



June 2, 2004

VIA ELECTRONIC SUBMISSION

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 12th Street, SW  
Washington, DC 20554

Re: **Ex Parte**  
**WC Docket No. 01-338**

Dear Ms. Dortch:

On June 1st and 2nd, 2004, Michael DiMauro (President & CEO, Omega Communications Services), Jim Farmer (CTO, Wave7 Optics), Tom Simmering (Chief Engineer, Zero dB), Thomas Cohen (The KDW Group LLC), and I (Leonard Ray, VP for Business Development, Atlantic Engineering Group) met with the following FCC personnel:

Matthew Brill, Senior Legal Advisor to Commissioner Kathleen Abernathy  
Daniel Gonzalez, Senior Legal Advisor to Commissioner Kevin Martin  
Scott Bergmann, Legal Advisor to Commissioner Jonathan Adelstein  
Pamela Arluk, Brent Olson, Jeremy Miller and Marcus Maher of the Wireline Competition Bureau.

The purpose of these meetings was to update the Commission on the progress made to date in deploying FTTH (fiber-to-the-home) and to provide technical information on the advantages of FTTH over FTTC (fiber-to-the-curb). The attached presentation and affidavit were distributed at each meeting.

Yours truly,

A handwritten signature in black ink that reads "Leonard Ray / TEM".

Leonard Ray  
Vice President for Business Development  
Atlantic Engineering Group

cc: Matthew Brill  
Daniel Gonzalez  
Scott Bergmann  
Pamela Arluk  
Brent Olson  
Jeremy Miller  
Marcus Maher

FTTH is the future.  
Hybrid networks are the past.  
FTTC is a hybrid network.



**Presentation  
for the  
Federal Communications Commission  
June 1-2, 2004**

# Individuals and Companies

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- **Len Ray**, VP for Business Development, Atlantic Engineering Group
  - FTTH design, build and installation
- **Mike DiMauro**, President and CEO, Omega
  - Network engineering, design and installation
- **Jim Farmer**, CTO, Wave7 Optics
  - FTTH electronics manufacturer
- **Tom Simmering**, Chief Engineer, Zero dB
  - Network engineering and design



# Meeting Objectives

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- Emphasis our support of the FTTH rules in the FCC's Triennial Review Order
- Discuss numerous differences between FTTH and hybrid networks such as FTTC (fiber fed VDSL and ADSL)
- Identify inaccuracies and misleading statements in BellSouth and Marconi's *Ex Parte* filings

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# Triennial Review and FTTH

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- We applaud the FCC's bold and brilliant initiative to bring the most advanced broadband possible, FTTH, to all Americans
- FCC's decision...
  - Based on sound technical reasoning
  - Focused on the future
  - Designed to reward investment; more importantly, does not reward legacy stagnation
  - Will encourage the U.S. to catch the world and pass it

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# The FCC Got the FTTH Rules Right!

Larry Babbio:  
2 million  
homes passed  
for Verizon in  
2004

FCC releases final  
Triennial Review Order  
and confirms FTTH in  
green field applications  
is free from unbundling

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Feb '03

Mar

Jun

Aug

Dec

Jan '04

Feb

FCC Press Release:  
FTTH in green field  
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John White: Verizon  
will select FTTH  
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Verizon press  
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Cristopher T. Rice, VP of Network  
Planning and Engineering, SBC  
Communications: "2H/2004 –  
limited deployment of FTTP in  
greenfield applications; 2005 –  
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300,000 premises a year"

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# FTTH is the future. FTTC is legacy.

- FTTC cannot deliver 100 Mbps to subscribers
  - No commercial system does it today
  - Marconi's own product literature states it can only do 10BaseT or 10 Mbps
- FTTH can be easily upgraded, FTTC cannot
  - FTTH allows for simple electronics swap in HE or CO
  - FTTC requires considerable electronic replacement at the CO and the remote terminal as well as significant upgrade to outside plant; likely to include copper replacement and the addition of category 5 cable and coaxial cable

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# FTTH is the future. FTTC is legacy.

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- FTTC does not provide similar service capabilities as FTTH
  - FTTH can provide robust symmetrical services, FTTC cannot
  - FTTH provides far greater bandwidth capacity and transmission speeds than FTTC
  - FTTC has considerably more in common with DLC than FTTH

