THE MERTON GROUP

Municipal Broadband Network

Feasibility Study Report[1]

TOWN OF HANOVER, NH

TOWN of HANOVER

HANOVER, NEW HAMPSHIRE 03755
P.O. BOX 483 603/643-4123

May 15, 2003

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Moreover, no information regarding these findings will be released to a third party by the licensee, the Town, without the express written consent of an authorized representative of Merton.

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1. EXECUTIVE SUMMARY

A Feasibility Study of the viability of a Municipal Broadband Network (MBN) has been performed for the Town of Hanover, NH (the "Town").

1.1 Study Objectives

This document summarizes the results of that study. The Study was comprised of several parts:

Market Study	The preparation of a market study based on statistical samples from residents of the Town. The study addresses two areas: Current usage: This includes current penetration of Internet, CATV, and advanced telephony uses. It will also include estimates of revenues available and satisfaction with service providers. Propensity to Buy: This part of the study will include a determination of a propensity to buy or shift service providers and a desire to purchase new or bundles services.
Architecture	This was an architectural study of the network services, installations, operations and maintenance and performance issues.
Detailed Design	This is a detailed design adequate to prepare a capital budget for analysis. It includes deployment of backbone fiber as well as end user drops of fiber.
Technology Choices	This was a set of technological choices comparing passive only technology with active gigabit Ethernet technology. The Company has certain recommendations as a result of this study.
Financial Model	A detailed financial model was developed. This includes revenue modeling, capital plant requirements and estimates, and operations costs for maintenance and repair. The model also includes income statements, cash flows and balance sheets suitable for municipal operations.
Risk Analysis	A detailed analysis of the risk factors and actions appropriate to manage those risks has been provided.
Service Provider Negotiations	The Company has interfaced and is negotiating with potential Service Providers such as ValleyNet, AoL and MSN.
Bonding Issues	An analysis of municipal bonding and related legal issues has been provided, based on discussions with bond counsel.
Regulatory Analysis	An evaluation of the regulatory elements and actions is provided.

1.2 Study Results

1.2.1 Market Demand

1.2.1.1 Municipal Broadband Network Services

1. The current Internet penetration rate in Hanover is 88%, comprising 74% dial-up access, 12% DSL, 2% cable modem and less than 2% satellite.
2. An overwhelming 84% of Hanover homes are in favor of the Town building its own broadband network as long as it does not increase their taxes.
3. About 46% of households are likely or very likely to switch to the MBN for broadband Internet access at the price of $40 per month.
4. Over 34% of homes are likely or very likely to switch to the MBN for enhanced video services at the price of $40 per month.
5. Almost 55% of the households where the decision maker is less than 65 years old are likely or very likely to switch to the MBN for broadband Internet access at $40 per month. This segment forms almost 69% of all households in Hanover.
6. Only about 25% of the homes where the decision maker is over 65 years old are likely or very likely to switch to the MBN for broadband Internet access at $40 per month. This segment forms less than 31% of all homes.
7. Almost 70% of current DSL users are likely or very likely to switch to the MBN for broadband Internet access at $40 per month.
8. About 35% of homes where the decision maker is less than 65 years old are likely or very likely to switch to the MBN for enhanced video services at $40 per month.
9. About 32% of homes where the decision maker is over the age of 65 are likely or very likely to switch to the MBN for enhanced video services at $40 per month.

1.2.2 System Designs and Technology

1. Passive Optical Network (PON) is a passive technology that "splits" signal in a set of passive optical splitters, allowing each residence to have a share of the data link. PON uses one of several transmission characteristics on the link, typically ATM or even an Ethernet format.

2. Gigabit Ethernet (GigE) uses active splitters, which provide Ethernet as the transmission approach all the way throughout the network. The use of Ethernet protocols on the backbone is the differentiators.

3. PON has passive non-powered field units and GigE uses powered intelligent devices.

4. The backbone network will be built out over approximately 65 miles of streets in Hanover as part of the initial build; 70% households in the town will be passed by the network day one

5. As subscribers sign up, fiber drops will be installed, along with subscriber electronic units

6. It is estimated that there will be approximately 7% trenching required for installation of the fiber, with 93% of the installation being aerial.

7. Merton estimates that approximately 29% of poles in the town have make-ready issues; hence, such make-ready costs have to be taken into consideration

8. The backbone network and feeders will have 48 strands of fiber; each subscriber location will get 2-strand fiber drops

1.2.3 Financial Analysis

Based on the above network architecture and assumed acceptance rates of the MBN, the total capital expenses for the MBN, including all network components, are as follows:

- Initial capital of about $3.3 million in the first two years, which enables approximately 40% of Hanover households getting serviced for broadband Internet access
- Total capital expenses of approximately $4.3 million over 20 years, which would enable servicing of 80% of households for broadband Internet access
- Required bond size is $3.3 million. Annual debt service payments are approximately $255,000 over 20 years of bond term; principal is deferred in the first year
- Year 1 revenues are expected to be about $300,000, increasing to $900,000 million in Year 10.
- Year 1 operating expenses are expected to be $100,000, increasing to $200,000 in the 10th year.
- Free cash flow is negative in the first 3 years, and is funded from bond proceeds; the project becomes cash flow positive in the 4th year; free cash flow by the 10th year is $370,000, and $900,000 by the 20th year

1.2.4 Regulatory Issues

There are no significant regulatory issues, state or federal, at this time.

1.2.5 Bonding Issues

1. Outside counsel did not see any major problems and thought that Merton's bonding initiatives can be successful, however a different set of strategies must be employed in each state to streamline and standardize the process.

1.3 Recommendations

1. Based on the market research, the market potential for MBN in Hanover is large enough to provide sufficient bond coverage and to justify implementation, assuming revenue is available.

2. Before any town vote on bonding, it is essential that Merton provide revenue commitments from service providers sufficient to cover the bonds.

3. This Feasibility Study Report should be socialized with town selectmen and citizens to educate and elicit interest.

4. Merton and town should commence detailed discussions with town’s bond counsel and financial team to determine potential bond structures.

5. Town and Merton should continue to aggressively address State and Federal legislative bodies regarding more favorable legislation regarding MBN.

6. The town should consider eliciting a preliminary town vote to move forward with various aspects of the project, subject to certain conditions like commitments from service providers.

7. The town and Merton should commence negotiations on a Master Service Agreement, setting a framework for further work packages to be delivered by Merton at a suitable time.

8. The town should issue through Merton, a Request for Information (RFI) to fiber construction and electronic vendors to assess the level of interest among vendors as well as their credibility and capabilities; this will also provide the opportunity for vendors to be prepared to participate in a competitive bidding if and when the town proceeds to that stage.

9. Merton does not specifically recommend one fiber-optic technology (PON or GigE) over the other because the capabilities and costs of the two technologies are quite similar; however, Merton does recommend using an Ethernet based standard that will allow for substantial capacity, open interfaces and ease of upgradability.

10. In the selection of PON versus GigE, the town should especially take into consideration the long-term viability of vendors; this is important from the point of view of ongoing electronics maintenance and upgrade capabilities of these vendors. Today, PON is being offered by more established firms because it is a more mature technology; the GigE vendors are typically small and privately owned, and have funding / long-term viability risk. However, Ethernet is an open, widely accepted and evolving standard, and therefore, as a technology, is likely to outlive its competitors.

2. MARKET STUDY

2.1 Introduction

In this Report, The Merton Group ("Merton") presents the results of the market research study performed as part of the Feasibility Study conducted for the Town of Hanover, NH (the "Town"). This market research was focused on determining the feasibility of providing Municipal Broadband Network (MBN) services to the Town, with such infrastructure potentially financed by municipal bonds. The MBN services are 100 Mbps data access and potentially enhanced video services using fiber to the home (FTTH). The primary focus of the market research effort was to ascertain if the Town has the fundamental base of Internet users to convert and if this base of users would convert to the new service. A secondary objective was to ascertain what the interest and acceptance would be for new services such as digital video.

The main goal for this market research was simply:

"To establish the viability for conversion from an existing Internet service provider to an MBN interconnection in a wide enough user base to ensure bond coverage."

The study has several key objectives. They are as follows:

1. Ascertain the current use of Internet and cable/satellite TV by key demographic metrics like age; from this analysis to determine if there are certain demographic factors in the Town which are more favorable to conversion to the MBN.

2. Ascertain current Internet Service Providers' penetration by key demographic metrics

3. Ascertain conversion rates to MBN for existing Internet and cable/satellite TV users by key demographic metrics

4. Ascertain price points for MBN acceptance; these must reflect the range of offerings from simple dial up replacement to fully enhanced 100 Mbps Internet along with enhanced video, telephony, server hosting and whatever else may be of interest

This Report summarizes the statistics collected from a residential mail-in survey commissioned and conducted by the Town in April 2003.

2.2 Methodology

As part of the initial preparatory discussions for the market research effort, Merton suggested the following possible methodologies to the Town for conducting the survey associated with the study:

1. *Intercept Interview*
   A study conducted in person with respondents who are approached or intercepted in high traffic locations such as grocery stores or shopping malls.
2. *Mall Intercepts*
   Interviews conducted in shopping malls by randomly selecting people from among those present to be screened. The main part of the interview can take place either on the mall floor or inside the offices of a data collection company located within the mall.
3. *Telephone Survey*
   Respondents are interviewed via the telephone. The telephone interview is normally conducted from a central telephone facility.
4. *Mail-In Survey*
   A standard survey questionnaire is mailed to a randomly selected portion of the total population of residences and/or businesses, or where reasonable, to the entire population of such parcels.

Of the recommended methods, the Town chose to use the Mail-In Survey technique. The final questionnaires were prepared in close discussions with the Town. Two different forms of questionnaires were developed to reflect different price points for conversion to the MBN. The final form of questionnaires is attached as *Exhibit A*.

In April 2003, the Town of Hanover mailed out the questionnaires, with a cover letter explaining the purpose of the survey, to 1,500 randomly selected residences in the Town; 750 of the first form and 750 of the second were mailed. The questionnaires were not sent to businesses because they did not comprise the target market for purposes of the current MBN study. The residences were requested to return the questionnaire in stamped envelopes provided.

As of May 13, 2003, the Town had received 871 completed surveys, 423 of the first form and 448 of the second, a return rate of 58%, an extraordinarily high number in comparison to average return rates on mail-in surveys, typically about 5%-10%.

The accuracy of projections obtained, in other words, how representative the surveyed population is of the entire Town population, depends heavily on the number of survey responses obtained. If 175 to 200 responses were obtained, then it would be possible to make projections with a +/- 7.5% accuracy with 95% confidence. With about 400 responses, the accuracy of the survey increases to +/- 5%. In other words, with about 400 responses, a sample survey of current Hanover residents would differ no more than +/- 5% than if all Hanover residents were contacted and included in the survey. Further, if the survey were replicated, the statistics would fall within the margin for error 95 out of 100 times.

The Town entered the data from the 871 questionnaires into its records, which Merton then processed and analyzed to generate the results in this Report. This sample size, as explained above, yields accuracy in results of about +/- 3%.

2.3 Highlights

2.3.1 Internet Access Demographics

1. About 88% of Hanover households have Internet access
2. About 74% of Hanover homes use dial-up Internet access, 2% use cable modem, 12% use DSL and less than 2% use satellite; penetration of “broadband” is only 15%.
3. About 33% of households use ValleyNet for Internet access, 11% use AoL, 26% use Dartmouth College/DHMC, and the remaining 19% use other service providers like Verizon (DSL), Earthlink, Turnpike Tech, AT&T GlobalNet, MSN, Sovernet, FCG Network, Segnet, Netzero and Starband .
4. About 59% of homes want higher speed in their Internet access, while 19% want cheaper rates and less than 5% want better service.

2.3.2 Cable TV Demographics

1. About 63% of Hanover homes have cable TV, less than 20% have satellite TV service, about 3% have both, and the remaining 14% have neither.
2. About 63% of homes use Adelphia as their CATV provider, while 12% use DirectTV and 7% use Dish Network.

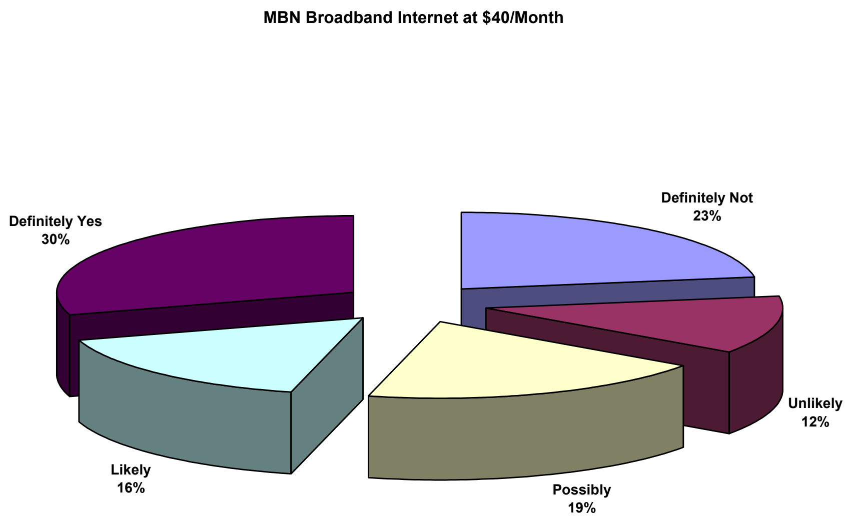
2.3.3 Telephone Demographics

1. About 6% of households have no land telephone line, indicating that they likely use cell phones only at home. 51% use a single line (number) while 42% of households have two or more telephone lines.

2.3.4 Municipal Broadband Network Services

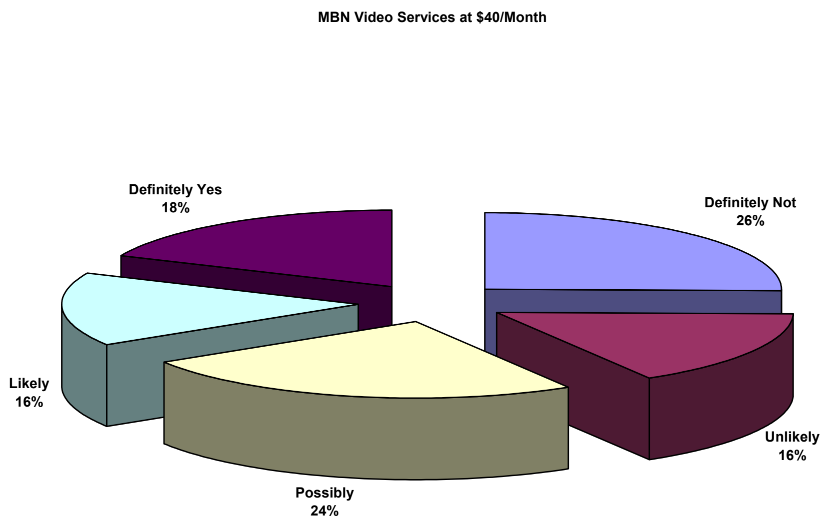
1. **About 84% of Hanover homes are in favor of the Town building its own broadband network as long as it does not increase their taxes.**
2. **About 46% of households are likely or very likely to switch to the MBN for broadband Internet access at the price of $40 per month.**

The chart below represents the potential size of MBN market for Internet access (at a price point of $40 per month) in Hanover. The minimum size of the MBN Internet market can be expected to be 30% of households and the maximum size about 65%. Merton estimates the market size to be 46% of homes. Clearly, the market for MBN Internet is significant and robust at the price point of $40 per month.



3. **About 34% of homes are likely or very likely to switch to the MBN for video services at the price of $40 per month.**

The minimum market size for MBN video services is 18% of households and the maximum is 59%. Merton estimates the market size to be 34%. The market for MBN video is weaker than for MBN Internet, but there is still good potential at the $40/month price point.



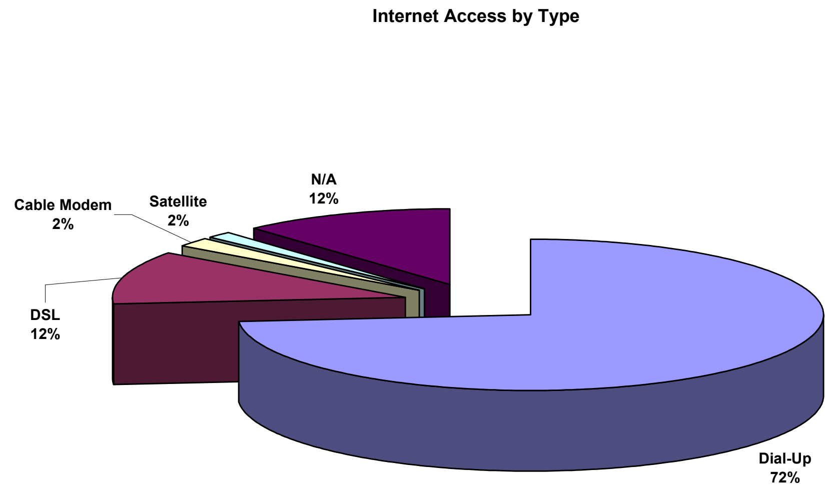
4. Almost 55% of the households where the decision maker is less than 65 years old are likely or very likely to switch to the MBN for broadband Internet access at $40 per month. This segment forms almost 69% of all households in Hanover.
5. Only about 25% of the homes where the decision maker is over 65 years old are likely or very likely to switch to the MBN for broadband Internet access at $40 per month. This segment forms 31% of all homes.
6. Almost 70% of current DSL and cable modem users are likely or very likely to switch to the MBN for broadband Internet access at $40 per month.
7. About 35% of homes where the decision maker is less than 65 years old are likely or very likely to switch to the MBN for video services at $40 per month.
8. About 32% of homes where the decision maker is over the age of 65 are likely or very likely to switch to the MBN for video services at $40 per month.

2.4 Detailed Results

2.4.1 Internet Market Statistics

2.4.1.1 Internet Access Usage

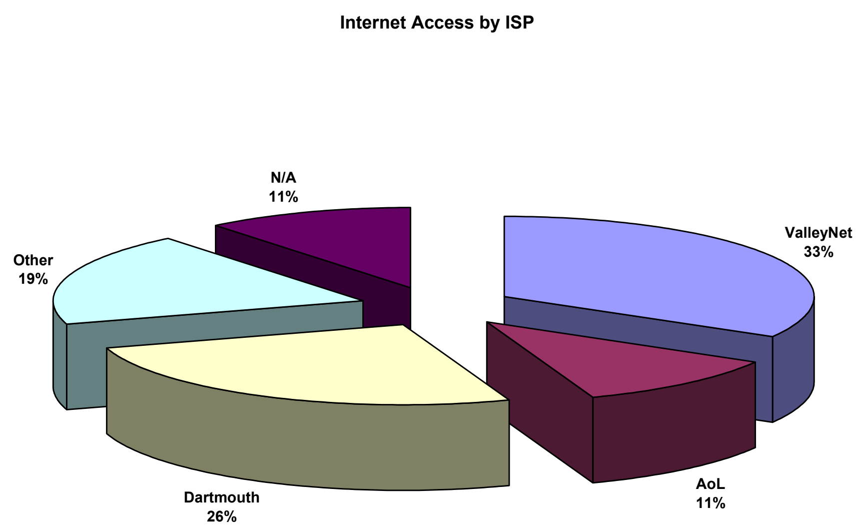
The survey asked the respondents what kind of Internet access service they had at home. The choices provided were dialup, cable modem, DSL and satellite. The results are shown below.



The results clearly show that there is a low penetration of "broadband" data service in the town, only about 15% comprising cable modem, DSL and satellite Internet service.

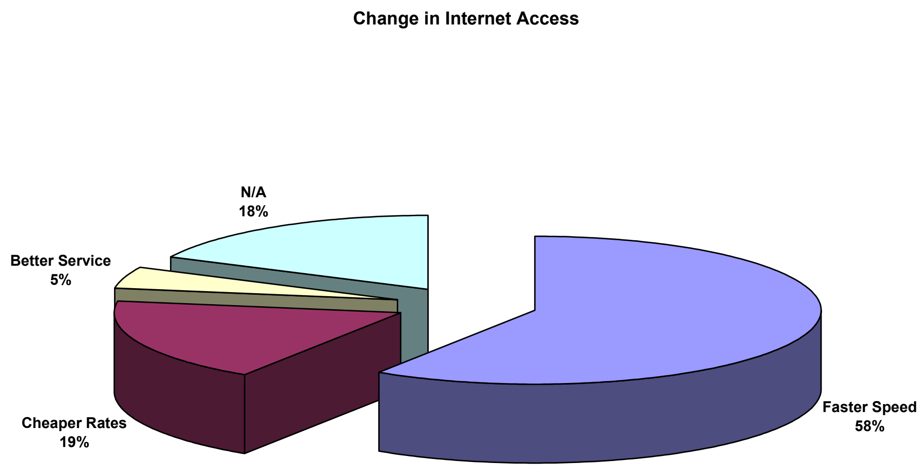
2.4.1.2 Internet Service Providers

The respondents were then asked about who their ISP is; the choices provided were ValleyNet, AoL, Dartmouth/DHMC and Other. The results are show below. The majority of Internet users, about 33%, use ValleyNet as their ISP, for dialup service. The other major dial-up ISP used is AoL. Cable modem users have AT&T and DSL is mostly from Verizon. The other commonly used ISPs are Earthlink and Turnpike Tech and Sover.net.



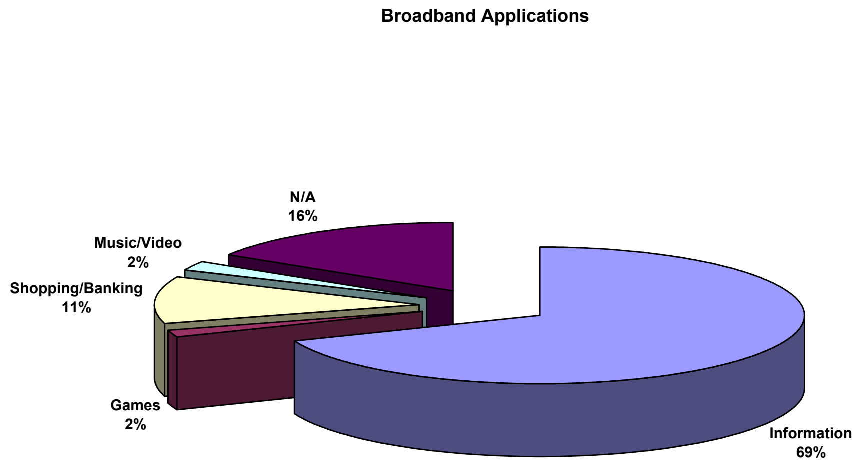
2.4.1.3 Desired Improvement in Internet Access

The survey was also targeted at determining the psychographic profile of Internet users in the Town. The survey asked what the respondents would like to see changed/improved about their Internet access service. About 58% indicated that they would like to have faster access; lower price came in a distant second.



2.4.1.4 Broadband Applications

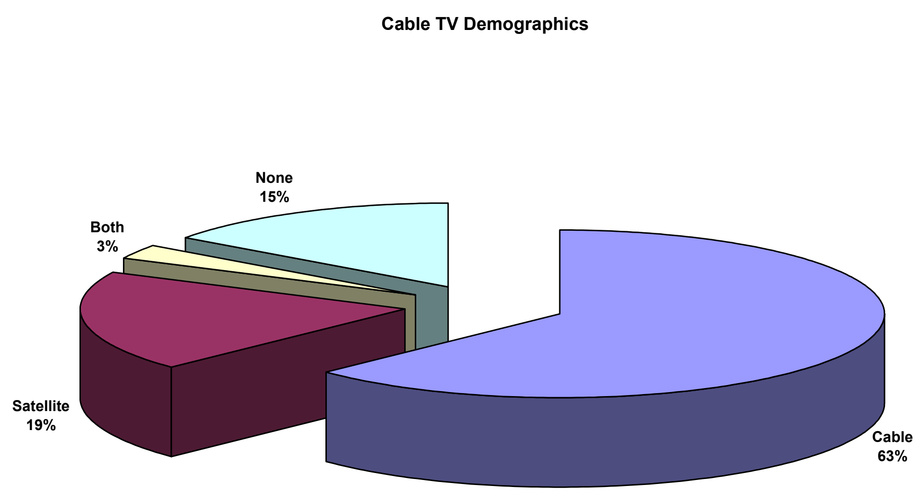
In order to understand the market for broadband services, and to determine what the Town residents would use the Internet for if they had broadband access, the survey asked what specific applications, other than the most common tasks of email/chat, the respondent would use the Internet if they had very high-speed access; the choice provided were Information (research, news, etc.), Games, Shopping/ Banking, and Music/Video comprising entertainment. This information is valuable to ISPs who wish to deliver broadband services over the MBN. The results indicated that the vast majority would use broadband for Information. The potential usage of other broadband applications appears to be weak; however, it must not be ignored that the residents of the town have not had an opportunity to experience these other enhanced services because of lack of broadband infrastructure as well as lack of broadband providers. Perhaps, the availability of such premium services at affordable costs might spur demand.



2.4.2 Cable TV Market Statistics

2.4.2.1 Cable / Satellite TV Usage

In order to understand the penetration of cable or similar services in the Town, the respondents were asked what kind of cable or dish TV service they used at home. From the results, it is clear that almost 86% of Town residents use cable or satellite TV service, or both. The breakout is shown below.



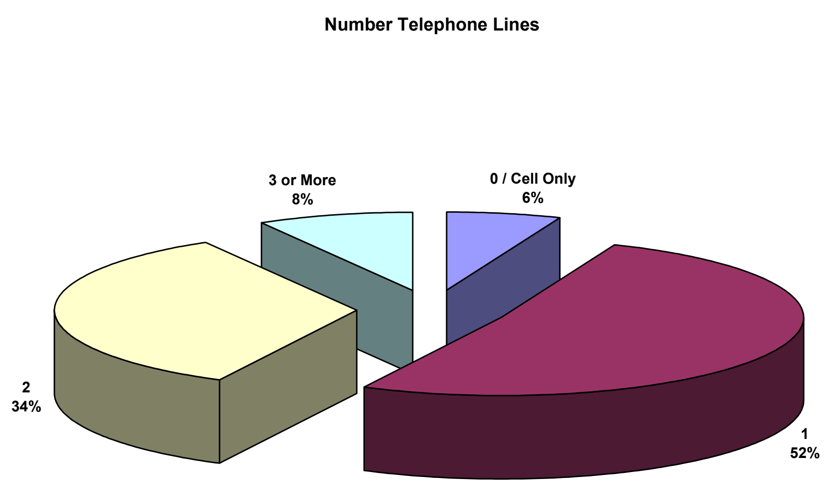
2.4.2.2 Cable / Satellite TV Providers

The survey also asked who the provider of the respondent's cable or satellite TV service currently is. The breakout by service provider is shown below. The percentages in the Valid Percent column indicated the proportion of households using the respective service provider.

7.	Who is your primary cable or satellite television company?				
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Adelphia	554	63.6%	63.8%	63.8%
	Direct TV	100	11.5%	11.5%	75.3%
	Dish Network	63	7.2%	7.2%	82.5%
	Other	18	2.1%	2.1%	84.6%
	N/A	134	15.4%	15.4%	100.0%
	Total	869	99.8%	100.0%	
Missing	Errors	2	0.2%		
Grand Total		871	100.0%		

2.4.3 Telephone Service Statistics

The survey was also targeted at understanding the current telephone service demographics in the Town. More importantly, the segment of the population, which uses more than one telephone line, represents the initial target market for conversion to the MBN. This is because a household is probably paying about $25 to their ISP and another $25 for the second telephone line dedicated to data/fax. With the MBN, the second telephone line could be eliminated, and the end-user could be paying the same total of $50 to an ISP for 10+ Mbps Internet access service. This segment of the population therefore represents the "low hanging fruit" for transfer to the MBN. The results are shown below; about 42% have more than one line (number).



2.4.4 MBN Internet Access

As alluded to before, this market study is primarily targeted at measuring the adoption of new services enabled by the MBN, including 100 Mbps data service and enhanced digital cable services. This *information is cross-tabbed with key demographic factors to understand which segments of the market will be the potential user base, and what the price sensitivity is of that potential user base.*

The survey was targeted at determining the "take rate" or rate of adoption to MBN services at two different price points ($40 per month, $60 per month) for two different services (100 Mbps Internet access, enhanced digital video services). The questions were asked in two different forms of the questionnaire as alluded to before in order to eliminate any psychological biases in having two price points in the same questionnaire; respondents might be biased to be inclined to the lower price point and strongly disinclined to the higher price point if both appeared on the same questionnaire. The above adoption rates were then segmented by key demographic metrics, including age and current type of Internet/ cable TV connection.

2.4.4.1 MBN Internet Adoption Rates

The respondents were asked the question how likely they would switch to a broadband Internet service that would be dramatically faster than what they currently have today. Two different forms of the questionnaire was developed to ask the above question at two different price points for the new service; $40/month and $60/month. The results are shown below for the price point of $40. The percentages in the Valid Percent column indicate the proportion of households responding with the respective affirmative or negative reaction. The results are very favorable, with 46% likely or very likely to switch.

11. Would you be willing to pay $40 per month for a very high speed Internet connection that is 1000 times faster than your current service?

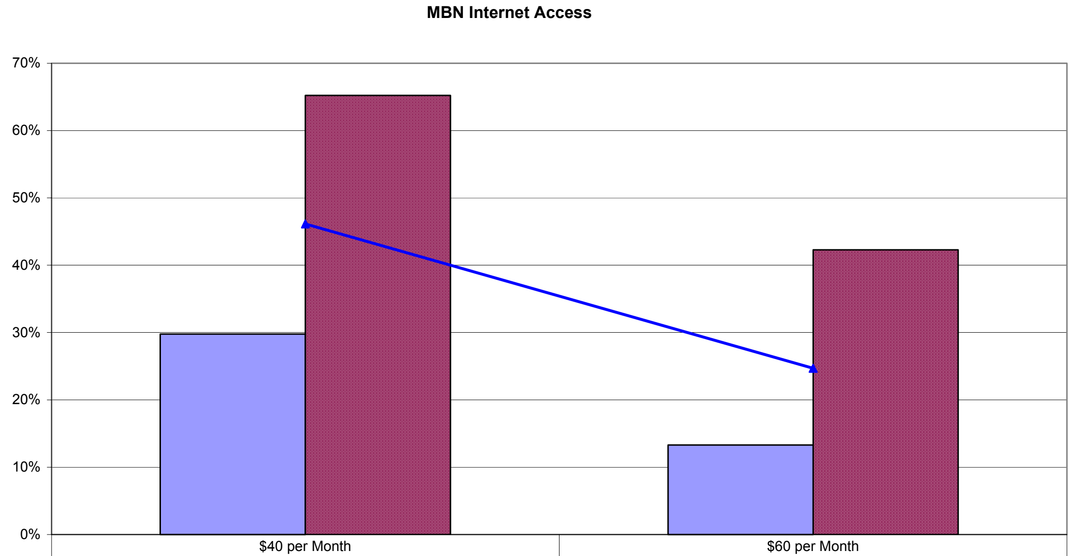
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely Not	99	11.4%	22.5%	22.5%
	Unlikely	54	6.2%	12.3%	34.8%
	Possibly	84	9.6%	19.1%	53.9%
	Likely	72	8.3%	16.4%	70.2%
	Definitely Yes	131	15.0%	29.8%	100.0%
	Total	440	50.5%	100.0%	
Missing	Errors	431	49.5%		
Grand Total		871	100.0%		

The results at the price point of $60 are shown below. Again, the Valid Percent column indicates the proportion of respondents with the affirmative or negative responses. The results show a weaker market base at this higher price, with 25% likely or very likely to accept the new service at $60/month.

