and encouraged entry by requiring the Bell Companies to open their networks to competitors.[1] Allowing new entrants to purchase unbundled network elements ("UNEs") at economic cost encourages entry into local markets by reducing barriers to entry.[2] Consumers will be the ultimate beneficiaries of this network unbundling. Consumers will not receive these benefits if the

[1] Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56, codified at 47 U.S.C., §§ 151 et seq. ("1996 Act").
[2] As long as the network elements are priced properly, efficient facilities-based entry will not be discouraged. As discussed below, CLECs use UNEs to market more efficiently and to reduce the overall cost of expansion.

ability of CLECs to compete is impaired due to ILECs refusing to provide UNEs that the competitors need to fill out their networks.

3. This Declaration is organized as follows. Our qualifications are set forth in Section I. Section II provides some general background on high-capacity services. Section III discusses barriers to CLEC entry and expansion. Section IV describes the potential for wireless and cable telephony technology to provide high-capacity services. The Declaration concludes in Section V with a discussion of why CLECs will be impaired if ILECs are not required to provide high-capacity loop and transport UNEs.

I. Qualifications

4. My name is A. Daniel Kelley. My current position is Senior Vice President of HAI Consulting, Inc. (formerly Hatfield Associates, Inc.). My professional experience began in 1972 at the Antitrust Division of the U.S. Department of Justice where I analyzed mergers, acquisitions and business practices in a number of industries, including telecommunications. While at the Department of Justice, I was a member of the U.S. v. AT&T economics staff. In 1979, I moved to the Federal Communications Commission ("FCC" or "Commission") where I held several positions, including Special Assistant to the Chairman, Senior Economist in the Policy and Rules Division of the Common Carrier Bureau and Senior Economist in the Office of Plans and Policy. After leaving the FCC, I was a Project Manager and Senior Economist at ICF, Incorporated, a public policy consulting firm. From September 1984 through July of 1990, I was employed by MCI Communications Corporation as its Director of Regulatory Policy.

5. In my present position, I conduct economic and policy studies on a wide variety of telecommunications issues, including local competition, dominant firm

regulation, and the cost of local service. I have prepared economic studies of the wireless industry and have analyzed several telecommunications mergers. I have advised foreign government officials on telecommunications policy matters and have taught seminars in regulatory economics in a number of countries.

6. I have testified on telecommunications issues before the California, Colorado, Connecticut, Florida, Georgia, Hawaii, Maryland, Massachusetts, Michigan, Oregon, Pennsylvania, Utah and Washington Commissions, as well as the FCC and the Federal-State Joint Board investigating universal service reform.

7. I received a Bachelor of Arts degree in Economics from the University of Colorado in 1969, a Master of Arts degree in Economics from the University of Oregon in 1971, and a Ph.D. in Economics from the University of Oregon in 1976.

8. My name is Richard Chandler. I am a Senior Vice President of HAI Consulting, Inc., and my business address is 737 29th Street, Boulder, Colorado, 80303.

9. I have BSEE and MSEE degrees from the University of Missouri and an MBA from the University of Denver. I also have completed additional graduate study in electrical engineering at the University of Colorado. I worked as an electronic engineer at the Institute for Telecommunication Sciences studying microwave and optical propagation and analyzing radar systems.

10. I then worked at Bell Laboratories in the exploratory development of customer switching systems. While at Bell Labs, I worked extensively on packet switching and circuit switching technologies. I then transferred to AT&T, where I was a product manager working on, among other things, product strategies for packet switching systems.

11. At HAI (and its predecessor, Hatfield Associates, Inc.), I have been the principal developer of the Hatfield/HAI cost models. I have also analyzed a range of telecommunications technologies and systems for a number of clients.

12. I have also taught graduate-level telecommunications technology courses in digital switching, basic telephony, and cellular and wireless communications at the University of Colorado, the University of Denver, and Pace University.

13. I have filed numerous Affidavits and Declarations in various federal and state jurisdictions.

II. Background

14. Several of the largest ILECs ("Petitioners") have asked the Commission to find that "high-capacity loops and dedicated transport should not be subject to mandatory unbundling."[3] The Petitioners have defined high-capacity loops as DS-1 or higher-speed circuits. The Petitioners base their case on the alleged and widespread presence of CLEC networks.