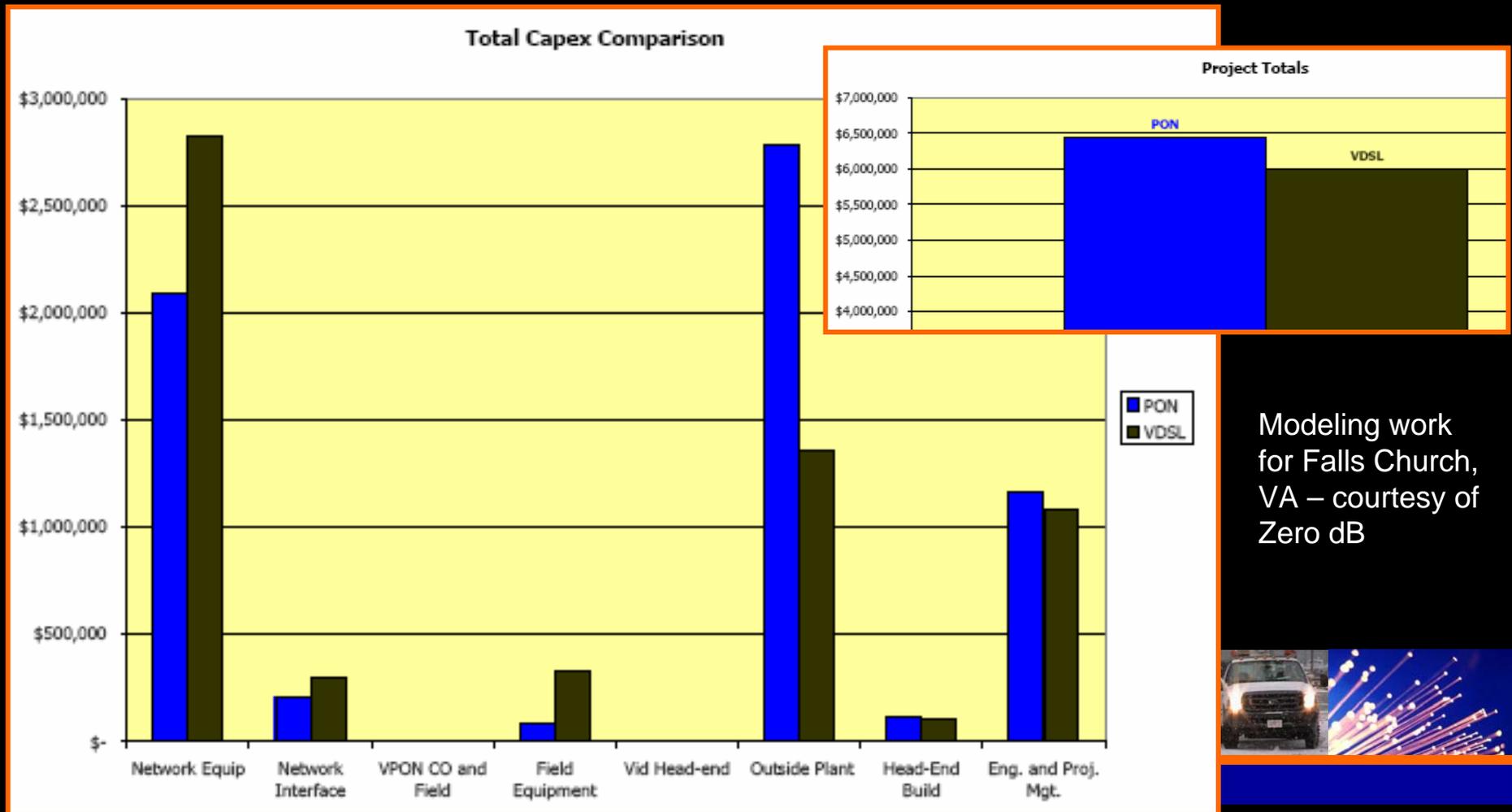
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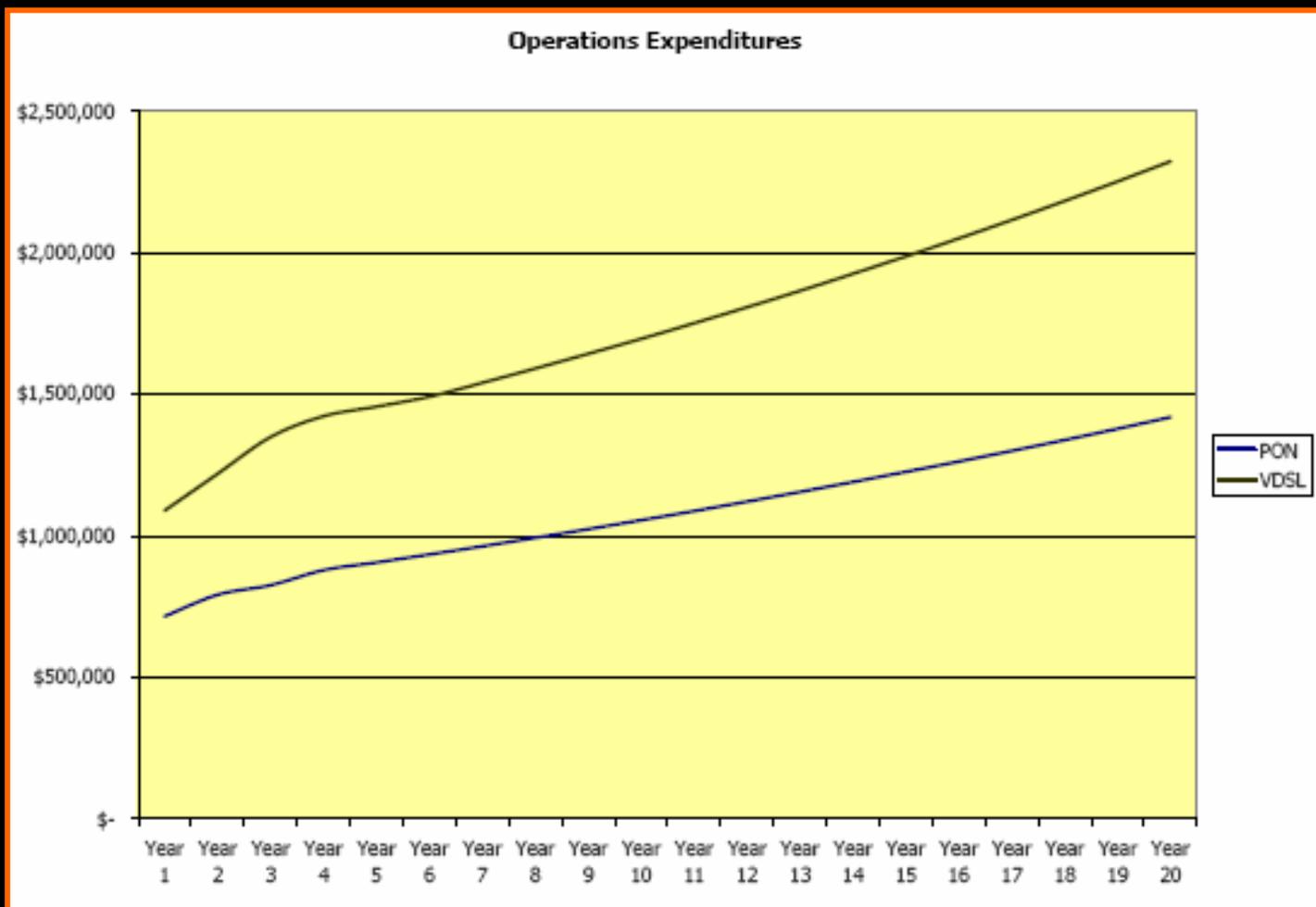
# FTTH is the future. FTTC is legacy.