11. Would you be willing to pay $60 per month for a very high speed Internet connection that is 1000 times faster than your current service?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely Not	160	18.4%	38.0%	38.0%
	Unlikely	83	9.5%	19.7%	57.7%
	Possibly	74	8.5%	17.6%	75.3%
	Likely	48	5.5%	11.4%	86.7%
	Definitely Yes	56	6.4%	13.3%	100.0%
	Total	421	48.3%	100.0%	
Missing	Errors	450	51.7%		
Grand Total		871	100.0%		

The "floor" or minimum potential market for Internet access on the MBN was established as those respondents who answered "Definitely Yes". The "ceiling" or maximum potential market was defined as those who answered "Likely" and "Possibly" in addition. Merton, however, estimates the market potential as only those respondents who answered "Definitely Yes" and "Likely". The results of these estimates are presented below. Clearly, the market potential for MSB broadband Internet is very substantial and robust if priced at $40 per month, but declines materially if priced at $60/month.



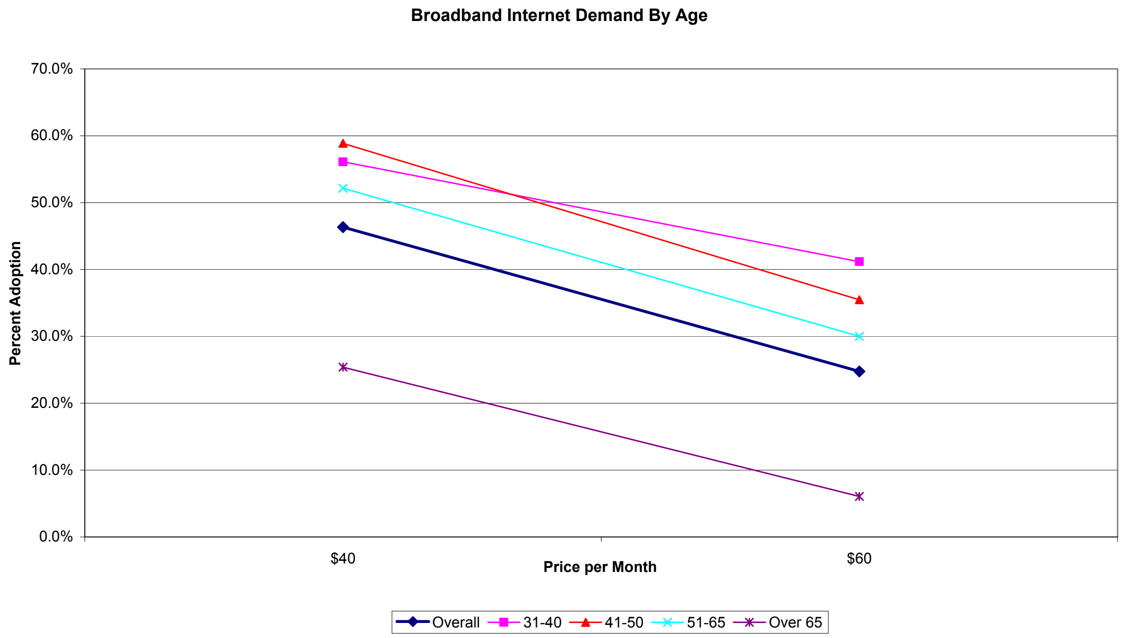
	$40 per Month	$60 per Month
Floor	30%	13.3%
Ceiling	65%	42.3%
Estimate	46%	24.7%

2.4.4.2 MBN Internet Price Sensitivity

The above MBN Internet access results was further segmented by age of the respondent to get a better idea of which population segments to target for provision of MBN broadband Internet services. The results are presented in the chart below. These are the "demand curves" for MBN broadband Internet service.

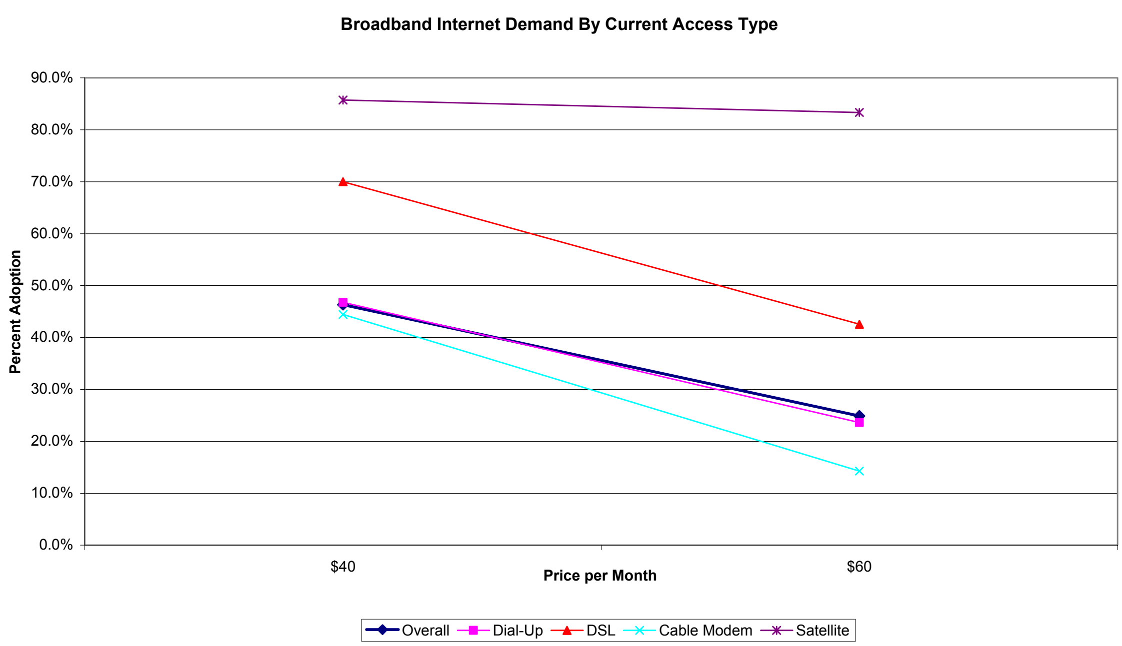
Two facts are very evident from the chart:

- There is a wide difference in interest in broadband Internet access across different age groups, varying from 59% amongst the 41-50 respondents to about 25% amongst the senior citizens of the town (over 65 years old) at the low end, at $40 per month.
- The demand for broadband Internet is very sensitive to the pricing. At $40 per month, the overall demand is 46%, falling to 25% at $60 per month. According to this trend, if broadband Internet access were offered at say $50 per month, the estimated demand would be approximately 36%.



2.4.4.3 MBN Internet Adoption by Current Access Type

The MBN broadband demand was also segmented by the type of Internet access service that the respondents currently have, i.e., dialup, cable modem, DSL or satellite. This greatly helps to better understand to what extent the current users of dial-up and DSL/cable modem type services would switch to a must faster service offered by the MBN. The analysis was performed at the two price points of $40 and $60 per month. The results are shown in the chart below.



It is an extremely interesting observation that about 70% of current DSL and 95% of satellite Internet users are likely to switch to the MBN level broadband service (10-100 Mbps) if the price were $40 per month. Again, all segments of users are quite sensitive to the price of the broadband service; for example, the percentage of current dial-up users who would want to switch to the MBN sharply declines from about 47% at $40/month to about 24% at $60/month. The price sensitivity is sharper for current cable modem users, declining from 44% at $40/month to 14% at $60/month.

2.4.5 MBN Video Services

2.4.5.1 MBN Video Adoption Rates

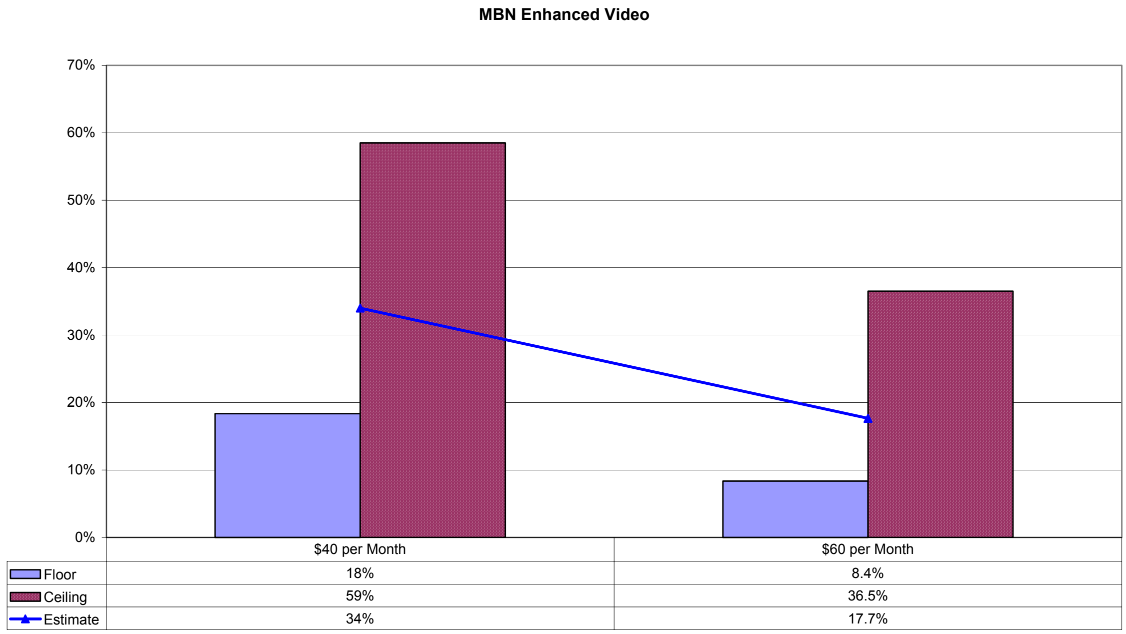
The respondents were asked the question how likely they would switch to enhanced video services on the MBN that would provide dozens of channels of programming. The survey asked this question at the two different price points, $40/month and $60/month, in two different forms of questionnaires. The results are shown below. The table below shows the results at the $40 price point. The percentages in the Valid Percent column indicate the proportion of households responding with the respective affirmative or negative reaction. The results are favorable, with 34% likely or very likely to switch.

12. Would you be willing to pay $40 per month for high quality video service with a wide choice of channels for news, sports, music and movies?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely Not	111	12.7%	25.2%	25.2%
	Unlikely	72	8.3%	16.3%	41.5%
	Possibly	108	12.4%	24.5%	66.0%
	Likely	69	7.9%	15.6%	81.6%
	Definitely Yes	81	9.3%	18.4%	100.0%
	Total	441	50.6%	100.0%	
Missing	Errors	430	49.4%		
Grand Total		871	100.0%		

The results at the price point of $60 are shown below. Again, the Valid Percent column indicates the proportion of respondents with the affirmative or negative responses. The results show a weak market base at this higher price, with only about 18% likely or very likely to accept the new service at $60/month.

12. Would you be willing to pay $60 per month for high quality video service with a wide choice of channels for news, sports, music and movies?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely Not	156	17.9%	37.2%	37.2%
	Unlikely	110	12.6%	26.3%	63.5%
	Possibly	79	9.1%	18.9%	82.3%
	Likely	39	4.5%	9.3%	91.6%
	Definitely Yes	35	4.0%	8.4%	100.0%
	Total	419	48.1%	100.0%	
Missing	Errors	452	51.9%		
Grand Total		871	100.0%		

The “floor” or minimum potential market for enhanced video services on the MBN was established as those respondents who answered “Definitely Yes”. The “ceiling” or maximum potential market was defined as those who answered “Likely” and “Possibly” in addition. Merton, however, estimates the market potential as those respondents who answered “Definitely Yes” and “Likely”. The results of these estimates are presented below. The market for MBN video appears to be less substantial and robust than the MBN Internet market, but holds good potential at the $40/month price point.

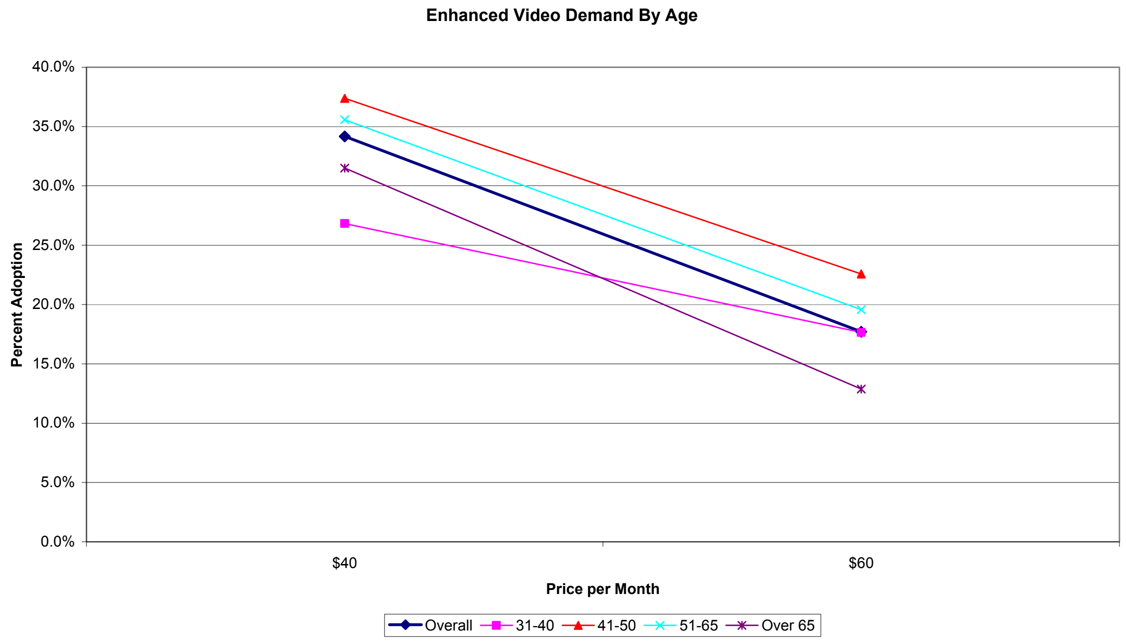


2.4.5.2 MBN Video Price Sensitivity

The above MBN video demand information was further segmented by age of the respondent to get a better idea of which population segments to target for provision of MBN video services. The results are presented in the chart below. These are the "demand curves" for MBN video.

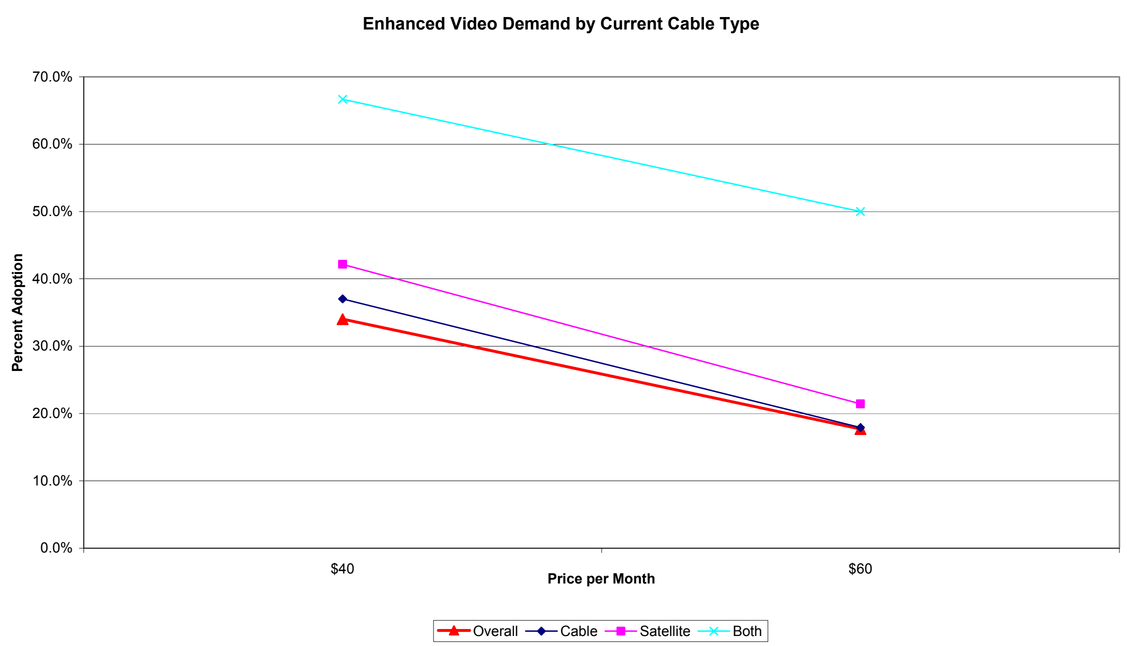
Two facts are very evident from the chart:

- There is a small variation in interest in enhanced video services across different age groups, varying from 37% amongst the 41-50 age groups to about 27% in the 31-40 age group on the low end, at $40 per month.
- The demand for enhanced video is very sensitive to the pricing. At $40 per month, the overall demand is 34%, falling to 18% at $60 per month. According to this trend, if broadband Internet access were offered at say $50 per month, the estimated demand would be approximately 26%.



2.4.5.3 MBN Video Adoption by Current Access Type

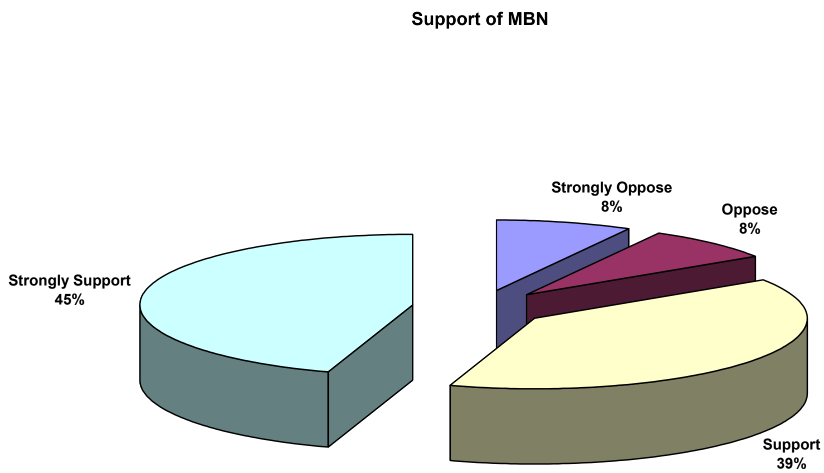
The demand for enhanced video services was also segmented by the type of cable/satellite service that the respondent currently subscribes to. The results are shown below.



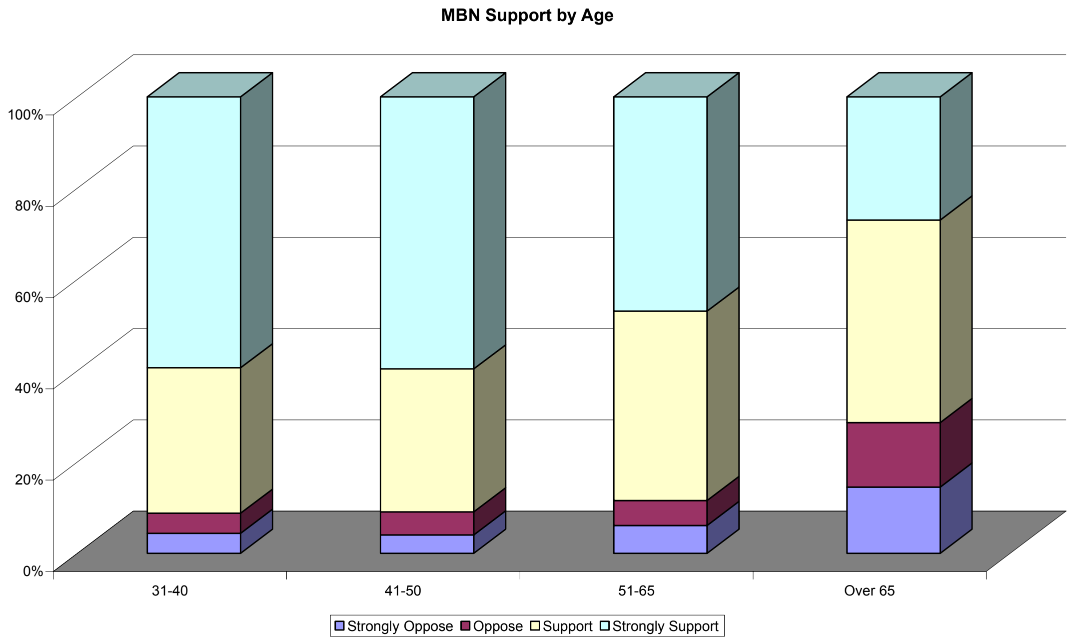
Clearly, there is a huge propensity for the current subscribers of both cable and satellite TV services to switch to MBN video at $40/month. The current dish TV subscribers appear to be dissatisfied with either the quality of service or the price they are paying right now, and form the most willing segment of users to move to video services potentially offered on the MBN.

2.4.6 MBN Support

To determine he predisposition of the citizens of Hanover to a Town-built fiber facility, the survey asked the question to what extent the respondent would support or not support such an initiative by the Town *if it did not increase their taxes*. It appeared from the completed questionnaires that the driving factor behind the overwhelming support, 84% of households, of such an initiative may have been the fact that the question specified that there would not be an increase in taxes as a result of the MBN. The survey did not ask the above question under the scenario of an increase in taxes as a result of the MBN.



The responses to the above question was further segmented by age of the respondent to better understand the segments of the population that the MBN needs to be marketed to more intensely. The results are shown below.



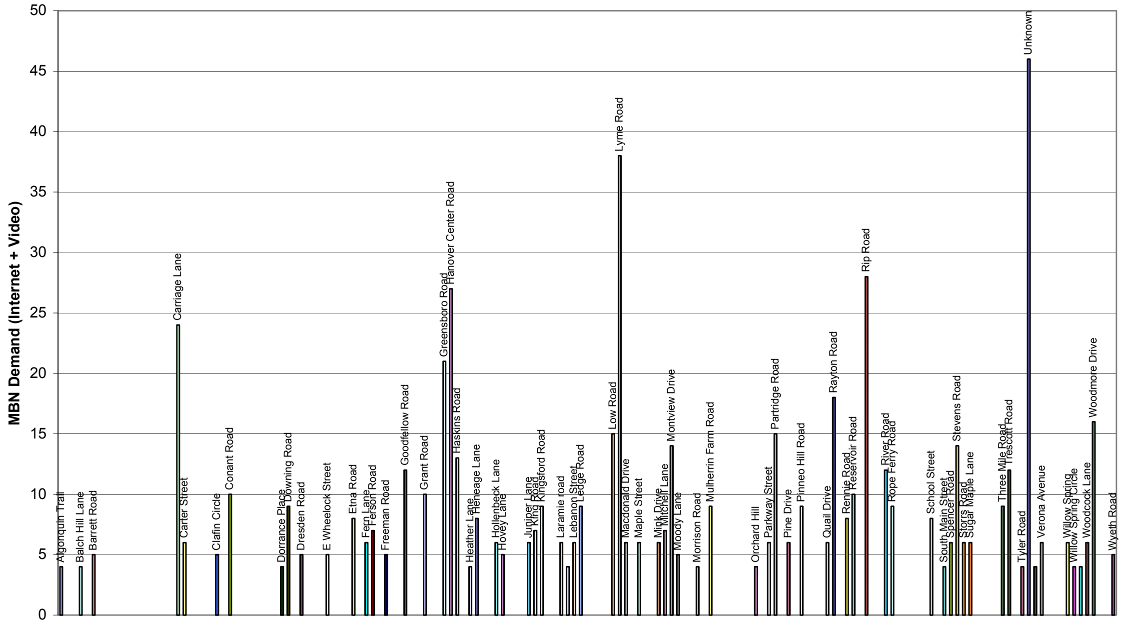
The results indicate that the strongest support for MBN comes from the 31-40 and 41-50 age groups, with 91% supporting or strongly supporting the initiative in each case. The relatively weaker support is from the senior citizens in the town, the 65 or above age group, with 71% of the respondents in support of MBN.

2.4.7 MBN Demand by Street Location

The survey also attempted to determine the number of households who are likely to switch to MBN Internet or video services by the location of their street in the Town. The respondents were asked to provide the name of the street on which they live (not their street address). Merton then cross-tabulated the street information with the demand data for MBN Internet and video services at both price points of $40/month and $60/month, and arrived at a metric of demand by street location. The metric for a given street simply measures the sum of the number of households on that street who are either likely or very likely to switch to MBN services. Such results are expected to be useful in determining, or at least influencing, the initial and ongoing design of the buildout of the MBN in the Town.

The results of demand by street location from the survey are influenced by the number of households on a given street participating in the survey. Although the questionnaires were sent out by the Town to randomly selected households, some streets had many more households responding than did others; such a bias could potentially be eliminated by surveying every household on every street, not a cost-effective solution. In addition, there are significant differences in number of households on the various streets in the Town.

Notwithstanding the above, the results in the chart below give an idea for the geographical dispersion of MBN demand in Hanover; in the interest of readability, the chart presents only those streets that had a minimum of four households that are likely or very likely to switch to MBN Internet or video services.



2.4.8 General Demographics

2.4.8.1 Age

The column "Valid Percent" represents the age distribution of the respondents.

1. What is your age group?					
		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	*Below 30*	5	0.6%	0.6%	0.6%
	31-40	92	10.6%	10.6%	11.2%
	41-50	200	23.0%	23.0%	34.2%
	51-65	305	35.0%	35.1%	69.4%
	Over 65	266	30.5%	30.6%	100.0%
	Total	868	99.7%	100.0%	
Missing	*Errors*	3	0.3%		
Grand Total		871	100.0%		

2.4.8.2 Size of Household

2. How many people are there in your household?					
		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	1	141	16.2%	16.2%	16.2%
	2	362	41.6%	41.7%	57.9%
	3	115	13.2%	13.2%	71.2%
	4	148	17.0%	17.1%	88.2%
	>=5	102	11.7%	11.8%	100.0%
	Total	868	99.7%	100.0%	
Missing	*Errors*	3	0.3%		
Grand Total		871	100.0%		

Based on the above data, the average size of a household in the Town is 2.7.

2.4.8.3 Personal Computer Use

3. Do you use a personal computer at home?					
		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	*Do Not Use*	89	10.2%	10.2%	10.2%
	Home Only	273	31.3%	31.3%	41.6%
	Home & Biz	509	58.4%	58.4%	100.0%
	Total	871	100.0%	100.0%	
Missing	*Errors*	0	0.0%		
Grand Total		871	100.0%		

It is important to note that a majority of households in Hanover, about 58%, use a personal computer at home for both personal and business use. This is a significant factor suggesting that these households would derive substantial benefits from the MBN for broadband Internet as well as other enhanced services.

3. TECHNOLOGY OVERVIEW

This section presents technical and some high level financial details on the infrastructure elements of the Municipal Broadband concepts. The information contained herein is a combination of information based upon Merton analyses and vendor information concerning certain equipment elements. We begin with a high level overview of Internet Protocol and what is called "IP". This is the basic backbone element of the Internet and its ease of connectivity.

IP telecommunications is the use of the IP protocol and routers to communicate from one place to another. IP also works with another underlying means of communicating called TCP. Together they are called TCP/IP. The Internet is the collection of all networks that satisfy the following two criteria. First, any and all communications must be done using IP and IP only. Second, the networks must be interconnected or interconnectable using IP.

IP protocol is a method to send packets of information from one place to another using a very simple network in between. In the world of IP, the "intelligence" all resides at the edge of the network and the inside of the network is a simple as possible. IP is the basis of that simple network. IP headers are simply the set of information bits that are on any packet that tells it how to go from one point to another.

IP sends a packet at a time out onto a network, which is comprised of transmission facilities and intelligent devices called routers. The device, the router, then reads the directions and instructions on each packet which are contained in the IP header, and immediately decides where to send it and possibly how to process the information across the network. The IVN, IP Voice Node, takes and packetizes the voice and then places it in a TCP/IP format as we have discussed above. The packets are then sent out over the network.

3.1 Optical Communications Overview

This section is a more detailed presentation of the elements of the fiber communications infrastructure. It is a high level view of the communications elements, which are part of the overall network design and operations.

3.1.1 PON vs. Gigabit Ethernet

The first step is to understand that there are two major options: PON or passive optical networks, and Gigabit Ethernet, GigE.

1. PON is a passive technology, which "splits" signal in a set of passive optical splitters, allowing each residence to have a share of the data link. PON uses one of several transmission characteristics on the link, typically ATM or even an Ethernet format.

2. GigE uses active splitters, which provide Ethernet as the transmission approach all the way throughout the network. The use of Ethernet protocols on the backbone is the differentiator.

PON has passive non-powered field units and GigE uses powered intelligent devices. We now present some high level discussions on protocols and then on each technology.

3.1.2 Protocols

Protocols are agreed to standards for the purpose of establishing communications between two or more computers. The development of protocols has been significant ever since the development of computer communications. The performance, costs, expandability, scalability, and many other factors are highly dependent on the protocol set chosen. In this report, we focus on layer 2 and 3, and the two choices are PON and Gigabit Ethernet, each has advantages and disadvantages, both are separated at layer 2.

Protocol Layers

Application	*The applications software, it is what the end user sees and uses.*
Presentation	*Provides for such things as security and security management.*
Session	*Controls communications between applications, flow management, and creates sessions between applications at end user level.*
Transport	*Ensures reliable end to end transport and flow control*
Network	*Provides point to point and point to end point reliable links*
Data Link	*Provides for reliable physical link transport; can be divided into LLC and MAC functions*
Physical	*Provides physical connections and electrical connections, including modulation.*

3.1.2.1 TCP/IP

TCP/IP is the key protocol used in the Internet. It is a protocol, which is what is called a "best efforts" approach to telecommunications. In effect, it takes a set of headers, TCP and IP, and then attaches a data packet, a packet of variable length. It then sends this over a network and "hopes" that it gets there. In the early days it was stated, "every packet was an adventure". It has been learned however that the basic networks are highly reliable so lost packets are not a serious problem; packet delays may be a very serious one, depending on the network traffic.

Apart from a great deal of header information, the key fact of IP is that the length of the data packets is variable! This is not the case of ATM. One can put IP on top of ATM or Ethernet, but IP does best with variable data packet lengths; ATM does not do that whereas Ethernet does.

3.1.2.2 ATM

ATM is a telephone-based packet. It differs from TCP/IP in two key ways; first, it is a fixed length and does not vary as data requires, you send a fixed length frame whether you need it or not; second, there is large overhead to ensure quality of service requirements so that loss and delay can be guaranteed in some specified limits.

Now ATM is a layer 2 protocol, it is what is below IP and IP is below TCP; this is in reality a concatenation of overheads, each with their own functions. ATM frames have lots of overhead for such tings as quality control and services level administration. ATM was built by telephone people not computer people; it was a higher speedway to interconnect telephone switches as we knew them in the early 1990s. It did not anticipate such things as IP telephony.

ATM is a telephone-based format. In addition to the fixed frame size, whether used or not, it also had selected data rates, OC 1 as 45 Mbps, OC 3 as 155 Mbps, OC 12 as 622 Mbps, and OC 48 as 2.5 Gbps. It is possible to put IP on ATM, since ATM is layer 2 and IP is layer 3 and TCP layer 4. Thus, as has been done, TCP/IP rides on top of ATM.