15. Competitors have been building competitive fiber facilities since the mid-1980s. The passage of the 1996 Act helped to accelerate the growth of competitive networks.[4] The Petitioners document, albeit not always accurately, the growth of these rival telecommunications networks. Nevertheless, after 15 years of growth, the geographic reach of competitive local fiber networks is still quite limited. As we discuss below, the presence of barriers to entry and expansion imply that this lack of ubiquity is more significant than the fact that CLEC networks can serve the customers they do serve.

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[3] FCC, In the Matter of Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, CC Docket No. 96-98, comments of BellSouth, April 5, 2001, p. 1.

[4] See, HAI Consulting, "Consumer Benefits of the Telecommunications Act of 1996," February 2, 2000.

16. Figure 1 shows a dedicated high-capacity circuit from end user location "X" to location "A" and "B". Each circuit consists of two high-capacity loops, one at each customer location, and transport between the wire centers that serve the customers.[5] It is possible in such a local network that one or more locations, but not all locations, could be served by a CLEC fiber ring instead of on ILEC facilities.

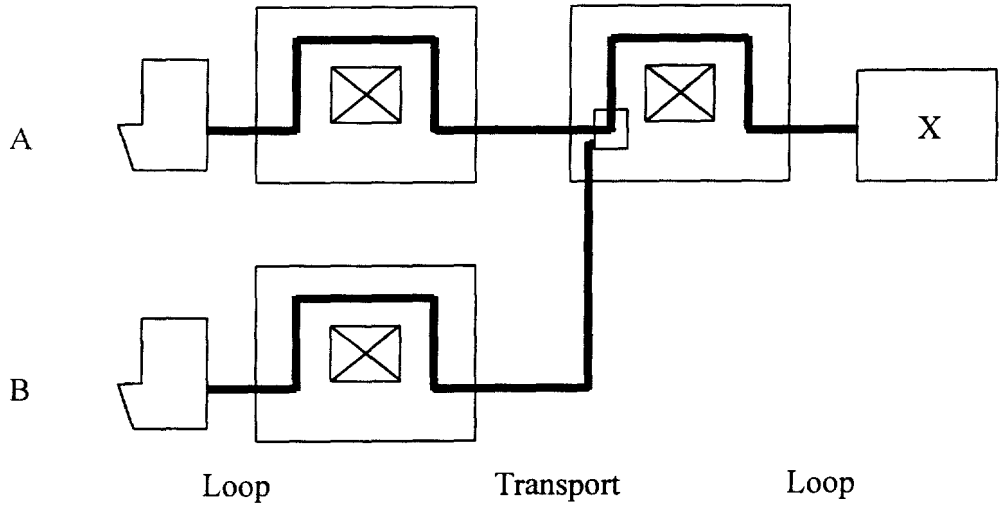

Figure 1
Elements of a High-Capacity Circuit

17. Four types of firms may theoretically provide these circuits or pieces of them. The ILECs, of course, are the dominant providers of these services. On the vast majority of point-to-point routes, and in many parts of the country, they are also the only providers. Beginning in the late 1980s, the competitive access providers ("CAPs") began

[5] The access equivalent to these UNEs are Channel Terminations, Entrance Facilities and Interoffice Channels. At one time the ILECs bundled these individual pieces of a high-capacity circuit. In 1992 the Commission required unbundling of these piece parts in order to facilitate competition. *See,* FCC, Transport Rate Structure and Pricing, Petition for Waiver of the Transport Rules filed by GTE Service Corporation, CC Docket No. 91-213, *Report and Order and Further Notice of Proposed Rulemaking*, 7 FCC Rcd 7006 (1992).

to construct fiber ring facilities in the central business districts ("CBDs") of many urban areas. Their networks were primarily designed to supply the IXCs and their customers with alternatives to ILEC provided special access services. The passage of the 1996 Act meant that these high-capacity circuits could legally be provided as part of a local service offering throughout the nation. Large IXCs have vertically integrated into the special access business in order to provide dedicated circuits to their largest customers in certain parts of the country. In some cases, this integration has been accomplished through acquisition of CAPS.[6]

18. The fourth category of special access provider is relatively new. A number of CLECs have recently entered the telecommunications business in order to take advantage of the market-opening opportunities created by the 1996 Act. These firms are attempting to use UNEs or resale to provide a variety of services, including local high-capacity and special access circuits. Many of these CLECs have constructed fiber rings of their own and plan to expand their networks as a customer base is acquired through the use of UNEs. Unlike ILECs or IXCs, the non-integrated CAPs and new entrant CLECs are relatively specialized firms. They may concentrate on particular geographic regions or particular product niches.

