Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities	)	CC Docket No. 02-33
	)	
Universal Service Obligations of Broadband Providers	)	
	)	
Computer III Further Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Regulatory Review – Review of Computer III and ONA Safeguards and Requirements	)	CC Docket Nos. 95-20, 98-10

DECLARATION OF IAN T. GRAHAM
ON BEHALF OF WORLDCOM, COMPTEL AND ALTS

1. My name is Ian T. Graham and I am Executive Director, WorldCom OnNet DSL. In this role, I have operational responsibility for executing WorldCom's facilities-based DSL strategy, which is largely centered around WorldCom's acquisition of certain DSL network assets of Rhythms NetConnections ("Rhythms"). On behalf of WorldCom, I filed a Declaration in the FCC's Triennial Review explaining that WorldCom's DSL strategy is dependent on the continued availability of unbundled network elements from the Regional Bell Operating Companies ("RBOCs").[1]

2. The purpose of my declaration is to explain certain aspects of digital subscriber loop ("DSL") technology, related aspects of computer networking technology, and competitors' need for unbundled access to ILEC facilities.

Overview of Computer Networking

3. DSL technology encompasses a family of related protocols that have been developed over the years to push traffic at relatively high bit rates over copper wires. DSL comes in various specific implementations—ADSL, IDSL, RADSL, HDSL, HDSL2, G.dmt, G.lite, G.shdsl, VDSL, and SDSL—each of which is a specific DSL-based protocol. A "protocol" is nothing more than a set of standards and rules that specify how communications will take place.

4. Protocols serve the same function in the context of communications between devices. As a general matter, protocols answer questions such as (i) how should a machine on a network determine whether the network is available to accept traffic; (ii) how should that machine signal to others that it wishes to transmit information; (iii) what information should be included in the message to ensure that it reaches its destination, and how should that information be formatted; (iv) how will a machine know whether it has received the complete message; and (v) if there is an error, should the entire message be resent or just the missing part.

5. Writing rules for information exchange between only two devices on a network would be relatively simple. For example, for two computers to exchange information, they would each have to follow the same set of rules for transmitting information over the physical medium that connects them and know when that information was received in complete and correct form. This set of rules could be relatively simple because the number of variables one would have to address would be

[1] Comments of WorldCom, Declaration of Ian T. Graham, Attachment C, CC Docket No. 01-338, dated April 4, 2002, ("Graham Triennial Declaration")

limited (one would know the type of physical connection between the computers; the operating system on each; the destination of each message (by default, it would be the other machine)). However, as the network expands, the process gets more complicated. Add a third computer to the network, and one must now add rules by which each computer will determine whether or not a given message was intended for it. Add different applications (word processing, spreadsheets) to each computer, and the protocol must be expanded to include rules by which the computers will determine which type of information is being received. Similarly, add different networks, and one must add rules to determine which network a transmission is destined for. As the number of networks and computers expand, different variables come into play. For example, if one were connecting networks in different buildings, or between different companies, one would need to have rules that would take into account different physical media for transmitting the information (copper, fiber, wireless), different operating systems, and different applications.

6. In an attempt to address the complexities of networking together large numbers of devices, and in an attempt to facilitate communications between different networks, the International Standards Organization, in the 1970s, developed its Open System Interconnection ("OSI") model for computer networking.

7. The OSI model is not a protocol itself. Rather, the OSI model divides the standard functions of computer networking into seven different layers. Each layer describes a subset of the functions that need to be performed during the course of providing communications over a network and between networks. The basic concept of

the OSI model is that operations that take place at a certain layer depend upon the existence of the functions being performed at each lower layer, and that the protocols (rules for communications) at a given layer need not address all of the issues raised in the lower layers.

8. The OSI model is as follows (it is usually presented from the bottom up):

Layer 7: The Application Layer
Layer 6: The Presentation Layer
Layer 5: The Session Layer
Layer 4: The Transport Layer
Layer 3: The Network Layer
Layer 2: The Data Link Layer
Layer 1: The Physical Layer

According to the OSI model, the functions that are to be performed at each layer are as follows:

Layer 1 (The Physical Layer): Protocols at this layer define the physical interface between devices. This layer covers issues such as the type of media (twisted pair, fiber, coaxial cable, etc.) and interface types (RJ11, RJ45, etc.) to be used for the communications. It covers issues related to transmission of information over that media at the physical level (voltages, frequencies, wave-lengths) and whether the information is to be encoded in analog or digital form. As discussed below, DSL is primarily a layer 1 protocol—it provides a set of rules that devices must follow in order to exchange digitally encoded information over pairs of copper wires using high-frequency electronic signals.