- FTTH is cheaper per Mbps than FTTC



# FTTH is the future. FTTC is legacy.

- FTTH has a better business case than FTTC



Modeling work  
for Falls Church,  
VA – courtesy of  
Zero dB



# Conclusion

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- The FCC got the broadband rules right
- Do not torpedo your own success by diluting the definition of FTTH by including legacy hybrid networks such as FTTC, VDSL and ADSL
- FTTH is clearly superior to FTTC
- BellSouth's and Marconi's *Ex Parte* filings contain technical arguments without merit and should be rejected

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Engineering Group



Before the  
**FEDERAL COMMUNICATIONS COMMISSION**  
Washington, DC 20554

In the Matter of	)	
	)	
Review of the Section 251 Unbundling	)	CC Docket No. 01-338
Obligations of Incumbent Local Exchange Carriers	)	
	)	
Implementation of the Local Competition	)	CC Docket No. 96-98
Provisions of the Telecommunications Act of 1996	)	
	)	
Deployment of Wireline Services Offering	)	CC Docket No. 98-147
Advanced Telecommunications Capability	)	

**DECLARATION OF LEONARD RAY**

I, Leonard Ray, do hereby declare as follows:

1. I am the Vice President for Business Development at Atlantic Engineering Group. My business address is 1136 Zion Church Road, Building A, Suite 110, Braselton, Georgia, 30517. Atlantic Engineering Group is the nation's leading municipal fiber-to-the-premise ("FTTP") network design and construction company. In my capacity as Vice President at Atlantic Engineering Group, I am responsible for customer relationships, promoting advanced broadband and recommending broadband access network solutions to clients. In addition, through the FTTH Council as the 2002 and 2003 Government Relations Committee Chairman, I have developed significant expertise with regards to public policy and how it can impact the deployment of broadband networks. I have given two keynote speeches on the subject at the 2002 and 2003 FTTH Conferences. Furthermore, I am presently the Vice President of the FTTH Council and will be President in 2005.

2. I have reviewed BellSouth's Petition for Clarification and/or Partial Reconsideration of the Commission's *Triennial Review Order*, including its request that the

Commission treat fiber-to-the-curb (“FTTC”) loop architectures the same as FTTH loop architectures for unbundling purposes.<sup>1</sup> I am writing to respond to a number of technical arguments that BellSouth and Marconi have made in support of BellSouth’s petition.<sup>2</sup> In short, I believe that these technical arguments are without merit and should be rejected.

3. *First*, BellSouth alleges that there is no service distinction between FTTC and FTTH loops, noting, for example, that FTTC can deliver 100 Mbps data transmission speeds as well as multichannel video service.<sup>3</sup> While it is certainly the case that FTTC loops and FTTH loops can both provide the “triple play” of voice, video, and data services, it is a gross overstatement to say that there are “no service distinctions” between the two loop architectures. Not all video services are the same and not all data services are the same. In fact, the only similarities between FTTH and FTTC are the first three words of the acronyms; the last word of each constitutes a world of difference.

4. FTTH provides far greater *bandwidth capacity* and *transmission speeds* than FTTC. For example, Wave7 Optics provides a FTTH system today using commercially available “off-the-shelf” equipment that delivers transmission speeds up to 500 Mbps shared over a maximum of 16 subscribers, with an average speed per subscriber of 31.25 Mbps both upstream and downstream.<sup>4</sup> The system can provide up to 500 Mbps symmetrically to one

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<sup>1</sup> See BellSouth Petition for Clarification and/or Partial Reconsideration, filed in CC Dkt. No. 01-338 (Oct. 2, 2003) (“Petition”). BellSouth defines FTTC to include fiber loops that extend to within 500 feet (or less) of the customer’s premises. See *id.* at 8-9. I use that definition for purposes of this declaration.

