Fiber to the Home;

Capital Costs and the Viability of Verizon's FIOS

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Abstract

The deployment of fiber to the home, FIOS as called by Verizon, has commenced and there are many prognostications in the press and in the financial analysts reports. In this paper we present our firsthand direct market priced results from 150 markets in New England. From 2002 through 2005 we had performed detailed field studies and designs for 150 markets and targeted 35 for initial deployment. In fact we were successful obtaining USDA Rural Utilities Services financing for these systems. However, due to the excessively high costs of the franchise process and irrational behavior of some of the towns, we had to withdraw. The results contained herein, however, clearly point to the true costs of deploying a FIOS or FTTH system. Our results clearly show that the Verizon projections are, in our opinion, without merit and grossly underestimate the true costs of deploying what they seek to deploy. Further, in our opinion, Verizon, in the midst of a potential melt down of astronomical proportions in the wireline market, as we have shown a year ago, may very well be underestimating the true costs of this market.

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1. INTRODUCTION

Fiber to the home has been developing over the past twenty years plus. It is a simple technology and generally is a tree and branch type design with limited active elements in the field. The passive optical network (PON) designs for example are nothing more than splitter of the light and sharing bandwidth. Passive devices being simple and generally less expensive can provide easily a 1 Gbps access per residence. One still wonders what to do with 1 Gbps, but that is a secondary issue. In addition, it also begs the question of how to provide the last 100 feet so that the 1 Gbps can actually reach a user, human or otherwise, a problem FTTH does not readily answer, even with wireless extensions.

Recently, Verizon made certain announcement regarding their targetd capex per sub for FIOS, namely $717 per subscriber. In this paper, we look at that number and raise several serious concerns. We do so not as analysts, but as operators, operators who were there first, and Verizon followed behind us. We thus speak from the distinct disadvantage of experience.

In June 2005, we terminated the Merton Group which was our investment and operating entity deploying FTTH in New England. This termination was done specifically as a result of the failure to reach agreement with towns for franchises which were both financially viable to Merton and at the same time pari passu with the incumbent cable company. On August 4, 2006 Verizon did the same[2]. Specifically the press related the Verizon franchise negotiations termination is as follows:

"Before it even got in, Verizon Communications is pulling out of the New Hampshire cable television business, at least for now, a company spokeswoman said yesterday..Since 2004, the telecommunications giant has spent billions of dollars across the country, ...Verizon spokeswoman Jill Wurm said the company has sent equipment and franchise negotiators intended for New Hampshire to New Jersey, where a single franchise agreement can be negotiated at the state level..."We're disappointed," said lawyer Robert Ciandella, who had been negotiating with Verizon on Salem's behalf. "We were trying to … conduct a very effective franchise negotiation." Ciandella's firm, Donahue, Tucker and Ciandella of Exeter, was negotiating on behalf of five other New Hampshire towns, as well, Ciandella said....Ciandella said the company does have a track record of seeking legislative solutions to the problem of negotiating town by town. "Verizon is exploring whether there's a political strategy that would allow it to avoid (local negotiations)," he said...Salem Town Administrator Henry LaBranche yesterday criticized Verizon's decision.."I find their strategy rather bewildering," he said. "If, indeed, they've pulled out of the process, it's a rather premature reaction on their part.""

The above statements clearly represent what we had experienced many times over. In fact, with the same principals in many cases. The towns became, in our opinion, just greedy and the entire process became bogged down in local politics and legal game playing, which just raises the cost per subscriber by anywhere from $500 to over $1,500 in some cases. In a bizarre move, however, the New Hampshire Legislature granted the towns the rights to build their own municipal broadband but they have no duty to obtain a franchise. The New Hampshire legislature, in my opinion, being a Legislatively appointed member of the legislative committee reviewing the new legislation, had no idea what it had enacted. A state like New Hampshire has, in my opinion, insured that it will never have a broadband network.[3]

From Cable Digital News of August 1, 2006 Verizon has stated[4]:

"In their second quarter earnings call with analysts this morning, Verizon executives indicated that they are rolling out FIOS faster than expected this year, at least partly because of heightened competition from

[2] See http://www.freepress.net/news/16902

[3] See McGarty, The Hidden Cost of Broadband. www.telmarc.com

[4] See http://blog.cabledigitalnews.com/index.php?id=504

Comcast and other cable operators plunging into IP telephony. With 4.5 million homes passed by their new fiber-to-the-premises (FTTP) plant by mid-July, up 1.5 million households from the close of 2005, Verizon officials are now shooting to exceed their target of 6 million homes passed by the end of the year. Verizon executives are also looking to drive up their FIOS Internet and TV take rates faster and further than before. Disclosing its FIOS data subscriber numbers for the first time, the company said 375,000 phone customers have signed up for the high-speed Internet service so far, which amounts to 12 percent of the 3.1 million customers who could get it during the second quarter. The telco netted 111,000 FIOS data subscribers in the spring quarter.

"Could we go higher?" says Verizon Chairman & CEO Ivan Seidenberg. "The answer to that is: I expect it to and that we drive our people to make it go higher."

..... in roughly 60 markets scattered throughout seven states, including Florida, Texas, New York, and California. They also claimed that phone customers are increasingly signing up for the video packages...."We are seeing great initial acceptance by customers across our whole footprint, particularly in the more mature data markets," says Doreen Toben, executive vice president and CFO of Verizon. "Our average video penetration rates are 7 percent at the three-month mark and 10 percent after six months."

The FIOS moves come as Verizon's line losses continue to pile up. In the traditionally weak second quarter, the company shed 1 million total access lines, including 553,000 consumer retail lines, lowering its total to 47 million lines. Before that, it lost 837,000 overall lines in the first quarter, including 678,000 residential lines.