Layer 2 (The Data Link Layer): Protocols at this layer include rules for dividing the electrical or optical signals generated at the physical layer into groups that have meaning (data bundles). These data bundles are often referred to as frames or packets. Layer 2 protocols will specify which bits and bytes transmitted by the electronics are to contain addressing information, which are to indicate when a message begins and ends, and which are to contain error correction information. Layer 2 protocols also generally arbitrate access to the network by different devices and direct traffic to destinations on the local network (switching). Frame relay, Ethernet, and asynchronous transfer mode (“ATM”) are examples of layer 2 protocols—they set rules for the size of data bundles and for the location within each bundle of different types of necessary information (type of data being carried; source of transmission; destination; data payload; error correction information.) DSL modems and Digital Subscriber Line Access Multiplexers (“DSLAMs”) use layer 2 protocols to organize and pass data traffic between each other over copper facilities using layer 1-transmission protocols.

Layer 3 (The Network Layer): Protocols at this layer specify rules for routing groups of data (packets) through a network and between networks. Protocols at this layer add addressing information to the data bundle that was prepared by the layer 2 protocol, and use that additional information to route the data bundle to its destination. The Internet Protocol (a protocol for inter-network delivery of traffic) is an example of a layer 3 protocol.

Layer 4 (The Transport Layer): Protocols at layer 4 govern the overall transmission of the data bundle. They set rules for what a device will do to correct errors in the transmission (e.g., how many times will it ask for information to be resent). Layer 4 protocols also allow for the transmission of information to vary based on the type of data in the payload. For example, a layer 4 protocol might be written to indicate that voice or video traffic receives a higher priority on the network, or it might specify certain security-related rules that routers and other network devices must follow in connection with traffic over virtual private networks ("VPNs"). The Transfer Control Protocol ("TCP") is an example of a layer 4 protocol. Together with the Internet Protocol (with the combination being commonly abbreviated as "TCP/IP"), it is the standard protocol used for the exchange of traffic between the many different networks that make up the Internet.

Layer 5 (The Session Layer): Protocols at this layer govern the overall communications session between two different devices. Because the information to be passed between devices almost always is broken down into many (hundreds, thousands, millions) of discrete data bundles, protocols at the session layer are required to set rules for how a device will indicate that it is done sending information. Session layer protocols also determine whether two devices can send data to each other at the same time (whether communications are full duplex or half duplex). Session layer protocols may also have security features built in (such as whether a device is permitted to respond to requests from others).

Layer 6 (The Presentation Layer): Protocols at this layer define how information will be presented to the device that receives it. Presentation layer protocols, for example, may be responsible for encryption and decryption of information. They may determine how information is formatted before being passed to a certain application.

Layer 7 (The Application Layer): Protocols at this layer generally define how applications (email, Web browsing, etc.) will access the network and interact with protocols at layers 1 through 6.

9. By following the OSI model, programmers (the persons writing the protocols) can subdivide the many different tasks that are required to send information between different devices on different networks. As a result, for example, in the Internet context, the developers of TCP/IP did not have to include in that protocol standards for transmitting information over an Ethernet network. Rather, they were able to rely on the layer 1 and layer 2 protocols that had already been developed for transmitting information on an Ethernet network. Similarly, the developers of the popular Eudora email program didn't have to worry about whether the email was going to be sent over fiber or copper—they could rely on the existence of lower-level protocols to handle those tasks.

10. As mentioned above, however, the OSI model is just that—a model. The distinctions between the layers are not clear-cut, nor are they always strictly observed. For example, both layer 2 and layer 4 protocols perform an error checking function (albeit usually from two different perspectives). In addition, many computer-networking companies have their own proprietary protocols that, for example, might

handle the functions of layers 1 and 2 in a single protocol. Despite this, however, the OSI model persists as a useful way of segregating and categorizing the different functions performed during the course of sending information over a computer network.