<sup>2</sup> Similar technical arguments have been made by BellSouth and Marconi in other filings in this proceeding. See, e.g., BellSouth *Ex Parte*, filed in CC Dkt. No. 01-338 (Sept. 30, 2003) (“BellSouth *Ex Parte*”); Marconi *Ex Parte*, filed in CC Dkt. No. 01-338 (Sept. 26, 2003); Marconi *Ex Parte*, filed in CC Dkt. No. 01-338 (Dec. 3, 2003) (“Marconi *Ex Parte*”); Marconi Reply, filed in CC Dkt. No. 01-338 (Nov. 17, 2003) (“Marconi Reply”).

<sup>3</sup> See Petition at 3-4; BellSouth *Ex Parte*; Marconi *Ex Parte*.

<sup>4</sup> The FTTH specification incorporated into the May 3, 2003 BellSouth-Verizon-SBC joint RFP calls for 622 Mbps delivered over one wavelength to 32 households. See AT&T *Ex Parte*, filed in CC Dkt. No. 01-338 (Nov. 14, 2003).

subscriber if desired. In addition, a typical FTTH system can deliver up to 870 MHz of traditional CATV video services and/or IP video services along with multiple telephone lines in either VoIP or traditional TDM formats as well as current and next generation data services at speeds in excess of 100 Mbps. Contrary to BellSouth's and Marconi's assertions, FTTC does not provide similar service capabilities. In fact, Marconi's own product descriptions for its "Deep Fiber" platform bears out this point. In a 2000 white paper on its FTTC network, Marconi promises "up to 24 VF voice channels, symmetrical 10BaseT connectivity and 750 MHz broadcast video services."<sup>5</sup> A 10BaseT channel provides 10 Mbps data connectivity, compared with up to 500 Mbps for the Wave7 Optics system discussed above.

5. BellSouth and Marconi have also referenced the Telcordia GR-909 specification for FTTC in support of the claim that FTTC and FTTH have similar service capabilities.<sup>6</sup> However, there are no references in the Telcordia specifications for transmission speeds exceeding 20 Mbps. This speed is discussed only in connection with video-over-IP transmission, and this is shown only as an objective.<sup>7</sup> Otherwise, the highest speed found for FTTC systems is less than 10 Mbps. In fact, BellSouth who has deployed a FTTC network for several years, does not provided any more bandwidth than traditional Asymmetric Digital Subscriber Line (ADSL) service with a maximum of 1.5 Mbps (for those fortunate enough to live close to the optical node). I live in BellSouth's territory and the incumbent markets residential data rates of 1.5 Mbps in my neighborhood.

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<sup>5</sup> *Deep Fiber Solutions: Advanced Broadband Services*, Marconi White Paper (May 2000).

<sup>6</sup> *See BellSouth Ex Parte* at 11; *Marconi Reply* at 5-6.

<sup>7</sup> *See Telcordia Standard GR-909*, "Generic Criteria for Fiber in the Loop Systems," § 2.6.5.

6. Moreover, it is even doubtful that FTTC loops can, in all or even some cases, provide 10 Mbps transmission speeds at 500-foot distances. While the GR-909 specification anticipates that the optical-to-electrical conversion point will be located within 500 feet of the user (thereby allowing multiple homes to be served by one conversion point), the specification notes that the standard maximum distance for 10/100Base-T communications (standard Ethernet) is 330 feet. The distance can sometimes be extended successfully to 500 feet in laboratories but there is no reason to think that this will be true for all or even some end user connections in the real world. Thus, FTTC systems that rely on 500 feet of copper to the end user will likely be unable to deliver even the 10 Mbps data rate in the Telcordia GR-909 specification. Transmission speeds will be reduced even further where the copper portion of the loop has degraded with age or where the introduction of line taps, coils, bridges etc, has rendered the capability of the copper plant to support broadband applications of any kind problematic at best.

7. There are other clear differences in service capabilities between FTTH and FTTC architectures. FTTH networks can be *easily upgraded* to deliver even greater transmission speeds. For example, Wave7 Optics like many other FTTH equipment providers plans to double the transmission speeds of FTTH loops, as technology costs decline, through relatively simple module changes in the optical network termination (ONT) and optical line termination (OLT), the two key non-fiber components of FTTH loops.<sup>8</sup> In contrast, FTTC networks cannot be upgraded without significant additions to the existing equipment infrastructure both in the head-end and the field as well as re-conditioning and/or replacing the copper plant itself. In fact, most FTTC solutions require the addition of category 5 cable and coaxial cable to the existing twisted

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<sup>8</sup> ONTs are also referred to in the Petition (and in the technical literature generally) as Optical Network Units (“ONUs”). There is no technical difference between ONUs and ONTs, and for ease of reference, I refer to all such devices in this declaration simply as ONTs.

pair (assuming the twisted pair is in good enough condition to be reclaimed). Moreover, for any foreseeable level of consumer bandwidth demand growth over the lifetime of the fiber itself, FTTH networks' fiber will almost certainly have adequate transmission capacity with simple upgrades to equipment modules in the in the head-end only to increase capacity. In contrast, hybrid fiber-copper networks, such as FTTC, are unlikely to provide adequate transmission capacity to meet foreseeable consumer bandwidth demand growth primarily due to the physical limitations of the transmission medium.