*Although a good chunk of those losses are due to wireless substitution, cable broadband and VOIP products are stealing an increasing share of the pot. In a recent research report on cable VOIP's progress, Sanford C. Bernstein estimated that Verizon lost nearly 1.8 million lines to cable telephony last year, more than any other RBOC, largely because of aggressive VOIP rollouts by Time Warner Cable and Cablevision Systems in the telco's hometown New York market. Bernstein projects that Verizon will lose an additional 2.8 lines this year, once again more than any other Bell...In response, Verizon seems focused on deploying FIOS in markets where cable operators are strongly pushing VOIP. In the New York market, for instance, the telco has been rolling out and heavily promoting both of its FIOS products to fight back against Cablevision and Time Warner. .....To make it easier to do so, Verizon is seeking to trim the expense of its pricey all-fiber network builds. The company, which is **now spending more than its target cost of $717 per FIOS connection**, said it's renegotiating contractor rates, implementing pre-fabricated and pre-slicing work and shaving fiber purchase costs, among other things...."*

The above quote raises several other issues. These issues then go the heart of the analysis in this paper.

1. The company has 4.5 million homes passed, 3.1 million activated, and 375,000 subscribers. That is the 12% penetration indicated. What is missing is who they are and what the ARPU is for this set. In our experience the early adopters, the initial 15% is easy, the next 15% is hard, and the rest will be near impossible.

2. Verizon lost 1.8 million access lines last year and will loose 2.8 million this year. In our analysis, done late last year, we concluded that it may likely be twice that number[5]. We further argued that Verizon has a duty under FASB 121 to write off massive amounts of it capital plant and equipment as being impaired. It has not. We, in our opinion, believe that this is a great error.

3. The take by cable of the telephony market will just accelerate. The acceleration in our opinion will be massive. With the Adelphia markets now being Time Warner and Comcast, we see that they will just dominate the voice business. This will put accelerated pressure on the FASB 121 issue and will drive up the cost of capital to Verizon. The base cost of capital is rising as the Fed

[5] See McGarty Evolutionary Process.

increases its rate and with the loss of the core and the true costs of FTTH being seen, Verizon may see explosive costs of capital.

4. The capex per sub is grossly over optimistic in our opinion. We shall detail that herein. In fact we believe the capex per sub to be three or more times greater!

To preface our analysis it is useful to sketch out a "*back of the envelope*" analysis. Consider the following:

1. The fiber install is generally about $25,000 per mile for aerial fiber with no make ready requirements. This is true for most residential suburban markets such as those which we have studied. To perform a make ready doubles the cost to $50,000 per mile and if it is buried then it triples the cost to $75,000 per mile. Assume that we have 50% aerial, 25% make ready and 25% buried. The we have an average cost per mile of about $45,000.

2. Now assume we have 50 HH per mile. That means 25 HH on each side of the street or a frontage of 200 feet per HH. But, since there are intersections and other types of common land this reduces the real frontage of a home to about 100 feet. Thus this is a typical residential neighborhood, not an upscale multi acre zoned area, but just plain vanilla residential.

3. Now assume we penetrate that market, at 10%, we have 5 HH per mile or $9,000 per HH for just the fiber on the pole. The fiber never touches a home. it just goes on the pole. At 30% penetration we have $3,000 per HH! And this 30% is a good penetration number, above that things get hard! Even at 100% penetration the fiber, all by itself, is $900! Remember that the Cable company is part of the make ready process, and they will fight it.

4. Now let us consider getting from the pole to the home. This is a two part process. First we need a drop, a cable extension from the pole to the side of the house. This is a several hour process of a two man crew at a minimum and costs about $400 fully loaded. Labor costs just keep rising. We can assume the fiber itself is free. Then we have the box on the side of the house, the optical network unit, ONU, for example. It is currently listed at about $500 but we see it going down to $200 plus install. Assume an hour to install, that makes it $300. One must remember that the people who work poles do not work the house! Thus the 200 feet to the home is an added $700.

5. Now there is the electronics on the fiber system such as PON, and the electronics in the headend to control, monitor, and manage. One can assume that that costs will be about $200-300 per HH at a minimum.

6. Finally is the capital equipment in the home, such as a set top converter or likewise. That will be a minimum of $150 per television set. Assume two sets per HH and we have another $300.

7. Add these up; (i) say $2000 for fiber, (ii) $700 for drop and ONU, (iii) $200 common electronics, (iv) $300 converters. That is a total of $3,200. This is almost five times the Verizon number! There are no scale economies in labor, one cannot outsource it to India, one must deal with the local environment.