DSL is a Layer 1 and 2 (Physical and Data Link Layer) Protocol and Represents the Next Step in the Evolution of Voice and Data Communications Over Local Loops

11. As mentioned above, DSL is a layer 1 and 2 protocol designed to allow two devices to communicate over pairs of copper wire by using high-frequency electrical signals to exchange information that has been encoded in digital form.[2] As such, DSL simply represents the current evolutionary state of communications over the existing outside-plant infrastructure that connects millions of homes and businesses in the United States to the public switched telephone network.

12. The public telephone network was originally designed to transmit speech. Human vocal cords produce an analog signal (a sound wave that varies continuously in pitch (frequency) and volume) and the PSTN was originally designed to take this analog sound wave and convert it into an electrical signal that could be passed over the telephone network and be re-translated into sound waves on the other end. Currently, much of the PSTN still transmits information in analog form. The majority of telephone sets in American homes today are analog phone sets that receive and transmit information over pairs of copper wire using electric signals with a frequency of between 300 Hz and 3,300 Hz.

[2] Some DSL routers go as high as Layer 4.

13. Digital technology involves the transmission not of a continuously variable signal (as one might get by gradually increasing or decreasing the amount of electric current passing through a wire), but rather the transmission of information using a signal that is either on or off—there is no "in-between" position in a digital network. Digital technology is what was employed in the telegraph network, the counterpart to the telephone network that was designed to carry short text messages (data) using a combination of "on" and "off" signals. In the telegraph example, the technical specifications that governed how much current should be sent over the wire when the operator depressed the switch could be considered to be the layer 1 protocol for the telegraph network, and the Morse Code, which was the predominant code used by operators to decide when and for how long to depress the switch can be considered to be the layer 2 protocol for the telegraph network.

14. Encoding information digitally has a number of advantages over encoding it in analog form when transmitting information by electric current over pairs of copper wire. As the electric current travels through the wire, it weakens. In addition, the signal encounters various types of electrical interference, which distort it and inject noise (electrical energy that was not part of the original wave form transmitted by the originating device). Boosting an analog signal on a line is necessary to permit that signal to travel over any significant distance. The process of amplifying the signal, however, results in an amplification of the noise associated with it, because the wave forms and distortions that make up the noise (the unwanted part of the signal) are virtually indistinguishable at that point in the transmission from the wave form associated with the

desired communication. When this happens on a voice call, people generally hear static as the noise (unwanted electric signals) is transformed into sound waves by the telephone receiver. Below a certain level, static would not generally impede a person's ability to understand what was being said.

15. When information is encoded digitally, however, the electric current does not need to be modulated to produce a continuously variable wave form. Rather, the current only needs to be turned on and off. Each state—on or off—represents one bit of information—literally called a "bit" in computer parlance. A combination of eight bits—called a byte—is the building block of the binary system, which is the foundation of digital communications and information processing. To transmit data in digital form over a telephone line, one need only turn the current on and off in some manner that makes sense (much like the use of Morse code over the telegraph system). This presents a number of advantages over the analog method. First, although the electric current still weakens and picks up noise as it passes over the line, it is much easier to accurately boost the signal because the digital demarcation (between off and on) stands in stark contrast to the analog form of the noise signals created by the interfering sources. Thus, noise can be effectively filtered out of the transmission and the signal can be more effectively boosted over longer distances. In addition, digital transmissions usually result in fewer errors at the receiving end because the receiving device need only determine whether the current was on or off at a given point in time. Finally, because of their two-state nature (either on or off, no gray area in between) digital signals are easier to process than analog signals. This permits faster sending and receiving of information.

16. Given these advantages (speed, ability to accurately boost signal and thereby transmit information over longer distances with enhanced accuracy), digital technologies have gradually worked their way into the telephone networks over time. Today, virtually all of the communications and transmissions over long haul and transport circuits take place using digital protocols. Using DSL technology to extend the use of digital techniques over the last-mile copper loop to the end user is merely the current step in the evolution of the PSTN.

