Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Comment sought on Impact of Middle and	)	
Second Mile Access on Broadband	)	GN Docket Nos. 09-47, 09-51 and 09-137
Availability and Deployment	)	
	)	
NBP Public Notice # 11	)	

COMMENTS of ADTRAN, Inc.

ADTRAN, Inc. ("ADTRAN") respectfully submits the following comments in response to the Commission's *Public Notice*, which seeks tailored comment on the impact of middle and second mile access on broadband availability and deployment for the purposes of the Commission's development of a National Broadband Plan.[1] As a telecommunications equipment manufacturer, ADTRAN has a strong interest in the successful and widespread deployment of broadband to all Americans. These comments expand upon our previous filings, and are structured as a direct response to one of the questions posed in the *Public Notice*, with paragraph numbering identical to that in the *Public Notice*. ADTRAN has limited the scope of its comments to the questions addressed in Paragraphs 1(a) and 1(b) of the *Public Notice*.

[1] Comment sought on Impact of Middle and Second Mile Access on Broadband Availability and Deployment, *Public Notice*, DA 09-2186A1, released October 8, 2009 (hereafter cited as "*Public Notice*").

1. **Network Components of Broadband Connectivity.**

   a. ADTRAN respectfully submits a White Paper[2] as an attachment to these comments, which provides a detailed analysis estimating current and projected capacity requirements for consumer access networks pro-rated by subscriber household. The traffic data used in the analysis is from Cisco's annual Visual Networking Index (VNI)[3] (updated by correspondence with Cisco[4]) and from the University of Minnesota.[5] The projections are shown below (Table 6 in the ADTRAN White Paper).

Direction	2009	2012	2015
Down (kbps per household)	400	1000	2400
Up (kbps per household)	150	300	550

The current White Paper updates an earlier paper,[6] which used data from last year's VNI. We note that the latest data from Cisco includes growth rates for North American consumer Internet traffic that are significantly higher than last year's data, and that this has caused a correspondingly significant change in our

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[2] ADTRAN, *Defining Broadband Speeds: Deriving Required Capacity in Access Networks*, White Paper, attached to this submission.

[3] Cisco, "Cisco Visual Networking Index – Forecast and Methodology, 2008-2013," available at http://www.cisco.com/en/US/netsol/ns827/networking_solutions_sub_solution.html.

[4] Email correspondence between Usha Andra (Cisco) and Ken Ko (Adtran) which provided updates to the VNI 2008-2013, 23 October 2009.

[5] Minnesota Internet Traffic Studies, available at http://www.dtc.umn.edu/mints/home.php.

[6] ADTRAN, *Defining Broadband Speeds: An Analysis of Required Capacity in Network Access Architectures*, White Paper, attached to Letter from Stephen L. Goodman, Counsel for ADTRAN, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 09-51 (filed June 23, 2009).

own projections for required capacity. This is important not only in that the projections are higher, but as an indication of the volatility inherent in projecting future Internet traffic. We recommend that any projections going beyond three years (such as the year 2015 values in the table above) be considered tentative, and that projections such as this be revisited at least every three years and perhaps more frequently.

The required capacity projections in the above table are based on traffic per household projections during the peak daily usage periods identified by diurnal traffic patterns. The projected traffic is scaled by a factor of four to generate the capacity requirements. The scaling accommodates two factors: the burstiness inherent in Internet traffic; and variation in average traffic due to the user population being served by a specific access network.

These two factors act differently with regard to population size. The burstiness in the traffic exhibits self-similar traits and is largely independent of the number of subscribers served by the network. The distribution of average demand, when unchecked, may also have a heavy tail and exhibit self-similar characteristics – however, this distribution tends to be bounded by the limits imposed by service providers. As a result, simulations indicate that the variation in average demand has an inverse relationship to the size of the subscriber population. Additional detail is available in Section 3 of the attached ADTRAN White Paper.[7]

[7] ADTRAN, *Defining Broadband Speeds: Deriving Required Capacity in Access Networks*, White Paper, attached to this submission.

The effect of different usage patterns or demands of particular end user segments can be modeled using the same methodology described in Section 4 of ADTRAN's White Paper,[8] provided those usage patterns are understood. Potential differences include changes in the diurnal traffic cycle (for instance, small business subscribers will generate peak demand during office hours, as opposed to the evening demand generated by consumers), as well as changes in traffic volumes associated with different application classes.

b. Second mile and middle mile capacity requirements can both be derived using the same methodology, as described above. While they are largely similar, the following trends may differentiate them to some degree:

   - The subscriber populations served by second mile facilities will generally be smaller than those served by middle mile facilities, resulting in greater variation in the average demand. This is a relative comparison that may not apply across different regions – for example, the second mile in an urban deployment may serve many more subscribers than the middle mile in a rural deployment.

   - In some deployments, the second mile may serve a more homogeneous population than the middle mile – for example, the middle mile may include both small business and residential subscribers which are segregated in the second mile facilities. If these populations (along with their usage patterns) can be accurately predicted during the planning phase, it may be possible to reduce the required margin for variation in average demand in specific

[8] *Id.*

instances. This approach must be used with some caution, however, because usage patterns can change rapidly with the emergence of new applications.[9]

Respectfully submitted,

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[9] Floyd, S. and Paxson, V., "Difficulties in Simulating the Internet," IEEE/ACM Transactions on Networking, 2001, volume 9, pp 392-403.