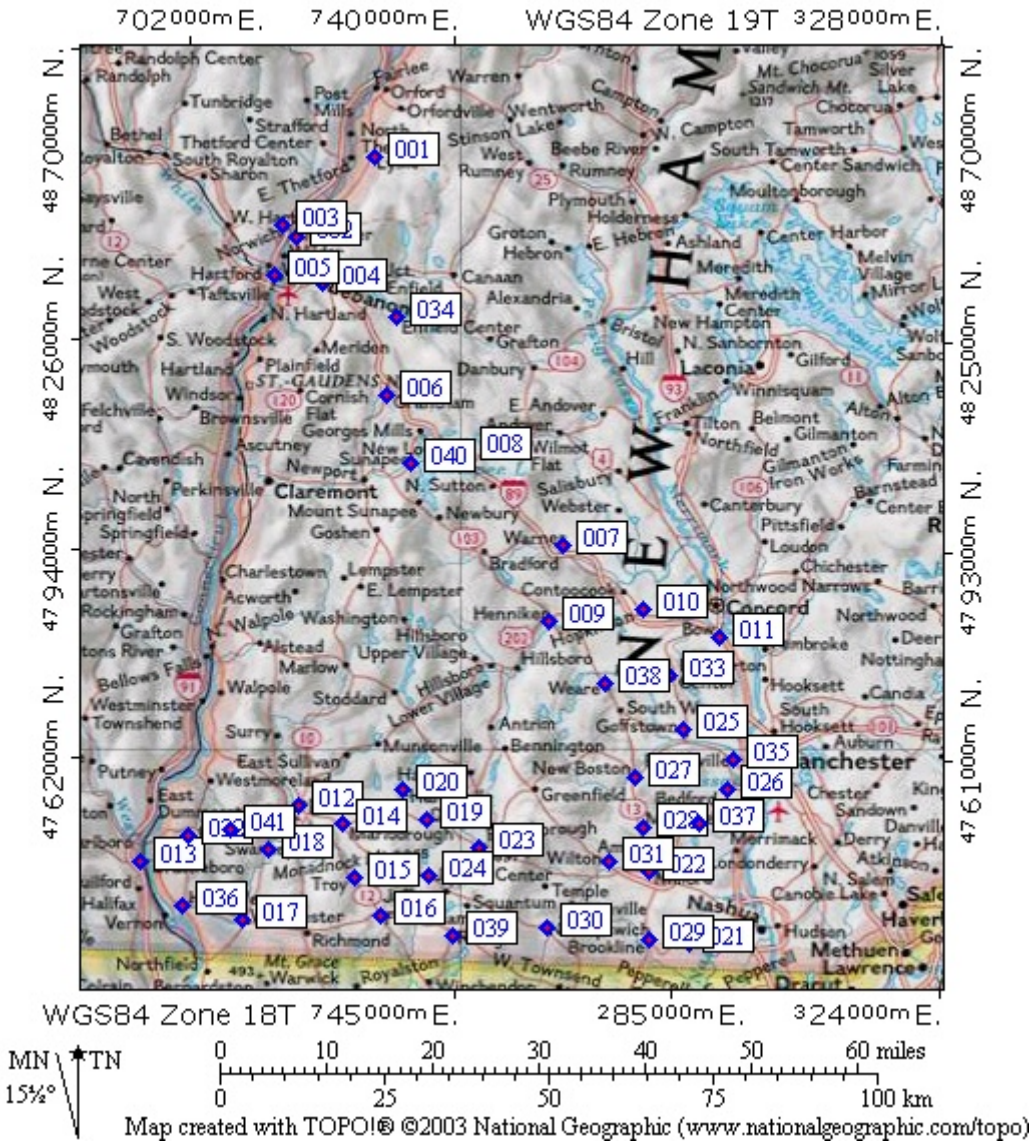
We will detail this result in this paper.

2. NETWORK ELEMENTS

This section provides a high level analysis of the details in the build of a FTTH system. We start with a coverage model and then proceed with the detailed elements.

2.1 Coverage

We have used as a baseline design a regional coverage. The region is a combined New Hampshire and Vermont set of clusters. The details on each town are available on the Telmarc web site so we defer discussion of the local level here. The full build proposed looks as follows:



2.2 Overall Network Elements

The following are details on network elements, interconnections, and interfaces. The system uses a Passive Optical Networking over a fiber to the user network. The following then builds from the overall network and then provides detail on each element. We also present details on the routes via strand mapping and the interconnection of the elements. The design is fundamentally a Passive Optical Network system using a cable TV headend. It also uses a standard router based Internet interface for operations.

The network has standard three layers; layer 1 is the physical PON layer, layer 2 is the Ethernet layer using standard MAC protocol, and layer 3 is the standard IP layer. The network is connected town by town by a backbone network. We show that connectivity in detail herein. It should be noted that our intent is to build out a regional network of towns ultimately and that this will be fully interconnected. The design that we analyze is for towns shown below.

The overall network elements are shown below. They include:

Customer Premise Systems:

1. Fiber Drops: These are the drops from the pole to the customer premise.

2. CPE/ONU: This is the optical/electronic interface which connects the fiber to the home or end user electronic systems.

3. Set Top Converter: This is the device which converts channels, un-digitizes video, and supports pay per view systems.

Fiber Network:

1. Fiber on Poles: This is the fiber on the poles which is a combination of backbone and distribution fiber. The size of the fiber is determined by the local design. The details are provided in the financial model.

2. PON Interfaces: These are the optical splitters. Note from the Applications we stated that the system is E PON. The backbone network is 1 to 10 Gbps backbone and uses up to a 32:1 splitting. The splitting will be described shortly.

Headend:

1. Video Headend: This is a standard video headend with a set of antennas. The current design has two, one north and one south. Ultimately with a fully connected network this may be reduced to one.

2. Internet Headend: This is merely a router, firewall, server, and DNS (domain name server) allowing network connectivity.

3. Optical/Electronic Headend: This is the collection of equipment interfacing with the fiber network and the electronics on the headend side.

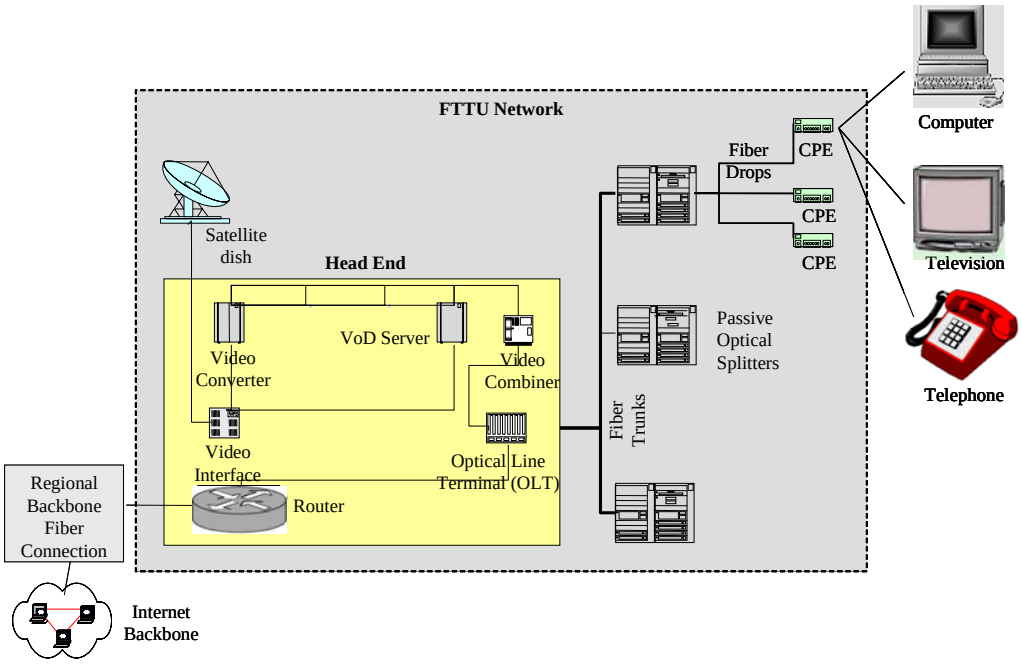
Operations Support Systems:

1. Billing: This is an integrated billing system. We have previously provided detailed Methods and Procedures on this.

2. Customer Care: This is an integrated customer care system. We have previously provided detailed Methods and Procedures on this.