17. The next step in the evolution of the local network is likely to be fiber deeper into the network. Just as turning the electric current on and off to encode information digitally has advantages over simply varying the strength of the current to encode information in analog form, using light waves over fiber optic cables has advantages over using electrical signals over copper wire. These advantages are largely related to the difference between beaming light through glass and pulsing electricity through copper. (Fiber optics still encode information digitally—the light beam is either on or off, and the combination and order of the on/off pulses is what has meaning. SONET is a widely used layer 1 protocol for transmitting information over optical networks.). First, individual fibers are smaller and lighter than copper wires (a single strand of fiber is approximately the diameter of a human hair) so fiber requires less duct/conduit space. Second, light waves traveling over fiber are immune to electrical interference, and so are not distorted by radio waves, nearby power lines, electric signals on other coppers wires, etc. Third, fiber optics provide for more secure communications because it is largely resistance to taps and does not emit electromagnetic signals. Fourth,

there is less weakening of light signals over fiber optic lines, so the signals can travel further without requiring amplification. Finally, there is no sparking hazard associated with fiber optic cables because they are not powered.

18. Fiber does have a number of disadvantages when compared with copper as well. First, fiber technology is relatively new, so the devices to send information over fiber are more expensive, as is the human capital needed to install and maintain it. Second, fiber is less flexible than copper, so more care in handling is needed. Finally, power must be added at the customer premise (because fiber does not carry its own power), which adds to the cost and inhibits the provision of services like lifeline telephone service. For these reasons, fiber is widely used in backbone and long-haul networks (virtually all of the long distance network is fiber). Fiber is also prevalent in metro-area networks and is frequently installed in office buildings for in-building networks. In addition, the RBOCs are beginning to install fiber in their outside-plant infrastructure, where it is used as a means to carry traffic between a remote terminal and the RBOC's end office. Fiber to the home is currently not seen as a cost-effective proposition.

History of DSL

19. DSL is not new. DSL technology was first developed in the late 1980's. Originally, the Bell Companies hoped to be able to use DSL to deliver video on demand over existing copper phone lines to compete with cable. This market never materialized, but the RBOCs have gone on to deploy DSL technology in other ways.

20. One way in which the RBOCs use DSL technology is to provision T1/E1 access services. HDSL technology is employed by the RBOCs to deliver DS-1 service over copper loops. Usually, two pairs are used in this implementation. Use of HDSL technology permits the RBOCs to deliver this telecommunications service over copper loops of up to 12,000 feet in length without the use of repeaters. T1/E1 service is also provided by RBOCs over single pair copper loops of up to 11,000 feet in length using HDSL2 technology.

21. Another way in which RBOCs have used DSL technology is for pair gain. Using DSL over the copper loops between the end office and a remote terminal permits the RBOC to limit the number of physical copper loops that need to be connected back to the central office. This is done by terminating the neighborhood loops in the remote terminal and using DSL (or some other technology) to multiplex the telecommunications traffic from these neighborhood loops onto a single copper pair for transmission back to the central office.

22. Most recently, DSL technology has been viewed as a desirable means by which to deliver Internet content over existing copper loops.

23. The various DSL protocols mentioned briefly, above, are generally centered around a common goal—transmitting information at high bit rates over existing copper local loops. DSL achieves this by using high frequency signals in the range of 10kHz to 1.0mHz. By not restricting itself to the frequencies used for voiceband communications (300 Hz to 3,300 Hz), DSL can achieve higher transmission speeds over the same medium—a copper loop. This higher speed comes at the cost of compatibility

with most of today's fiber-based telecom infrastructure; whereas a standard telecom computer modem can transmit information using voiceband frequencies between any two points in the telecom network *(e.g.*, one could use a standard telecom computer modem to call a computer in another state), today's DSL technology (with its corresponding use of high frequency signals) is used only to transmit information from one end of a copper local loop to the other.

24. In order for an end user to use DSL technology, that end user must obtain a DSL-compatible modem for his or her computer, and there must be a compatible device at the other end of the copper loop (usually, the nearby central office, but it could also be in a remote terminal). The device that is placed in the central office or remote terminal to terminate a DSL data stream is usually called a Digital Subscriber Line Access Multiplexer ("DSLAM"). This device takes the DSL signals from the copper loop, aggregates the traffic into a higher-bandwidth circuit, and sends the traffic on to its destination, which could be another point on a customer's data network, or an Internet gateway device.