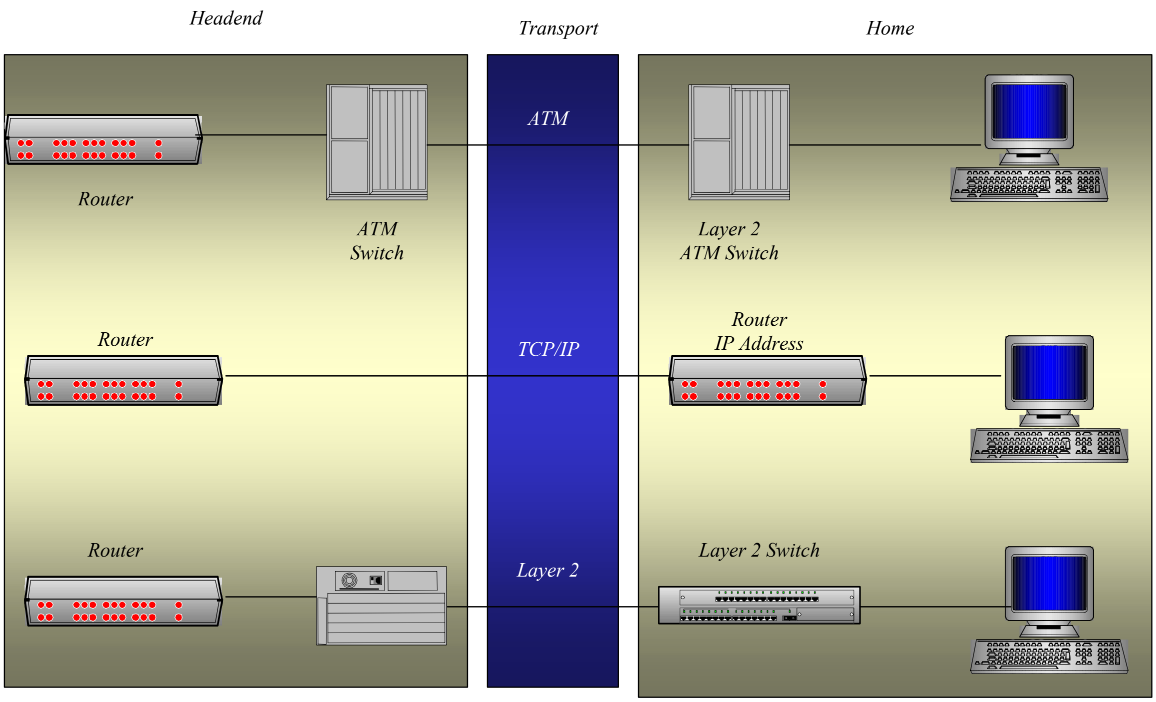
3.1.2.3 Ethernet

In contrast to layer 2 ATM networks, there is a layer 2 computer protocol called Ethernet, and TCP can ride on this as well. Ethernet, albeit older that ATM, is truly a packet approach. It anticipates full flexible packet capabilities. The following is the layer 2 level of Ethernet, as specified by the IEEE 802.3 standard.

Ethernet at layer 1 uses 10 Base T and 100 Base T forms of 10 Mbps and 100 Mbps. In addition, the signalling is CSMA/CD. Carrier sensed multiple accesses with collision detection.

3.1.3 Interconnectivity

These network schemes can be laid out in the following categories. It must be remembered that TCP is layer 4, IP IS layer 3, and Ethernet and ATM ARE both layer 2. Thus, we must consider connecting ATM to ATM, Ethernet to Ethernet, and then having TCP/IP riding on top of either.



Both ATM and Ethernet have the same architectural elements; some central device, some filed unit for distribution, and some end user interface. However, the differences are significant:

1. Data Size: ATM is fixed frame format Ethernet is variable

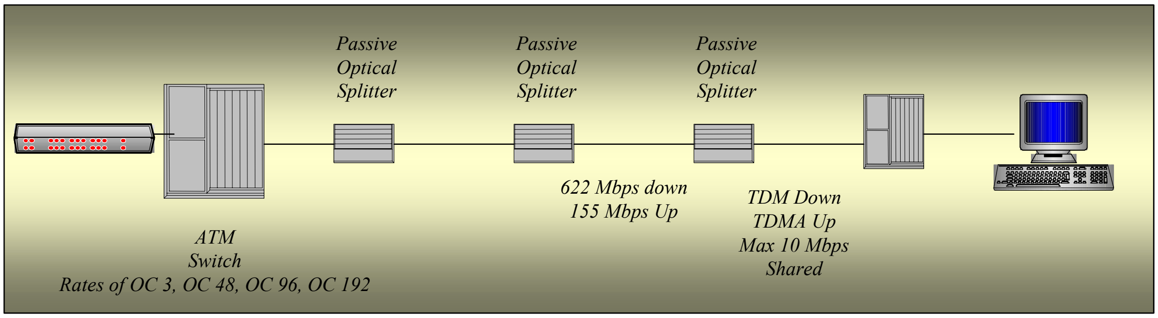
2. Field Unit: ATM uses PON and is passive; Ethernet is an active level 2 switch.

3. Distance: ATM using PON has range limits and Ethernet has extended range. This may or may not be a problem.

4. QoS: ATM allows QoS so that video can be guaranteed via central control, Ethernet uses IP based flow control and has QoS “engineered” via over capacity

5. Data Rates: ATM is fixed in SONET frames whereas Ethernet is highly scaleable and flexible.

ATM



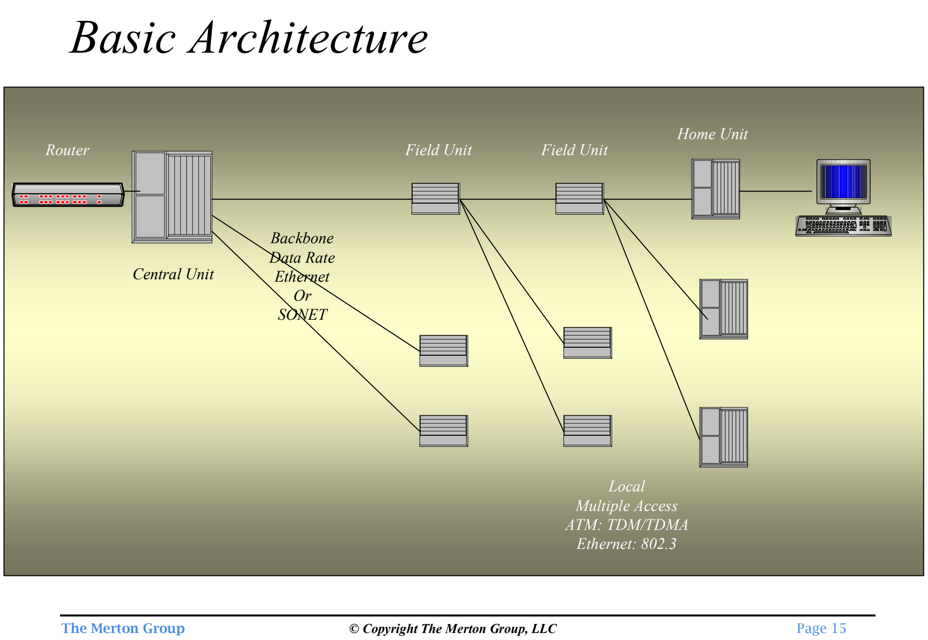
3.1.4 Basic Architecture

The basic architecture for PON or Gigabit Ethernet is shown below. The elements are:

1. Central Unit: This is at a headend or some similar central location and provides for central management and interface.

2. Field Units: These units are the n:1 splitting devices, active or passive, which take a backbone signal and share it amongst several home units. In GigE the backbone rate is 1 Gbps down and up using two fibers, in ATM PON it is a single fiber using several wavelengths, one up and one down, using SONET and ATM formats. SONET is a layer 1 protocol.

3. Home Units: These are the devices in the home made to support data, voice, and video.



3.2 Gigabit Ethernet

This section is a more detailed technical presentation on Gigabit Ethernet and details the key technical elements.

3.2.1 Introduction: Evolution of Ethernet Standards

Ethernet has enjoyed tremendous success in enterprise LANs since its introduction in the early 1980s. It has grown from a shared 10 Mbps technology, where all users on the network contend for the same pool of bandwidth, into a switched technology providing dedicated bandwidth to each subscriber at up to a full gigabit of throughput.

The IEEE 802.3 committee, which is responsible for the Ethernet standard, is broken into sub-committees based on the different versions of Ethernet. The following are the specific committees.

- IEEE 802.3 – Ethernet (10 Mbps)
- IEEE 802.3u – Fast Ethernet (100 Mbps)
- IEEE 802.3z – Gigabit Ethernet (1000 Mbps)
- IEEE 802.3ae – 1- Gbps Ethernet (10 Gbps); standard under development

3.2.2 Gigabit Ethernet for FTTH

Fast Ethernet (100 Mbps) and Gigabit Ethernet are currently ideal for community FTTH networks. Since fiber reaches all the way to the subscriber, it is feasible to provide the user with up to 1 Gbps capacity. In addition, they provide other new features such as full-duplex operation, and auto-negotiation. This has established Ethernet as a scalable technology. The new Gigabit Ethernet standards will be fully compatible with existing Ethernet installations. It will support full duplex as well as half duplex modes of operation. Initially, single-mode and multi mode fiber and short-haul coaxial cable will be supported. Gigabit Ethernet is expected to be deployed as a backbone in existing networks. It can be used to aggregate traffic between clients and "server farms", and for connecting Fast Ethernet switches.

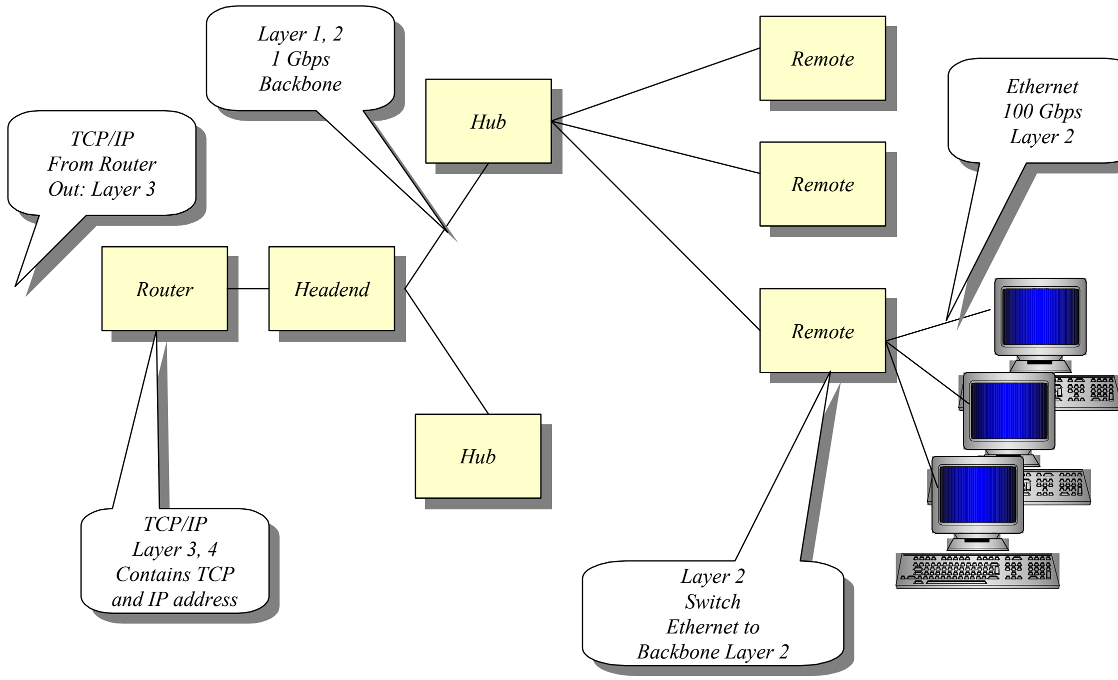
The Physical Layer of Gigabit Ethernet uses a mixture of proven technologies from the original Ethernet and the ANSI X3T11 Fibre Channel Specification. Gigabit Ethernet is finally expected to support four physical media types. These will be defined in 802.3z (1000Base-X) and 802.3ab (1000Base-T).

Gigabit Ethernet maintains the minimum and maximum frame sizes of Ethernet. Since, Gigabit Ethernet is 10 times faster than Fast Ethernet, to maintain the same slot size, maximum cable length would have to be reduced to about 10 meters, which is not very useful. Instead, Gigabit Ethernet uses a bigger slot size of 512 bytes. To maintain compatibility with Ethernet, the minimum frame size is not increased, but the "carrier event" is extended. If the frame is shorter than 512 bytes, then it is padded with extension symbols. These are special symbols, which cannot occur in the payload.

QoS is not built into the Ethernet standard. Implementation is left up to the manufacturers of Ethernet devises and the standards bodies that develop the QoS technologies to deploy their switches and routers. This keeps the standards for the technology simple, while introducing high-level features in the hardware that transport the data. Many devices now incorporate comprehensive QoS measures that allow packets to be classified, prioritized, policed, queued, etc. and then forwarded accordingly. This allows a certain communications to be handled differently from others; for example, a packetized MPEG-2 stream can be forwarded along a higher-bandwidth, lower latency link than typically web-surfing traffic.

Gigabit Ethernet is today a dedicated-bandwidth technology, having evolved from the shared, broadcast-oriented technology Ethernet used to be a decade ago. With the advent of full-duplex communications, the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method that handled contention and collisions within a broadcast domain, disappeared from Ethernet's operation. Where once up to 1,024 users would share10 Mbps, now a single user could receive up to 1 Gbps of full-duplex bandwidth for their exclusive use.

The general layout of Gigabit Ethernet networks is shown below:

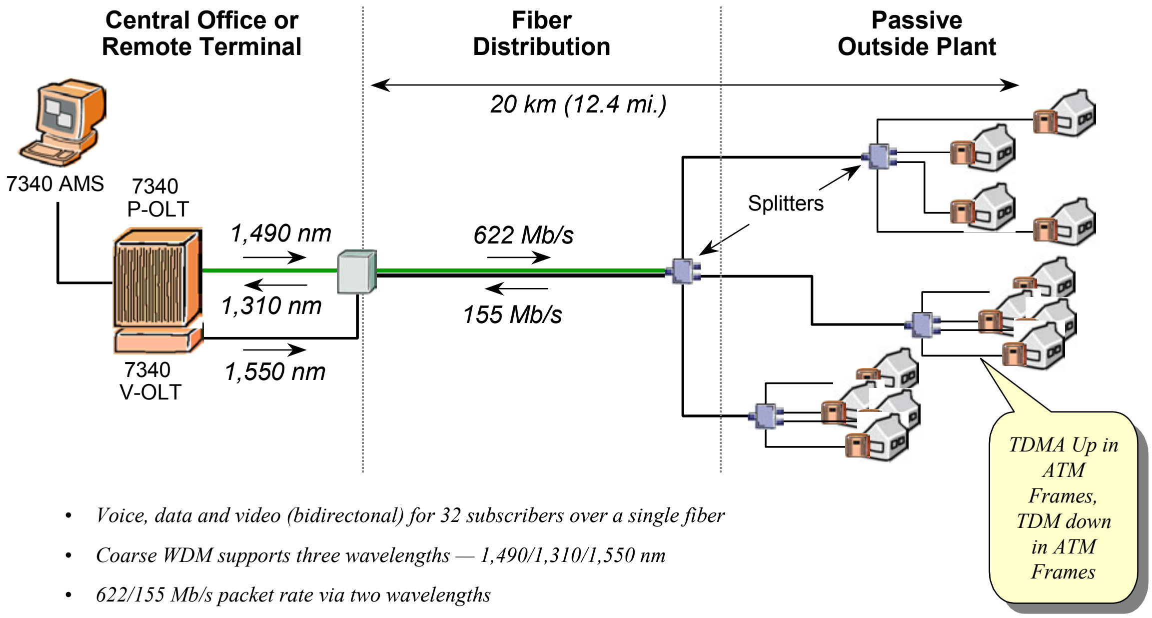


3.3 Passive Optical Networks (PON), ATM

There are several versions of PON technology and the following table details them:

APON - ATM PON	*First commercial product, used primarily for business applications*
BPON - Broadband PON	*Expanded version of APON with added functionality to support robust video services*
EPON - Ethernet PON	*PON using Ethernet for packet data - still evolving*
GPON - GigaPON	*evolving PON technology at gigabit rates*
Proprietary PON	*long term viability and support issues*

Today's access network, the portion of a public switched network that connects CO equipment to individual subscribers, is characterized by predominantly twisted-pair copper wiring. Fiber-optic technology, through local access network architectures such as fiber to- the-home/building (FTTH/B), fiber-to-the-cabinet (FTTCab), and fiber-to the- curb (FTTC) offers a mechanism to enable sufficient network bandwidth for the delivery of new services and applications. ATM–PON technology can be included in all these architectures, as shown in below.



- *Voice, data and video (bidirectonal) for 32 subscribers over a single fiber*
- *Coarse WDM supports three wavelengths — 1,490/1,310/1,550 nm*
- *622/155 Mb/s packet rate via two wavelengths*
- *Dedicated wavelength for video — very high capacity (4 Gb/s Broadband Entertainment)*
- *20 km (12.4 mi.) span*

In general, the optical section of a local access network can be a point-to point, ring, or passive point-to-multipoint architecture. The main component of the PON is an optical splitter device that, depending on which direction the light is traveling, splits the incoming light and distributes it to multiple fibers or combines it onto one fiber. FTTC architecture runs an optical fiber from the CO to an optical splitter and then on to a small curb-located cabinet, which is near (typically within 500 ft) to the subscriber. It is then converted to twisted copper pair.

The PON can be common to all of these architectures. However, it is only in the FTTH/B configurations that all active electronics are eliminated from the outside plant. The FTTCab and FTTC architectures require active outside-plant electronics in a neighborhood cabinet or curb.

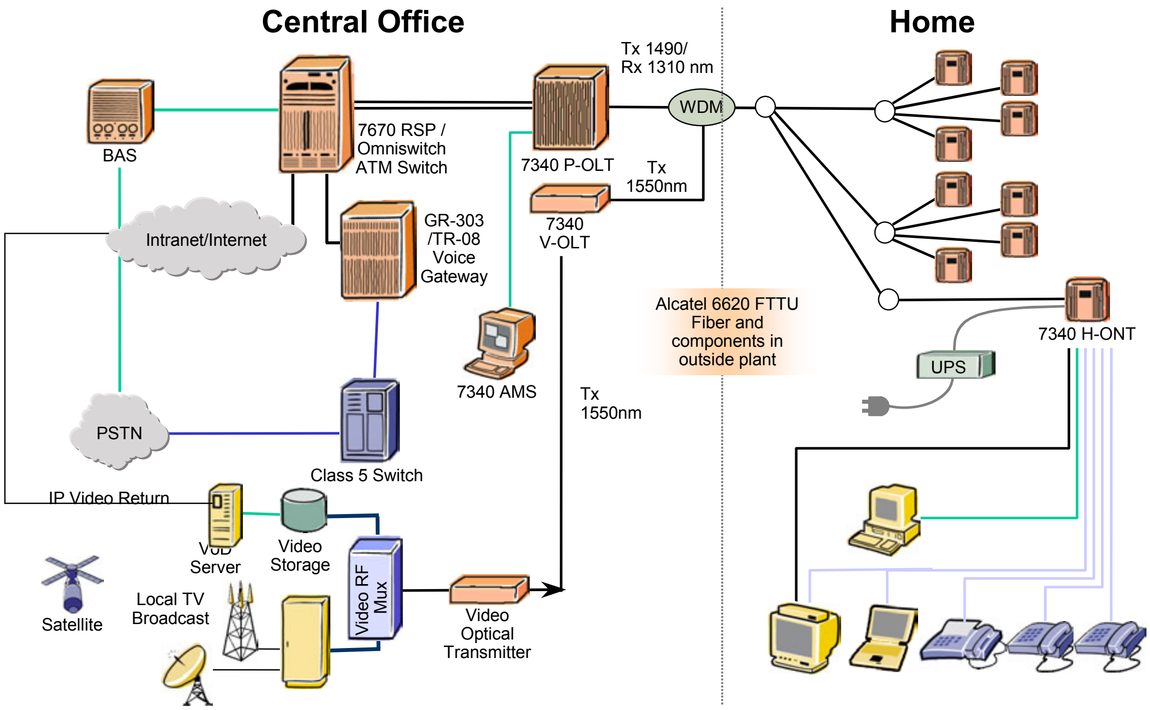
When fiber is used in a passive point-to-multipoint (PON) fashion, the ability to eliminate outside plant network electronics is realized, and the need for excessive signal processing and coding is eliminated. The PON, when deployed in an FTTH/B architecture, eliminates outside plant components and relies instead on the system endpoints for active electronics. These endpoints are comprised of the CO–based optical line terminal (OLT) on one end and, on the other, the optical network termination (ONT) at the subscriber premises. Fiber-optic networks are simple, more reliable, and less costly to maintain than copper-based systems. As these components are ordered in volume for potentially millions of fiber-based access lines, the costs of deploying technologies such as FTTH, FTTB/C, and FTT/Cab become economically viable.

One optical-fiber strand appears to have virtually limitless capacity. Transmission speeds in the terabit-per-second range have been demonstrated. The speeds are limited by the endpoint electronics, not by the fiber itself. For the ATM–PON system today, speeds of 155 Mbps symmetrical and 622 Mbps/155 Mbps asymmetrical are currently being developed. As the fiber itself is not the constraining factor, the future possibilities are endless. Furthermore, because fiber-optic technology is not influenced by electrical interferers such as cross-talk between copper pairs or AM band radio, it ensures high-quality telecommunications services in the present and future. In addition, fiber does not exhibit radio frequency (RF) emissions that can interfere with other electronics and is regulated by the Federal Communications Commission (FCC).

While copper-based transport technologies remain ubiquitous, the long-term industry belief holds that it is inevitable that fiber will replace copper throughout the access infrastructure. Because copper infrastructure is embedded in communications systems, this transformation to optical transport is expected to occur over many years. Over time, new builds ("Greenfield") will be all fiber based, and existing builds will be rehabilitated by replacing copper with fiber or by overlaying new fiber on the existing copper infrastructure. Electronic equipment, as well, must be replaced with optical equipment.

3.3.1 How ATM PONs Work

Recent technological advances and economies of scale have drawn increasing interest to optical-distribution networks with ATM PON. A functional overview of ATM–PON architecture is presented in *Figure 2*.



The ONT placed at the customer premises, which suggests FTTH/B architecture. The carrier's demarcation point would be the subscriber side of the ONT, typically in the form of a T1, Ethernet, integrated services digital network (ISDN), plain old telephone service (POTS), etc. For FTTCab and FTTC architecture, an optical network unit (ONU), rather than an optical network termination (ONT), is used. It is placed in the outside plant and must be temperature-hardened and properly enclosed. The final drop to the network termination (NT) at the customer premises may be copper or fiber. The carrier demarcation point is the subscriber side of the NT in the form of a T1, Ethernet, ISDN, POTS, etc.

Access to bandwidth on the PON may be obtained by several methods, including time division multiple access (TDMA), wave division multiple access (WDMA), code division multiple access (CDMA), and subcarrier multiple access (SCMA). TDMA in the upstream and TDM in the downstream were chosen by the Full- Service Access Network (FSAN) group and submitted to the International Telecommunications Union (ITU) for standardization, based on their simplicity and cost-effectiveness.

The network components supporting ATM PON consist of OLT, ONT, and a passive optical splitter. One fiber is passively split up to 64 times between multiple ONTs that share the capacity of one fiber. Passive splitting requires special actions for privacy and security, and a TDMA protocol is necessary in the upstream direction. The use of the optical splitter in the PON architecture allows users to share bandwidth, thus dividing the attendant costs. Costs are further reduced by a decrease in the number of opto-electronic devices needed at the OLT; one interface may be shared among many ONTs.

The ATM–PON system uses a double-star architecture. The first star is at the OLT, where the wide-area network interface to services is logically split and switched to the ATM–PON interface. The second star occurs at the splitter where information is passively split and delivered to each ONT. The OLT is typically located in the carrier's CO. The OLT is the interface point between the access system and service points within the carrier's network. When data content from the network reaches the OLT, it is actively switched to the passive splitter using TDM in the downstream. The OLT behaves like an ATM edge switch with ATM– PON interfaces on the subscriber side and ATM–synchronous optical network (SONET) interfaces on the network side.

The ONT will filter the incoming cells and recover only those that are addressed to it. Each ATM cell has a 28-bit addressing field associated with it called a virtual path identifier/virtual channel identifier (VPI/VCI). The OLT will first send a message to the ONT to provision it to accept cells with certain VPI/VCI values. The recovered ATM cells are then used to create the service interface required at the subscriber side of the ONT.

Because TDMA is used in the upstream direction, each ONT is synchronized in time with every other ONT. The process by which this happens is called ranging the ONTs. The OLT must determine how far away in distance each ONT is so they can be assigned an optimal time slot in which to transmit without interfering with other ONTs. The OLT will then send grant messages via the physical layer operation, administration, and maintenance (PLOAM) cells to provision the TDMA slots that are assigned to that ONT. The ONT will then adapt the service interface to ATM and send it to the PON using the TDMA protocol. Ethernet and T1s are two examples of what can be transported over the ATM– PON. As ATM–PON is service-independent, all legacy services and future services can be readily transported.

In the upstream direction, the capacity is reduced to 149.19 Mbps because there are three overhead bytes per ATM cell. In addition to the three overhead bytes per cell there are PLOAM cells in the upstream direction, the rate of which is defined by the OLT for each ONT, depending on the required functionality. The minimum PLOAM rate in the upstream direction is one PLOAM every 100 ms. This equates to approximately one PLOAM every 655 frames, which is negligible. Although the maximum PLOAM rate is undefined, it is also expected to be negligible. The three overhead bytes contain a minimum of four bits of guard time to provide enough distance in time to prevent collisions with cells from other ONTs. This field length is actually programmable by the OLT. The preamble field is used to acquire bit synchronization and amplitude recovery. The Delimiter field is used to indicate the start of an incoming cell.

Given that a single fiber is used for both the upstream and downstream paths, two wavelengths of light are used—1550 nm for the downstream and 1310 nm for the upstream. Although one wavelength can also be used, two provide better optical isolation between the laser transmitters and receivers and eliminate the need for expensive beam-splitting devices. Instead, low-cost planar light circuits (PLCs) can be used, which enable low-cost manufacturing techniques to be employed, somewhat similar to the production of silicon chips. ATM cells are directly converted to light and sent to the PON. Because of the broadcast nature of the PON, encryption techniques are employed to prevent security breaches. In the upstream direction, the ONT uses the TDMA protocol and again directly converts ATM cells to light for transport over the PON.

A typical ATM–PON system can furnish up to 64 customer locations on a single, shared strand of fiber running at 155 Mbps. Most, however, will likely utilize 32 locations in the distribution and drop portion of the network in the near term. In the future, the ATM–PON specification does allow for up to 64 locations to be served.

3.4 PON vs. Gigabit Ethernet

ATM is today the most prevalent and popular flavor of PON. Therefore, we compare the pros and cons of ATM-PON to that of Gigabit Ethernet.

When ATM (Asynchronous Transfer Mode) was introduced, it offered 155 Mbps bandwidth, which was 1.5 times faster than Fast Ethernet. ATM was ideal for new applications demanding a lot of bandwidth, especially multimedia. Demand for ATM continues to grow for LANs as well as WANs.

On the one hand, proponents of ATM try to emulate Ethernet networks via LANE (LAN Emulation) and IPOA (IP over ATM). On the other, proponents of Ethernet/IP try to provide ATM functionality with RSVP (Resource Reservation Protocol) and RTSP (Real-time Streaming Transport Protocol). Evidently, both technologies have their desirable features, and advantages over the other. It appears that these seemingly divergent technologies are actually converging.

ATM was touted to be the seamless and scaleable networking solution - to be used in LANs, backbones and WANs alike. However, that did not happen. Ethernet, which was for a long time restricted to LANs alone, evolved into a scalable technology.

As Gigabit Ethernet products enter the market, both sides are gearing up for the battle. Currently, most installed workstations and personal computers do not have the capacity to use these high bandwidth networks. Therefore, the imminent battle is for the backbones, the network connections between switches and servers in a large network.

Gigabit Ethernet seems to be ready to succeed. It is backed by the industry in the form of the Gigabit Ethernet Alliance. The standardization is currently on schedule. Pre-standard products with claims of inter-operability with standardized products have already hit the market. Many Fast Ethernet pre-standard products were inter-operable with the standard. Therefore, it is expected that most pre-standard Gigabit Ethernet products will also be compatible with the standard. This is possible because many of the companies that have come out with products are also actively participating in the standardization process.

ATM-PON still has some advantages over Gigabit Ethernet:

1. ATM-PON is already there. It has a head start over Gigabit Ethernet. Current products may not support gigabit speeds, but faster versions are in the pipeline.

2. ATM is better suited than Ethernet for applications such as video, because ATM has QOS (Quality of Service) and different services available such as CBR (constant bit rate) that are better for such applications. Though the IETF (Internet Engineering Task Force, the standards body for Internet protocols) is working on RSVP, which aims to provide QOS on Ethernet, RSVP has its limitations. It is a "best effort" protocol, that is, the network may acknowledge a QOS request but not deliver it. In ATM, it is possible to guarantee QOS parameters such as maximum delay in delivery.

3. With PON in general, the components in the field are all passive (splitters, cabinets, etc.) and do not require power systems. As a result, the ongoing maintentance and operations costs of the field elements are expected to be lower than those corresponding costs for GigE.

4. ATM-PON is a mature technology compared to GigE, and is offered by well-established vendors. In comparison, GigE is typically provided by smaller private companies, which, especially in tough economic climates, face funding and long-term viability risk.

Gigabit Ethernet has its own strengths:

1. The greatest strength is that it is Ethernet. Upgrading to faster Ethernet is expected to be painless. All applications that work on Ethernet will work on Gigabit Ethernet. This is not the case with ATM. Running current applications on ATM requires some amount of translation between the application and the ATM layer, which means more overhead.

2. Currently, the fastest ATM products available run at 622 Mbps. At 1,000 Mbps, Gigabit Ethernet is almost twice as fast. GigE offers full-duplex operation at such higher speeds, and is not a shared resource like PON. So there are no capacity bottlenecks.

3. GigE supports multiple topologies without geographic or distance restrictions, making subscriber addition much simpler than PON, making capital investment coincide with revenue generation. With PON, typically all splitters will have to be deployed prior to subscribers joining, and may need some fiber re-runs in the event that new subscribers need to be added beyond the capacity of existing splitters.

4. GigE also supports multiple service providers on a single network more seamlessly than PON. PON is optimized for a sole provider business model, requiring additional lambdas (wavelengths) to support multiple service providers.

5. With IP Video services, GigE uses bandwidth capacity much more efficiently than PON by delivering channels only once to the curbside aggregation points and then replicating to multiple users. In contrast, PON does not use bandwidth very efficiently with IP video because it uses broadcast from the head-end, delivering all channels to every subscriber.

Merton does not make any specific recommendation to the town regarding the choice of one technology or the other. Instead, we suggest that the town make such a determination from an issue of a Request for Proposal (RFP), which will clearly indicate the credibility and capabilities of the various vendors, as well as the long-term viability of the vendors themselves.

3.5 Economics of PON versus GigE

This section uses the Hanover MBN analysis to illustrate the elements and cost comparisons of PON and Gigabit Ethernet technologies. Please note that this section presents a simplified set of numbers relative to the detailed budgetary financial analysis performed by Merton of MBN for the Town as part of this Feasibility Study and presented later in this document.

The assumed architecture for both networks includes a 2-fiber strand drop to subscribers and 36 strands of fibers in the backbone/feeder segments of the networks. The PON architecture has a maximum of 32 subscribers from each splitter while the GigE design has a maximum of 24 subscribers from each aggregator or remote box.