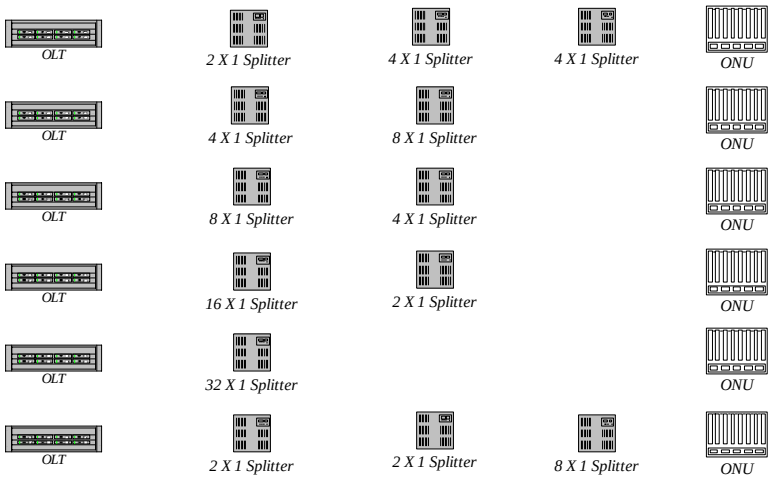
3. Network Management: Manages the overall network. We have previously provided detailed Methods and Procedures on this.

These are the key system elements. We now provide more detail.

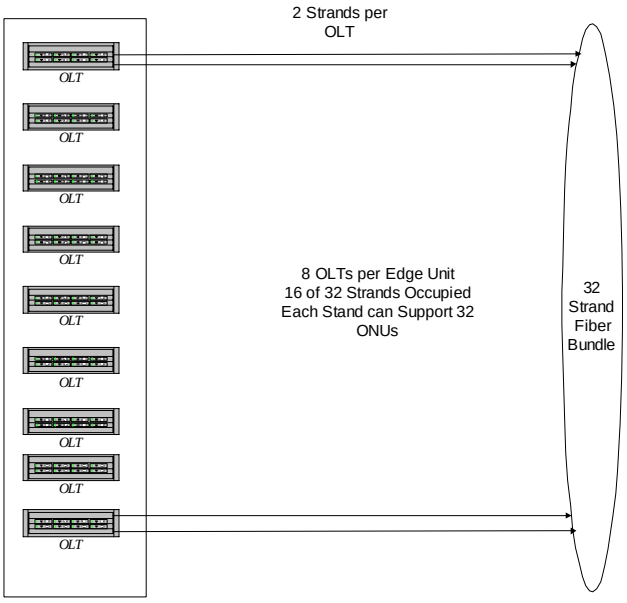


2.3 Fiber Plant

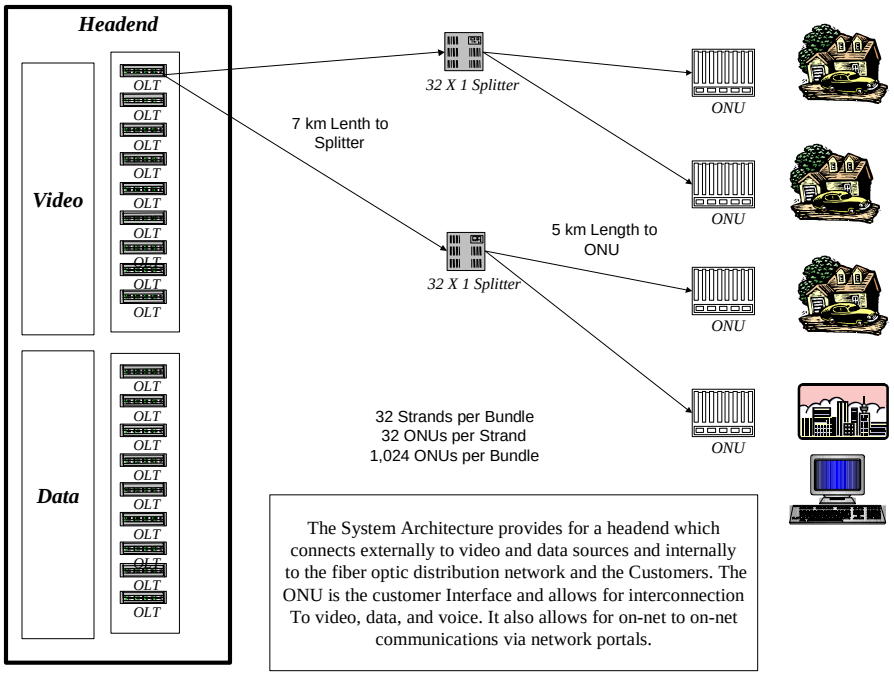
The fiber plant is all passive. The elements in the plant are the splitters as shown below and they are any combination which yields a 32:1 split maximum. The end devices the ONU and OLT are active but reside outside the outside plant.