25. In the case of ADSL technology, which uses higher-frequency signals above the voiceband communications, both voice (0-4kHz) and DSL (10kHz+) services can be offered over the same copper loop at the same time without interfering with each other. To do this, both the end user and the central office have to deploy splitters or filters to separate the voice and DSL traffic. At the end user site, the passive filter sits just behind the telephone, and filters out the high-frequency DSL signal so that it does not interfere with the user's conversation. At the CO end of the copper loop, the splitter is a

passive device that directs the low frequency signals (voice) to the local voice switch and the high frequency signals (DSL) to the DSLAM.

26. At its essence, however, DSL technology is nothing more than the implementation of a set of standards and protocols for transmitting signals over a copper loop. Those signals can be used to encode and transmit any type of information (a phone call, a song, a movie, a Web site, a spreadsheet, a photograph, a document, an email message) that can be expressed in a digital format.

The Public Debate: Different Groups Use the Term "DSL" to Mean Different Things

27. Part of the confusion that appears to be present in the current debate over "broadband" services relates to the different ways in which different groups have used the term "DSL."

28. Competitive local exchange carriers ("CLECs") generally use the term "DSL" when discussing their right to lease an unbundled local loop (either the whole "dry" loop for SDSL or IDSL, or the high-frequency portion for ADSL), from the RBOC, and use DSL as a layer 1 protocol to transmit traffic between the end-user location and the CLEC's DSLAM. Generally, the end user wants to send its data to some destination beyond the DSLAM, and so the CLEC generally also supports some type of layer 2 protocol (frame relay or ATM, usually). Increasingly, the end users want access to the Internet. Accordingly, many CLECs offer Internet access service as well (layer 3 and layer 4 capabilities). In sum, when discussing the availability of "DSL", the CLEC community usually uses the term "DSL" as a proxy for the right to obtain UNEs from the

RBOCs and use them in connection with DSL layer 1 protocols over the local loop to provide telecommunications (layer 2) and Internet (layer 3 and layer 4) services.

29. Internet service providers ("ISPs") generally use the term "DSL" in a slightly different way. When an ISP says it wants access to DSL, it usually means it wants the right to purchase, on competitive, wholesale terms, a service from a CLEC or RBOC in which the facilities-based provider uses DSL technology over the local loop and bundles it with aggregation and some level of backhaul transport. The ISP, who generally is not a facilities based provider, but who may or may not have their own Internet backbone network, generally wants to pick up its customer information from the facilities based provider either at layer 2 (typically using permanent virtual circuits via ATM protocols) or at layer 3 and 4 (by receiving already packetized traffic directly over the Internet). If the ISP picks up the traffic at layer 2, it is generally adding its own IP addresses and other high-layer-related technology components. Traditionally, the RBOCs have tariffed Layer 2 DSL service. For example, the RBOCs have been combining DSL connections with metro-area ATM aggregation and transport to provide a "bulk DSL" service to wholesale customers. WorldCom currently buys such a service under a wholesale tariff arrangement with Bell South.

30. When consumers use the acronym "DSL" it is usually used as a synonym for "broadband or high speed Internet access." In these cases, the consumer is referring to the ability of an end user to access Web sites on the Internet, send email, use instant messaging, play online games, download music and videos, bank online, and generally have access to the Internet over a faster-than-dial connection. When used in

this way, the term "DSL" is not a reference to any particular protocol or technology, nor is it a reference to any particular provider or combination of providers of network services. It's just a reference to "something that is faster than my dial-up modem that will let me surf the 'Net" and is frequently used interchangeably with "broadband" access or "high-speed" access.

DSL is Separate from the Internet

31. Regardless of the way in which the term "DSL" is used in public discussion, one thing needs to be clearly understood—DSL is completely separate technically from the Internet. DSL service is delivered today via a combination of layer 1 and 2 computer-networking protocols. A DSL-enabled local loop is merely a transmission path—a means of obtaining information from some source. Whether that source is a computer on a private corporate frame relay network or whether it is a Web server in a entertainment company's server farm, the use of DSL as a layer 1 & 2 technology in no way affects or alters the content or nature of the information flowing over the copper loop to the customer's location. As a practical matter, the only difference between obtaining information via DSL technology and voiceband (POTS) technology is the frequency range and the other layer 1-related aspects of the different protocols that are used to transmit the electronic signals over the last-mile copper local loop. The use of higher frequencies with DSL requires the use of different equipment at the customer premise and the central office, but that equipment is not altering the customer-transmitted information any more or less than is the traditional telecom equipment that transmits information at voiceband frequencies.