8. In addition, as noted above, FTTH can deliver high transmission speeds on a *symmetrical* basis. This characteristic has important implications for the deployment of bandwidth-intensive service applications today and going forward. Many of the highest bandwidth-demanding applications being pursued today are symmetric in their demand for bandwidth. For example, very high symmetric transmission speeds will be necessary to enable customers to host web servers out of their homes, play next-generation interactive games, have video phone calls, actively participate in educational high-definition video conferences, use telemedicine, host personal television stations or develop the next-generation of Internet and computer based technology advancements. FTTC, in contrast, provides adequate bandwidth to deliver certain *current* generation services, such as *asymmetric* narrowband data and some limited voice services, but will be unable to accommodate new services coming to market that require high bandwidth *both* downstream and upstream. The introduction of symmetric services over FTTC network platforms such as Very-high-data-rate Digital Subscriber Line (VDSL) would be very limited in deployment due to the excessive cost of re-conditioning the existing copper infrastructure.

9. In sum, I do not agree with the assertion that FTTC solutions have the same features as FTTH systems. Rather, treating FTTC loops in the same manner as FTTH loops for purposes of the unbundling rules will provide an incentive for incumbent broadband providers to stagnate with *legacy* technology that has inherently limited service capabilities, is not easily upgradeable, and cannot meet the growing demand for new, bandwidth-intensive symmetric broadband applications.<sup>9</sup> Furthermore, including FTTC in the definition of FTTH could create a definitional loop-hole that will result in some RBOCs never advancing beyond ADSL or 1.5 Mbps, even with FTTC architectures.

10. *Second*, BellSouth has argued that FTTC loops are "far superior" to fiber-fed Digital Loop Carrier (DLC) systems.<sup>10</sup> This is inaccurate. As an initial matter, FTTC and DLC loops use similar architectures and in most cases, the same or similar equipment. In fact, Telecordia defines both as "Fiber in the Loop." However, FTTC has much more in common with DLC than with FTTH. In many instances, DLC loops can be easily modified to provide FTTC functionality. Alcatel, for example, markets its FTTC solution as an "extension" of its Litespan DLC platform.<sup>11</sup> Likewise, Lucent's AnyMedia systems can support ONTs up to 9.3 miles from host remote terminals.<sup>12</sup>

11. Moreover, FTTC and DLC loops can deliver similar services to customers. While it is certainly true that FTTC loops have potentially more capabilities than current generation

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<sup>9</sup> The fact that FTTC is *already* widely deployed -- BellSouth's FTTC network passes nearly 1 million homes with fiber-based loops today and has been operational since the very beginning of the World Wide Web -- further demonstrates that FTTC is not the type of "next-generation network" the Commission intended to benefit with unbundling relief. See Ed Gubbins, *NFOEC: BellSouth CTO Defends Fiber-To-The Curb*, Telephony Online (Sept. 8, 2003) (quoting BellSouth's chief technology officer).

<sup>10</sup> See Petition at 4-5.

<sup>11</sup> See *Litespan Multiservice Access Platform*, Alcatel Product Description (2000).

<sup>12</sup> See *AnyMedia Optical Network Unit*, Lucent Product Description (2002).

DLC loops, there are new DLC products coming to market that can provide the triple play of voice, data, and limited video services at levels that are functionally equivalent to those provided by FTTC systems.<sup>13</sup> These products can be integrated into existing telecommunications networks at limited cost and utilized to deploy today's narrowband data services of 1.5 Mbps and limited multichannel video to subscribers.<sup>14</sup>

12. *Third*, BellSouth has argued that FTTC can deliver the same service characteristics as FTTH at "substantially reduced initial cost."<sup>15</sup> According to BellSouth, these alleged cost savings derive from two basic sources: (1) in an FTTC system, several homes share the cost of ONT equipment while in a FTTH system every home must have dedicated ONT equipment and (2) FTTC loops use network power while FTTH loops use customer-supplied power.

13. As stated earlier, FTTC or hybrid loops cannot deliver the same services as FTTH. They can only provide the same services based on a loose definition of the literal words (i.e. video could mean one data channel). Much like a tricycle and a jet airliner can both get you from point A to point B and they are both defined as 'vehicles'; there is still significant and obvious differences in their performance capabilities.