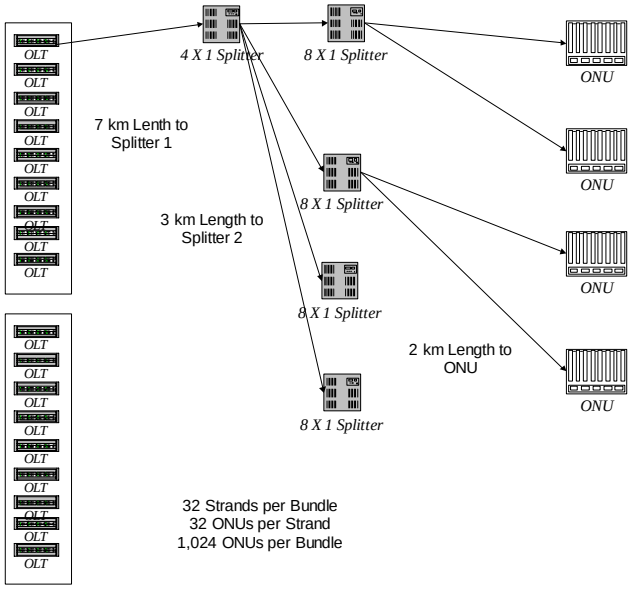
A typical design is shown below. It demonstrates 2 strands per OLT. It feeds a 32 strand fiber. Note that 96 strand fibers are readily deployed and the details will be left to the system engineer based on final strand mapping. We have worked with multiple vendors to perform preliminary strand mapping for each town.



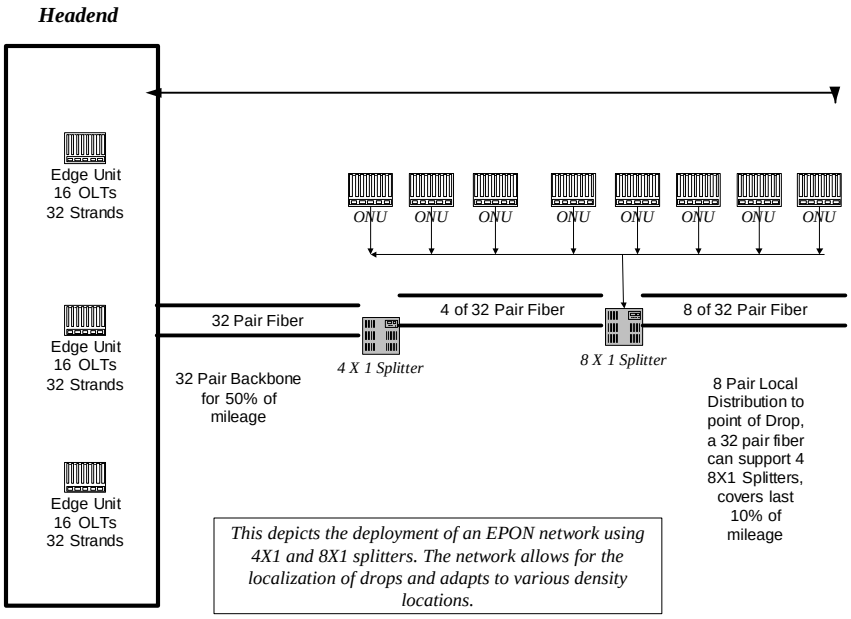
A typical build out is shown below. This time distance are also applied. Note that any company will have an active headend per town. This will appear as a hybrid active/passive design. The passive side is per town and this minimizes operations and maintenance costs. The active side is in one enclosed unite per town. The active equipment per town takes not more than 150-250 sq ft areas and can be readily housed in local space.



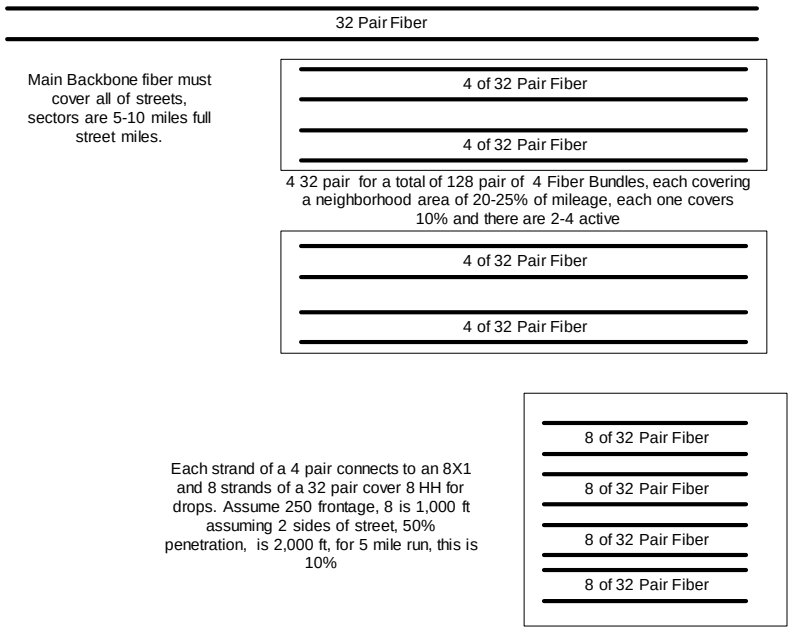
A more detailed design is shown below. In this design we show a 4:1 followed by a 8:1 splitter giving a full 32:1 split. Note that if more capacity is needed less splitting can be done or higher speed provided on the backbone or any combination of these.



The following is full detail on the distribution on the fiber network.



The following is the typical build plan for a section of the network describing the capacity and coverage elements of the typical design, The above are a complete description of the system design.