32. Today, the RBOCs routinely bundle their local voice service with "enhanced" services, such as voicemail, yet there is no question that the service sold to the end user has a "telecommunications service" component that the RBOCs have an obligation to make available on a stand alone basis. The high-speed Internet access service that the RBOCs sell to end-users is no different. The service contains both a "telecommunications service" component and an "information service" component that together are sold to the end user as a bundled offering. DSL, like basic POTS service, can be sold with or without an "information service" component. Like their traditional voice offerings, the RBOCs are simply choosing to sell a bundled offering to their end users. Their decision to do so should not in any way alter the nature of the underlying DSL transmission.

Demand for DSL

33. DSL has a number of features that make it a desirable technology for transmitting information in digital format. First, it works over the existing copper local loop infrastructure. Impediments to the implementation of DSL technology over copper local loops (such as load coils and bridged taps) are being eliminated, and a large percentage of the current population currently receives telephone service over a copper local loop that is capable of supporting DSL transmissions.

34. Second, DSL permits faster, and a broader variety of, transmission speeds than does the use of voiceband frequencies. Content that would take a long time to transmit over a traditional telecom modem (<56k) can be retrieved more quickly using DSL technology. Similarly, time-sensitive transmissions (such as video conferencing,

online gaming, and voice services) are easier to support with high data transmission rates. In addition, unlike dial-up, DSL can be provided at a variety of speeds, each of which can be made available at different price points. With DSL, customers can tailor their bandwidth purchase to their specific needs.

35. Third, DSL technology is less expensive than the alternative high-speed access services of ISDN and T1. ISDN service involves terminating a digital subscriber connection on a digitally enabled port on a telephone switch and is generally sold as a metered service with per-minute pricing. DSL service, on the other hand, is priced at a level many consumers can afford, and typically is sold at a flat fee for always-on, unlimited usage. Similarly, the terminating equipment and local transport facilities required for DSL are generally much less expensive than those required for high-capacity leased line services, such as a T1 or fractional T1 (frame relay) service.

36. Fourth, DSL, particularly ADSL service using line-sharing, can be provisioned more quickly than high-capacity leased service (i.e., T1), because, in most cases, the installation of the customer premise equipment (“CPE”) can be handled by end users, most of whom are not specially trained in computer or information technologies. This helps lower the cost of installing the service relative to high-capacity service options.

37. Finally, in its various flavors and options, DSL is flexible enough to meet the high-speed access requirements of most small/medium businesses, enterprise teleworkers, and end users of ISPs. Customers upgrading dial-up connections to DSL

generally experience a significant and satisfactory decrease in the amount of time it takes to download information.

38. Because of these features, DSL is an attractive access solution for four main customer segments. First, retail end user customers that use the Internet frequently, or that use it for Internet-enabled applications such as online entertainment, file-sharing, and digital picture and video presentation, are buying DSL as a "dial upgrade."

39. Second, small and medium sized businesses can use DSL to access the Internet for document sharing, online research (such as Lexis.com), online procurement, email, and other collaborative online business applications (such as web-based video conferencing or net-meetings). These business customers often cannot afford the costs associated with a high-capacity leased line, but at the same time cannot afford the application unresponsiveness associated with performing these functions over a dial-up connection. DSL is the perfect solution for their needs because it provides them with the amount of bandwidth they need but at a cost less than a high-capacity leased line.

40. The third segment is the enterprise segment. Large Fortune-500 companies find DSL to be a cost-effective way of connecting many different retail or distribution points (such as gas stations or fast-food restaurants) to a private corporate network. These companies may use DSL services to connect nodes on a private corporate network using traditional data networking protocols, such as frame relay or ATM services, or using newer IP virtual private networking protocols ("IP VPN"). In addition, these companies are increasingly turning to DSL as an access solution for

remote work and telecommuting solutions in which the company buys the employee's DSL line at home or reimburses the employee for the costs of such service.