19. In addition to competing with ILECs, the IXCs, CAPs and CLECs are also significant customers of the ILECs. For example, both IXCs and CLECs report that a very high percentage of their high-capacity demand is satisfied through the purchase of

[6] AT&T acquired TCG while MCI acquired the local assets of Western Union. WorldCom acquired MFS and Brooks Fiber prior to acquiring MCI.

ILEC circuits.[7] In some cases, the non-ILEC competitors may both compete with the ILEC and purchase from the ILEC to provide an individual circuit to a customer. An IXC may also self-provision entrance facilities and transport for an end-user special access circuit, but purchase multiplexing and channel terminations from the ILEC.

20. Typical CLEC facilities networks are illustrated in Figure 2. The bulk of the investment is in the core urban areas or CBDs of larger cities. The CLEC networks may reach many buildings within a CBD, but are unlikely to reach all of them. The CLEC networks may extend to one or more outlying business districts, but like buildings in the CBD, do not necessarily reach all of them. Large portions of the metropolitan area will not be served by CLEC networks.

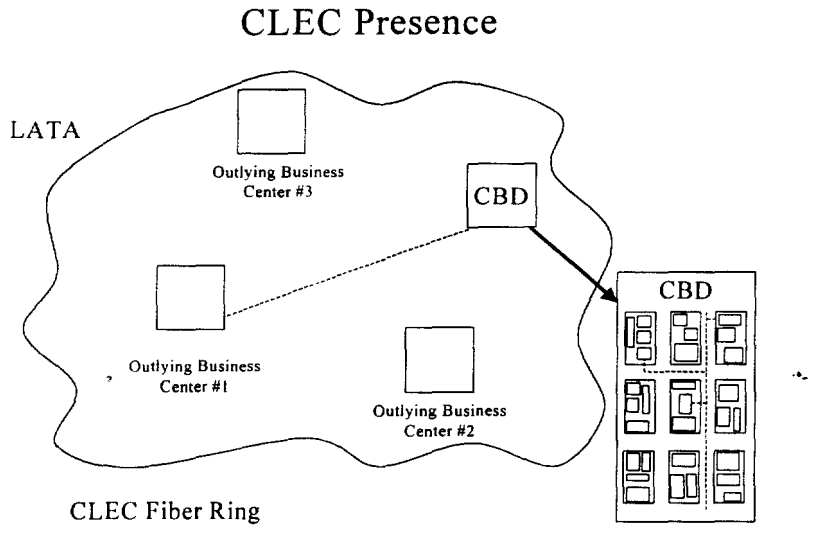

Figure 2
CLEC Fiber Rings

[7] *See,* FCC, In the Matter of Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, CC Docket Nos. 96-98, 99-70, Affidavit of Mark Shipley and David Rauschenberg, filed with comments for Covad, May 24, 1999.

21. While it may be true that the majority of high-capacity lines are in the areas served by CLECs, there will be significant demand in other areas as well. The "urban sprawl" common in many cities results in businesses being located throughout a large urban area. This will include branches of businesses that are located in the CBD or other areas of concentrated demand where the CLECs do have facilities. For example, a large bank or retail operation will have outlets throughout the city. In order to provide local service or a local data network to these customers as a "full service" provider, it will be necessary to provide them a citywide network. This in turn requires the purchase of UNEs from the ILEC. Without the ability to do so, the CLEC ability to compete will be impaired unless the CLEC can rapidly and efficiently construct the necessary facilities. As discussed below, the economic and technical barriers to expanding CLEC facilities simply make this impossible.

III. Barriers to CLEC Entry and Expansion

22. The Petitioners claim that competitive fiber networks are currently capable for serving a large portion of special access customers. They also allege that these networks can be easily expanded. There are several flaws in their presentation. First, the Petitioners have vastly overstated the competitive presence and significance of CLEC networks. Second, there is substantial demand for high-capacity access circuits outside the core urban areas where competitive facilities have been constructed. Indeed, as the demand for high-speed data services grows, high-capacity demand is growing across the board, including in areas that the CLEC networks currently do not serve. Third, CLECs face significant barriers to expansion, even within core urban areas where fiber networks have been constructed.