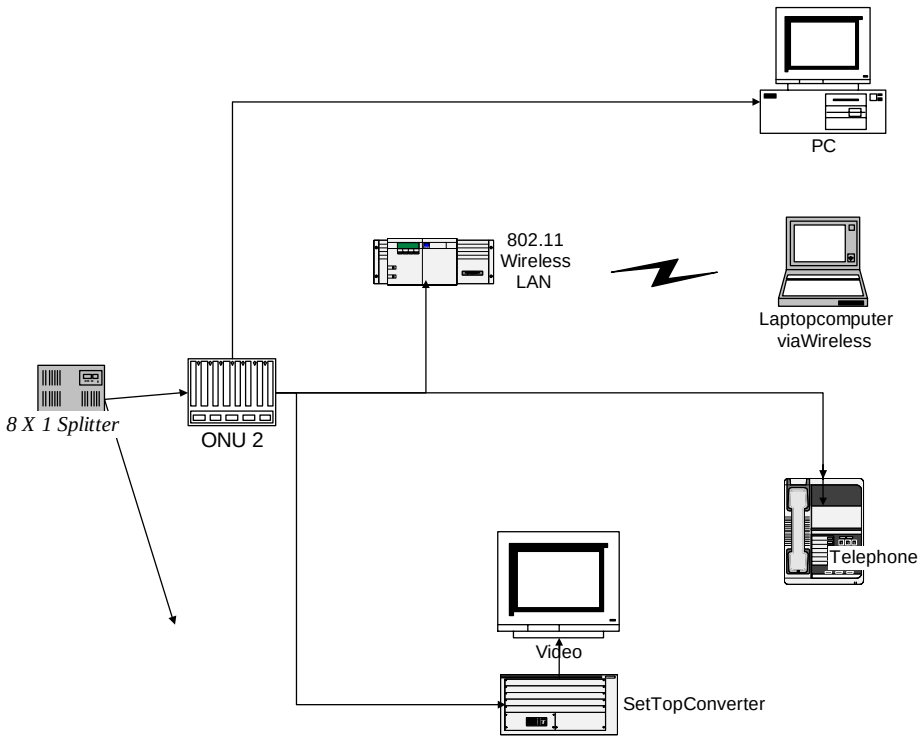
For a PON system one must always be concerned about having adequate signal. This is done by calculating the link budgets. The following is the link budget for this system.

Link Budget

	1510 nm Down	*1310 Up*
Fiber Loss	*0.25 dB per km*	*0.35 dB per km*
1 X 32 Loss	*18.2 dB*	*18.2 dB*
Connector Loss	*0.2 dB per*	*0.2 dB per*
1 X 8 Loss	*10.7 dB*	*10.7 dB*
1 X 4 Loss	*7.5 dB*	*7.5 dB*
1 X 2 Loss	*3.5 dB*	*3.5 dB*
Link Loss		
Maximum Loss	*23 dB*	*23 dB*
Link Margin		

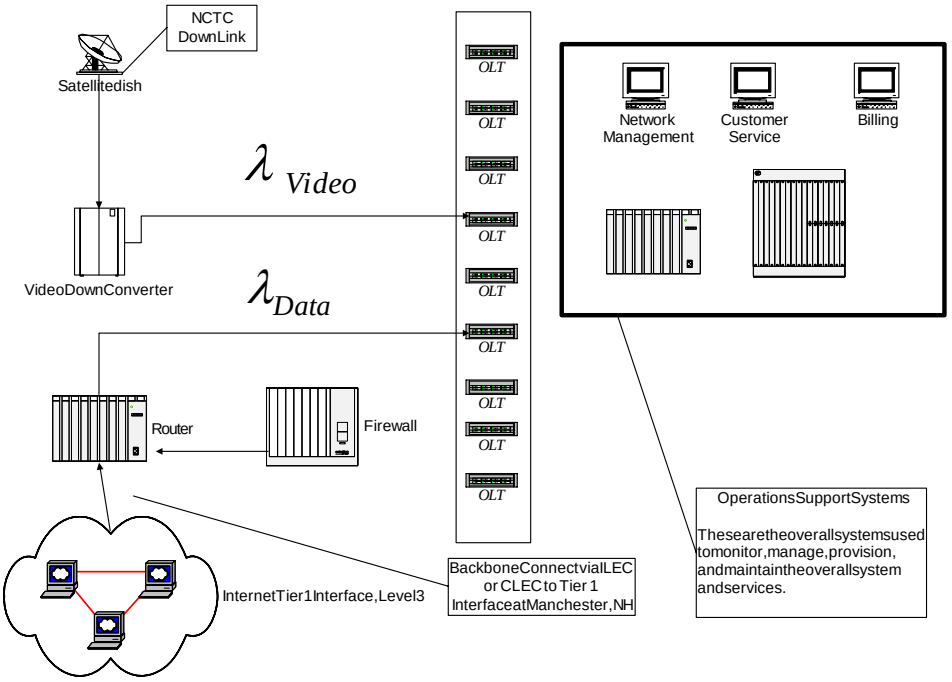
2.4 End User Plant

The end user plant is what we would anticipate putting in or at the customer premise. The details are shown below. As described above, the drop is followed by an ONU and a set top box for any video services. Set top box prices are continuously falling. Also there may be the deployment of wireless 802.11 LANs in the home by the homeowner. In other designs we believe that there may be significant advances which allow for the use of 802.11 devices in place of the drops. This may make it possible for the end user to “self deploy” their systems, namely buy the box and deploy automatically, saving significant amounts in capex.



2.5 Head End

The following is the detail on the head end including the OSS with billing, customer services and network management. The current design show two wavelengths, λ_{Video} and λ_{Data}. We are also considering the use of IP video but at this time it is still a bit early. IP video would allow full integration and would eliminate the need for any headend. We believe that this will be possible within the year but has planned for the deployment of a classic no risk design at this time.



2.6 Video Interconnection

Video interconnection is as shown above using a satellite connection to a video provider; IP video or a traditional headend.

2.7 Internet Connection

Internet connection is via a backhaul network to Level 3 in Manchester, NH. The system has been designed to provide a 2 Mbps per subscriber loading at the Level 3 headend using a 10:1 sharing ratio.

2.8 Operating Support System

OSS may be in house or outsourced.

2.9 Elements and Vendors

The following Table depicts a summary of all network elements, vendors, vendor status and pricing. We have eliminated vendor specific data.