3.5.1.1 Network Cost Elements

The following table lays out the cost elements for PON and GigE architectures. The network is broken down into headend, field and subscriber elements.

	Headend Elements	*Field Elements*	*Subscriber Elements*
PON	• PON Cards/Optical Line Terminals (OLT) • ATM Switch • OC-3/OC-12 cards • Racks	• Splitters • Splitter cabinets • Taps & Splices	• Optical Network Terminal (ONT) or CPE • Management Software
GigE	• Access Distributor (Layer 3 Switch) • Hub Routers • Racks	• Access Concentrators and Remotes (Layer 2 Switch) • Enclosures • Power Systems	• Subscriber Gateway or CPE
Fiber Components	-	• Backbone / Feeder Cable	• Drop Cable
Services	• Headend Installation	• Outside Plant Services • Outside Plant Engineering	• CPE Deployment

3.5.2 Network Cost Analysis

The analysis here uses the engineering design developed by the Merton Group and presented in Section 4. To generate a fair comparison of PON and GigE architectures, a very similar physical fiber design was used to generate costs for electronics for the two technologies. In addition, it was assumed in both cases that incremental passive or active components in the field, as well as subscriber terminals (CPEs), would be added as subscribers signed up for services over the MBN. In other words, there would be a fixed cost component and a variable cost component for both architectures.

The summary results of the comparison of PON and GigE are shown below assuming 1,000 subscribers on the network; this represents an acceptance level of 35% of the Town households.

Unit	Fixed(1)	Variable(1)	Capacity	CAPEX	CAPEX per HH
Number Households (HH)				1,000	
CPE (End User Unit)		$1,000	1 per HH	$1,000,000	$1,000
Taps / Splice		$550	Max. 12 HH per Tap	$45,833	$46
Splitter & Splitter Cabinet	$7,000	$1,250	Max. 32 HH per Splitter; Max. 6 splitters per cabinet	$84,333	$84
ATM Switch & OC-3 Cards	$40,000	$4,000	Max capacity 15 OC-3 Cards per ATM Switch; peak data rate 2Mbps per User, avg. 20% utilization	$52,000	$52
OLT PON Card & Shelfs		$6,000	Max 64 HH per PON Card; Max 18 PON Cards per Shelf	$96,000	$96
OLT Rack	$10,000		Max 3 Shelves per Rack	$10,000	$10
Total Electronics Cost				$1,288,167	
Total Electronics per HH				$1,288	$1,288
Fiber Construction	$28,037		40 miles backbone, assuming 25 HH per mile	$1,121,472	$1,121
Home Drop Cost		$728	1 drop per HH	728,000	$728
Total Fiber Cost				1,849,472	
Total Fiber Cost per HH					$1,849
Total CAPEX				3,137,639	
Total CAPEX per HH					$3,138

(1) Reflects average list price with no discounts

The numbers for GigE design are shown below.

Unit	Fixed[1]	Variable[1]	Capacity	CAPEX	CAPEX per HH
Number Households (HH)				1,000	
CPE (End User Unit)		$1,000	1 per HH	$1,000,000	$1,000
Remote		$7,000	Max 24 100 Mbps port pairs with 10 km range	$294,000	$294
Concentrator		$7,000	Max 16 1 Gbps connections at 10 km range; Min 1 connection to Headend & rest to Remotes	$21,000	$21
Headend	$200,000	$10,000	Max 120 1 Gbps connections	$230,000	$230
Total Electronics Cost				$1,545,000	
Total Electronics per HH					$1,545
Fiber Construction	$28,037		40 miles backbone, assuming 25 HH per mile	$1,121,472	$1,121
Home Drop Cost		$728	1 drop per HH	728,000	$728
Total Fiber Cost				1,849,472	
Total Fiber Cost per HH					$1,849
Total CAPEX				3,394,472	
Total CAPEX per HH					$3,394

(1) Reflects average list price with no discounts

It is evident from the results that the fiber installation costs are not different between PON and GigE; in reality, there could be slight differences, but not material enough to note. The cost of GigE electronics is a bit higher on a per active user basis than that for PON; about 10%-15% higher.

However, it is important to note two facts: (i) GigE products are developing and emerging, and such costs are likely to drop more rapidly than PON products, a technology that is relatively more mature; (ii) GigE is today typically offered by smaller private companies that are likely to provide more significant discounts on their retail pricing than would the more established PON dealers.

It is also important to note that the fiber installation cost scales dramatically with number of active users because of the predominantly fixed nature of installation costs; about 80% of fiber install costs are backbone related and fixed, regardless of whether PON or GigE is used. On the electronics side, the costs are predominantly variable, resulting in less dramatic scaling with number of active users. About 90% of electronics is variable with number of active users for PON, with such ratio being slightly higher for GigE. This is important from the point of view of matching capital expenses with revenues from active users; both architectures are very attractive in this regard.

4. HANOVER PLANT DESIGN

This is a preliminary engineering analysis of the plant build for Hanover, NH. It is based upon an analysis of the town based upon direct analysis of the network size, demand, layout for coverage, and performance. The analysis is also based upon detailed field measurements, which are contained in detail herein. The analysis is NOT the final analysis of the cost to build, it is a preliminary analysis based upon the field engineering data. The main purpose of this report is to provide a review mechanism for the overall plan.

4.1 Objectives

The objectives of this report are as follows:

1. Establish the key design factors for the deployment of the MBN.

2. Determine the detailed design elements and do so in a fashion, which uses actual field measurements.

3. Develop a baseline network build plan for the town.

4. Perform a detailed analysis of the town and the elements, which will be part of the build plan. This includes the development of a data base of images of the key deployment elements, including; pole make ready issues, percent aerial, set back distances per HH, and frontage per HH.

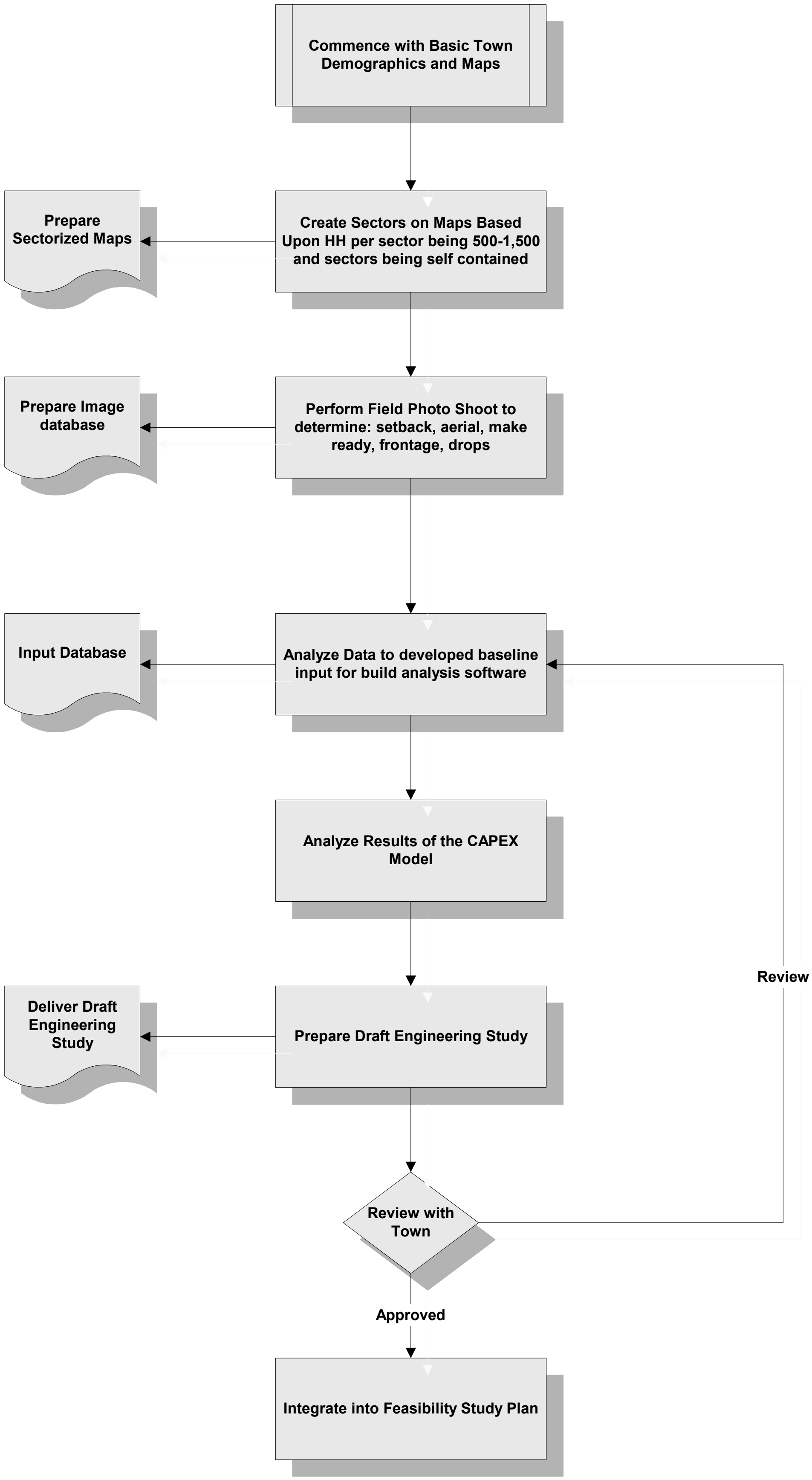
5. Use the detailed results to develop as preliminary design.

6. Using the preliminary design, develop a capital estimating model for the network

These elements have been accomplished and are contained herein.

4.2 Design Process

The actual process used in the development of the engineering analysis is shown in the following graphic which is further detailed in this report.


Commence with Basic Town Demographics and Maps
Create Sectors on Maps Based Upon HH per sector being 500-1,500 and sectors being self contained
Prepare Sectorized Maps
Perform Field Photo Shoot to determine: setback, aerial, make ready, frontage, drops
Prepare Image database
Analyze Data to developed baseline input for build analysis software
Input Database
Analyze Results of the CAPEX Model
Prepare Draft Engineering Study
Deliver Draft Engineering Study
Review with Town
Review
Approved
Integrate into Feasibility Study Plan

4.3 Network Layout

The network layout is based upon the constraints, performance, and to some degree upon the technology choice. The technology choice can be reduced to one of two types; PON, passive optical networking, and Giga Bit Ethernet, GigE. It has been shown elsewhere that they are both conceptually similar but have differing performance characteristics.

4.3.1 Design Constraints

The major design constraints are:

1. Total population: This is the total population of the town. The penetration of actual customers and their geographical distribution will be part of the market research effort. Moreover, there may be certain sections of the town, which are unreachable.

2. Total number of streets: The total number of served streets is critical. There may be large commercial areas or areas long in length, which are, not targets for the FTTH service. These must be identified. Commercial street locations may, however, be targets for commercial service provisions.

3. Frontage: The frontage is the average length of the front of a HH. It is a measure of local HH density. Large frontages may be an added cost to capital plant deployment.

4. Drop Lengths: The drop length is the distance from the point of the fiber on a pole to a local household. The drop may be aerial or buried. The nature of the buried fiber may also be a key cost element. Long drop lengths may be exceedingly costly.

5. Total Mileage: Total road mileage will be a key factor in the design. The "served" mileage will, however, be the driving factor.

4.3.2 Design Inputs

The following table depicts the key design inputs.

Design Input	*Implication*
Total Miles of Streets	This is the total street miles. It also requires a detailed analysis of what streets must be covered, a timing of the streets deployment and a preliminary discussion of commercial areas.
Total Number of Households	This is the total HH count. It is important to understand HH counts and user counts. Namely, there may be student or multiple HH residences.
Services Desired: -Broadband Internet Access -Video, Analog and Digital -Telephony	The actual services required must be factored into the overall design. This is a question of both service demand in size as well as timing. In addition, a detailed definition of the services will be required. This report focuses only on an IP supported infrastructure.

Design Input	*Implication*
Anticipated Location of Headend	The headend is “anticipated” to be at a certain location. Clustering of headends over multiple towns is also a strong possibility. This will be considered in detail in the later stages of the design process.
Streets Identified for Initial Build	The initial build streets must be identified for each quarter for the first two years. In this model, we have done so in a generic fashion. For the definitive model, this will need further work.
Percent Aerial Construction	This is a measure of the percent of fiber, which can be deployed on telephone poles.
Percent Buried / Trenched Construction	This is the percent of fiber, which must be buried.
Who Owns Poles and Aerial Rights of Ways?	The pole ownership must be clarified. Although not a key element of this study, it will be a key element in understanding the ultimate study results.
Who Owns Buried Rights of Ways?	This is the same set of issues as regards to pole rights.
Total Number Poles	This is the development of a data base of all poles, who owns them, where they are, what is on the poles, and an estimate of any and all make ready issues.
Average Distance Between Pole	This distance may be a standard for the town but should be understood at least on the sector level.
Pole Identification Numbers by Streets	This is the data contained in the pole database.
Average Setback of Homes	The setback is from the street but is typically measure from the nearest pole of buries access point. Thus setback is the gross effective setback measurement.
Known “Make-Ready” Issues	Make ready costs and times must be further understood. The model uses standard make ready costs for the region. Generally, these are consistent but must ultimately be reduced to a definitive number.
Is Electrical Space Available for Fiber Run?	The basic availability of space is a key issue. No space, no deployment. In most towns of interest, this is not a problem but must be ascertained.

4.3.3 Design Performance Issues

The following are the proposed performance factors for the design.

Performance Factor	*Measure*
Reliability	99.9%
Mean Time to Repair	< 2 hours
Delay or Latency of Packets	$< 10^{-6}$ sec
Maximum Downlink Data Rate per HH	100 Mbps
Maximum Uplink data rate per HH	100 Mbps
Minimum Downlink Data Rate	10 Mbps
Minimum Uplink Data Rate	10 Mbps
Bit Error Rate	Less than 10^{-9}

4.3.4 Design Methodology

The design methodology used in this study is intended for a feasibility study analysis and not a detailed design analysis. The basic elements are:

1. Sectorization of the network into sectors of generally comparable population and generally contiguous streets or accessibility.

2. Field evaluation of the frontage, set back, aerial percentages, make build costs, and drop availability using a photo database and sampling techniques is performed.

3. Data analysis of field information to develop a sectorized financial model.

4. Use of two basis technologies, PON and GigE, and using averaged industry pricing numbers for the development of a pricing model for all capital plant.

5. Overall, network optimizations and analysis using field data, vendor average price data, and optimized design methodologies for a capital plant deployment cost analysis.

4.4 Analysis of Plant Build

This section details the basic design and analysis methodology. It must be repeated that this is a Feasibility study and not a detailed design study. It is most likely that any third party making a bid to perform the work discussed herein may have a different design and in addition, there may be added design factors that may not have been included herein.

Thus, the methodology chosen is used for feasibility analysis only.

4.4.1 Methodology

The methodology is composed of several elements. The approach consists of the following steps:

1. Establishment of Headend.

2. Sectoring the town. This step breaks the town into sectors of no more than 1,500 HH and has sectors with generally consistent characteristics.

3. Establish of the network elements.

4.4.1.1 Headend

The headend is the key location for the central interconnection of all inbound and outbound communications. The headend is selected for each tow although it may be possible to combine headend for common towns.

4.4.1.2 Network Elements

The network is a series of a bundle of fibers. A typical bundle may have upwards of 36 strands of fiber. The end goal is to have a strand or strand pair per HH. The ability to perform this interconnection is based upon the integration of three units; the CSU, the FSU, and the EUU. The CSU is the main interconnection point, the FSU is a branching and sharing point, and the EUU is in the household.

The network has the following elements:

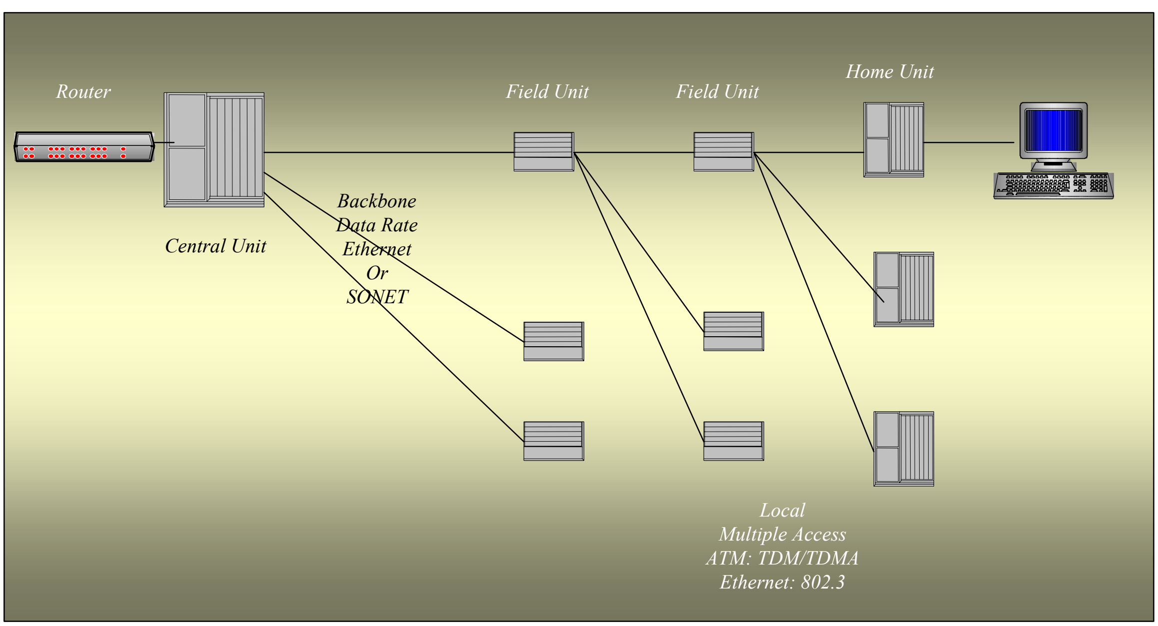
Central Service Unit (CSU): This unit provides for the interconnection of any and all inbound and outbound communications. The unit had a fixed initial capacity, say 8,000 users, and variable capacity say 2,000 users per new unit element. These numbers will vary depending on the vendor. The CSU provides for interconnectivity of all services and its price and variability will depend upon the service mix. The CSU is in the headend.

Field Service Unit (FSU): The FSU interconnects a single or pair of fibers to multiple bundles of fiber. The fibers coming from the CSU are carrying a high-speed data backbone service of 1 Gbps or greater in both directions. The FSU then shares this amongst multiple outbound fiber bundles. The FSU has a fixed cost element for a minimal number of outgoing fiber bundles and a variable amount. In addition, the FSU has a maximum capacity of outgoing fiber bundles. The FSU is a branching element, which “shares” the bandwidth or data rate on the backbone with all end users on the final terminating leg. This is generally the bottleneck in any network. In PON designs, this is fixed and in GigE, this can be dynamically managed.

End User Unit (EUU): The EUU is the household interconnection device. It connects to the fiber or fiber pairs and then to the in home Internet access, telephony, or video.

The typical network is shown below:

Basic Architecture



4.4.2 Sectorizing

Sectorizing is based upon two factors:

1. Maximum capacity per single fiber bundle.

2. Commonality and clustering of proximate neighborhoods.

As stated above, the FSU has a maximum capacity. This again depends upon the specific vendor and technology. However, this means that sectors must be no larger than a single FSU capacity. The design initially starts with 50% or less maximum loading per sector. It should be noted that new sectors can be added at any time if additional capacity is required.

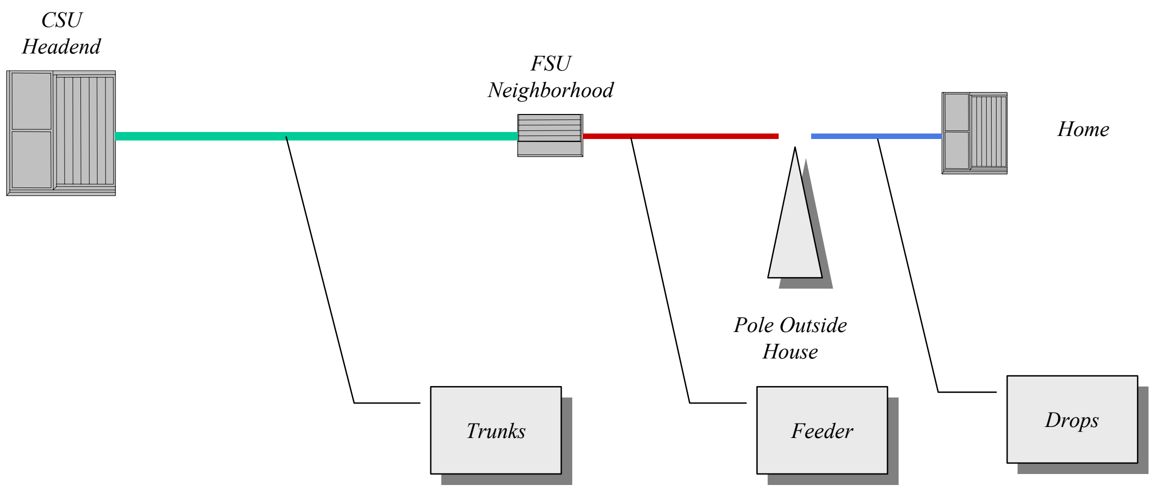
The second issue is that the sectors should have some commonality in terms of end users; household since, setback, frontage, aerial or otherwise, or other similar factors.

4.4.2.1 Network Layout

The network is deployed with an initial deployment of a fiber bundle to each sector, which connects to an FSU in each sector.

The three elements are shown below. They figure generally depicts the three elements of trunk, feeder and drop. The financial model uses this nomenclature and build costs elements.

Generic Fiber Network Elements



4.4.2.1.1 Trunking

Trunks are from the headend to the FSU. They are the high speed backbone elements of the network. The general scheme is a trunk is co-located with a sector. There may be more than one trunk per sector, however. In the initial designs a trunk and a sector are unique. The trunk has 48 fiber bundles, each fiber going to a FSU. The trunk may be most likely aerial. It will typically follow a major road but that will often be determined by the make ready costs associated with the poles on that route.

4.4.2.1.2 Feeders

From each FSU to each home there is a set of feeder cables. The feeders are sets of bundles emanating from a FSU. The number of bundles and in turn the number of feeder cables will depend on technology but multiple ones are possible. Thus with a 48-strand trunk, and having a minimum of say 2 feeder per FSU, one can achieve 2X48X48 HH to be served, or 4,608 HH with that design alone.

4.4.2.1.3 Drops

The drops are the strands from the feeder to a single household. The drops are measured in what is termed set back distances. Whereas the trunks are typically 10-20% of the total road mileage, and the feeders make up the rest, the drops may become a significant additional set of build if the build requires large set back distances.

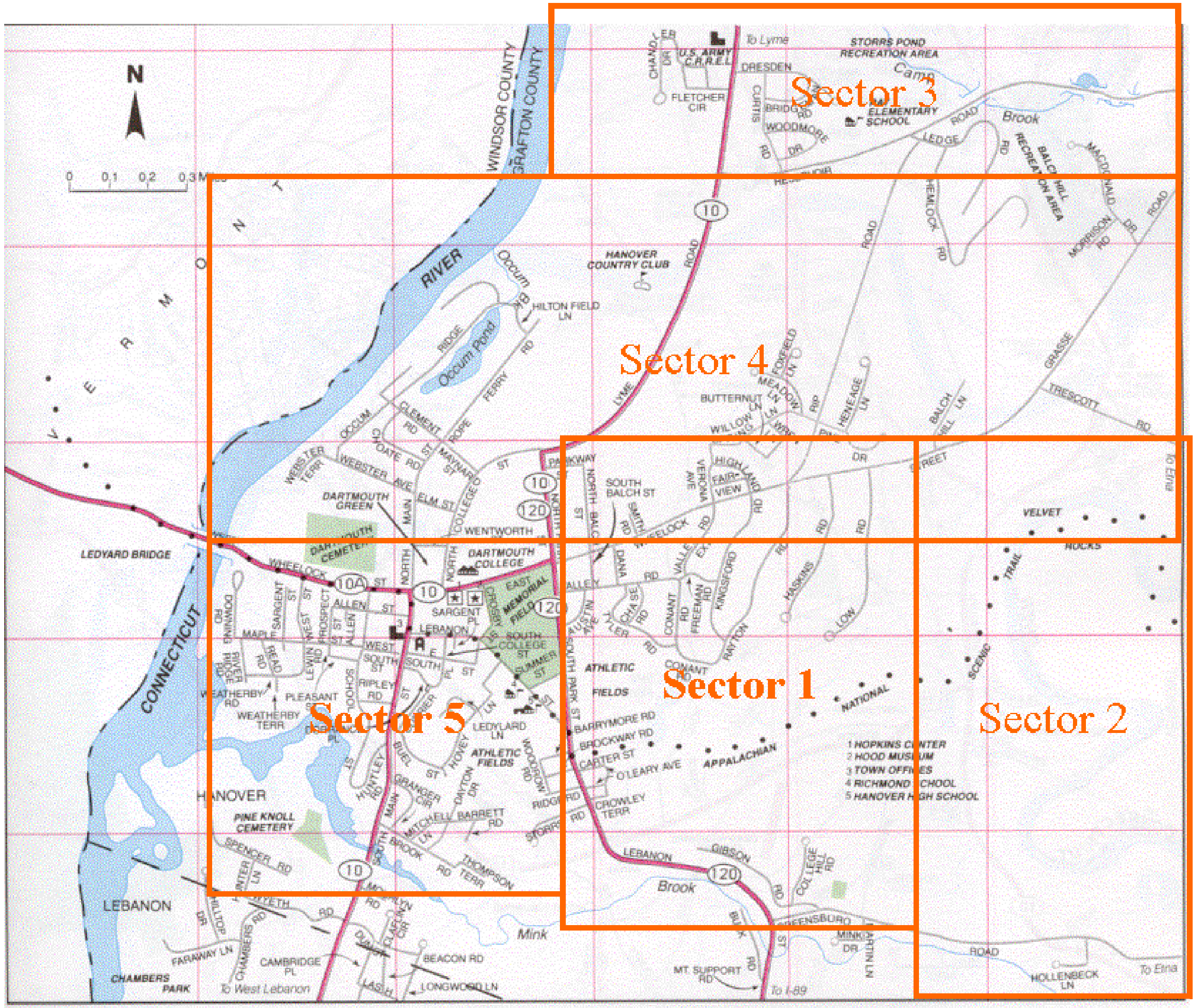
4.5 Results

This subsections details the overall design based on the field analysis. On March 31, 2003, the Merton team made field analysis of all of Hanover. The town was sectored and each sector had a drive through. Data were recorded both quantitatively as well as with images. The image date is shown in the final section of this report.

4.5.1 Sector Design

The following figure depicts the Hanover sector map. The town was divided into 5 sectors. They are shown on the map, which is contained in the following.

Based upon the field analysis, the following map shows the network trunk network design. Feeders are then brought out to serve the remainder of the sectors.


Sector 1
Sector 2
Sector 3
Sector 4
Sector 5
N
0 0.1 0.2 0.3 MILES
HANOVER
LEBANON
CONNECTICUT RIVER
WINDSOR COUNTY
GRAFTON COUNTY
HANOVER COUNTRY CLUB
DARTMOUTH COLLEGE
DARTMOUTH GREEN
LEDYARD BRIDGE
PINE KNOLL CEMETERY
STORRS POND RECREATION AREA
U.S. ARMY C.R.R.E.L.
ATHLETIC FIELDS
APPALACHIAN
NATIONAL
SCENIC
TRAIL
VELVET
ROCKS
1 HOPKINS CENTER
2 HOOD MUSEUM
3 TOWN OFFICES
4 RICHMOND SCHOOL
5 HANOVER HIGH SCHOOL
To Lyme
To Etna
To West Lebanon
To I-89

4.5.2 Basic Network Build Data Analysis

The following data depicts the network summary data for each sector. The raw data is contained in the end of this report.

The first table, shown below, depicts the overall breakout for the town. It is an estimated population and street mile count per sector. These numbers will be used with the field data to estimate the sector setback, aerial and make ready requirements. It is important to reiterate that the data are samples with feasibility study accuracy. The results are not to be relied upon for a definitive build. In that latter case, it will be required to perform a detailed design study.

Sector	Population	Percent	Street Miles	Percent
1	850	30%	16	18%
2	850	30%	23	26%
3	566	20%	25	28%
4	566	20%	14	16%
5	283	10%	11	12%
				100%
Total HH:	2,832			
Total Miles Streets:	90			

4.5.3 Setback

The following table depicts the summary analysis for the setback. As expected, some regions have significant set back and others are small. The average setback is shown in the analysis.

Sector	Street Miles	Average Set Back	Weighted Average Setback
1	16	115	29
2	23	133	33
3	25	200	40
4	14	140	28
5	11	86	9
Total Average Set Back			139

4.5.4 Make Ready

A similar analysis has been performed on the make ready amounts. Significant make ready is required in some areas. However, the overall make ready is less than 30%.

Sector	Street Miles	Average Make Ready	Weighted Average Make Ready
1	16	38%	9%
2	23	67%	17%
3	25	8%	2%
4	14	0%	0%
5	11	13%	1%
Total Average Make Ready			29%

4.5.5 Aerial

The amount aerial has been calculated. The town is mostly aerials and buried requirements are minimal.

Sector	Street Miles	Average Aerial	Weighted Average Aerial
1	16	100%	25%
2	23	100%	25%
3	25	67%	13%
4	14	100%	20%
5	11	100%	10%

Total Average Aerial 93%

5. FINANCIAL ANALYSIS

5.1 Market & Service Assumptions

The primary market base for MBN services constitutes all residential users in the Town of Hanover. There are approximately 2,800 parcels in the town.

The three services potentially offered by service providers over the MBN are:

1. *Broadband Internet access:* the network could provide data speeds ranging between 10 Mbps to 100 Mbps, and in some instances, in excess of 100 Mbps, on an as per needed basis.
2. *Video Services:* the network may be able to provide the user with access to analog and digitized video services. This may also enable the provisioning of interactive video services. This would also support High Definition TV (HDTV).
3. *Telephony (Voice):* The system may provide fully switched toll grade quality voice service. The voice quality may be telephone toll grade or better and there may be no delays in speech that are perceptible to the user.

The market research study for Hanover indicates that __% of current residents are likely to switch to broadband Internet access if it is offered at $40 per month. The results also indicate that __% of current residents will buy video services if it is available at $40 per month.

The financial model presented here makes the following assumptions:

1. The MBN is used to provide only broadband Internet access to the citizens of Hanover.
2. The MBN is used to provide services to only residential customers in Hanover, not the commercial or business customers.