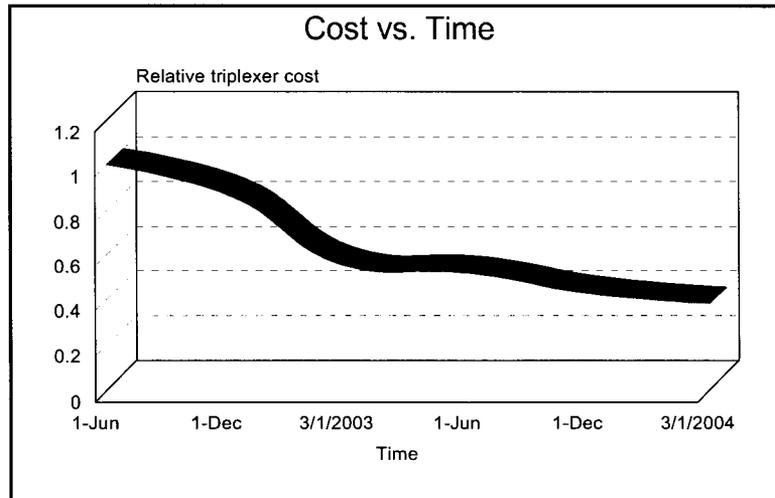
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<sup>13</sup> See Malcolm Loro, *Copper and Fiber in the "Broadband Era" of Access Network Modernization*, Converge! (Sept. 30, 2003) (describing broadband loop carrier technology), available at <http://www.convergedigest.com/blueprints/ttp03/z2catena1.asp?ID=20&ctgy=Loop>. See also "Broadband Loop Carrier: Enabling Video in a Triple Play Architecture", Occam Networks White Paper (Jan. 2003), available at <http://www.occamnetworks.com/blc6000/pdf/TriplePlay.pdf>.

<sup>14</sup> Such products include: Occam's BLC 6000 System and Catena Network's CN1000 Broadband Loop Carrier.

<sup>15</sup> *Id.* at 5.

14. Furthermore, it is increasingly uncertain that FTTC provides even the first alleged short-term cost savings. For example, the cost of ONTs has dropped dramatically in recent years and continues to drop. The following chart illustrates the cost changes Wave7 Optics has



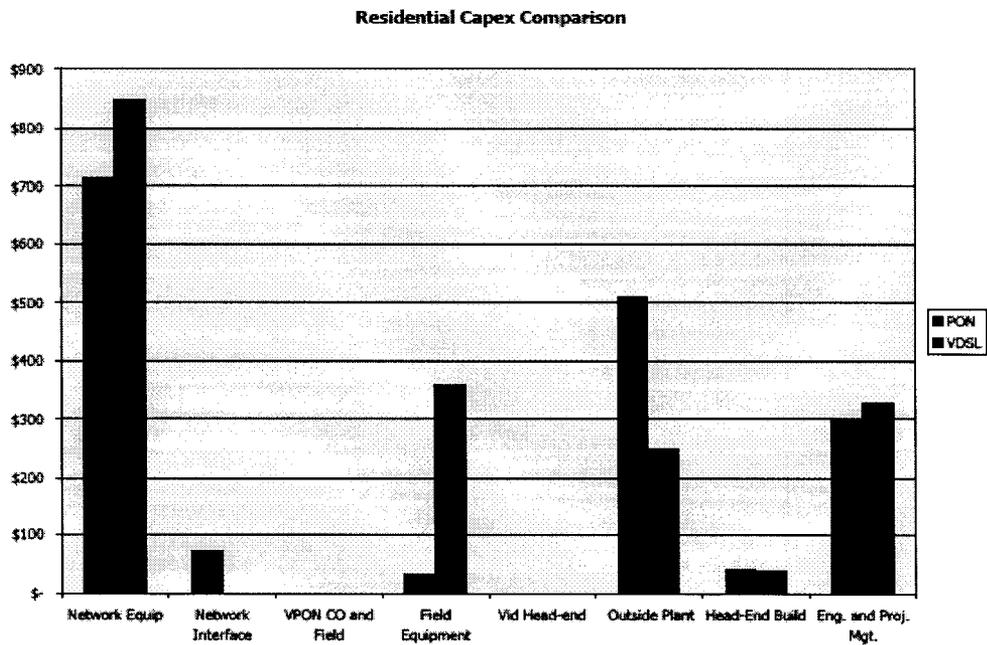
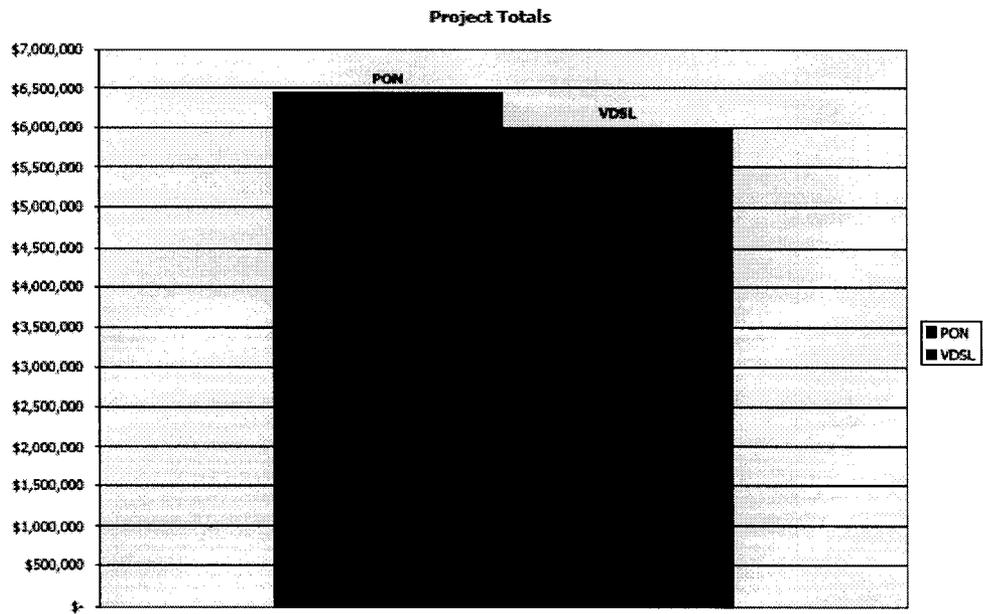
experienced over the last two years for optical-to-electronic conversion circuitry.<sup>16</sup> ONT equipment can be shared in FTTC but not in FTTH networks. What the curve shows, however, is that the cost of the conversion circuitry is coming down fast enough that any advantage that accrues to FTTC by virtue of sharing the conversion equipment is likely to be short-lived. In particular, the cost of supplying copper-side drivers to cover longer distances will begin to outweigh the alleged savings in sharing ONT equipment.<sup>17</sup>