23. Foremost among the barriers to entry and expansion that must be overcome by the CLECs are the significant sunk costs that they must incur to provide service. The ILECs have already constructed ubiquitous networks that are being used to provide high-capacity services. As a result, the ILECs enjoy significant economies of scale and scope.

24. Simply put, construction of competitive CLEC facilities in less dense geographic portions of cities is not viable. Economies of scale in local networks suggest that for the foreseeable future the ILECs will be the sole supplier of both low and high-capacity services in many geographic areas, including geographic areas that contain high-capacity customer locations.

25. The source of these economies is easy to explain. The basic telephone company infrastructure consisting of poles, conduit and underground plant that support both voice grade and high-capacity loops is, within a large range, invariant to the number

of circuits provided.[8] Investment in these infrastructure items accounts for a high proportion of the total cost of the network. For example, in the HAI Model, infrastructure (trenching, poles, conduit, and manholes) typically accounts for more than a third of total loop investment.[9] Essentially, a CLEC must make all of these sunk investments to serve the first customer.

26. High-Capacity transport is also subject to significant economies of scale due to the need to make large sunk investments in infrastructure. Moreover, the ILEC has the advantage of being able, in many cases, to share interoffice transport and loop feeder facilities.[10] The ILEC transport networks carry substantial traffic, all of which produces revenue to defray the fixed costs of construction. CLECs will only be able to justify construction of such facilities on the most highly trafficked routes.

27. Finally, the ubiquity of the ILEC networks allows for construction of a more efficient transport network. A CLEC wishing to expand its transport network from three to four nodes will have to construct two links to the fourth node to ensure path redundancy. But having done so, one of the links connecting the existing three nodes becomes superfluous.[11]

28. Dr. Mark T. Bryant quantified the economies inherent in providing local services in a study presented in the UNE Remand Proceeding.[12] Dr. Bryant used the HAI

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[8] Note that these elements of the network are, sometimes literally, sunk costs.
[9] HAI Model, version 5.0a ("HM 5.0a"), filed with the FCC February 16, 1998 ("HM 5.0a").
[10] *Ibid.* See also, the FCC's cost proxy model, HCPM/HAI Synthesis Cost Proxy Model, http://www.fcc.gov/ccb/apd/hcpm/.
[11] This issue is discussed at greater length in the Declaration of Dr. Mark T. Bryant filed in the UNE Remand proceedings. See, FCC, In the Matter of Implementation of the Local Provisions in the Telecommunications Act of 1996, and Interconnection between Local Exchange Competition Carriers and Commercial Mobile Radio Service Providers, CC Dockets No. 96-98, and No. 95-185 ("UNE Remand Order"), Declaration of Mark T. Bryant, on behalf of MCI WorldCom, Inc., May 26, 1999 ("Bryant Declaration").
[12] *Ibid.*

local telephone proxy cost model to estimate the costs per line of serving customers with a ubiquitous network when the serving carrier serves only a fraction of the market. Dr. Bryant found that in New York, "in dollar terms, the CLEC cost disadvantage ranges from $2,300 per line per month in the most rural areas, to $43 per line per month in the most dense areas at the five percent penetration level."[13] Similar results were obtained for transport costs, with the cost disadvantage higher for low competitive penetration, but disappearing more rapidly as market share increased.[14]

29. This, of course, explains why CLECs have chosen to concentrate their investment where telecommunications demand is most dense – the central business districts and some outlying business centers within large cities. In these areas there are a sufficient number of potential customers for loop services, including high-capacity loops, to justify the sunk costs of building the necessary infrastructure to serve them.[15]

30. The above analysis explains why the CLECs have concentrated their investment in narrow geographic niches. However, it is important to recognize that the CLECs face significant barriers to entry and expansion even for the highly concentrated business centers where CLECs have already constructed fiber rings. By assumption, the CLEC will have incurred the substantial time and expense of achieving certification, acquiring rights of way and building space, and constructing a fiber ring. The next step is to extend its network to serve additional customers. This entails a number of activities.