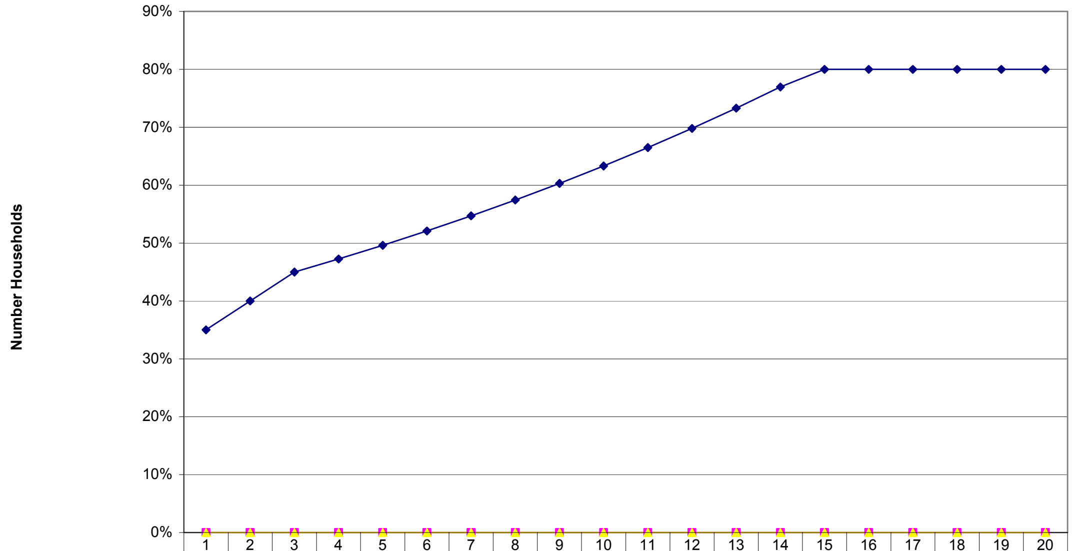
Both assumptions above are conservative. With the first assumption, we ignore potentially significant revenues from other sources including telephony services, sale of dark fiber[2] to local businesses and CLECs, etc. With the second assumption, we ignore potentially significant revenues from the entire business community in Hanover from the use of the MBN. We have made these assumptions to provide a conservative analysis and maintain simplicity of the model.

The model also assumes that at the beginning of the first year of operations, 25% of Hanover residents sign up for broadband Internet access. By the end of the first full year of operations, 35% of Hanover residents would have converted to the MBN for broadband Internet access; this is an average penetration for the first year of 30%. This acceptance rate is slowly increased to about 50% by the end of year 5 and 65% by end of year 10. This is quite conservative given the acceptance rate for broadband estimated from the market research, and compared to acceptance rates for similar services in other towns/municipalities[3].

The chart below captures the acceptance rate used in the financial model.

[2] Dark fiber is fiber strands in a network that are not used to carry traffic. A typical fiber backbone network will have many such fiber strands that are "empty"; for example, out of say 48 fiber strands installed, only 6 might be used to carry traffic and reserved for redundancy. The remaining could potentially be sold by the town on long-term contracts to businesses or ISPs/CLECs interested in gaining ownership of last-mile fiber in the town.

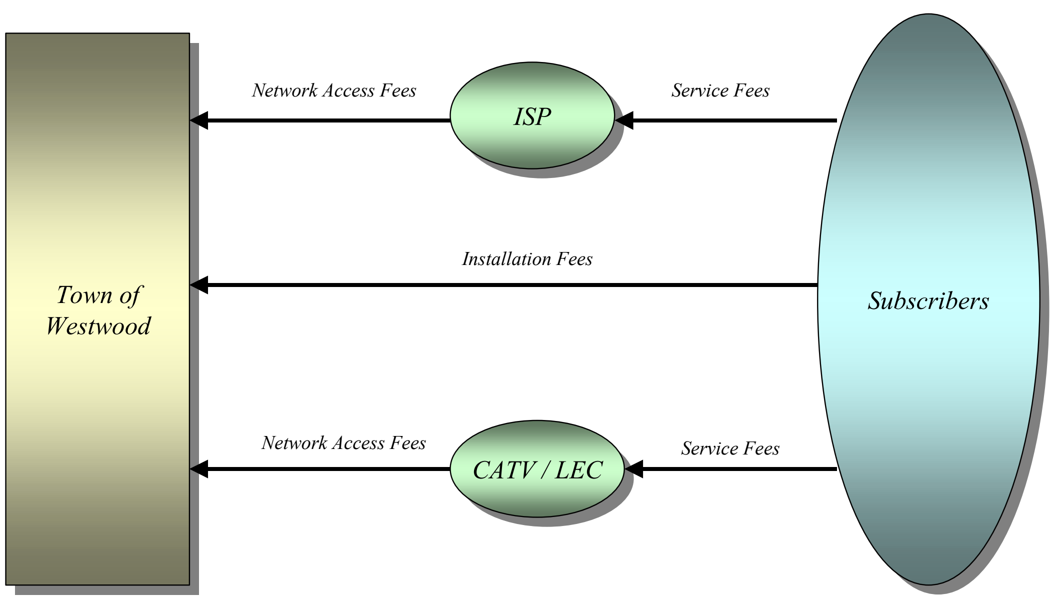
[3] Norwood, MA has achieved over 60% acceptance on its municipal network in less than 18 months; similar acceptance rates have been experienced in many other cases including Tacoma, WA and Lagrange, GA.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
EOY % Broadband Internet	35%	40%	45%	47%	50%	52%	55%	57%	60%	63%	66%	70%	73%	77%	80%	80%	80%	80%	80%	80%
EOY % Video	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
EOY % Telephony	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

5.2 Revenue Model and Pricing Assumptions

According to the MBN business idea discussed with Hanover, the MBN is a fully open-access network to which any and all service providers can interconnect to deliver services to the citizens of the town. Such service providers could be ISPs like AoL and MSN, cable TV providers like Aol Time Warner and DirectTV, or local exchange carriers. Such service providers will use the MBN as a broadband pipe to deliver their services to end-users. The town will receive a monthly fee from each one of these service providers for access or rental use of the MBN. In other words, the end-user (subscriber) pays the service provider for the service he/she receives, and the service provider pays the town, network access fees. In addition, the town could charge the subscriber an installation fee for providing connectivity to the MBN; this will be a one-time fee paid by the subscriber when service is turned on. The following chart captures the revenue flow relationship between the subscriber, the service provider and the town:



The model essentially considers two sources of revenues to the town:

1. *Installation Fee:* a one-time fee of $50 per subscriber for installing MBN connectivity. This fee is like the residential installation charge for say DSL or satellite.
2. *Network Access Fee (for broadband Internet access):* a recurring fee of $25 per subscriber per month that an ISP will pay the town. In other words, the ISP will charge the subscriber say $50 for 10 Mbps Internet access, email, etc, and out of that $50, will pay the town $25 as network access fee. This fee is likely to go up gradually because the larger ISPs are likely to offer increasingly value added content in their service package at higher prices if subscribers are willing to buy; the town can then get its share of such enhanced services in higher access fees.

No revenues from video or telephony services are considered. Please note that the financial model presented here assumes network access revenues from only one ISP and only one cable TV provider. In reality, there will likely be multiple ISPs, CATV/dish providers and even CLECs paying the town for access to the MBN.

The key assumption factors are presented below for the first 10 years of MBN operation. Please note that the business users (large businesses and Small & Medium Enterprises (SME)) are not considered revenue-generating customers for the purpose of this model.

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
EOY Large Business Users	-	-	-	-	-	-	-	-	-	-
EOY SME Users	-	-	-	-	-	-	-	-	-	-
EOY Households	991	1,133	1,274	1,338	1,405	1,475	1,549	1,626	1,708	1,793
Total EOY Users	991	1,133	1,274	1,338	1,405	1,475	1,549	1,626	1,708	1,793
Total EOY Users Penetration %	35%	40%	45%	47%	50%	52%	55%	57%	60%	63%
Total Avg Number End-Users	850	1,062	1,204	1,306	1,372	1,440	1,512	1,588	1,667	1,751
Avg Penetration End-Users	30%	38%	43%	46%	48%	51%	53%	56%	59%	62%
Broadband Internet Access										
EOY Penetration Large Businesses	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
EOY Penetration SMEs	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
EOY Penetration Households	35%	40%	45%	47%	50%	52%	55%	57%	60%	63%
EOY % Broadband Internet	35%	40%	45%	47%	50%	52%	55%	57%	60%	63%
Installation Charge Large Businesses	-	-	-	-	-	-	-	-	-	-
Installation Charge SMEs	-	-	-	-	-	-	-	-	-	-
Installation Charge Households	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50
Avg Fee/ Month/ User Large Businesses	-	-	-	-	-	-	-	-	-	-
Avg Fee/ Month/ User SMEs	-	-	-	-	-	-	-	-	-	-
Avg Fee/ Month/ Households	$25	$27	$28	$30	$32	$33	$35	$38	$40	$42

5.3 Network Deployment Assumptions

As presented in prior sections, Merton has developed a detailed network design for Hanover as part of this feasibility study. This includes the identification of head-end location, layout of the network and topology, identification of pole make-ready issues, requirements of trenching versus aerial construction, location of field electronics, and other engineering and design issues.

For the sake of this financial analysis, the MBN is separated into two physical components:

1. The backbone network and associated electronics, including head-end installations
2. Fiber drops, or fiber extensions to subscribers, along with associated subscriber electronics

The financial model makes the following assumptions:

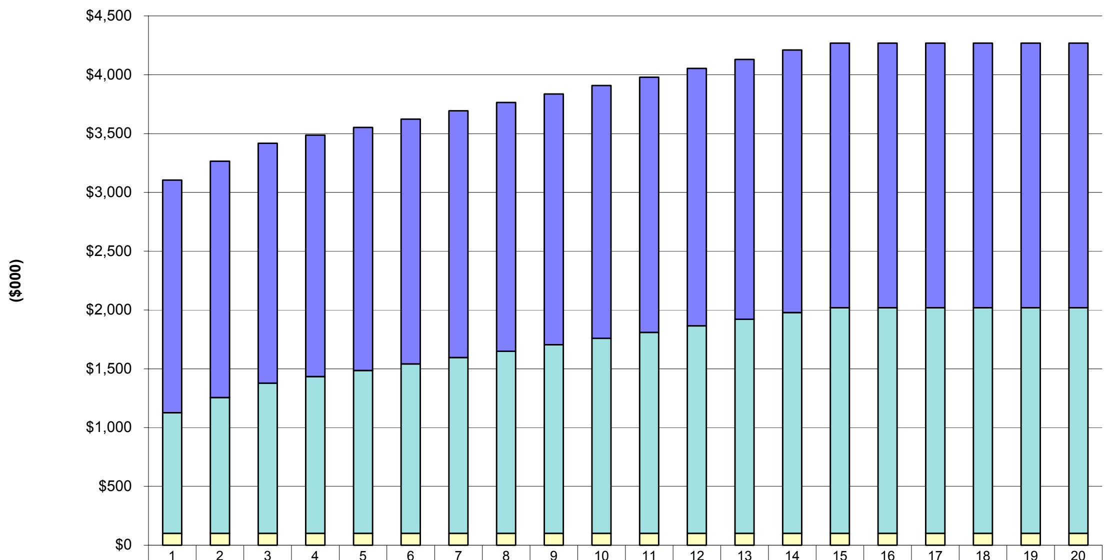
- The backbone network will be built out over 70% of approximately 90 miles of streets in Hanover as part of the initial build
- As subscribers sign up, fiber drops will be installed, along with subscriber electronic units
- Trenching versus aerial construction assumptions are as per the engineering design presented
- “Make Ready” requirements and costs are as per the engineering design presented
- The backbone network and feeders will have 48 strands of fiber; each subscriber location will get 2-strand fiber drops
- Electronics costs decline slowly over a period of time, reflecting historical trends in technology pricing
- A discount off the retail price will be available from both PON and GigE vendors
- The financial analysis models both PON and Gigabit Ethernet; the upfront costs are not significantly different between the two technologies

5.4 Capital Expenditures

The capital expenses for building MBN were analyzed for both PON and GigE architectures. This section presents the results for PON. Based on the above network architecture and assumed acceptance rates of the MBN, the total capital expenses for the MBN, including all network components, are as follows:

- Initial capital of about $3.3 million in the first two years, which enables approximately 40% of Hanover households to get serviced for broadband Internet access
- Total capital expenses of approximately $4.3 million over 20 years, which would enable servicing of 80% of households for broadband Internet access

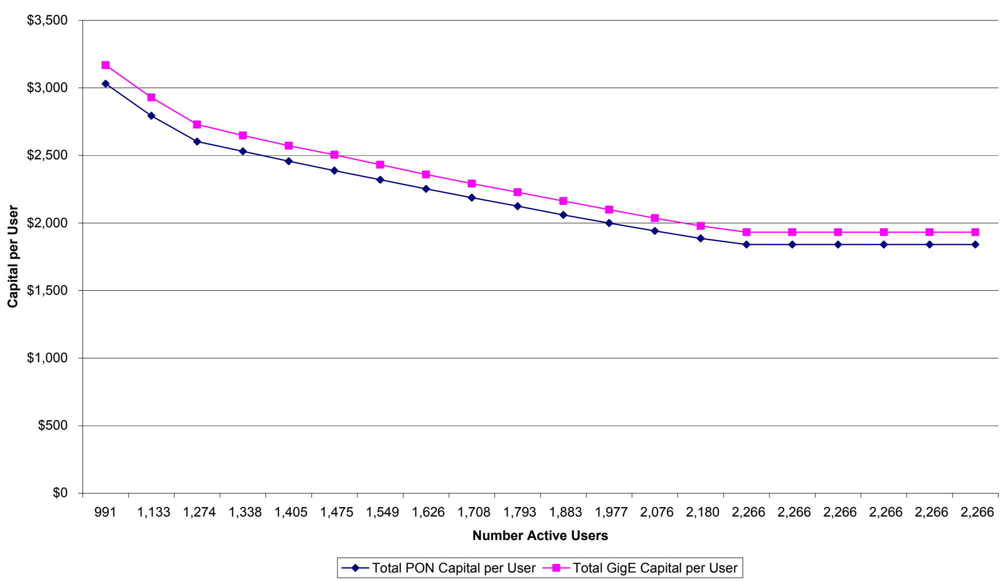
The chart below shows the total capital expenses incurred over 20 years.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Fiber Installation Capital	$1,978	$2,009	$2,039	$2,053	$2,067	$2,082	$2,098	$2,114	$2,132	$2,150	$2,169	$2,189	$2,210	$2,233	$2,251	$2,251	$2,251	$2,251	$2,251	$2,251
Equipment Capital	$1,026	$1,156	$1,278	$1,334	$1,385	$1,441	$1,496	$1,549	$1,605	$1,660	$1,710	$1,765	$1,821	$1,878	$1,919	$1,919	$1,919	$1,919	$1,919	$1,919
Other Capital	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100

The chart clearly shows that the fiber installation capital (backbone network installation) grows much more slowly than equipment capital. This is because the major component of ongoing capital expenses is the subscriber electronics, and those expenses are incurred only as new users are added to the network. The variable cost component of MBN that varies with number of active users increases from 35% of total costs in the first year to almost 50% eventually as new users are added.

The capital per active subscriber decreases rapidly over time as the number of users increase, and the initial buildout costs of the network is amortized over a larger and larger user base. As shown below, the capital per user is not significantly different between PON and Gigabit Ethernet technologies. PON introduces a higher cost element as a result of adding video capabilities to the network; without video, PON would be cheaper on an active user basis.



5.5 Financing (Bond) Assumptions

The assumption here is that Hanover will finance the MBN capital costs with the issue of a 20-year tax-exempt municipal bond. We have modeled such a financing at current interest rates for Hanover's credit rating based on an issuance through the conduit issuer New Hampshire Municipal Bond Bank (Aa2 from Moodys). The bond will be issued approximately 6-9 months before such construction period; only interest will be paid on the bonds during the construction period and during the first full year of operations; after this period, both principal and interest will be paid starting the second year of operations. Starting the second year, debt service will be level, i.e., the same amount of interest + principal will be paid on a periodic basis.

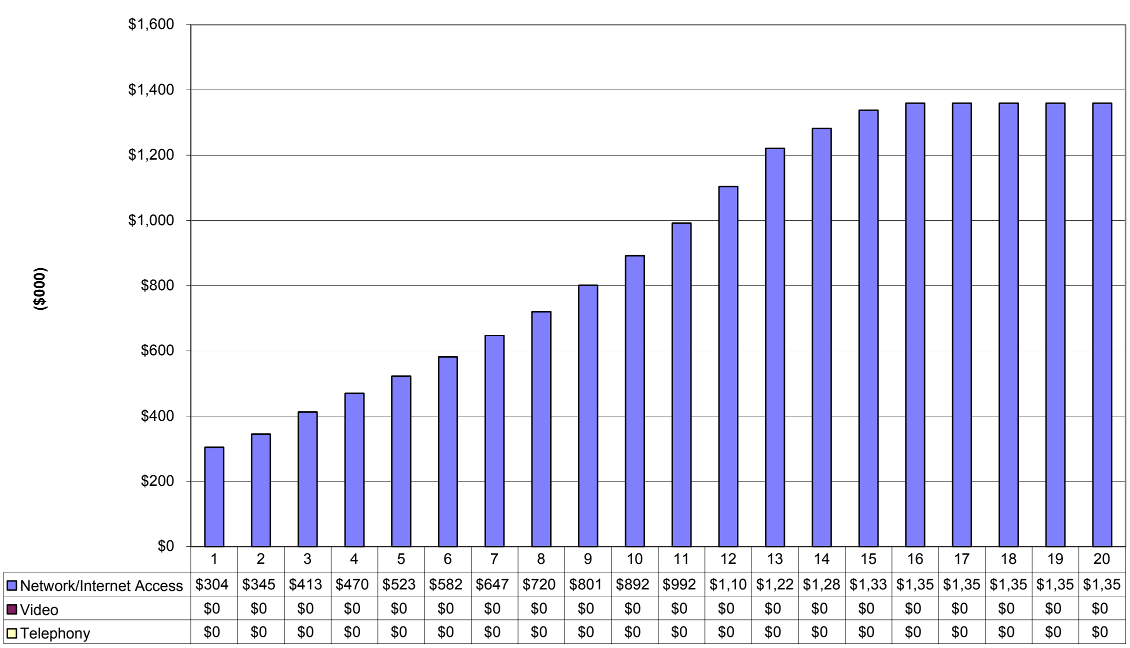
The MBN project for Hanover would require a bond issue of approximately $3.3 million. This is sufficient to finance all capital, operating expenses and bond debt service until such time that the MBN generates sufficient revenues to cover not just ongoing capital needs but also all operating expenses and bond debt service. According to our analysis, the MBN will generate sufficient revenues from Year 4 onwards to sustain all ongoing capital, operating and debt service expenses.

The bond schedule is shown below for the first ten years.

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Beginning Principal ($000)	$3,260	$3,260	$3,144	$3,022	$2,896	$2,764	$2,626	$2,483	$2,333	$2,177
Interest Rate (%)	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%
Interest Payment ($000)	$139	$139	$134	$128	$123	$117	$112	$106	$99	$93
Principal Payment ($000)	$0	$116	$121	$127	$132	$138	$143	$149	$156	$162
Total Debt Service ($000)	$139	$255	$255	$255	$255	$255	$255	$255	$255	$255
Ending Principal ($000)	$3,260	$3,144	$3,022	$2,896	$2,764	$2,626	$2,483	$2,333	$2,177	$2,015

5.6 Revenues

As mentioned before, the financial model assumes that the town generates revenues from three kinds of fees; up-front installation fee and ongoing network access fees for broadband Internet access. For the acceptance rates of subscribers assumed, the revenue of the town is as shown below:



It is clear that the revenue opportunity to Hanover is significant, starting at $300,000 in the first year, increasing to almost $1.4 million per year in 20 years. If other potential sources of revenue not modeled here are included, like business sector revenues, telephony revenues, and revenues from sale of dark fiber, these numbers could be substantially higher, by a factor of 100% or more.

5.7 Operating Expenses

The town will incur operations expenses in the following categories:

1. *Fiber Backbone Maintenance & Operations:* The fiber backbone will require monitoring and first level maintenance. The architecture of the fiber may be a ring based architecture and the failure modes will be this generally on the tail elements. The First Level Maintenance, FLM, on this element will require a 24X7 force, which can establish repairs in less than 2-6 hours. This can be achieved with a third party contract especially since there will be anticipated regional expansion, for example, through Merton's Network Operations Center (NOC).

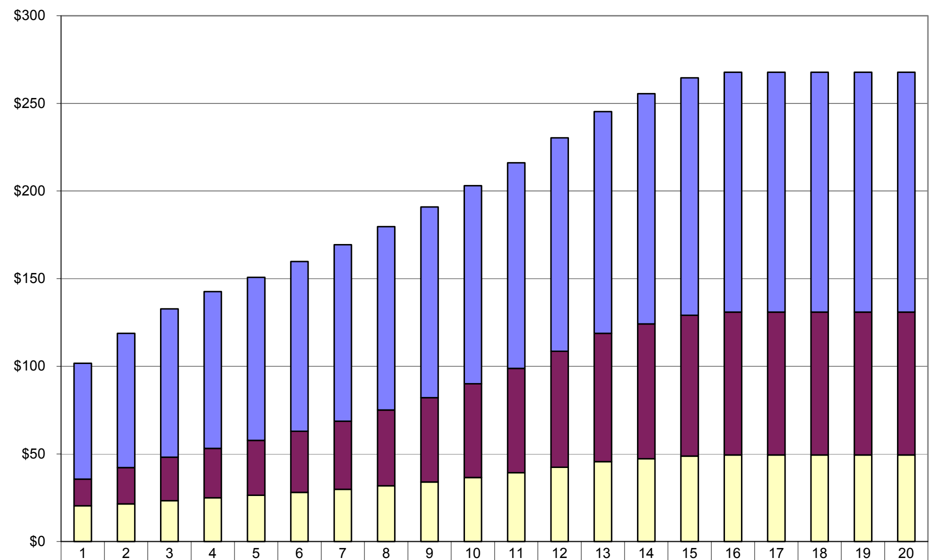
2. *Electronics Maintenance & Operations:* This is the monitoring and first level maintenance of the electronics. Generally, the vendor or some related third party supports this effort. The efforts are based upon a Service Level Agreement (SLA) with the vendor and the vendor may use a related third party like Merton. The costs are a small percent of the installed base annually.

3. *Sales Management and Development:* The most critical element is the sale management and development. For example, the establishment of an AoL agreement and the management of that relationship is a Merton function. The extension to msn, Earthlink and others is also a Merton function. The expansion to video and telephony and the contract negotiation is a Merton function.

4. *Billing & Administration:* The town will have some minimal expenses related to billing of service providers and related overhead and administration costs; these are functions that the town is fully equipped to handle, and could potentially be done using existing personnel.

Please note that the town will not have any Customer Service related expenses because that is the responsibility of the service provider (ISPs, etc.) who owns the customer. Merton's NOC will handle any network related customer issues; the service provider will handle everything else at their cost.

The anticipated operating expenses to the town are shown below for 20 years:



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Network Operations & Maintenance	$66	$77	$85	$89	$93	$97	$101	$105	$109	$113	$117	$122	$126	$131	$135	$137	$137	$137	$137	$137
Sales Commissions	$15	$21	$25	$28	$31	$35	$39	$43	$48	$53	$60	$66	$73	$77	$80	$82	$82	$82	$82	$82
Billing & Administration	$20	$21	$23	$25	$26	$28	$30	$32	$34	$37	$39	$42	$46	$47	$49	$49	$49	$49	$49	$49

Before depreciation and interest expenses, the operating margin of the town is expected to increase from approximately 70% in the early years to about 80% in the later years of operation.

5.8 Financial Pro Forma

The financial projections for the MBN project for the first 10 years is shown below; the pro forma also shows the bond interest expenses during the construction period:

Year	0H2	1	2	3	4	5	6	7	8	9	10
Total Revenue											
Internet Access		$304,440	$344,796	$412,789	$469,919	$522,819	$581,687	$647,196	$720,097	$801,224	$891,506
Video		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Telephony		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Revenue		$304,440	$344,796	$412,789	$469,919	$522,819	$581,687	$647,196	$720,097	$801,224	$891,506
Operating Expenses											
Network Operations & Mainenance			$76,593	$84,643	$89,471	$93,039	$96,842	$100,740	$104,687	$108,814	$113,051
Sales Commissions		$15,222	$20,688	$24,767	$28,195	$31,369	$34,901	$38,832	$43,206	$48,073	$53,490
Billing & Administration		$20,372	$21,482	$23,352	$24,923	$26,378	$27,996	$29,798	$31,803	$34,034	$36,516
Total Operating Expenses		$101,759	$118,763	$132,762	$142,589	$150,785	$159,739	$169,370	$179,695	$190,921	$203,058
Operating Profit		$202,681	$226,033	$280,028	$327,330	$372,034	$421,948	$477,827	$540,402	$610,303	$688,449
Operating Profit %		67%	66%	68%	70%	71%	73%	74%	75%	76%	77%
Depreciation Expense		$326,495	$341,692	$348,655	$355,210	$362,280	$369,389	$376,365	$383,631	$390,942	$397,899
Operating Income		($123,814)	($115,658)	($68,628)	($27,880)	$9,753	$52,559	$101,462	$156,770	$219,361	$290,550
Operating Margin		-41%	-34%	-17%	-6%	2%	9%	16%	22%	27%	33%
Interest Expense	$69,275	$138,550	$138,550	$133,601	$128,441	$123,062	$117,454	$111,609	$105,514	$99,161	$92,537
Net Income	($69,275)	($262,364)	($254,208)	($202,228)	($156,321)	($113,309)	($64,895)	($10,147)	$51,256	$120,201	$198,012
Net Income Margin		-86%	-74%	-49%	-33%	-22%	-11%	-2%	7%	15%	22%

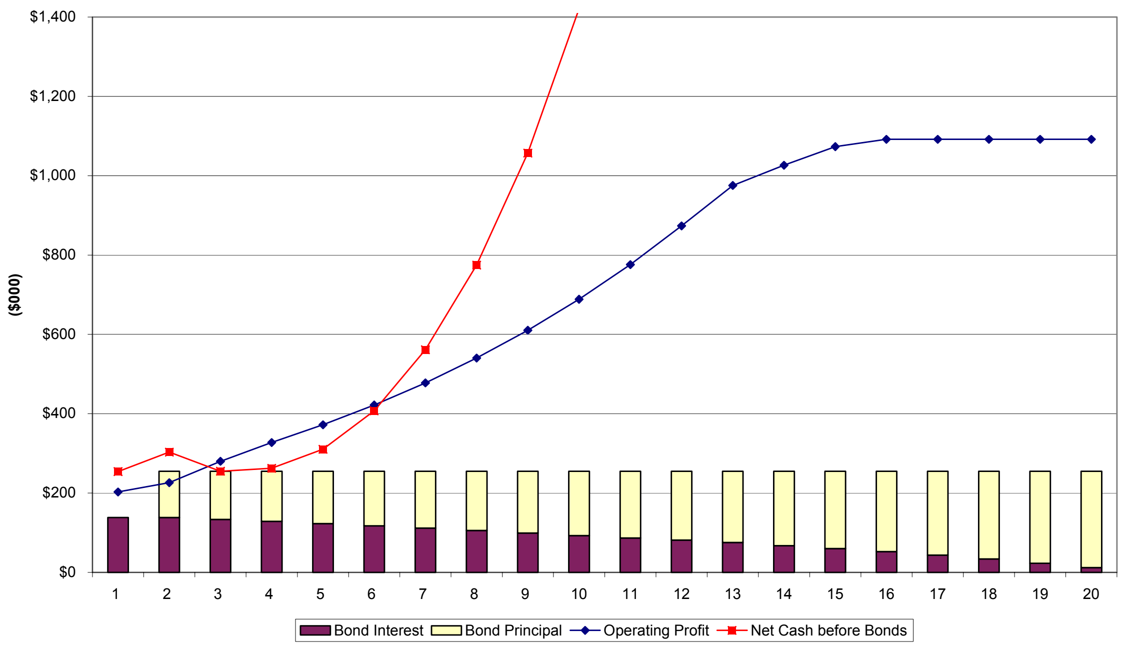
5.9 Bond Coverage

Based on the above analysis of revenues, operating expenses and financing, the anticipated bond coverage (sufficiency of operating profits or net cash to cover bond interest and principal payments) can be determined. The annual debt service payments on the bonds are about $260,000. Please note the following:

- Our financial model sizes the bonds such that the proceeds from the bonds are sufficient to meet all uses of cash (net of revenues) related to the MBN project, until such time that the project becomes cash flow positive (4th year of operations). In other words, the town would borrow enough upfront to always have enough cash on hand to meet all project expenses.

- The cumulative cash position is initially positive, and gradually decreases to a small amount by the 3rd year of operations; the cash then starts to build up after the 4th year

- After the 4th year, the network becomes “self-funded” in the sense that the network generates enough revenues to cover all cash expenses, including operating costs, capital expenditures and debt service.



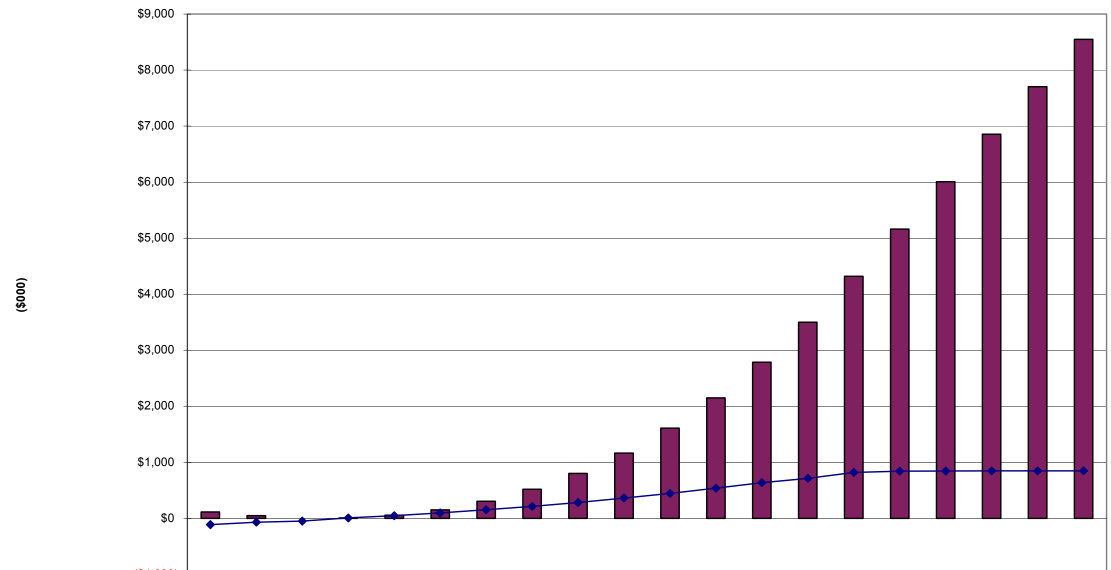
Starting the 3rd year of operations, operating profits (revenues less operating expenses) exceed bond debt service; by the 5th year, such coverage is 150%, by the 10th year, it is 300% and by the 20th year, it is 450%. In the first two years of operations, there is enough cash from the bonds to pay for debt service. Starting the 4th year of operations, the net cash available (after capital expenses) provides coverage of debt service. Such cash coverage of the bonds increases rapidly and dramatically to over 500% in the 10th year and over 3400% by the 20th year (not shown in chart).

5.10 Cash Flow

The MBN project becomes free cash flow positive in the 4th year of operations. The cumulative cash position is always positive, as explained above. The cumulative cash from the project increases to over $1.2 million by the 10th year and almost $9 million by the 20th year of operations. The table below shows the detail cash flow pro forma for the first 10 years.