15. Zero dB, a prominent telecommunications engineering and design firm, recently modeled several broadband network technologies for Falls Church, Virginia. Zero dB looked at, among others, Passive Optical Network (PON) and VDSL or FTTC. The work identified a very

<sup>16</sup> Jim Farmer, Chief Technical Officer at Wave7 Optics

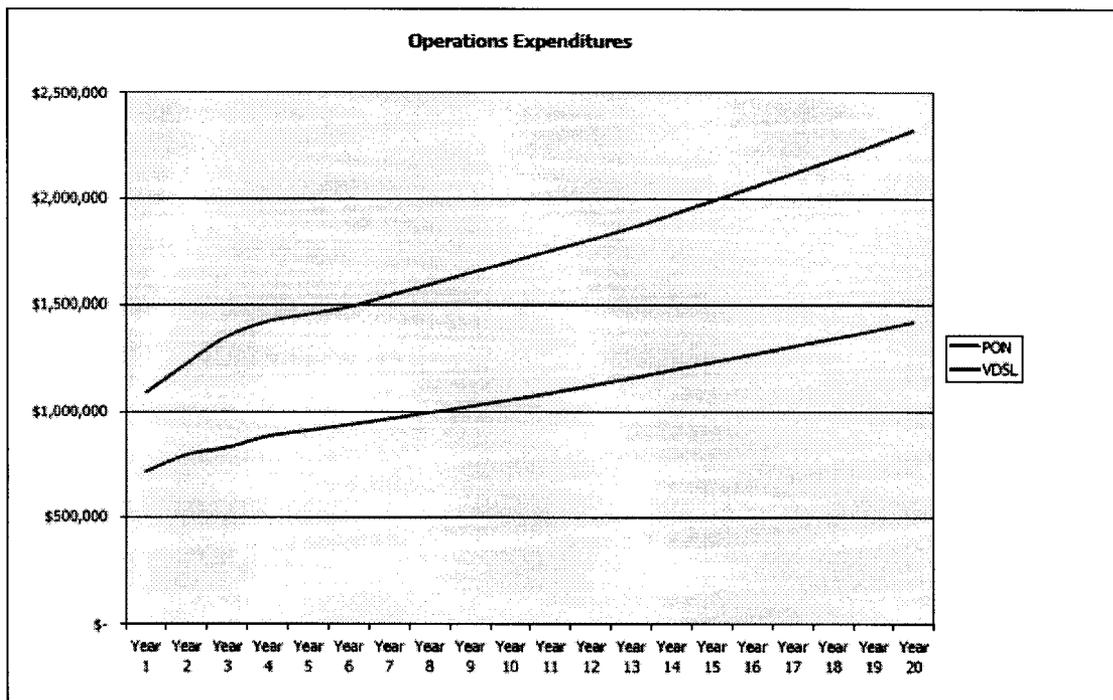
<sup>17</sup> There are other costs associated with the FTTC architecture. For example, multiple types of copper (for video, voice and data) must be installed from the ONT to the home, so there is not an advantage to FTTC from a labor standpoint.

small difference in the first installed cost of each network. The result of the analysis for each solution is attached.<sup>18</sup>



<sup>18</sup> Tom Simmering, Chief Engineer, Zero dB

16. With respect to powering issues, it is difficult to see how network powering of the ONT would provide any cost advantages to the provider over home powering of the device. If anything, such an arrangement would result in higher power costs to the provider since the provider, rather than the subscriber, is paying the electricity bill in an FTTC situation. More generally, it is also unclear the extent to which the incumbents are continuing to rely on the network to power remote terminal equipment. Zero dB's analysis of Falls Church, Virginia showed a distinct benefit with regards to operational cost savings for the all fiber solution as is illustrated in the chart below.