Element	*Fiber*	*Fiber Install*	*Fiber Maintain*	*Electronics (ONU)*	*Electronics Install*	*Electronics Maintain*	*Video HE*	*Video HE Install*	*Video HE Maintain*	*End User Drops*
Vendors										
Services/Products	Fiber, fiber planning, optical devices interfaces	Install on pole and underground	Repairs							Deploy customer drops

Cost Elements										$200 per 200 ft maximum

Element	*Set Top Converter*	*Set Top Install*	*Set Top Maintain*	*Video Content*	*Internet Interface*	*OSS*	*Local Backhaul*	*Pole Attachments*	*Project Management*	*Sales*
Vendors										
Services/Products										
Cost Elements										

2.10 Local Networks

This section details the full network. As discussed above the full network is ultimately targeted at a regional set of sectors covering 41 towns. The local networks have been analyzed and designed by preliminary strand mapping. The details and photos of the ten local networks are provided on a separate disk. This section provided an overview.

Town	Sector	Population HH	Percent	Street Miles	Percent	HH/mi
Amherst	1	1,077	30%	28	28%	38.46
	2	1,077	30%	29	29%	37.14
	3	1,077	30%	31	31%	34.74
	4	359	10%	12	12%	29.92
Bedford	1	5,000	100%	80	100%	62.50
Goffstown	1	1,410	25%	13	11%	106.84
	2	1,410	25%	14	12%	97.93
	3	1,015	18%	12	10%	84.62
	4	395	7%	13	11%	29.91
	5	451	8%	12	10%	37.61
	6	451	8%	17	14%	26.86
	7	226	4%	22	18%	10.45
	8	282	5%	17	14%	16.79
Hartford Vt	1	5,100	100%	150	100%	34.00
Hollis	1	2,500	100%	82	100%	30.49
Jaffrey	1	2,120	100%	74	100%	28.65
Lebanon	1	4,638	100%	130	100%	35.68
Milford	1	2,080	40%	27	35%	77.19
	2	780	15%	12	15%	67.55
	3	1,560	30%	27	35%	57.90
	4	780	15%	12	15%	67.55
Peterborough	1	868	37%	36	34%	24.08
	2	352	15%	23	22%	15.09
	3	399	17%	22	21%	17.92
	4	164	7%	12	11%	14.08
	5	563	24%	13	12%	44.26
Rindge	1	1,854	100%	97	100%	19.11
Total		37,990		1,016		37.39

The following taken from the State of NH website detail the towns and their demographics.

Municipality	State	County	Cluster	Population	Number Households	Road Miles
Amherst	NH	Hillsborough	Peterborough	10,769	3,590	129
Bedford	NH	Hillsborough	Peterborough	18,274	6,251	180
Goffstown	NH	Hillsborough	Peterborough	16,929	5,641	131
Hollis	NH	Hillsborough	Peterborough	7,015	2,440	101
Jaffrey	NH	Cheshire	Peterborough	5,476	2,120	91
Lebanon	NH	Grafton	Hanover	12,568	5,500	106
Milford	NH	Hillsborough	Peterborough	13,535	5,205	88
Peterborough	NH	Hillsborough	Peterborough	5,883	2,346	85
Rindge	NH	Cheshire	Peterborough	5,451	1,502	85
Hartford	VT	Windsor	Hanover	10,367	4,509	180
Total (or Average)				106,267	39,104	1,175

We now shown the strand maps for each town. As described in detail in the Application, we have strand mapped each town and also performed detailed GPS based surveys. The data is provided on the accompanying disk. We details each town strand map. Note that we have shown that we need not cover 100% of the streets to obtain 90% coverage. Typically 80% coverage can be attained at 20-25% street coverage and 90% can be attained with less than 50% coverage. Typically less than 10% of the population is covered by 50% or more of the streets.

2.11 System Design

The following Table depicts the services to be offered. Note that the Plan submitted to RUS includes only Retail Video and Broadband Internet. There are however six services being offered to three market segments, for a total of eighteen offerings. There are thus sixteen offerings not factored into the current revenue stream. Also not that the other offering do not require any significant capital to deploy. If such is required it becomes customer supplied.

		Off Net			***On Net***	
Services	*Video*	*Internet*	*Telephony*	*Portal, Best Effort*	*VPN*	*SLA Circuits*
Characteristics	Analog, Digital video, HDTV, Video on Demand, Pay per View	Broadband Internet access, 10/100 Base T connection with max 100 Mbps rate. Average customer access is 2 Mbps shared	Currently reseller only	IP access portal allowing access to all On Net users via local routers and DNS. Designed as "best effort" transport with no security on the network.	A Virtual private network for On Net connection allowing secure, authenticated and fire walled interconnections	A point to point or point to multipoint service with a service level guarantee including guaranteed minimal data rate.
Residential	Standard home video offerings.	An offering typically twice that of cable modem maximum access speed but guaranteed independent of overall network load.	NA	Generally for local resident access to community servers, library etc.	Can be used as part of a commercial offering.	NA
Commercial	As for the home.	An offering typically twice that of cable modem maximum access speed but guaranteed independent of overall network load.	NA	Can be used for non-secure best effort LAN access	Primarily a commercial offering to hospitals, schools, business, local government and public safety.	Example would be the delivery of a 2 Mbps Internet backbone connection. Another would be DS3 to OC 48 level local or regional service.
Reseller	Network open for video providers.	Network open for IP providers	Access for IP telephony or will sell UNE access to reseller.	Available but not priced at this time.	NA	Same as commercial.
Pricing	See Tariff Sheet	Targeted to compete with incumbent.	UNE access at 50% of the ILEC UNE, currently $7.00 per month per residential UNE	Not in current Business Model, anticipated residential at $40 per month per portal.	Not in current Business Plan. To be priced on level of service required.	Not in current Business Plan. 2 Mbps service would be typically the combination of a portal fee and the SLA rate from Level 3 backbone provider at network PoP.

The following is a detailed description of the type of technology to be used to deliver the broadband services. If more than one technology is proposed in the application, then this description should clearly state which technologies will be used in each community. This description should also address distance or coverage limitations with the proposed technology. We have done this both in the application and above.