Year	0H2	1	2	3	4	5	6	7	8	9	10
Cash Flow:											
Operating Income	$0	($123,814)	($115,658)	($68,628)	($27,880)	$9,753	$52,559	$101,462	$156,770	$219,361	$290,550
+ Depreciation	$0	$326,495	$341,692	$348,655	$355,210	$362,280	$369,389	$376,365	$383,631	$390,942	$397,899
+ Municipal Debt	$3,260,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
- Interest Pmt on Debt	$69,275	$138,550	$138,550	$133,601	$128,441	$123,062	$117,454	$111,609	$105,514	$99,161	$92,537
- Capital Expenditures	$3,104,501	$160,451	$151,964	$69,637	$65,546	$70,706	$71,080	$69,765	$72,665	$73,106	$69,568
- Principal Pmt on Debt	$0	$0	$116,455	$121,404	$126,564	$131,943	$137,551	$143,397	$149,491	$155,844	$162,468
- Financing/Misc. Fees	$118,857	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
- Change in Working Capital	($258,708)	$14,247	($113,488)	$3,447	($700)	($1,580)	($1,152)	($803)	($646)	($165)	$444
Free Cash Flow	$226,075	($110,567)	($67,447)	($48,061)	$7,479	$47,902	$97,015	$153,860	$213,378	$282,357	$363,432
Cumulative Cash Flow	$226,075	$115,509	$48,061	$0	$7,479	$55,381	$152,396	$306,256	$519,634	$801,991	$1,165,423

The chart below shows summary cash from the project over 20 years.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cumulative Free Cash Flow	$116	$48	$0	$7	$55	$152	$306	$520	$802	$1,165	$1,610	$2,148	$2,786	$3,501	$4,320	$5,162	$6,008	$6,854	$7,701	$8,549
Free Cash Flow	($111)	($67)	($48)	$7	$48	$97	$154	$213	$282	$363	$444	$538	$638	$715	$819	$843	$845	$846	$847	$848

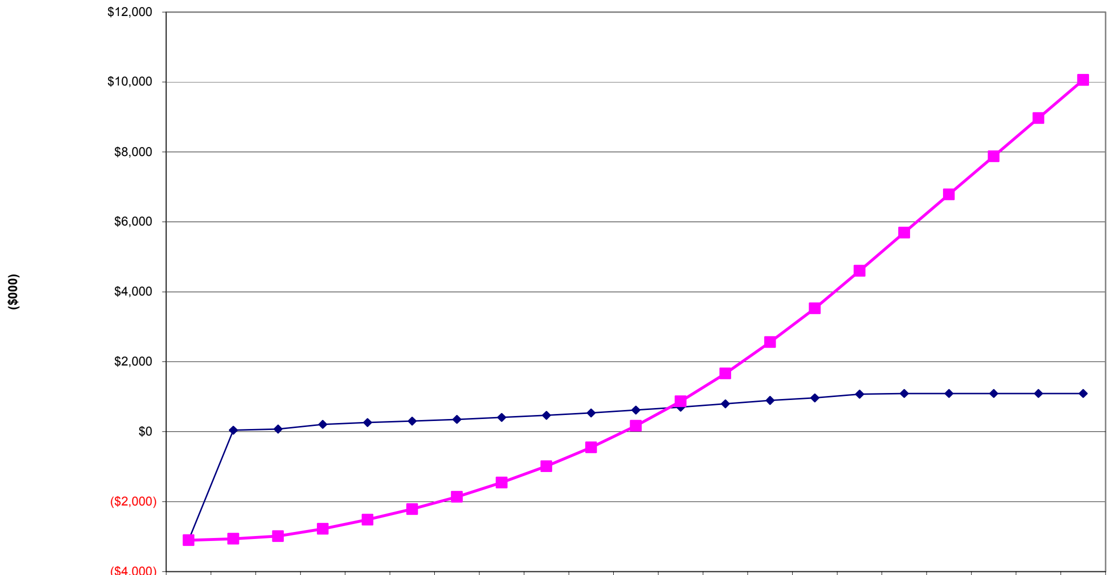
5.11 Payback

The average life of a fiber network as contemplated is very high, typically exceeding 25 years. The town will be making significant near term investments of capital to build a network that yields long-term financial and economic benefits to the town and the community. Therefore, it can be expected that the payback of the MBN network will be slow compared to private sector projects that are targeted at achieving near-term returns to shareholders, with 3-5 years for Return on investment (ROI).

A more appropriate approach to view the MBN is in terms of a Cost of Recovery model that measures how long a given project takes to recover all investments made in it. In the case of MBN, such a model would take into consideration operating expenses, capital fund, debt service and ongoing upgrades.

The payback of the MBN is determined by computing the Net Revenues from the project. Net Revenues is defined as revenues less operating expenses less capital expenses. In other words, Net Revenues is a metric that shows whether a project is generating a positive or negative return from money invested at a given period in time. The payback period of a project is the time taken for the project to generate positive cumulative Net Revenues. However, any payback analysis is flawed because it does not measure profitability during or after the payback period, and it ignores the time value of money.

As shown in the chart below, the MBN project for Hanover has a payback period of approximately 10 years.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Net Revenue	($3,105	$42	$74	$210	$262	$301	$351	$408	$468	$537	$619	$701	$796	$896	$968	$1,073	$1,092	$1,092	$1,092	$1,092	$1,092
Cumulative Net Revenue	($3,105	($3,062	($2,988	($2,778	($2,516	($2,215	($1,864	($1,456	($988)	($451)	$168	$869	$1,665	$2,561	$3,528	$4,602	$5,693	$6,785	$7,877	$8,968	$10,060

6. RISKS

Some of the major risks are as follows. They are described as well as an assessment of what strategies can be used either to avoid them or to recognize them as early as possible.

1. *Inability to Obtain Adequate Revenues over the MBN:* This means that the bonds will be General Obligation (taxpayer subsidized) and may be more difficult to sell. Working with the dominant ISPs, cellular carriers, video providers, and other service providers is critical. This is a first step in the process. It requires large numbers of households passed to establish a credible base.

2. *Wireless Competitor:* Will wireless, 802.11 or similar, provide an aggressive technical competition. At this time the answer is no, but one always has to monitor and respond accordingly. Wireless is also a good complimentary solution in some cases with MBN.

3. *Overbuild by Existing or New Competitor:* The risk of a third party overbuild will always be a major risk; this could reduce the marketability of the MBN. However, if there is a successful operational build then the cost to overbuild will be excessive for any new entrant.

4. *Failure of Hardware Vendors to survive:* This is the major risk. Vendors are coming and going. Selecting a stable standard will be critical; PON or Gigabit Ethernet.

5. *Inappropriate but Delaying Litigation by ILECs:* Good counsel, pre-emptive working with the ILEC in a “friendly” manner, good legislative politicking, and working Washington is critical.

7. REGULATORY RISK ISSUES

This section details some of the regulatory issues regarding broadband, the 1996 Telecommunications Act and the impact on MBN for states and towns. This information draws heavily of material provided to Merton by one of its counsels, Kelly, Drye, and Warren and thus this is not just a Merton contribution but is KDW contribution as well.

7.1 Federal Legislation: Telecommunications Act of 1996

The Telecommunications Act of 1996 embodied in US Federal Code 47, makes certain statement concerning telecommunications, what it is and what it is not. It further states who may be a provider of services, telecommunications services and otherwise.

From Section 3 of the Act, the following definition apply:

(48) TELECOMMUNICATIONS- The term telecommunications means the transmission, between or among points specified by the user, of information of the users choosing, without change in the form or content of the information as sent and received.

(49) TELECOMMUNICATIONS CARRIER- The term telecommunications carrier means any provider of telecommunications services, except that such term does not include aggregators of telecommunications services (as defined in section 226). A telecommunications carrier shall be treated as a common carrier under this Act only to the extent that it is engaged in providing telecommunications services, except that the Commission shall determine whether the provision of fixed and mobile satellite service shall be treated as common carriage.

(50) TELECOMMUNICATIONS EQUIPMENT- The term telecommunications equipment means equipment, other than customer premise equipment, used by a carrier to provide telecommunications services, and includes software integral to such equipment (including upgrades).

(51) TELECOMMUNICATIONS SERVICE- The term telecommunications service means the offering of telecommunications for a fee directly to the public, or to such classes of users as to be effectively available directly to the public, regardless of the facilities used.

The above definitions are critical. First, the Act's definition of telecommunications hinges on the statement “without change in the form or content”, and since the services provided by the town is an IP based network, both form and content are changed. The service provided is information and not telecommunications but information as viewed by the FCC is an integrated and form change in the IP packets. It is not the connection of a voice to a voice.

The following definition is determinative and key. It is for an information service as compared to a telecommunications service.

(41) INFORMATION SERVICE- The term information service means the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications, and includes electronic publishing, but does not include any use of any such capability for the management, control, or operation of a telecommunications system or the management of a telecommunications service.

Section 253 of the Act further states:

SEC. 253. REMOVAL OF BARRIERS TO ENTRY.

(a) IN GENERAL- No State or local statute or regulation, or other State or local legal requirement, may prohibit or have the effect of prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service.

(b) STATE REGULATORY AUTHORITY- Nothing in this section shall affect the ability of a State to impose, on a competitively neutral basis and consistent with section 254, requirements necessary to preserve and advance universal service, protect the public safety and welfare, ensure the continued quality of telecommunications services, and safeguard the rights of consumers.

(c) STATE AND LOCAL GOVERNMENT AUTHORITY- Nothing in this section affects the authority of a State or local government to manage the public rights-of-way or to require fair and reasonable compensation from telecommunications providers, on a competitively neutral and nondiscriminatory basis, for use of public rights-of-way on a nondiscriminatory basis, if the compensation required is publicly disclosed by such government.

(d) PREEMPTION- If, after notice and an opportunity for public comment, the Commission determines that a State or local government has permitted or imposed any statute, regulation, or legal requirement that violates subsection (a) or (b), the Commission shall preempt the enforcement of such statute, regulation, or legal requirement to the extent necessary to correct such violation or inconsistency.

(e) COMMERCIAL MOBILE SERVICE PROVIDERS- Nothing in this section shall affect the application of section 332(c) (3) to commercial mobile service providers.

(f) RURAL MARKETS- It shall not be a violation of this section for a State to require a telecommunications carrier that seeks to provide telephone exchange service or exchange access in a service area served by a rural telephone company to meet the requirements in section 214

(e) (1) for designation as an eligible telecommunications carrier for that area before being permitted to provide such service. This subsection shall not apply-- (1) to a service area served by a rural telephone company that has obtained an exemption, suspension, or modification of section 251(c) (4) that effectively prevents a competitor from meeting the requirements of section 214(e) (1); and (2) to a provider of commercial mobile services."

In Missouri Municipal v FCC with SBC as the Intervenor, the 8th Circuit Court overthrew a Missouri law, which prohibited towns from operating a telecommunications service. The law, Missouri House Bill 1402, 2002 Mo. Legis. Serv. H.B. 1402 (Vernon's), signed into law on July 11, 2002, extended the expiration date to August 28, 2007, as well as making certain other changes in the wording of § 392.410(7), none of which affect our analysis in this case.

The Court stated:

"Section 392.410(7) of the Revised Statutes of Missouri prohibits the state's political subdivisions from obtaining the certificates of service authority necessary to provide telecommunications services or facilities directly or indirectly to the public. It provides: Missouri House Bill 1402, 2002 Mo. Legis. Serv. H.B. 1402 (Vernon's), signed into law on July 11, 2002, extended the expiration date to August 28, 2007, as well as making certain other changes in the wording of § 392.410(7), none of which affect our analysis in this case.

1. No political subdivision of this state shall provide or offer for sale, either to the public or to a telecommunications provider, a telecommunications service or telecommunications facility used to provide a telecommunications service for which a certificate of service authority is required pursuant to this section.

Nothing in this subsection shall be construed to restrict a political subdivision from allowing the nondiscriminatory use of its rights-of-way including its poles, conduits, ducts and similar support

structures by telecommunications providers or from providing telecommunications services or facilities; (1) For its own use; (2) For 911, E-911 or other emergency services; (3) For medical or educational purposes; (4) To students by an educational institution; or (5) Internet-type services*.... The Commission expressed its disagreement with the policy of the Missouri statute because it had found previously that "municipally-owned utilities . . . have the potential to become major competitors in the telecommunications industry . . . [and] can further the goal of the 1996 Act to bring -5- the benefits of competition to all Americans, particularly those who live in small rural communities." ... the Commission felt bound by legal authorities not to preempt the statute, particularly a decision of the United States Court of Appeals for the District of Columbia, City of Abilene v. FCC, 164 F.3d 49 (D.C. Cir. 1999). .. The Missouri Municipals then filed a petition for a review of the Commission's order. Southwestern Bell Telephone Co. and the State of Missouri intervened in support of the Commission's decision."*

The Court further states:

"Accordingly, we conclude that because municipalities fall within the ordinary definition of the term "entity," and because Congress gave that term expansive scope by using the modifier "any," individual municipalities are encompassed within the term "any entity" as used in § 253(a). This language would plainly include municipalities in any other context, and we should not hold otherwise here merely because § 253 affects a state's authority to regulate its municipalities. Congress need not provide specific definitions for each term in a statute where those terms have a plain, ordinary meaning and Congress uses an expansive modifier to demonstrate the breadth of the statute's application."

Finally, the Court states:

"Missouri argues that because § 392.410(7) addresses its municipalities' authority to provide telecommunications services rather than their ability to do so, § 253 does not apply. Missouri contends that if § 392.410(7) is held to be preempted, it would not be able to prevent its attorney general's office from providing telecommunications services. Putting aside the highly fanciful nature of this argument, it needs only to be noted that unlike municipalities, the Missouri Attorney General's office has no independent authority to provide telecommunications services. Section 392.410(7) is a prohibition on the ability to exercise the authority that municipalities otherwise possess, precisely the type of prohibition that § 253 is designed to prevent.[4] The Commission's order is vacated, and the case is remanded to the Commission for further proceedings consistent with the views set forth in this opinion."

Clearly, the Court rejected the SBC complaint and further the Court ordered that municipalities have indeed far reaching powers, despite even State Legislatures attempting to delimit them, since they derive from Federal statutes.

In a landmark decision with major implications for regulation of the Internet, on March 15, 2002, the FCC ruled that cable modems were not "telecommunications service" but "information service". FCC 6N Doc. No.00-185 (Inquiry Concerning High Speed Access to Internet Over Cable and Other Facilities) concluded that cable modem service is properly classified as an interstate information service and is therefore subject to FCC jurisdiction. The FCC determined that cable modem service is not a "cable service" as defined by the Act. The FCC also said that cable modem service does not contain a separate "telecommunications service" offering and therefore is not subject to common carrier regulation.

The FCC said that the ultimate resolution of this item will promote broadband deployment, which should result in better quality, lower prices and more choices for consumers. In considering the issues raised by the original *Cable Modem NOI* and today's *Notice*, the FCC is guided by the following principles and policy goals:

[4] See City of Bristol, 145 F. Supp. 2d at 748 (Virginia municipalities otherwise have authority to provide telecommunications services and state statute designed to prohibit them from exercising that authority preempted by § 253).

1. Encourage the ubiquitous availability of broadband access to the Internet to all Americans.

2. Ensure that broadband services exist in a minimal regulatory environment that promotes investment and innovation.

3. Develop an analytical framework that is consistent, to the extent possible, across multiple platforms.

With respect to state and local issues, the *Notice* makes three significant tentative conclusions:

1. The statute does not provide a basis for a local franchising authority to impose an additional franchise for the provision of cable modem service.

2. The provision of cable modem service should not affect the rights of cable operators to access the public rights-of-way.

3. In the interest of national uniformity, the FCC should exercise its forbearance authority in light of the U.S. Court of Appeals for the Ninth Circuit's decision in the *Portland* case, which classified cable modem service as both an "information service" and "telecommunications service."

Regarding franchise fees, the FCC notes that the law limits franchise fees to 5 percent of the gross revenues the cable operator receives from cable service. The FCC said that revenues from cable modem service should not be used in computing this franchise fee ceiling.

This decision follows five other related proceedings – the *Cable Modem NOI*, the *National Performance Measures NPRM*, the *Incumbent LEC Broadband Notice,* the *Triennial UNE Review Notice* and, most recently, the *Wireline Broadband NPRM*. These proceedings, together with today's actions, are intended to build the foundation for a comprehensive and consistent national broadband policy.

The FCC in its Declaratory Ruling further states:

"34. Because the classification of cable modem service turns on statutory interpretation, we begin with a review of relevant statutory definitions. The 1996 Act defines "telecommunications service" as "the offering of telecommunications for a fee directly to the public, or to such classes of users as to be effectively available directly to the public, regardless of the facilities used."[5] "Telecommunications" is defined in turn as "the transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent and received."[6]

35. The Act defines "information service" as "the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications, and includes electronic publishing, but does not include any use of any such capability for the management, control, or operation of a telecommunications system or the management of a telecommunications service."[7]

[5] Communications Act § 3(46), 47 U.S.C. § 153(46).

[6] Communications Act § 3(43), 47 U.S.C. § 153(43).

[7] Communications Act § 3(20), 47 U.S.C. § 153(20). The term "information service" follows from a distinction the Commission drew in the First, Second, and Third Computer Inquiries ("Computer Inquiries"). See generally Regulatory and Policy Problems Presented by the Interdependence of Computer and Communications Services and Facilities, Docket No. 16979, Final Decision and Order, 28 F.C.C. 2d 267 (1971), aff'd in part sub nom. GTE Service Corp. v. FCC, 474 F.2d 724 (2d Cir. 1973), decision on remand, Order, 40 F.C.C. 2d 293 (1973); Amendment of Section 64.702 of the Commission's Rules and Regulations (Second Computer Inquiry) ("Computer II Final Decision"), CC Docket No. 20828, Final Decision, 77 FCC 2d 384 (1980), on reconsideration, Section Opinion and Order, 84 F.C.C. 2d 50 (1980) and Section Opinion and Order on Further Reconsideration, 88 F.C.C. 2d 512 (1981), aff'd sub nom. Computer and Commun. Indus. Ass'n v FCC, 693 F.2d 198 (D.C. Cir. 1982), cert. denied, 461 U.S. 938 (1983); Amendment of Section 64.702 of the Commission's Rules and Regulations (Third Computer Inquiry), CC Docket No. 85-229, Report and Order, Section Opinion and Order on Further Reconsideration, 104 F.C.C. 2d 958 (1986), on reconsideration, Section Opinion and Order on

None of the foregoing statutory definitions rests on the particular types of facilities used. Rather, each rests on the function that is made available.[8] *Accordingly, we examine below the functions that cable modem service makes available to its end users. The Commission's prior analysis regarding Internet access service informs our analysis."*

The FCC goes on to state:

"55. The Commission and courts have long distinguished between common carriage[9] *and private carriage by examining the particular service at issue.*[10] *As the D.C. Circuit has stated, "the primary sine qua non of common carrier status is a quasi-public character, which arises out of the undertaking to carry for all people indifferently."*[11] *In contrast, an entity is a private carrier for a particular service when a carrier "chooses its clients on an individual basis and determines in each particular case 'whether and on what terms to serve' and there is no specific regulatory compulsion to serve all indifferently."*[12] *The record indicates that AOL Time Warner is determining on an individual basis whether to deal with particular*

Reconsideration, 2 FCC Rcd 3035 (1987), Section Opinion and Order on Reconsideration, 3 FCC Rcd 1135 (1988) and Section Opinion and Order on Further Reconsideration and Second Further Reconsideration, 4 FCC Rcd 5927 (1989), vacated in part, California v. FCC, 905 F.2d 1217 (9th Cir. 1990); Report and Order, 2 FCC Rcd 3072 (1987), on reconsideration, Section Opinion and Order on Reconsideration, 3 FCC Rcd 1150 (1988), vacated in part, California v. FCC, 905 F.2d 1217 (9th Cir. 1990); Computer III Remand Proceedings, Report and Order, 5 FCC Rcd 7719 (1990), on reconsideration, Section Opinion and Order on Reconsideration, 7 FCC Rcd 909 (1992), petitions for review denied, California v. FCC, 4 F.3d 1505 (9th Cir. 1993); Computer III Remand Proceedings; Bell Operating Company Safeguards and Tier I Local Exchange Company Safeguards, CC Docket No. 90-623, Report and Order, 6 FCC Rcd 7571 (1991), vacated in part and remanded, California v. FCC, 39 F.3d 919 (9th Cir. 1994), cert. denied, 514 U.S. 1050 (1995); Computer III Further Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Review - Review of Computer III and ONA Safeguards and Requirements, CC Docket Nos. 95-20, 98-10; Further Notice of Proposed Rulemaking, Report and Order, 13 FCC Rcd 6040 (1998), Report and Order, 14 FCC Rcd 4289 (1999), on reconsideration, Order, 14 FCC Rcd 21628 (1999).

These decisions drew a distinction between bottleneck common carrier facilities and services for the transmission or movement of information on the one hand and, on the other, the use of computer processing applications to act on the content, code, protocol, or other aspects of the subscriber's information. The latter are "enhanced" or information services. This distinction was incorporated into the Modification of Final Judgment ("MFJ"), which governed the Bell Operating Companies after the Bell System Break-Up, and into the 1996 Act. Universal Service Report 13 FCC Rcd at 11536 ¶ 75 (1998), citing United States v. Western Electric Co., 673 F. Supp. 525 (D.D.C. 1987), and 714 F. Supp. 1 (D.D.C. 1988), rev'd in part, 900 F.2d 283 (D.C. Cir. 1990). The Commission has confirmed that the two terms – enhanced services and information services – should be interpreted to extend to the same functions. Implementation of the Non-Accounting Safeguards of Sections 271 and 272 of the Communications Act of 1934, as amended, CC Docket No. 96-149, First Report and Order and Further Notice of Proposed Rulemaking ("Non-Accounting Safeguards Order"), 11 FCC Rcd 21905, 21955-56 ¶ 102.

[8] Universal Service Report, 13 FCC Rcd at 11530 ¶ 59 (noting "Congress's direction that the classification of a provider should not depend on the type of facilities used . . . [but] rather on the nature of the service being offered to consumers.").

[9] The Commission has repeatedly found in various contexts that the definition of "telecommunications service" under the Act is equivalent to "common carrier" service. See, e.g., Cable & Wireless, PLC, File No. SCL-96-005, Cable Landing License, 12 FCC Rcd 8516, 8521 ¶13 (1997); AT&T Submarine Systems, Inc., File No. S-C-L-94-006, Section Opinion and Order, 13 FCC Rcd 21585, 21587-88 ¶ 6 (1998), aff'd, Virgin Islands Tel. Co. v. FCC, 198 F.3d 921 (D.C. Cir. 1999); Federal-State Joint Board on Universal Service, CC Docket No. 96-45, Report and Order, 12 FCC Rcd 8776, 9177-78 ¶ 785 (1997), aff'd in part, reversed in part, and remanded in part, Texas Office of Public Utility Counsel v. FCC, 183 F.3d 393 (5th Cir. 1999), cert. granted, 530 U.S. 1213 (2000); Declaratory Ruling, 14 FCC Rcd 3040, 3042 ¶ 6 (1999), remanded on other grounds, State of Iowa v. FCC, 218 F.3d 756 (D.C. Cir. 2000). Moreover, the D.C. Circuit has held that the FCC's interpretation of "telecommunications service" as common carrier service is reasonable and permissible. Virgin Islands Tel. Co. v. FCC, 198 F.3d 921, 926 (D.C. Cir. 1999).

[10] See National Ass'n of Reg. Utils. Comm'rs v. FCC, 525 F.2d 630, 640 (D.C. Cir.), cert. denied, 425 U.S. 992 (1976) ("NARUC I"); NARUC v. FCC, 533 F.2d 601, 608-09 (D.C. Cir. 1976) ("NARUC II"); Southwestern Bell Tel. Co. v. FCC, 19 F.3d 1475, 1481 (D.C. Cir. 1994); AT&T Submarine Systems, Inc. Application for a License to Land and Operate a Digital Submarine Cable System Between St. Thomas and St. Croix in the U.S. Virgin Islands, File No. S-C-L-94-006, Section Opinion and Order,13 FCC Rcd 21585, 21588-89 ¶¶ 8-9 (1998), aff'd, Virgin Islands Tel. Corp. v. FCC, 198 F.3d 921 (D.C. Cir. 1999); NORLIGHT Request for Declaratory Ruling, File No. PRB-LMMD 86-07, Declaratory Ruling, 2 FCC Rcd 132, 133 ¶ 14 (1987). See also Cox Comments at 45-46; NCTA Comments at 13-17.

[11] NARUC II, 533 F.2d at 608-09 (quotation marks omitted). See also authorities cited supra note 10.

[12] Southwestern Bell Tel. Co. v. FCC, 19 F.3d 1475, 1481 (D.C. Cir. 1994); see NARUC I, 525 F.2d at 641 ("a carrier will not be a common carrier where its practice is to make individualized decisions, in particular cases, whether and on what terms to deal").

ISPs and is in each case deciding the terms on which it will deal with any particular ISP.[13] ***To the extent that AOL Time Warner is making an offering of pure telecommunications to ISPs, it is dealing with each ISP on an individualized basis and is not offering any transmission service indiscriminately to all ISPs.***[14] ***Thus, such an offering would be a private carrier service, not a "telecommunications service."*** *Similarly, to the extent that other cable providers elect to provide pure telecommunications to selected clients with whom they deal on an individualized basis, we would expect their offerings to be private carrier service."*

7.2 Recent FCC Rulings

On February 20, 2003 the FCC ruled, in a contested ruling, that broadband would no longer be controlled by the 1996 Telecom Act as was required for unbundling. Specifically the FCC stated:

"2. ***Broadband Issues*** *– The Commission provides substantial unbundling relief for loops utilizing fiber facilities: 1) the Commission requires no unbundling of fiber-to-the-home loops; 2) the Commission elects not to unbundle bandwidth for the provision of broadband services for loops where incumbent LECs deploy fiber further into the neighborhood but short of the customer's home (hybrid loops), although requesting carriers that provide broadband services today over high capacity facilities will continue to get that same access even after this relief is granted, and 3) the Commission will no longer require that line-sharing be available as an unbundled element. The Commission also provides clarification on its UNE pricing rules that will send appropriate economic signals to carriers."*

What this means is that the monopoly carriers such as Verizon will no longer have to unbundle any loop, which has any fiber content, this means almost 95% of the loops in New England. Verizon's response, rather than being supportive, stated that because of this position it would not be building broadband. In detail the FCC stated:

*"**Mass Market Loops***

Copper Loops – *Incumbent LECs must continue to provide unbundled access to copper loops and copper subloops. Incumbent LECs may not retire any copper loops or subloops without first receiving approval from the relevant state commission.*

Line Sharing – *The high frequency portion of the loop (HFPL) is not an unbundled network element. Although the Order finds general impairment in providing broadband services without access to local loops, access to the entire stand-alone copper loop is sufficient to overcome impairment. During a three-year period, competitive LECs must transition their existing customer base served via the HFPL to new arrangements. New customers may be acquired only during the first year of this transition. In addition, during each year of the transition, the price for the high-frequency portion of the loop will increase incrementally towards the cost of a loop in the relevant market.*

Hybrid Loops *– There are no unbundling requirements for the packet-switching features, functions, and capabilities of incumbent LEC loops. Thus, incumbent LECs will not have to provide unbundled access to a transmission path over hybrid loops utilizing the packet-switching capabilities of their DLC systems in*

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[14] See AOL Time Warner Jan. 22, 2002 Ex Parte at 3 (referring to its "individually negotiated affiliation agreements" with ISPs), at 4 (suggesting that AOL Time Warner intends to exercise its discretion in choosing which ISPs participate in its multiple ISP offerings to subscribers: "TWC also believes that this partnering arrangement works best for customers because TWC is putting its reputation on the line with every ISP it sells, both in the case of affiliated ISPs like AOL, and unaffiliated ones like EarthLink."). See also AOL Time Warner Inc., Texas Networking, Inc., Petition for Declaratory Ruling and Complaint Regarding Violations of Merger Conditions and for Enforcement of Merger Conditions, CS Docket No. 00-30, AOL Time Warner Response and Opposition at 8 & n.22 (describing part of AOL Time Warner's multiple ISP access activities, specifically a questionnaire for ISPs "to provide [Time Warner Cable] with information to help evaluate the companies which sought to enter into agreements with TWC. It requests basic information touching on matters related to the integrity, consumer acceptability and stability of a business and the people who run it.") (filed Sept. 4, 2001).

remote terminals. Incumbent LECs must provide, however, unbundled access to a voice-grade equivalent channel and high capacity loops utilizing TDM technology, such as DS1s and DS3s.

Fiber-to-the-Home (FTTH) Loops *– There is no unbundling requirement for new build/greenfield FTTH loops for both broadband and narrowband services. There is no unbundling requirement for overbuild/brownfield FTTH loops for broadband services. Incumbent LECs must continue to provide access to a transmission path suitable for providing narrowband service if the copper loop is retired.*

Enterprise Market Loops - *The Commission makes a national finding of no impairment for OCn capacity loops. The Commission makes a national finding of impairment for DS1, DS3, and dark fiber loops, except where triggers are met as applied in state proceedings. States can remove DS1, DS3, and dark fiber loops based on a customer location-specific analysis applying a wholesale competitive alternative trigger.*

2. Dark fiber and DS3 loops also each are subject to a customer location-specific review by the states to identify where loop facilities have been self-deployed.

Subloops - *In addition, incumbent LECs must offer unbundled access to subloops necessary for access to wiring at or near a multiunit customer premises, including the Inside Wire Subloop, regardless of the capacity level or type of loop the requesting carrier will provision to its customer."*

Thus, it is clear that the FCC has given the monopoly players such as Verizon a clear path to FTTH but Verizon and the other three have expressly rejected this option. There are no encumbrances in this recent ruling from the FCC as regards MBN.

7.3 Cable/Telecom Overbuilding by Municipalities

This section addresses issues related to a municipal government's construction of a fiber-to-the-home ("FTTH") network to be owned and operated by a municipal utility, for the provision of voice and data telecommunications services and cable television programming. Specifically, this section discusses actions that incumbent telephone or cable companies may take to impede or prevent the construction of an overbuild fiber network.

Incumbent telephone companies and cable operators have challenged municipal overbuilds, with mixed results:

1. Challenges based on constitutional and antitrust arguments have failed.
2. "Dillon's Rule" challenges (asserting that the municipality lacks authority) have been successful in states that do not expressly grant such authority, including Vermont and New Hampshire.
3. The few states that have passed legislation preventing municipal entry have been successful, although such legislation is currently being challenged in court.
4. Regulations that impose on municipalities the same rules that apply to incumbents have generally been upheld.
5. Proposed legislation and Federal Communications Commission ("FCC") regulatory initiatives may support municipal buildouts in the future, but may take years to implement if they are adopted.

Although municipal ownership of cable television is not a new concept, and has been in existence nearly as long as the technology itself, it used to be limited to small, and relatively isolated communities that wired themselves by default because a larger cable provider could not be encouraged to enter and construct a system.[15] This is no longer the case--municipalities are entering this field in two principal ways: (1) revoking or denying renewal of the incumbent's franchise and replacing that operator with their own systems; or (2) permitting the incumbent to remain in business, but awarding themselves competitive franchises that allow a governmental unit to overbuild the private operator. As discussed in this section, numerous municipalities have built out and control fiber infrastructure in direct competition with cable television operators and telecommunications providers. There are several obvious advantages to this tactic (at least from the municipality's point of view):

1. Customers can be offered lower prices for services.

2. Municipal public utilities are often exempt from public service commission guidelines and therefore have greater flexibility than commercial enterprises.

3. Pricing can be manipulated to incentivize business growth, or for other reasons deemed worthy by the municipality.

4. The municipality can achieve greater control over public rights of way, and help to discourage disruptive trenching by various competitive entities, which will instead be encouraged (by the favorable pricing) to purchase bandwidth on the existing system.

5. Greater emphasis can be placed on the public interests in education, school programs, and remote learning.

Example: Glasgow, KY.