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[13] *Id.*, para. 28. This analysis is directly applicable to the high-capacity loop issue. A T1 loop is typically provisioned by ILECs by using HDSL technology together with a pair of two wire loops.
[14] *Id.*, para. 30.
[15] See, UNE Remand Proceeding, Declaration of John E. Kwoka, Jr. on behalf of MCI WorldCom, Inc., May 26, 1999 ("Kwoka Declaration"), para. 11, where Dr. Kwoka explains this issue in terms of minimum viable scale.

31. First, a circuit must be completed between the potential customer and the fiber ring. In CBDs, where facilities are almost always installed in underground conduit, the cost for material and construction is $70 or more per foot to get to the target building.[16]

32. Once at the building, the CLEC will have to gain permission to enter the building. As noted earlier, building access is not automatic, it requires negotiations with the building owner, and, in most cases, building owners require compensation for (1) the right to enter their building; (2) the floor space required to install circuit equipment within the building; and (3) the use of the building's riser conduit. The amount of compensation will vary from building to building, but access can cost anywhere from a few hundred dollars per month, to well over a thousand dollars per month, usually over a five or ten year lease period.[17]

33. The CLEC must then incur the fixed costs of the facilities necessary to serve customers in the building. If there is only demand for a small number of voice grade or T1 lines in a given building, or the building is located too far from the CLEC fiber ring, it may not be economical to build the facilities to serve customers in that building at all. The per-line cost of the terminal equipment, the ring extension, or both, may be too high. This means that even in the most competitive local market in the country, a significant number of customers do not have either current or realistic potential alternatives to the ILEC.

34. Even if the CLEC already serves a customer in a building, additional investment may be necessary to serve a new customer in that same building. More cable

[16] See, Declaration Of Edwin A. Fleming filed on behalf of WorldCom, Inc. in this proceeding ("Fleming Declaration"), para. 18. See also, FCC, In the Matter of Federal-State Joint Board on Universal Service, and Forward-Looking Mechanism for High Cost Support for Non-Rural LECs, CC Docket Nos. 96-45 and 97-160, *Further Notice of Proposed Rulemaking,* released May 28, 1999 (*"FNPRM"*).

will be required to reach the second customer. Often, there will be a need to add interface and ancillary equipment in the optical multiplexer in the building, or even to install an entirely new optical multiplexer.

35. The fixed costs associated with serving any given building are significant. With the building-related investments as high as $250,000[18] it will obviously be uneconomic to serve customers in buildings where there is limited DS-1 demand. Assuming annual revenue per DS-1 of approximately $6,000, it is obvious that a CLEC will not even consider expanding its network to a building unless many multiples of DS-1s can be served.

36. In summary, a CLEC must meet all of the following conditions in order to serve a high-capacity customer in a given location using only owned facilities. First, it must have a ring that passes close enough to the customer location so that a spur off the ring can be economically extended to the customers' premises. At some distance it will be less expensive and more reliable to extend a ring down the street on which the premises is located. Second, the spur from the ring to the premises must be in place. Third, the cable must enter the building and be connected to appropriate terminal equipment, located in an appropriately conditioned space, which provides circuits of the bandwidth required by the customers in the building. Fourth, inside wiring must extend from the terminal equipment to the individual customer's premises in the building.

37. The availability of high-capacity UNEs can help overcome these substantial barriers. If traffic can be added to network at an efficient cost through UNEs, it is more likely that the network will be built in the first place.

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[17] Discussions with industry experts experienced in leasing building space for CLEC networks.
[18] Fleming Declaration, para. 8.

IV. Alternative Technologies

38. This discussion has focused thus far on standard wireline technology deployed by the ILECs and most CLECs. Alternatives may include broadband wireless and cable telephony.

39. There have been abortive attempts over the years by would-be competitors to ILECs to provide high-capacity access to business customers using any of several fixed wireless technologies, including microwave and infrared systems. The most recent of the microwave-based companies, most notably Teligent and Winstar, are, as of this writing, in the process of going out of business. Free-space optical systems for high-capacity digital communications have been available for decades, but they generally apply to specialized needs and none has yet been an unqualified commercial success.