17. In all events, even assuming that FTTC provides *near-term* cost savings when compared to FTTH, FTTH is clearly the less expensive option as a *medium- to long-term* broadband solution. FTTH loops are more *durable* than FTTC loops. Most carriers replace all or part of every copper loop every 15 years. Optical fiber's shelf life is 30 years according to

fiber manufacturers, although none of the 30+ year old fiber in operation today has been replaced. In addition, FTTH loops are more *reliable* than FTTC loops. There are typically no active components in a FTTH network between the central office and the customer's premises. Consequently, operation and maintenance costs are always lower in FTTH networks than for copper-based or hybrid networks. For example, based on Atlantic Engineering Group's experience in building broadband access networks, the costs of outside plant maintenance for FTTH is about 80% lower than for hybrid fiber coax (HFC) cable networks.

18. *Fourth*, BellSouth has argued that competitive LECs (CLECs) are in an equally advantaged position to construct FTTC systems as RBOCs.<sup>19</sup> However, marketplace realities tell a far different story. In my experience, the only CLECs who have deployed FTTC have been rural ILECs who incorporate out of region as a CLEC and overbuild a RBOC, such as Rochester Telephone. Interestingly, Rochester Telephone has abandoned its FTTC network and is continuing its self-overbuild with FTTH. No true CLEC has deployed FTTC, as the business case for FTTH is more attractive. Furthermore, these entities are not tied to legacy systems. This is why according to Render, Vanderslice and Associates that CLECs account for 68% or the majority of all FTTH builds (municipalities and PUDs are second with 26%, followed by rural LECs with 5% and RBOCs with 0.4%).<sup>20</sup>

19. Furthermore, while a few competitive providers have studied FTTC as a possibility, most such providers have recently indicated that they are not going to pursue it to any significant degree. In fact, the general consensus in the rural LEC community is that FTTC is not a cost-effective option, particularly given the limitations of the technology identified above.

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<sup>19</sup> See *id.* at 6-7.

<sup>20</sup> Mike Render of Render, Vanderslice & Associates, 2003

Rather, nearly all rural LECs upgrading their networks to provide significant broadband are deploying FTTH plant. The fact that the total cost per subscriber of deploying FTTH networks has dropped from \$3,000 a few years ago to between \$1,200 and \$1,500 today makes FTTH an even more attractive solution. Furthermore, in high volume, high density network applications, the cost can drop significantly; for example, Verizon has publicly stated that it can now do FTTH for less than \$1,000 a subscriber.

20. *Fifth*, BellSouth has proposed a definition of a "fiber loop" that would include fiber connections between the distribution frame (or its equivalent) in the central office "and the loop demarcation point and/or fiber serving terminal supporting a service drop length of no more than 500 feet."<sup>21</sup> It is unclear what the technical basis is for adopting a rule based on the 500-foot distance between the remote terminal and the demarcation point. BellSouth does not make clear, for example, whether this "standard" relates to the technical performance of the copper portion of the network and what those technical performance levels are. BellSouth should, at a minimum, supplement the record with documentation explaining the technical basis for the 500-foot figure. This is especially true in light of the fact that the IEEE Ethernet specification states that, in order to deliver the functionalities described therein, the standard maximum distance for FTTC is 330 feet.

21. Moreover, regulators would likely encounter numerous practical problems in enforcing this standard. For example:

- How would regulators determine whether a "service drop" is no more than 500 feet from the ONT?
- Would the "service drop" be measured by the length of the cable or as the crow flies?

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<sup>21</sup> *Id.* at 8-9.

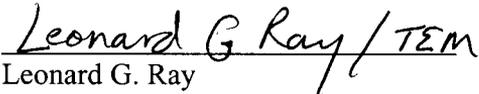
- How would such measurements account for driveways, shrubbery, and other landscape features around which or through which cables may pass?
  - Who would be responsible for measuring the cable where disputes arise?
  - Would an incumbent LEC qualify for the FTTC exemption if it is providing only voice services over the network? Or 1.5 Mbps?
22. Based on the foregoing, the Commission should reject BellSouth's FTTC-related proposals. The FCC got the broadband rules right with the *Triennial Review Order* released on August 21, 2004. This decision created a broadband regulatory structure that rewards broadband investment, competition and technology advancement. This is evident as illustrated by the following timeline of events:

- Feb '03 – FCC Press Release: FTTH in green field applications is free from unbundling – final documents to be released within 60 days
- Mar '03 – Larry Babbio: 2 million homes passed for Verizon in 2004
- Jun '03 – TIA Broadband Event at SuperComm: John White: Verizon will select FTTH vendor in Q3/03 and deploy FTTH in Q1/04, Andre Fuetsch: SBC will follow Verizon with delay
- Aug '03 – FCC releases final Triennial Review Order and confirms FTTH in green field applications is free from unbundling
- Dec '03 – Verizon press release announcing Fiber-to-the-Premise (FTTP) vendors and that FTTP roll out will begin in 2004
- Jan '04 – Ivan Seidenberg, DEC, Verizon: “We also are the first telecom company to make a major commitment to homes and small businesses. Our plan is to reach 1 million homes by the end of the year and potentially double that rate in 2005.”

- Feb '04 – Cristopher T. Rice, VP of Network Planning and Engineering, SBC Communications: “2H/2004 – limited deployment of FTTP in greenfield applications; 2005 –deploy FTTP in new builds ~ 300,000 premise a year” from presentation at the FCC

I urge you not to snatch defeat out of the jaws of broadband victory as I believe this country's economic and educational future depend on it.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and accurate.

  
Leonard G. Ray  
June 1, 2004