In Glasgow, KY, (pop. 14000), the city's electric utility has constructed a 120 mile broadband cable network that supports cable TV, phone service, Internet access, public school classrooms, city agencies, utilities, and about 7,000 residential and business customers. The system, constructed in 1989, offers CATV service (including such premium channels as HBO) to citizens for $13.50 per month, and 4 megabit Internet access for $9.95 per month. In addition, the system distributes electrical power throughout the area, and has enhanced management capabilities for the electrical grid. Glasgow estimates that it saves $175,000/year on better management of electrical distribution, and $1.2 million/year in reduced rates for cable and telecommunications services.

Not surprisingly, such shining examples as Glasgow, KY are highly threatening to incumbent cable operators, who generally claim that such enterprises are "risky," and "premature." Cable providers also note that they would not be likely to purchase bandwidth from existing municipal operations on entry to a new market, but would prefer to build their own infrastructure. Actions by municipalities to establish their own systems have been challenged in court by the incumbents, on First Amendment grounds, antitrust grounds, and on other legal theories. So far, such challenges have been uniformly unsuccessful. The reason for this is that federal statutory law explicitly permits municipal ownership of cable systems.[16] Federal statutory law also indirectly encouraged municipalities to enter the field of cable television by virtue of the 1984 Act's preemption of the local franchising authority's right to control rates: stripped of their ability to control rates, localities instead turned to shorter franchises, steeper franchise renewal requirements, and threats to overbuild in order to regain the leverage they had lost.

[15] According to a survey conducted by the National Civic Review, twenty-eight municipally owned systems were in operation in 1981, and they were principally in remote, small communities. Seventeen of the 28 communities in question had fewer than 2,500 residents, and 12 of them had fewer than 1,000 residents. However, in March, 1991, ten years later, 62 municipally owned cable systems were in full operation (including a number of overbuilds), and 86 additional communities in 20 states were considering or implementing overbuilds to compete with incumbent providers. And recently, the American Public Power Association published statistics that list over 200 municipalities that provide telecommunications, cable and other related services, to their constituents.

[16] See Cable Communications Policy Act of 1984, Section 613(e) (the "1984 Act"), Pub. L. No. 98-549, 98 Stat. 2779 (1984). The only restriction on municipal ownership of a cable system is that editorial control must be exercised by an entity separate from the franchising authority. This provision was not altered in the 1992 Cable Television Consumer Protection and Competition Act (the "1992 Act"), 47 U.S.C. Section 533(e), which bestowed new powers on local franchising authorities in other significant respects.

Although the municipalities have been challenged several times in court by incumbents, they have been successful so far in defending their entry into service provision. For example:

Paragould, AR:

In Paragould, Arkansas, the city sponsored an ordinance to permit construction of a city-owned system, overbuilding the incumbent operator's system. The measure was approved in 1986, and the city awarded a competitive franchise to its municipal City Light and Water Commission. $3.2 million was raised by means of a public bond issue, and the system began operations in 1991. Apparently the city encouraged customers to defect to its new system by claiming that, unless 60% of the cable market were served by the city's system, property taxes would have to be raised to finance it.

The incumbent operator in Paragould sued in federal court, claiming severally that the city had violated antitrust laws and the First (free speech) and Fourteenth (equal protection) Amendments, and additionally had breached its franchising agreement. However, the 8th Circuit Court of Appeals found that the State of Arkansas had clearly authorized municipalities to enter the cable business, and that as such the city was authorized to utilize its access to the existing infrastructure, such as utility poles, rights of way, etc., for this purpose. The court also rejected the incumbent's First and Fourteenth Amendment claims, noting that by entering into its franchise agreement, the incumbent had bargained away some of its Constitutional rights. *See Paragould Cablevision, Inc. v. City of Paragould,* 930 F.2d 1310 (8th Cir. 1990), *cert. den.* 502 U.S. 963 (1991).

Niceville, FL.

This pattern was repeated in Niceville, Florida. In 1985, the city council passed an ordinance authorizing the city to construct its own system: among the reasons this was done was that the city objected to the incumbent operator's editorial judgment and disagreed with the operator's policies as to certain religious programming. The incumbent operator sued in federal court, claiming that the city's conduct violated its constitutional rights of freedom of speech and due process. It sought damages, a declaration that the city's ordinance was unconstitutional, and injunctive relief against enforcement of the ordinance. The 11th Circuit Court of Appeals found for the city, however, noting that: (1) the potential economic injury to the incumbent did not rise to the level of a First Amendment injury; and (2) the private operator was not impeded in its continued ability to speak to Niceville cable viewers despite the presence of a competitive system operated by its local regulator. See Warner Cable Communications, Inc. v. City of Niceville, 911 F.2d 634 (11th Cir. 1990), cert den. 501 U.S. 1222 (1991).[17]

Morganton, NC.

In Morganton, North Carolina, a similar pattern of wrangling between the incumbent operator over policies and editorial discretion led to denial of the incumbent's renewal application, issuance of a franchise by the city to itself, denial of new franchise applications by the incumbent and a new competitive provider, and the imposition of a moratorium of five years preventing any system from offering cable television services in competition with the city. The incumbent sued, claiming that its First Amendment rights had been violated. In particular, the incumbent argued that it had the right to use the city's rights of way and poles indefinitely, notwithstanding the lack of a franchise. The federal district court again rejected all of the incumbent's claims.

[17] It should be noted that in the Niceville situation, the incumbent was required to pay 5% of its gross revenues to the city, whereas the city's system did not have to pay any such fee. In addition, the city's system was not subject to the property, sales and income taxes that the incumbent had to pay. Moreover, the city was able to cross-subsidize its system by resorting to general municipal funds and pledge tax revenues to raise capital. Not only that, but due to the tax favored treatment of municipal bonds, the city was able to borrow funds for construction at a significantly lower rate of interest. Despite these enormous, unilateral advantages, the incumbent's injury was nevertheless not deemed to be cognizable under its Constitutional claims.

Although initial attempts by incumbents centered on Constitutional violations and antitrust issues, attacks based on First Amendment free speech arguments, Fourteenth Amendment equal protection or due process arguments, or antitrust violations have been notably unsuccessful, so they are unlikely to be mounted again at this point, except possibly on a supplementary basis.

More recently, incumbents have explored a number of new theories to oppose new entrants. One of the most significant new approaches is to argue that any new market entrant must comply with *exactly the same* franchise terms as the incumbent, including build-out areas and up-front financial commitments. Where possible, cable operators have sought to include language in their franchise that binds the locality to such conditions. *See, e.g., Knology, Inc. v. Insight Communications Co., L.P.*, Civ. No. 3:00CV-723-R, 2001 U.S. Dist. LEXIS 6067 (W.D. Ky. March 20, 2001). In *Knology*, the incumbent managed to obtain franchise terms that required automatic suspension of any subsequently granted franchise if a legal action were *filed*, challenging whether the subsequent agreement was on a level playing field with the incumbent's franchise agreement. When the city granted a second franchise, the incumbent (Insight Communications) filed suit in state court, triggering the automatic suspension. The new entrant (Knology) countersued in federal court. No resolution has been reached yet, but Knology has survived Insight's initial motion to dismiss.

On a somewhat different issue, an incumbent managed to prevent competitive entry into its market by claiming that its franchise language was an exclusive grant for 25 years. The municipality unsuccessfully argued that the Cable Act of 1992 preempted the language in question, but the 6th Circuit rejected this argument, noting that the 1992 Act's scope was not retroactive on this issue. *See James Cable Partners, L.P. v. City of Jamestown,* 43 F.3d 277 (6th Cir. 1995), *rehearing den.* (1995). *But cf. Cox Cable Communications, Inc. v. U.S.,* 992 F.2d 1178 (11th Cir. 1993) (opposing view).

The restrictive franchise language approach relates to a less sophisticated time, when municipalities were outgunned by cable company lawyers and did not understand their bargaining power, giving considerable exclusivity and concessions. The advent of competitive cable and telecommunications in the marketplace, and the increasing sophistication of the municipalities, make it unlikely that this approach will constitute a problem in the future, except for existing language in some franchises that are not preempted by the 1996 Act, and will ultimately expire.

In addition to legal challenges, incumbents have on occasion done what a monopoly does best to combat its competition: lower its prices to unremunerative levels to provide a strong disincentive to keep customers from migrating to the new (municipal) entrant. For example, in the FCC's *Eighth Annual Report in the Matter of Annual Assessment of the Status of Competition in the Market Delivery of Video Programming*, released January 4, 2002 in CS Docket No. 01-129 (at 83-84), the FCC discusses a situation in which a cable operator (Charter Communications) in Scottsboro, Alabama, sought to deter customers from migrating to the new municipal entrant by offering reduced prices, and a bounty of $200 to switch back for customers that had already left, as well as an *additional* $200 bonus if the customer would also take Charter's Internet service. Apparently Charter also attempted such promotions in West Point, Georgia, and Montgomery, Alabama. The FCC noted that, although it was concerned with the power of large providers to bring to bear such resources to deter market entry in various markets, it does not currently have statutory authority to correct the situation, although it might consider requesting such authority from Congress if these tactics become widespread.

To the extent that municipalities enter the competitive field already occupied by an entrenched incumbent, they risk pitting themselves against a powerful foe that may have superior resources and the willingness to reduce rates to incremental or even predatory levels. The FCC has made clear that it does not have the authority to address such matters. In addition, antitrust challenges based on predatory pricing are now out of favor with the courts, and are almost impossible to prosecute successfully. Nevertheless, incumbents engaging in such practices may be vulnerable to challenges based on unfair competition, refusals to deal, price squeeze, tortuous interference with contract, or a number of other legal theories.

Another approach for incumbents bent on preventing new entry by municipalities is to claim that the proposed enterprise does not "serve a public purpose." Dependent on variances in state law, in some states a challenge may be mounted on this basis in the absence of an explicit state authorization for a municipality to enter this business. But the argument each time it is raised is essentially the same: a cable system is an enterprise that is not an appropriate subject for municipal ownership in competition with a private business. *See, e.g., Sheppard v. City of Orangeburg,* 442 S.E.2d 601 (S.C. 1994) (cable systems in South Carolina are neither recreational nor essential; therefore, municipalities may not operate them). This argument is available to incumbents, except where it has already been litigated, and the right of the municipality to provide telecommunications services has been upheld. For example, in North Carolina, the court system has affirmed municipalities' rights under state law to enter telecommunications markets.

If attacked on the grounds that the cable or telecommunications system is not an appropriate exercise of the municipality's legal authority, the municipality logically seeks refuge in generalized grants of power, and seeks to "infer" the requisite power from those general grants. The ability to do so successfully would depend on the exact nature of the grant of power from the state, and its wording and intent.

Certain states are governed by a general, judicially-created rule known as "Dillon's Rule," that effectively holds municipalities to affirmative grants of power—that is, a municipality does not have the authority to engage in an activity unless the authority is expressly granted by the state legislature. Accordingly, it is the absence of legislative action that effects the prohibition. Dillon's Rule, first enunciated by Chief Judge John Dillon of the Iowa Supreme Court, provides:

"[A] municipal corporation possesses and can exercise the following powers and no others: First, those granted in express words; second, those necessarily implied or necessarily incident to the powers expressly granted; third, those absolutely essential to the declared objects and purposes of the corporation—not simply convenient, but indispensable"...[18]

Moreover, it does not appear that the 1996 Act could be used to preempt Dillon's Rule. It would appear that the FCC cannot preempt in this situation essentially because there is nothing to preempt. In Dillon's Rule states, there is no express prohibition against engaging in telecommunications provision: it's just that the municipalities don't have the authority to do it. Arguably, the 1996 Act cannot *empower* the municipalities to act where state law makes no provision for it. On the other hand, it may be possible to argue that it does not require an affirmative prohibition, but rather only an *effective* prohibition to trigger the protection intended by Section 253(a) of the 1996 Act. Additional research would be required to determine whether such an argument could be made effectively.

Numerous localities in Pennsylvania, including Philadelphia, Reading, Scranton, and many others, have home rule charters that would theoretically except them from Dillon's Rule. Kutztown Borough does not have a home rule charter, and that could be a source of vulnerability apart from a specific state legislative act authorizing the Borough's entry into telecommunications and cable television provision, providing grounds for a potential challenge. In addition, since Kutztown used funds from the utility reserves and other sources to finance the project, it is likely that an argument could be made that the funds were not expended properly. Verizon (telephone) and Service Electric (cable) are the incumbents in the Borough, and although they are on record (in newspaper reports) as being unhappy with this new development, it would appear that the problem is too small at present to make it sensible for them to expend resources in opposition. However, if Kutztown carries through on its plans to expand the network out of town, to Kutztown University, Topton and Lyons, and the industrial park along Route 222, this might well be perceived as a growing threat requiring some response from the incumbents.

[18] See Clinton v. Cedar Rapids & Missouri River R.R. Co., 24 Iowa 455 (1868). The doctrine was adopted by Pennsylvania in Philadelphia v. Fox, 64 Pa. 169 (1870), and it remains fundamental for evaluation of local government powers. See Guthrie v. Borough of Wilkinsburg, 508 Pa. 590, 499 A.2d 570 (1985) (a political subdivision has only those powers expressly given it by the legislature). See also 23 Summ. Pa. Jur. 2d Municipal and Local Law § 13:3 (1995) ("Dillon's Rule is the law of Pennsylvania").

Dillon's Rule is generally interpreted as filling a legislative void, and preventing municipal action unless power has been granted by the state. As discussed below, state grants of authority have been issued in Massachusetts and Rhode Island, but not in Vermont or New Hampshire.

Massachusetts

The adoption of the Home Rule Amendment in 1996 and the subsequent enactment of the House Rule Procedures Act effected substantial changes in the legislative powers of the state legislature and the cities and towns. The Home rule Amendment effectively grants to "the people of every city and town the right of self-government in local matters." Moreover, the Amendment *rejects the general premise of Dillon's Rule* that no municipality has a vested rights in its form of government. Accordingly, the Amendment now serves as the touchstone of what a municipality can or cannot do.

Furthermore, the Amendment provides the cities and towns of Massachusetts with broad powers. Indeed, Article LXXXIX, Section 6 of the Massachusetts Constitution states, in pertinent part:
Any city or town may, by the adoption, amendment, or repeal of local ordinances or by-laws exercise any power or function which the general court has power to confer upon it, which is not inconsistent with the constitution or laws enacted by the general court in conformity with powers reserved to the general court by section eight, and which is not denied, either expressly or by clear implication, to the city or town by its charter.[19]

Combined with Article LXXXIX, Section 7 of the Massachusetts Constitution, which enumerates certain exceptions to the general rule,[20] these two sections repudiate the concept that all powers lie in the State except those expressly delegated to cities and towns.

Thus, municipalities are now free to exercise any power or function, excepting those denied to them by their own charters or reserved to the State by [section] 7, which the Legislature has the power to confirm on them, as long as the exercise of those powers is not inconsistent with the Constitution or laws enacted by the Legislature in accordance with [section] 8.[21]

Accordingly, municipal actions exercised under the Home Rule Amendment are presumed valid and will only be invalidated if in conflict with the Massachusetts Constitution or a state or federal statute.

Rhode Island

Traditionally, municipalities had no inherent right to self-government in Rhode Island. The 1951 enactment of the home rule amendment, now designated Article 13 of the Rhode Island Constitution, altered this traditional view by empowering cities and towns to legislate with regard to all matters. Specifically, Article 13, Section 1 of the Rhode Island Constitution provides, "It is the intention of this article to grant and conform to the people of every city and town in this state the right of self government in all local matters," and Article 13, Section 2 states, "Every city and town shall have the power at any time to adopt a charter, amend its charter, enact and amend local law relating to its property, affairs and government not inconsistent with this Constitution and laws enacted by the general assembly in conformity with the powers reserved to the general assembly."

However, the legislative power conferred by Article 13 is not unfettered. The Legislature continues to retain "the power to act in relation to the property, affairs and government of any city or town by general laws which shall apply alike to all cities and towns, but which shall not affect the form of government of any city or town."[22] Thus, municipalities may not legislate on matters of statewide concern, and the power of home rule is subordinate to the General Assembly's unconditional power to legislate in the same areas.

[19] Mass. Const. amend. LXXXIX, § 6.
[20] Section 7 does not authorize municipalities to, among other things, regulate elections, levy and collect taxes, borrow money or pledge the credit of the city or town, etc.
[21] Board of Appeals of Hanover v. Housing Appeals Comm., 294 NE.2d 393, 408 (Mass. 1973).
[22] R.I. Const. art. 13, sec. 4.

In Rhode Island, the Legislature continues to exclusively occupy the fields of education, elections, and taxation, thereby precluding any municipality's foray into these areas, absent specific legislative approval.

Vermont

Vermont has consistently adhered to the Dillon's rule that a "municipality has only those powers and functions specifically authorized by the legislature, and such additional functions as may be incident, subordinate or necessary to the exercise thereof."[23] Because there is no home rule constitutional provision in Vermont, towns have only those powers specifically authorized by the Legislature.[24]

New Hampshire

New Hampshire is governed by Dillon's Rule. Consequently, no city or town in New Hampshire can take action that is not already authorized by the Legislature. A proposed Constitutional Amendment that would have granted true Home Rule authority to cities and towns in New Hampshire breezed through the legislature in 1999 but failed to gain the necessary two-thirds support during the elections in 2000. Amendments to the constitution require a two-thirds vote to be ratified.

State legislatures have also been persuaded by incumbents to enact laws prohibiting local communities from entering into the telecommunications markets. At this point, there are approximately ten states that have enacted one form of prohibition or another, generally at the behest of the incumbent cable and/or local telephone providers.[25]

Some of these state statues are being contested in court. For example, the Texas legislature enacted the 1995 Texas Public Utility Regulatory Act ("PURA") which contains provisions preventing municipal entry. The Public Utility Commission of Texas strongly disagreed with the legislation, and asked the FCC to use its authority under the federal Telecommunications Act of 1996 (the "1996 Act") to preempt the state legislation. Section 253(a) of the 1996 Act expressly prohibits states and municipalities from enacting statues or regulations that prohibit "any entity" from providing telecommunications services.

The FCC denied the preemption petition, however, despite its policy of supporting telecom entry by all entities, including local governments. In denying the preemption request, the FCC found, among other things, that municipalities are creatures of the state and that the state has authority to prohibit their entry into the telecommunications market. *See Public Utility Commission of Texas,* 13 FCC Rcd 3640 (1007), *aff'd*, *City of Abilene v. FCC,* 164 F.3d 49 (D.C. Cir. 1999).

The FCC more recently denied a similar effort by Missouri municipalities to overturn legislation prohibiting their entry into telecommunications. *See Missouri Municipal League,* 2001 WL 28068 (FCC Jan 12, 2001). Just this summer, however, the FCC was reversed by the 8th Circuit Court of Appeals in *Missouri Municipal League v. FCC*, 299 F.3d 949 (8th Cir., 2002). That court found that the broad language of Section 253(a) of the 1996 Act should be construed to include municipalities. The 8th Circuit

23 Petition of Ball Mountain Dam Hydroelectric Project, 154 Vt. 189, 576 A.2d 124 (1990) (citing Hinesburg Sand & Gravel Co. v. Town of Hinesburg, 135 Vt. 484, 486, 380 A.2d 64, 66 (1977)).

24 Appeal of Northeast Washington County Community Health Center, 148 Vt. 113, 530 A.2d 558 (1987) (citing Welch v. Town of Ludlow, 136 Vt. 83, 87, 385 A.2d 1105 (1978)).

25 In addition to Texas, Missouri and Virginia (described above) the other states prohibiting or restricting municipal entry into telecommunications are: Arkansas (prohibiting municipal utilities from providing local exchange services); Florida (imposing various taxes to increase the prices of telecommunications services provided by public entities); Minnesota (requiring a 65% super-majority of voters before providing telecommunications services); Nevada (prohibiting municipalities from providing telecommunications services); Tennessee (banning municipal provision of paging and security service and allowing provision of various other services only upon satisfying various disclosure and voting requirements); Utah (limiting authority to own and operate facilities and to provide cable television and telecommunications services to a municipality's inhabitants); and Washington (limiting Public Utility Districts in existence before June 9, 2000 to providing only internal and wholesale telecommunications services).

remanded the case back to the FCC for reconsideration. The court is now considering petitions to reconsider its decision to remand, and likely will make a final decision next year.[26]

The 8th Circuit decision cited with approval a decision from a federal district court in Virginia that reached essentially the same determination. *See City of Bristol, Virginia v. Earley,* 145 F.Supp. 2d 741 (W.D. Va. 2001) (plain language of Section 253(a) of the 1996 Act includes cities among those entities whose right to entry into the telecommunications market is protected by the 1996 Act). That decision has been appealed to the federal Court of Appeals for the 4th Circuit.

It appears that, after further appeals and possibly remands to the FCC, federal courts of appeals will have issued conflicting rulings on whether the federal telecom act can preempt state statutes prohibiting municipal entry into telecom and/or cable markets. This may ultimately be resolved by the Supreme Court, but this process will take a minimum of three years. Until that time, passage of restrictive state legislation can be an absolute barrier to municipal entry.

Even state legislatures that have not been persuaded to ban municipal participation in the telecommunications and/or cable marketplace have in some cases acted to put in place restrictions that are intended to "level the playing field" between incumbents and new municipal entrants. For example, the Florida legislature has passed F.S.A. Section 166.047, which purports to subject municipally owned systems to the same sort of requirements that apply to private operators. Iowa, Ohio, Tennessee, Virginia and Washington all have enacted variations on this theme, permitting municipalities to compete, but only subject to certain requirements that rein in their discretion. But even apart from specific legislation it would seem possible for the incumbent to argue unfair discrimination in situations in which the municipality exempts itself from restrictions and expenses that the incumbent must bear pursuant to its franchise. Although this might not rise to the level of a Constitutional injury (see the discussion on *Niceville, supra*), it may contravene state or local law or ordinances.

State rules that do not prohibit municipal entry, but seek to restrict it in order to prevent "unfair" competition with the incumbent provider, are unlikely to be overturned. So the state does have some discretion in governing the ability of municipalities to enter the competitive field, although it may not prevent them altogether.

7.4 The "Open Entry" Provision of the 1996 Act

The 1996 Act contains Section 253(a), which states:

No State or local statute or regulation, or other State or local legal requirement, may prohibit or have the effect of prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service. This provision appears to be unambiguous, and should prevent any state legislation or regulation from prohibiting municipal entry into telecommunications. However, as discussed above, the FCC has to date resisted using this provision to preempt Texas and Missouri statutes that prevent or restrict a municipality's ability to provide telecommunications services, but this position is under challenge in federal courts.

Currently, there is an incipient split between the two federal appeals courts that have heard this issue. The D.C. Circuit, which has lately taken activist positions that support the Bell operating companies, has supported the FCC's interpretation that states may prohibit municipal entry. This court's theory is that municipal governments are instrumentalities of the state, and that the state has the authority to restrict their actions. In contrast, the 8th Circuit has read the 1996 Act strictly, finding that the reference to "any entity"

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[26] Petitions for Rehearing or Rehearing en Banc of the court's decision in the Missouri case were filed with the 8th Circuit Court of Appeals on Friday, September 27th by the FCC and United States, and Southwestern Bell Telephone (posted 10-1-2002). These parties argued that the court should reconsider its decision, because: (1) it is in conflict with the decision of the D.C. Circuit in City of Abilene v. FCC; (2) it puts the FCC in a quandary as to which Circuit to follow; (3) there are constitutional issues in play, and (4) the court failed to address two Supreme Court decisions that were brought to its attention after the completion of oral argument.

is intentionally broad, and applies to municipalities as well as any other entity wishing to provide telecommunications services. This is a surprising decision from the 8th Circuit, which tends to be activist in favor of protecting and enhancing state's rights.

The 8th Circuit remanded the FCC order back to the FCC for reconsideration, and is now considering petitions by the FCC and SBC Communications to reverse itself and to support the FCC decision. If the 8th Circuit denies those petitions and does remand back to the FCC, such action lays the groundwork for additional court challenges. If the 8th Circuit ultimately reaffirms its interpretation of 253(a), it will create a split with the D.C. Circuit, and parties may ultimately ask the Supreme Court to decide the issue. The appellate process would take 2-3 years to lead to a U.S. Supreme Court decision.

Conversely, if the 8th Circuit does remand the decision back to the FCC, such action may present an opportunity for interested parties to ask the FCC to reverse its earlier interpretation of §253(a). Such a reversal would allow municipalities to directly attack any state statute prohibiting or restricting entry into telecom or cable markets. The remand process at the FCC likely would take at least a year.

Recently, FCC Commissioner Kevin Martin gave a speech in which he proposed initiatives intended to promote deployment of fiber-to-home networks. The initiatives include deregulating incumbent telephone companies to the extent they deploy fiber-to-the-home, and the development of new universal service subsidies to promote broadband deployment. It is premature to conclude whether these initiatives would support municipal overbuilds, but the issue is worth watching – Martin is rumored to be the top candidate for the next FCC Chairman.

On March 1, 2001, Senator Hillary Clinton introduced a bill in the United States Senate, entitled "The Technology Bond Initiative of 2001, " S. 426 (the "Bond Initiative Bill"). The Bond Initiative Bill would amend the Internal Revenue code of 1986 to provide an income tax credit to holders of bonds financing new communications technologies. Recognizing that access to high-speed Internet is as important to 21st century as access to the railroads and interstate highways was to business of the last century, and that up to one-third of the United States population lacks access to high-speed Internet, the Bond Initiative Bill is intended to provide incentives to State and local governments to partner with the private sector to expand broadband deployment in their communities, especially underserved urban and rural areas.

Specifically, the Bond Initiative Bill provides that a taxpayer who holds a "qualified technology bond" will be allowed a tax credit determined according to a specified formula, which is tied to the face amount of the bond held by the taxpayer and the credit rate determined by the Secretary of Commerce. The term "qualified technology bond" means any bond issued as part of an issue if: (i) 95% or more of the proceeds of such issue are to be used for any or a series of "qualified projects"; (ii) the bond is issued by a State or local government within the jurisdiction of which such project is located; (iii) the bond is designated by the issuer as a qualified technology bond; (iv) the issuer certifies that it has obtained the written approval of the Secretary of Commerce for such projects; and (v) the term of each bond does not exceed 15 years.

The term "qualified project" is defined as a project: (i) to expand broadband telecommunications services in an area within the jurisdiction of a State or local government; (ii) which is nominated by such State or local government for a designation as a "qualified project"; and (iii) which the Secretary of Commerce, after consultation with the Secretary of Housing and urban Development designates as a qualified project or a series of qualified projects. In designating a "qualified project," preferences will be given to projects involving underserved urban or rural areas lacking access to high-speed Internet connections, and those that reflect partnerships and comprehensive planning between State and local governments and the private sector.

Finally, the Bond Initiative Bill sets a national technology bond limitation for each calendar year, which is $100,000,000 for 2002, 2003, 2004, 2005, and 2006, and zero (0) thereafter.

The Bond Initiative Bill has been referred to the Senate Committee on Finance. A House bill, H.R. 1415 (referred to as the "Tech Bond Initiative of 2001"), which was introduced in the House by Rep. Charles

Rangel on April 4, 2001, is similar in all material respects to the Bond Initiative Bill. The bill has been referred to the House Committee on Ways and Means.

There will be no further action on either bill this year. Moreover, these Clinton and Rangel bills are sponsored almost exclusively by Democrats, and neither bill is likely to proceed in an all-Republican Congress. Nevertheless, there will be substantial legislative activity next year, and this activity is likely to focus on means of increasing deployment of broadband services to rural and other underserved areas. It is possible that proponents of broadband will pursue supporting municipal activity in building broadband infrastructure in this process. We will advise you of any federal congressional activity that may present this opportunity.

For the most part, incumbents have been unsuccessful in their attempts to prevent the entry of municipalities into cable television and telecommunications provision. Their legal challenges have generally fallen flat when faced with municipalities that have the inherent power to enter into such enterprises. The most successful oppositions have resulted from incumbent efforts to pass restrictive legislation, and from the judicial doctrine known as Dillon's Rule.

There are no legislative issues in our target states, but we may face credible opposition based on Dillon's Rule in Vermont and New Hampshire.

This section is sent to you as a courtesy to advise you of actions taken by the Federal Communications Commission that may impact carriers deploying advanced services to small and medium customers.

In an open meeting on February 20, 2003, the FCC adopted its *Order* in the most recent Triennial Review proceeding. The full text of the *Triennial Review Order* has not been released yet, and in fact may not be released for another three weeks or more. What we know of the rules adopted in the Order comes from a Press Release issued by the Commission on the 20th, an Attachment to that Press Release, Separate Statements by all five Commissioners, and statements by the FCC Staff in a press conference following the open meeting.

This section addresses issues related to one portion of the *Triennial Review Order* – new rules that deregulate incumbent local exchange carrier ("ILEC") "broadband" services provided over hybrid fiber/copper "Mass Market" loops. This is by far the least understood portion of the FCC's *Order*. While most of the rules that the FCC adopted were widely debated in the months before the *Order* was adopted, the broadband deregulation rules were not. Rather, this portion of the *Order* was taken from a group of filings made by a small coalition of parties late in the proceeding, and was adopted literally the night before the *Order* was adopted. The haste and secrecy with which this issue was treated ensure that the issues were not vetted by all affected carriers, or by the FCC Staff. Indeed, two of the Commissioners complained that the broadband deregulation rules were not fully explained to them by the time the issue came to a vote.

The following memo analyzes what little of the broadband rules has been made public, and focuses on ambiguities and inconsistencies in the rules and policies. We hope that it may alert you to aspects of the new rules that may impact your business. Over the next several weeks, we anticipate discussing these issues with a number of carriers that may wish to seek clarification or modification of the rules when they are finally released.

7.5 Further Issues on Recent FCC Decision of Broadband

In its statements and press releases made upon adoption of the *Triennial Review Order*, the Commission enunciated the twin goals of the broadband deregulation section of its *Order*: 1) incent incumbent local exchange carrier ("ILEC") investment in new packet technology over hybrid fiber/copper loops, and 2) ensure that competitive carriers can continue to gain unbundled access to the "enterprise" loop functions that are available to them today. The means whereby the Commission proposes to reach these goals is to implement the rules proposed by a coalition of equipment and fiber manufacturers called the High Tech Broadband Coalition ("HTBC").[27]

The HTBC proposed rules are internally inconsistent, and will not serve as a basis for a rational or enforceable regulatory scheme. The lack of specificity concerning broadband unbundling in the Commission's press releases and the Commissioners' written statements could lead to terms that are inadequately defined and rules that are not fully thought-out. The major concern is that such rules, absent further input from interested parties, would have severe unintended consequences that would generate more uncertainty and that would be imprecise enough to allow ILECs to refuse unbundled access to loops in cases where the Commission did not intend to eliminate the unbundling requirement.

In the Press Release and Commissioners' statements issued following the meeting in which the *Triennial Review Order* was adopted, the Commission made clear that its broadband unbundling rules were designed to achieve two policy goals:

Providing Incentives for ILEC/RBOC Investment in Fiber and Electronics

The three Commissioners that voted to deregulate ILEC broadband services over fiber facilities made clear the policy goals that they hoped to achieve: "a broadband regulatory regime that will stimulate and promote deployment of next generation infrastructure . . . ." (Chairman Powell Separate Statement at 1); "ensure that network owners have adequate incentives to make the costly and risky investments needed to deliver broadband to all Americans." (Commissioner Abernathy Press Statement at 1); "it adjusts the 'wholesale' prices for all new investment." (Commissioner Martin Press Statement at 1).