40. Microwave systems for "short-haul" applications such as high-capacity urban access facilities for businesses operate at frequencies of 18 GHz and often higher. These bands are very susceptible to fading caused by rain, and the severity of the fading increases with increasing operating frequency. The overall effect of the fading is to reduce the operating range of the system, so that such microwave systems generally are not usable at ranges of more than a couple of miles if high availability is to be maintained.

41. Microwave systems also require suitable locations on buildings for mounting antennas. Rooftop access can be expensive and difficult to negotiate; particularly since the need to locate cellular and PCS antennas on buildings in urban areas has made roof space especially valuable to building owners. Some microwave systems are designed to operate through window glass, so that a microwave terminal can be placed in an office

and pointed at the other terminal forming the link. In order for this arrangement to work, however, there must be an office window in microwave line-of-sight of the remote terminal, and the office must be available to the customer.

42. Over-the-air optical systems are also susceptible to atmospheric transmission impairments, and more so than are microwave systems. These systems operate at near-infrared wavelengths and are affected by any atmospheric effect that reduces visibility, including snow, fog, smog, smoke, and heavy rain. Transmission distances are thus quite short. Depending on system design, the usable distance can be less than one mile if high reliability is to be maintained. In any case, reliability of over-the-air optical and microwave systems will generally be less than that of fiber-based transmission systems.

43. Cable television systems are unsuitable for high-capacity access service for several reasons: they often do not serve business districts, their reliability is historically much worse than that of telephone networks, and they do not generally have sufficient capacity for high-bit-rate private line services.

44. Cable systems were for the most part built to serve residential and suburban areas. A few cable systems may serve CBDs, but they are far from ubiquitous. Even in those places where cable service is available in a CBD, it has historically been unsuitable for high-capacity business use because of its lack of reliability in comparison with telephone service. While the reasons for this lack of reliability are beyond the scope of this paper, cable television service is not critical to public safety and has not been subject to the availability requirements placed on tariffed telephone service by state regulators.

45. Cable television systems do not have the capacity to serve large numbers of business customers requiring DS-1 and higher-speed services. These services require

dedicated capacity in the transmission system; a business must have the entire bandwidth available all the time. This is much different than the high-speed Internet access service now supported by many cable systems. This service supports relatively infrequent high-speed bursts of data to and from subscribers. Internet users typically transmit or receive data a small fraction of the time, often less than ten percent. Thus, although a cable modem may transmit at a bit rate of, say, six megabits per second, if a user is active ten percent of the time, the average bit rate offered by the user is only six hundred kilobits per second. The "bursty" nature of these transmissions allows cable capacity to be shared by a number of users, and no capacity is dedicated to any given user. Business users require service availability guarantees that such a shared system cannot support.

V. Implications for Competition

46. As we have explained, there are substantial barriers to CLEC entry and expansion in local telephone markets. These barriers extend to high-capacity services. Only in the densest urban areas will CLECs find it economical to construct their own facilities. However, CLECs need to provide high-capacity lines to customers outside of these areas in order to compete with ILECs for the business of multi-location customers and in order to realize economies in their switching and transport facilities.

47. CLECs will require access to UNEs even within areas of dense high-capacity demand due to the high fixed costs associated with entering individual buildings. In the absence of high-capacity UNEs, CLECs will be significantly impaired in their ability to compete for the business of an important set of customers. This impairment will ultimately result in lower, not higher, investment by CLECs (which helps explain the desire by the Petitioners to remove these UNEs from the market). Investment will be

lower because the CLEC addressable market will be smaller. This will not induce CLECs to build their networks more rapidly because sunk costs and economies of scale are the primary barriers to network expansion.

48. Removal of these UNEs from the market will harm consumers. First, consumers will lose the benefits of retail pricing and service competition. Second, the costs of entry and expansion will increase. This will ultimately result in reduced facilities competition.

49. Mandatory provision of UNEs would not be required if there were a functioning wholesale market. However, the brief history of the post 1996 Act period conclusively demonstrates that the ILECs will not provide the necessary UNEs to CLECs without intervention by regulators. This fact alone demonstrates that claims by the Petitioners that these facilities are abundant and virtually ubiquitously available are false. If the facilities competition and low barriers to entry and expansion that the Petitioners allege were real, then the ILECs would be anxious to make unbundled network elements available at economic cost to CLECs in order to generate demand on their own networks.