41. Finally, independent ISPs have found DSL to be an excellent delivery mechanism for Web content and other ISP services such as Web hosting, email, news, information, online photo albums, online scheduling services, online auctions, and a broad variety of other applications.

42. As described in my Triennial Declaration, the RBOCs have targeted the first of these four customer segments at the expense of the other three, while competitors, like WorldCom, are serving all four.[3]

If Competitors Are Unable to Access DSL-Enabled Local Loops, Business Customers Will Not Be Served and Prices for High-Speed Internet Access Will Remain High

43. Competitors cannot deliver the innovative DSL-based products they offer today and will offer in the future unless they have access to local loops. For example, WorldCom's DSL business requires continued access to local dry copper loops, the high-frequency portion of voice-enabled loops (where voice is provided by either the RBOC or a CLEC), high capacity transport out of the RBOC central office back to WorldCom metro aggregation facilities, and the associated RBOC systems that enable WorldCom to pre-qualify, order, status, and monitor such UNEs. There is no reasonable alternative that would permit WorldCom to continue to deliver high-speed data and Internet services. Duplicating the RBOC investment in outside plant facilities built over decades at a cost of billions of publicly subsidized dollars is not feasible.

[3] Graham Triennial Declaration at ¶¶ 38-41.

44. WorldCom and Covad are the only companies providing business-grade DSL service today on a national basis. Several aspects of the RBOCs' DSL network architecture and product offerings make it virtually impossible for an enterprise to receive business-grade DSL. For example, the RBOCs are not managing oversubscription and traffic on the network at levels that are suitable for a business-grade product; some are not supporting static IP addressing and routed CPE (which is generally the easiest and most cost effective way of supporting multiple users over a single DSL line); and most are not offering symmetric bandwidth capabilities for business locations whose usage patterns do not fit those of the typical residential customer. In addition, the RBOCs are not offering dry-copper loop service, which constricts a customer's ability to obtain any other type of DSL service other than ADSL. It is my opinion that the RBOCs have not developed a business-grade DSL offering because they do not want to diminish the lucrative revenues they receive from selling high-capacity T1 leased lines to businesses. (Ironically, those T1 lines are often simply dry copper loops with HDSL electronics).

Business-Grade Service

45. As I explained in my Triennial Declaration, for competitors to continue to provide dry copper and line shared DSL services to businesses and ISPs, they must have cost-effective access to the local loop (including fiber-fed loops) and related network elements.[4] If competitors lose access to the local loops and other RBOC UNEs or if these elements are not priced competitively, existing DSL providers would be forced

[4] Graham Triennial Declaration at ¶¶ 30-37.

to exit the marketplace, which will leave businesses with no other option but to purchase expensive dedicated high-capacity circuits from the RBOCs.

Internet Access to ISPs

46. It is critical for CLECs to continue to have cost-based access to DSL-enabled local loops so that independent ISPs can offer consumers with high-speed access to the Internet at affordable prices. Although WorldCom does not directly compete in the consumer DSL marketplace today, we enable our ISP customers to do so. ISPs are a significant source of innovation in the development of Web content and Internet applications, something that will in turn drive the demand for consumer broadband Internet access. In addition, competition for consumer-grade DSL service between independent ISPs and the RBOCs will result in lower prices and greater choice for consumers.

47. Unlike competitive carriers like WorldCom and Covad, the RBOCs have not developed a cost-effective wholesale ISP product because they would rather steer all DSL customers to the ISP of the RBOCs' choosing, which is often times the RBOC affiliated ISPs. Where they do offer a wholesale ISP product, it typically is at prices that prohibit small and medium ISPs from competing with the RBOC retail services, and is only a viable option to large ISPs if they are willing to make enormous volume commitments that keep the ISPs from buying services from competitive carriers. Without cost-effective DSL services provided by WorldCom, most ISPs (especially the small and regional players) cannot compete with the RBOC retail offerings and will

remain on the sidelines, thereby restricting consumer choice and limiting the opportunity for creative development of broadband applications that will drive consumer adoption.

48. This concludes my Declaration.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on May 3, 2002.

/s/
Ian T. Graham