The Intent to Maintain Competitive Carriers' Access to "Copper" Functions of Loop

The FCC states that, even though ILECs will no longer be required to unbundle "bandwidth for the provision of broadband services" over hybrid fiber/copper loops, "requesting carriers will continue to get that same access even after this relief is granted." (News Release at 1.) The apparent intent is to ensure that CLECs will continue to have access to DS1 and DS3 loops, as they do today. The Attachment to the Press Release states that that ILECs will not be required to unbundle the "transmission path over hybrid loops utilizing the packet-switching capabilities of their DLC [digital loop carrier] systems," but that they "must [continue to] provide . . . high capacity loops utilizing TDM [time division multiplexing] technology, such as DS1s and DS3s." (Attachment to News Release at 2.) Commissioner Abernathy elaborated on this policy, stating that: "I am persuaded that the best approach, which we have adopted today, is to preserve existing access rights but refrain from imposing new unbundling obligations on upgraded hybrid loops. . . . [C]ompetitive LECs will retain the very same access to high-capacity loops (DS-1s and DS-3s), subject to the impairment analysis set forth in the order, that they have today." (Abernathy Statement at 2.)

The FCC apparently intends to achieve these policy goals by adopting rules based on proposals made by the High Tech Broadband Coalition. While the Press Release is silent on this matter, the separate statement of Commissioner Martin states that "we endorse and *adopt in total* the High Tech Bandwidth Coalition's proposals for the deregulation of fiber to the home and any fiber used with new packet technology." (Martin Statement at 1, emphasis in original.)

The HTBC's proposals are set out in three *ex parte* filings dated January 24, February 7 and February 14, and in proposed rules appended to the latter filings. These filings define "broadband loops" in a way that attempts to distinguish the packetized functionalities of a fiber/copper hybrid loop – which will not be unbundled – and the non-packetized functionalities of a loop – which will continue to be unbundled.

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[27] The HTBC members listed on the most recent filings are: Texas Instruments; Corning; ADC; Westell; Lucent; Intel; Catena; Tellabs; Telcordia; Alcatel; Siemens; Telecommunications Industry Association; Information Technology Industry Association; and Consumer Electronics Association.

HTBC explains that their "definition of broadband loop would not include existing non-packet loop capabilities . . . . For example, DS-1s over TDM facilities would remain available . . . ." (2/7 ex parte at 2.)

The HTBC filings repeatedly and clearly state the policy behind their proposed rule changes: "Competitors would continue to have access to existing non-packet voice and data capabilities including DS-1s, subject to the impairment analysis." (2/14 *ex parte* at 1.)

"[The HTBC broadband loop definition] would assure that the competitors continue to get what they get today, but at the same time give all carriers the incentive to invest in new last mile fiber and related broadband facilities . . . ." (2/7 *ex parte* at 3.)

"Specifically, we recommend that the Commission exclude the [ILECs'] last mile integrated packet/fiber facilities from the unbundling regime, but continue to assure that the [CLECs] have access to all existing non-packet loop capabilities over hybrid fiber/copper loop facilities, subject to [an impairment analysis]." (1/24 *ex parte* at 1.)

"By distinguishing between legacy and last-mile packet-based facilities, we believe that this framework provides a clear and competitively-sound demarcation that would promote broadband investment, deployment and facilities-based competition." (*Id*.)

The HTBC's proposed rules state that ILEC broadband loops will not be subject to the unbundled access requirements of §251(c)(3) of the Act, and define a "broadband loop" as "any transmission path over fiber facility . . . that is used to transmit packetized information . . . . Also included is any electronics attached to a copper loop that is used in conjunction with or facilitates packetized transmission over such loop." (2/7 *ex parte*, attachment at 1; 2/14 *ex parte* Attachment, at 1.) Note that the proposed rules speak in terms of "packetized" information and transmission and do not mention TDM as the factor that delineates packetized and non-packetized information or transmissions. However, the text of the HTBC filings, along with the Commission's Press Release Attachment and statements by the Commission Staff, all reference TDM as the factor that defines whether functions of a Mass Market loop must be unbundled or not. The following sections discuss why a regulatory scheme based on a distinction between TDM and "non-TDM" functions or facilities should not be adopted.

Using TDM Technology To Determine Whether or Not Loop Functions Are Subject to Unbundling Is Impracticable. TDM technology is ubiquitous in both packetized and non-packetized loops. Time Division Multiplexing is employed by traditional multiplexers to aggregate both analog and digital voice traffic onto T-1 copper loop and transport facilities. It is also used to aggregate such traffic onto T-3 fiber loop and transport facilities. In addition, however, the "clocking" function performed by TDM – assigning millisecond time slots that set up sampling intervals, define bitrates, and perform other network control functions – are used by packet, frame or cell technologies, such as Frame Relay, Synchronous Optical Network ("SONET") and Internet Protocol ("IP"). As a result, "TDM systems, originally designed for voice service, will continue to be adapted for voice, data, video, and integrated applications."[28]

Use of TDM to determine what ILEC network functions must be unbundled is inherently vague. Because TDM technology is found ubiquitously throughout the ILEC networks, and is used in the provision of both packetized and non-packetized services, there is no clear way to draw a "bright line" distinction between TDM and "non-TDM" network functionalities. This creates an inherently vague regulatory scheme that will generate uncertainty, unnecessary litigation, and may unreasonably prevent competitive carriers from exercising their rights to obtain access to unbundled network elements. Recent history demonstrates that an effective regulatory scheme must avoid such ambiguity: vagueness in the Commission's rules regarding EEL availability; the circumstances in which ILEC dark fiber facilities are available for unbundling; and whether equipment that performs a packet switching function could be placed in collocation arrangements, all resulted in extensive litigation that prevented competitive carriers from exercising their rights under the

[28] J. Pecar, R. O'Connor & D. Garbin, *Telecommunications Factbook* 50, (1993).

1996 Act for extended periods – sometimes years. This history compels us to require precision in the FCC's rules governing broadband deregulation.

Most ILEC hybrid fiber/copper loop systems are now provisioned over Digital Loop Carrier ("DLC") systems deployed in remote terminals. This equipment is generally designed to be as versatile as possible, and to generate a variety of different services, from individual voice grade lines to high capacity data channels. In the remote terminal, these services are defined by line cards that are inserted into the DLC, and that are physically connected to the copper distribution plant that runs to the customer premises. A typical DLC system may accommodate line cards for analog or digital voice, DSL-based services, SONET services, Internet Protocol-based services, or others. In such an environment, a regulatory scheme that requires unbundling of TDM functions, but not non-TDM functions is not practicable.

The Alcatel Litespan 2000 provides a real-life example. Alcatel describes this Digital Loop Carrier system as follows:

[T]he Litespan Next-Generation Digital Loop Carrier (NGDLC) platform will support second generation, TDM based, high bit rate Digital Subscriber Line (HDSL2) connectivity. This offering would be made available on Litespan's footprint of over 45 million lines in North America. . . . Alcatel's Litespan is the world's most widely deployed multi-service access node offered to carriers to connect both voice and data access lines. . . . Litespan is used for all kinds of access lines, POTS, ISDN or xDSL and provides open interfaces to voice networks (V5.2 / GR303) and to broadband data networks.[29]

From this description of the technology, the following questions arise:

The Litespan 2000 represents the type of "next generation" loop technology that the Commission seeks to promote. Yet deployment of the NGDLC technology is evolutionary – it requires upgrades to existing, enterprise loop technology, not the wholesale replacement of existing equipment. As ILECs upgrade their existing Alcatel DLC equipment to the Litespan 2000, is it really the Commission's intention to eliminate unbundling requirements for that portion of the 45 million access lines that are now subject to the unbundling requirements?

ILECs may find it efficient to replace existing HDSL loops with ADSL or SDSL technology.[30] Currently, a significant proportion of DS1 loops that CLECs obtain from ILECs are provisioned over HDSL.[31] If an ILEC replaces an HDSL line card in its Litespan DLC with an SDSL line card, does that action transform the loop from a "TDM loop" to a "non-TDM loop" and thereby eliminate the unbundling requirement?

There are many variations on this theme: DLC equipment is being designed by equipment manufacturers to be a versatile as possible. 1.544 Mbps access lines now are provisioned over TDM, ISDN, ATM,[32] ADSL, HDSL, IDSL, Frame Relay, Cell Relay,[33] SONET,[34] and a variety of other technologies. Can an ILEC eliminate the unbundling obligation imposed by §251 of the Act simply by swapping out one line card and replacing it with another?

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[29] Alcatel: *Alcatel Teams with ADC and ADTRAN to support TDM-based HDSL2 solutions on an industry-leading Litespan platform*, 1 of 2, http://www.alcatel.com/vpr/?body=http://www.home.alcatel.com/vpr/archive.nsf/Archiveuk/50F9296987BFE184C1256B3600491FDC?opendocument

[30] "High data rate digital subscriber line (HDSL) is a technology that delivers 2 Mbps to the customers. . . . In some applications it is likely to give way to ADSL and SDSL in the near future." Lav Gupta, *Access Network Planning and Technologies*, 3 of 14 http://www.angelfire.com/nt/access1/web2001chap5.htm (Nov. 2001).

[31] "HDSL, one of the earliest forms of DSL technology, provides up 1.544 Mbps of bandwidth over a single wire of twisted-pair cable." Whatis.com, *Fast Guide to DSL*, http://whatis.techtarget.com/definition/O,289893,sid9_gci213915,00.html.

[32] "ATM scales in capacity, from the low end of T1 (1.5Mbps) up to OC-48 (2.5 Gbps) . . . ." International Engineering Consortium, *On-Line Education: Voice Telephony over Asynchronous Transfer Mode (VToA)*, http://www.iec.org/online/tutorials/vtoa/tipic05.html?Next.x=40&Next.y-14.

[33] 1.544 Mbps connections currently are provided by ILECs over Frame Relay, SMDS-based Cell Relay, ATM-based Cell Relay – all using Layer 1 protocols. J. Pecar, R. O'Connor, D. Garbin, *Telecommunications Factbook* 292 (1993).

[34] *SONET* is used to provide 1.544 Mbps transport to end user locations. See J. Pecar, R. O'Connor, D. Garbin, *Telecommunications Factbook* 294 (1993).

Finally, the Alcatel description of the Litespan 2000 encapsulates the dilemma faced by the Commission if it adopts the High Tech Bandwidth Coalition proposed regulations: HDSL-based DS1 loops are widely available on an unbundled basis to CLECs today. Alcatel's "next generation" DLC – the Litespan 2000 – can replace this technology with "HDSL2." Does HDSL2 remain subject to unbundling because, as Alcatel describes it, it is "TDM based"? Or is exempt from unbundling because it is new, "Next Generation" investment by the ILEC?

In short, a distinction between "TDM" and "non-TDM" has significance from an engineering perspective, but it is not appropriate as a basis for a new regulatory regime. If ILECs can eliminate the unbundling requirement by simply swapping line cards using different technologies, the Commission has created a huge loophole by which the ILEC could easily eliminate unbundling for virtually any loop. Conversely, if unbundling is still required for loops that employ packet technology, the TDM/non-TDM distinction is irrelevant, and another regulatory standard should be used.

A Blanket Decision that Packetized or Non-TDM Loop Functions Are Not Subject to Unbundling Will Not Promote the Policy Goals Identified by the Commission or the HTBC. The test would fail to "ensure that competitors continue to get what they get today" As noted above, the stated policy goal of both the HTBC and the Commission is to deregulate new ILEC investment and advanced service capabilities, while ensuring that competitive carriers will continue to have access to the unbundled loops that they have had available to them since the 1996 Act was passed. If ILECs are able to eliminate unbundling by replacing their "TDM" line cards with packet-switched service cards, competitors will not be able to "get what they get today." Rather than adopt a TDM/non-TDM demarcation, the Commission should clarify that requesting carriers will continue to have access to unbundled DS1 and DS3 loops at TELRIC prices, as they have today, regardless of the loop technology deployed by the ILECs.

The TDM test is overbroad in promoting new investment, because it applies to loops that were built years ago. The Commission has stated that its new deregulatory policy is intended to spur new ILEC investment. Yet at the press conference following the February 20 open meeting, FCC Staff member Brent Olson noted that the new rules would apply to all ILEC hybrid fiber/copper loop systems. Mr. Olson noted that currently, approximately 25-30% of ILEC residential customers are currently served over hybrid fiber/copper loops, meaning that the rules will deregulate technology choices that the ILECs made as long as a decade ago.

Moreover, ILECs have been deploying packet technologies for longer than that. ILECs started to deploy ATM technology in their networks in the 1980s; Frame Relay was introduced in ILEC networks in the early 1990s; and DSL has been deployed by ILECs for years: indeed, a substantial number of ILEC enterprise special access DS1 loops are currently provisioned over HDSL, and have been for the better part of a decade. Other DSL technologies, such as ADSL, have been deployed by the largest ILECs for over five years, and are currently extensively deployed: The Commission has reported that as of June, 2001, ILECs had deployed 2,511,000 high-speed DSL lines, with 2,322,000 of these deployed by the Bell companies.[35] Deployments clearly have increased beyond these numbers in the almost two years since the Commission's report. The Commission should make clear that its policy is to promote new investment in "next generation" Digital Loop Carrier equipment, not to reward ILECs for investments they have made in the past in response to competition. Indeed, Commissioner Copps questions the need to provide any regulatory incentives for "a step carriers have been taking in any event over the past years to reduce operating expenses . . . ." (Commissioner Copps Press Statement at 2).

The TDM test could lead ILECs to select network equipment based on regulatory incentives, as opposed to network efficiency. By tying relief from the unbundling requirements of the 1996 Act to the deployment of specific technologies (i.e., "non-TDM"), the Commission could be establishing regulatory incentives that would drive ILEC equipment selections, as opposed to the ILEC determination of the most efficient and economic technology. The Commission has long stated its desire to avoid distorting market decisions,

[35] *FCC Releases Report on the Availability of High-Speed and Advanced Telecommunications Capability*, FCC Press release at 2 (February 7, 2002).

but the prospect of self-deregulation based on specific technology selections is an extraordinarily powerful driver for ILECs.

The FCC Must Clarify that Loops Serving Small and Medium Sized Businesses Are Not Affected By the Broadband Deregulation Rules. The new rules adopted by the Commission make a distinction between "Mass Market Loops" and "Enterprise Market Loops." The definition of these terms is critical because, according to the Press Release Attachment, the broadband deregulation rules apply exclusively to Mass Market Loops, and not to Enterprise Market Loops. (Compare Attachment at 1 with Attachment at 2.)

These terms are not defined in the Commission's Press Release or Attachment, however, or in the statements of the Commissioners. The only statement of clarification came from Wireline Competition Bureau Chief William Maher in the press conference following the open meeting, in which he stated that the new broadband deregulation rules apply to loops to homes, and that loops containing fiber that serve businesses remain subject to the unbundling rules.

It therefore appears that the Commission does not intend broadband deregulation to apply to loops serving business customers. If this is true, the Commission must expressly reject that portion of the HTBC proposed rules that do specifically apply broadband deregulation to business lines: "[The broadband loop] changes should apply to small business customers as well as residential customers." (HTBC 2/7 *ex parte* at 3.) The Commission should clarify that this statement is incorrect regarding the application of the broadband deregulation rules to business loops for any sized customer.

This issue requires clarification because, in its last order reviewing unbundled network elements ("UNEs"), the Commission discussed "mass market" loops as serving customers with up to three lines.[36] The Commission made this statement in its analysis of the unbundled local switching UNE, however, and was referring to a "mass market" for dialtone voice services, not for advanced data services. In the instant case, where the Commission is defining "mass market" as the market for broadband services – in which ILECs compete against cable modem services – the same definition of "mass market" cannot apply. There is no evidence on the record that CATV companies provide cable modem services to small businesses using up to three lines. Moreover, the Small Office/Home Office ("SOHO") market is one that is particularly underserved by large ILECs, and for that reason is targeted by the full range of competitive carriers and providers: "UNE-L,"[37] "UNE-P,"[38] Data LECs[39] and VoIP providers.[40] There is no basis for distinguishing between small- and medium-sized businesses in this context.

The Commission necessarily will have to define "Mass Market" and "Enterprise Market" loops with specificity in its *Order*. In doing so, it should make clear that loops running to multiple dwelling units, while technically serving residential customers, are indistinguishable from loops serving business locations, both from a technical and market perspective. Service to Multiple Dwelling Units ("MDUs") has always been an important market for competitive local service providers, and nothing in the Commission's *Order* should interfere with a requesting carrier's ability to obtain unbundled loops to serve this market.

Access to unbundled DS1 and DS3 loops is essential to the competitive carriers' ability to provide these bundled service packages. Purchasing a single, high capacity link to the end user location allows competitive carriers to deploy electronics at the customer premises and in the competitive carrier's network that permit oversubscription on the loop, and that allows the provision of multiple data and voice services over the same transport facility. This generates the network efficiencies and cost economies that make this bundled service offering attractive. This is the use that competitive carriers have made of the unbundled loops that they obtain today. Continued access to these unbundled loops for the provision of bundled voice

[36] *Implementation of the Local Competition Provisions of the Telecommunications Act of 1996*, 15 FCC Rcd 3696 (1999) at ¶¶290-98.
[37] Carriers using Unbundled Network Element Loops.
[38] Carriers using the Unbundled Network Element Platform.
[39] Carriers using unbundled loops and transport to provide data services over ADSL or other technologies.
[40] Voice Over Internet Protocol providers, whether regulated carriers that obtain UNEs directly, or unregulated providers that resell service provided by competitive carriers that employ UNEs.

and data services is necessary to continue one of the most innovative and popular service offerings that competitive carriers now provide. The Commission should therefore clarify that ILECs must continue to make 1.544 Mbps and 45.736 Mbps loops available on an unbundled basis to competitive carriers, regardless of the types of technologies the ILECs deploy in their loops.

As discussed above, the HTBC's proposed rules, which would restrict competitive carries to using only the "TDM" functions of Mass Market loops, if adopted without modification and clarification, could have significant adverse unintended consequences. We are particularly concerned that any decision to limit competitive carriers to the "TDM" portion of Mass Market loops will prevent competitive carriers from offering Internet Protocol-based services, or other advanced technologies, to residential customers.

As technology continues to advance, many carriers are considering the efficiencies and cost economies that new technologies – such as voice over Internet Protocol – can bring to their networks. The Commission has determined that it is sound public policy to take steps to incent ILECs to deploy such technologies in their networks. By the same logic, the Commission should make clear that sound public policy prevents it from adopting regulations that would provide a <u>disincentive</u> to competitive carriers' deployment of the same technology.

The advanced services platforms being considered by competitive carriers often entail placing equipment that generates data packets – whether a Session Initiated Protocol ("SIP") phone or an IP gateway – at the customer premises. The packetized traffic is then transmitted over DS1, DS3, or even 64 kbps loops obtained from the ILEC. Using these applications, competitive carriers employ packet-switching and other Layer 3 functions – but they do so using their own equipment at the customer premises and at points on their networks. The unbundled loops that they obtain from the ILECs are the same transport loops that are currently available today, for use with non-packetized services.

The Commission has made clear its intent that its broadband deregulation rules for Mass Market Loops are geared to ensuring that ILEC investment in packet-switching technology will be exempted from the unbundling requirement. The Commission should clarify that its deregulation rules will not prevent competitive carriers from deploying their own packet-based technologies to provide service over loops that are available from ILECs today.

The Commission's Press Release expressly states that, for Enterprise Market Loops, dark fiber loops will be retained as UNEs, subject to impairment analysis by the respective state commission. (Press Release, Attachment at 2.) This apparently is inconsistent with the HTBC's proposed rules, which state that "the incumbent LEC shall not be required to provide unbundled access to a broadband loop as defined below and dark fiber deployed in any part of the local loop." (HTBC 2/7 *ex parte*, attachment at 1, proposed rule §51.319.) The Commission should clarify that the HTBC proposed rules are not adopted in this regard, and should draft new rules retaining as UNEs dark fiber Enterprise Market loops.

If the FCC's Policy Is to Prevent Competitive Carriers from Providing Services at Bit Rates Exceeding 1.544 or 45.736 Mbps of Capacity, there Are Less Intrusive Means to Implement Such a Restriction. As discussed above, the Commissioners and the HTBC have stated that one policy goal of its broadband rules is to ensure that competitive carriers retain the ability to obtain unbundled access to the DS1 and DS3 loops that have traditionally been available to them. Yet, as also discussed above, the rules that retain unbundling only for TDM-based loop elements could easily be circumvented, thereby defeating this stated goal. This problem can most easily be solved by a rule stating that competitive carriers will continue to have access to unbundled 1.544 Mpbs and 44.736 Mbps loops on any hybrid fiber/copper loop system, regardless of the loop technology deployed by the ILEC. This would ensure that "competitors continue to get what they get today" (HTBC 2/7 *ex parte* at 3), and eliminate confusion, possible ILEC gamesmanship, and regulatory market distortions.

If the Commission Feels Compelled to Adopt a Technology-Based Regulatory Scheme, It Should Focus On Protocol Layers, Not TDM. If the Commission seeks a technology-based means of distinguishing between deregulated broadband mass market loops (or loop functions) and loops (or loop functions) that remain subject to unbundling, it should focus on Layers of the Open System Interconnection ("OSI") Protocol Stack. The DS1 and DS3 loops that are currently available on an unbundled basis to competitive carriers are all provisioned over equipment employing functions of Layers 1 and 2.

Layer 1 is the Physical Layer, and is defined as the layer that "provides mechanical, electrical, functional, and procedural characteristics to activate, maintain, and deactivate connections for the transmission of unstructured bitstreams over a physical link."[41] "Fast Ethernet, RS232, and ATM are protocols with physical layer components."[42]

Layer 2 is the Data Link Layer: "The data link layer provides for reliable transfer of data across the physical link. It provides for mapping data units from the next higher (network) layer to frames of data for transmission. . . . Layer 2 provides for multiplexing one data link onto several physical links . . . ."[43] Frame Relay is service using only Layer 2 functions.[44]

The Layer 1and 2 functions govern the multiplexing and transmission of analog, digital and packetized traffic, and the technologies that are currently used to provide competitive carriers with access to unbundled DS1 and DS3 loops use these functions. In contrast, Layer 3 (the Network Layer) provides the higher level functionality: "This layer provides switching and routing technologies, creating logical paths, known as virtual circuits, for transmitting data from node to node. Routing and forwarding are functions of this layer . . . ."[45] It is at this layer that Internet Protocol resides.[46]

If the Commission were to provide for the deregulation of ILEC Layer 3 equipment and network functions, such a regulatory scheme would ensure that the new packet switching and routing equipment that ILECs install to provide advanced services are not subject to unbundling, and would allow them to compete with cable modems and similar technology on a deregulated basis. At the same time, such a regulatory scheme would ensure that competitive carriers continue to receive the same unbundled access to the DS1 and DS3 loops that they do today.

About the same time that the Commission initiated its *Triennial Review* proceeding, it initiated two other proceedings dealing with ILEC broadband service issues. The first was the "*Dominant/Non-dominant*" proceeding, which sought comment on whether ILECs were non-dominant in the provision of broadband services.[47] The second was the "*Title II*" proceeding, which sought comment on whether broadband service is not a "telecommunications service" as defined under Title II of the federal Communications Act, but rather is another category of service that is not subject to the regulations that apply to telecom service providers.[48] Both of these proceedings raise the possibility of completely deregulating ILEC broadband services. If the Commission found that ILECs are non-dominant in the provision of broadband services, such a finding could lead to the elimination of any regulations over those services, and possibly of the facilities that are used to provide them. Similarly, if the Commission were to find that broadband services are non-Title II services, regulations that apply to telecom carriers – including network unbundling and the other requirements of the Telecommunications Act of 1996, might be eliminated for these services and associated facilities.

Because the Commission has adopted rules that govern ILEC broadband services in its *Triennial Review* proceeding, these other proceedings are unnecessary. Indeed, the fact that the Commission has adopted rules that will apply to ILEC broadband services is inconsistent with a finding of non-dominance or non-Title II status. Because any further action in either the *Dominant/Non-dominant* proceeding or the *Title II*

41 J. Pecar, R. O'Connor, D. Garbin, *Telecommunications Factbook* 219 (1993).
42 Webopedia, "The 7 Layers of the OSI Model" 2 of 3, http://webopedia.internet.com/quick_ref/OSI_Layers.asp.
43 J. Pecar, R. O'Connor, D. Garbin, *Telecommunications Factbook* 219 (1993).
44 J. Pecar, R. O'Connor, D. Garbin, *Telecommunications Factbook* 225, 260 (1993).
45 Webopedia, "The 7 Layers of the OSI Model" 2 of 3, http://webopedia.internet.com/quick_ref/OSI_Layers.asp.
46 J. Pecar, R. O'Connor, D. Garbin, *Telecommunications Factbook* 220 (1993).
47 *Review of Regulatory Requirements for Incumbent LEC Broadband Telecommunications Services*, CC Docket No. 01-337 (2002).
48 *Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, CC Docket Nos. 02-33, 95-20 & 98-10 (2002).

proceeding would likely be inconsistent with the regulatory regime adopted by the Commission in the *Triennial Review* proceeding, the Commission should terminate those proceedings as soon as practicable.

8. BONDING ISSUES

Merton has reviewed the issues regarding bonding for towns New Hampshire. This section details that process.

8.1 New Hampshire Strategy

Merton has had discussions with various New Hampshire counsel regarding bonding. The following is a summary of their assessments:

Counsel thought that NH approach should be different given that it is a Dillon Rule state. In this case counsel recommends a comprehensive approach. The entire state other than Manchester, Concord and Nashua is primarily made up of small towns. We agreed that there is little likelihood that the private sector will at any time soon embark upon a massive roll out of broadband (DSL, Cable or other technologies) to satisfy the demand given the low population densities.

Counsel felt that the General Obligation Bond approach might be a better way than the Revenue Bond. They indicated that the GO would be an easier sell.

Counsel felt that NH law RSA 33B one could argue that authority exists, however any challenge would create a problem and litigation. Therefore a comprehensive approach may be the way to go. Merton told them about a model comprehensive law passed by the State of Utah's authorizing municipal broadband networks and other such services. They volunteered and counsel also volunteered Roger Vacco (Palmer & Dodge) to review such proposed legislation.

In summary, there is no impediment to such for the town.

8.2 New Hampshire Law Issues

There are several issues that are of concern under New Hampshire law. They are:

1. Is MBN a utility and must it be regulated?

2. Is the current Co-Op financing authority broad enough to cover MBN and should this be considered as a vehicle for such financing?

3. Is the current bond raising authority broad enough to allow both muni and Co-Op financing?

We argue that upon a first reading, without recourse to cases to the contrary that the financing issue are all favorable and that the utility status does not apply.

8.3 Utility

The first question is that of whether a utility approach applies to MBN. This can be investigated along two avenues.

First, under Chapter 38 the following definition applies:

"38:1 Definitions. – *In this chapter:*

I. "Commission' means the public utilities commission, unless the context otherwise indicates.

II. "Utility' means any public utility engaged in the manufacture, generation, distribution, or sale of electricity, gas, or water in the state.

III. "Municipality' means any city, town, unincorporated town, unorganized place, or village district within the state."

However, Chapter 362 states:

"362:2 Public Utility. –

I. The term "public utility"' shall include every corporation, company, association, joint stock association, partnership and person, their lessees, trustees or receivers appointed by any court, except municipal corporations and county corporations operating within their corporate limits, ***owning, operating or managing any plant or equipment or any part of the same for the conveyance of telephone or telegraph messages*** *or for the manufacture or furnishing of light, heat, sewage disposal, power or water for the public, or in the generation, transmission or sale of electricity ultimately sold to the public, or owning or operating any pipeline, including pumping stations, storage depots and other facilities, for the transportation, distribution or sale of gas, crude petroleum, refined petroleum products, or combinations of petroleum products, rural electric cooperatives organized pursuant to RSA 301 or RSA 301-A,* ***and any other business, except as hereinafter exempted, over which on September 1, 1951, the public utilities commission exercised jurisdiction****."*

This is again more specific. It focuses in on telephone or telegraph, but again MBN is not a Telecommunications Service, and since the 1996 delimit a State's ability to regulate to such entities they are therefore exempt from Chapter 362 as well.

8.4 Co-Op Statutes

Chapter 53-A of the New Hampshire general laws states:

"purpose of this chapter to permit municipalities and counties to make the most efficient use of their powers by enabling them to cooperate with other municipalities and counties on a basis of mutual advantage and thereby to provide services and facilities in a manner and pursuant to forms of governmental organization that will accord best with geographic, economic, population and other factors influencing the needs and development of local communities."

Furthermore it states:

"Any 2 or more public agencies may enter into agreements with one another for joint or cooperative action pursuant to this chapter. Appropriate action by ordinance, resolution or other action pursuant to law of the governing bodies of the participating public agencies shall be necessary before any such agreement may enter into force."

The limitation is as follows:

"V. Every agreement made hereunder shall, prior to and as a condition precedent to its entry into force, be submitted to the attorney general who shall determine whether the agreement is in proper form and compatible with the laws of this state. The attorney general shall approve any agreement submitted to him hereunder unless he shall find that it does not in substance meet the conditions set forth herein and shall detail in writing addressed to the governing bodies of the public agencies concerned the specific respects in which the proposed agreement substantially fails to meet the requirements of law. Failure to disapprove an agreement submitted hereunder within 30 days of its submission shall constitute approval thereof."

However, it further states:

"53-A:5 Approval by State Officers. – *In the event that an agreement made pursuant to this chapter shall deal in whole or in part with the* ***provision of services or facilities with regard to which an officer or***

agency of the state government has constitutional or statutory powers of control, *the agreement shall, as a condition precedent to its entry into force, be submitted to the state officer or agency having such power of control and shall be approved or disapproved by him or it as to all matters within his or its jurisdiction in the same manner and subject to the same requirements governing the action of the attorney general pursuant to RSA 53-A:3, V. This requirement of submission and approval shall be in addition to and not in substitution for the requirement of submission to and approval by the attorney general."*

The argument, based upon the above reference to both the 1996 Act and the Missouri case states that since this is not a Telecommunications Service it is not governed by the Public Utility Commission so that the above clause is not effective.

However, it is argued that since this is not a utility that this Co-Op power may be used as a financing vehicle.

8.5 Bond Raising Authority

The Bond raising authority is permitted and delimited in Chapter 162-G. Specifically this states;

"162-G:2 Declaration of Need and Purpose. – *It is hereby declared that there is a need for the development and preservation of business and industry within the state in order to alleviate and prevent unemployment, to insure the continued growth and prosperity of the state, and of the cities and towns within the state and to promote the general welfare of all its citizens. It is the purpose of this chapter to authorize the cities and towns of the state to foster and encourage the development of business and industrial facilities within or without their respective boundaries, acting directly or through a business and industrial development authority or a voluntary, nonprofit corporation, alone or in concert with one or more other governmental units, by acquiring, developing, expanding, leasing, and disposing of such facilities, where such development is more appropriate under this chapter than under RSA 162-A, as determined by the governing body. It is further declared that the acquisition of title to such facilities, either directly or through a business and industrial development authority or a voluntary, nonprofit corporation, and the lease or sale of such facilities as provided hereunder is a public purpose and shall be regarded as performing an essential governmental function in carrying out the provisions of this chapter. However, competition among communities in this state merely for the purpose of seeking relocation of business and industrial facilities located in this state is contrary to the policy of this chapter…"*

The remainder of this Chapter details the requirements of this bond process.

8.6 Proposed Changes

It is not clear that any changes are required. The pole issue however needs further analysis.

8.7 The Service:

The MBN is the provision by municipality or municipal power plant wherein the entity as described will finance, build, and operate a data connection enabling device which will provide for the interconnection of service providers and individuals and business in the municipality. The MBN in no way is the creator, provider, support, or effector of the service so provided. The MBN is an integrated TCP/IP backbone network which effects interconnectivity by an integrated packet switching network. There is no way in which the municipality can control the packets to effect service control.