3. FINANCIAL MODELS

This section details the financial models for the capital deployment. The analysis is based upon the actual agreements entered into a dozen third party vendors. There was an RFP process with over four dozen bidders and detailed engineering analysis of each market.

3.1 Fiber Build

The following is the detailed analysis of the fiber build. Note that there is a much lower make ready and buried in this market segment. The models are self explanatory.

Year	1	2	3	4	5	6	7
Fiber Installation							
Percent Aerial Construction	90%	90%	90%	90%	90%	90%	90%
Percent Trenching	10%	10%	10%	10%	10%	10%	10%
Percent "Make Ready" Requirement	15%	15%	15%	15%	15%	15%	15%
Number Clusters	1	2	4	5	6	7	7
Number Clusters per Headend	1	1	1	1	1	1	1
Number Headends	1	2	4	5	6	7	7
Number EOY Users	6,743	20,825	43,385	73,600	116,211	133,875	133,875
Number EOY Users per Headend	6,743	10,413	10,846	14,720	19,368	19,125	19,125
Number Users with Churn	7,081	21,576	45,420	77,975	124,382	147,048	152,403
Number Users per OLT	192	192	192	192	192	192	192
Number OLT Required	35	108	226	383	605	697	697
Number OLT per Headend	35	54	56	77	101	100	100
Total Street Miles Covered	590	1,459	2,431	3,300	4,168	4,689	4,689
Percent Street Miles for Feeder Cable	10%	10%	10%	10%	10%	10%	10%
Total Miles Feeder Cable	59	146	243	330	417	469	469
Overage Miles	3	7	12	16	21	23	23
Percent Street Miles for Distribution Cables	90%	90%	90%	90%	90%	90%	90%
Total Miles Distribution Cables	531	1,313	2,188	2,970	3,751	4,220	4,220
Overage Miles	53	131	219	297	375	422	422
Number Users per Splitter (1xN)	8	8	8	8	8	8	8
Percent Utilization Splitters	80%	85%	90%	90%	90%	90%	90%
Number Splitters Required	1,107	3,173	6,309	10,830	17,276	20,424	21,168
Number Splitters per Fiber Distribution Cabinet	12	12	12	12	12	12	12
Number Cabinets Required	93	265	526	903	1,440	1,702	1,764
Number Fiber Strands in Feeder Cable	48	48	48	48	48	48	48
Number Fiber Strands per Splitter	48	48	48	48	48	48	48
Number Redundant Fiber Strands per Splitter	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Number Splitters per Feeder Cable	1	1	1	1	1	1	1
Number Users per Feeder Cable	6	7	7	7	7	7	7
Number Feeder Cables Required	1,118	1,603	1,594	2,189	2,909	2,948	3,055
Number Fiber Strands in Distribution Cable	48	48	48	48	48	48	48
Number Fiber Strands in Home Drops	1	1	1	1	1	1	1
Pricing							
Engineering Costs							
Number HH Passed	39,667	98,000	163,333	221,667	280,000	315,000	315,000
Cost per HH passed	$35	$35	$35	$35	$35	$35	$35
Total Engineering Costs	$1,388,333	$3,430,000	$5,716,667	$7,758,333	$9,800,000	$11,025,000	$11,025,000
Construction Costs							
Aerial Construction Cost per Foot	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50
Trenching (Grass, Soil) Cost per Foot	$7.50	$7.50	$7.50	$7.50	$7.50	$7.50	$7.50
Trenching (Direct Bore) Cost per Foot	$12.50	$12.50	$12.50	$12.50	$12.50	$12.50	$12.50
Trenching (Rock) Cost per Foot	$50.00	$50.00	$50.00	$50.00	$50.00	$50.00	$50.00
Trenching (Grass, Soil) Percent	80%	80%	80%	80%	80%	80%	80%
Trenching (Direct Bore) Percent	15%	15%	15%	15%	15%	15%	15%
Trenching (Rock) Percent	5%	5%	5%	5%	5%	5%	5%
Miscellaneous Equipment	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50
Weighted Average Trenching Cost per Foot	$10.88	$10.88	$10.88	$10.88	$10.88	$10.88	$10.88

Aerial Cost per Mile	$13,200	$13,200	$13,200	$13,200	$13,200	$13,200	$13,200
Trenching Cost per Mile	$57,420	$57,420	$57,420	$57,420	$57,420	$57,420	$57,420
Effective Construction Cost per Mile	$17,622	$17,622	$17,622	$17,622	$17,622	$17,622	$17,622
Total Construction Cost	$10,405,004	$25,706,480	$42,844,134	$58,145,610	$73,447,086	$82,627,972	$82,627,972
"Make-Ready" Placement Cost per Foot	$4.00	$4.00	$4.00	$4.00	$4.00	$4.00	$4.00
"Make-Ready" Placement Cost per Mile	$21,120	$21,120	$21,120	$21,120	$21,120	$21,120	$21,120
Effective "Make Ready" Cost per Mile	$3,168	$3,168	$3,168	$3,168	$3,168	$3,168	$3,168
Total "Make Ready" Cost	$1,870,562	$4,621,390	$7,702,316	$10,453,143	$13,203,971	$14,854,467	$14,854,467
Fiber/Cable Material Cost per Foot - 2 Strands	$0.15	$0.15	$0.15	$0.15	$0.15	$0.15	$0.15
Fiber/Cable Material Cost per Foot - 24 Strands	$0.30	$0.30	$0.30	$0.30	$0.30	$0.30	$0.30
Fiber/Cable Material Cost per Foot - 48 Strands	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50
Fiber/Cable Material Cost per Foot - 72 Strands	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75
Fiber/Cable Material Cost per Foot - 96 Strands	$0.90	$0.90	$0.90	$0.90	$0.90	$0.90	$0.90
Fiber/Cable Material Cost per Mile - 2 Strands	$792	$792	$792	$792	$792	$792	$792
Fiber/Cable Material Cost per Mile - 24 Strands	$1,584	$1,584	$1,584	$1,584	$1,584	$1,584	$1,584
Fiber/Cable Material Cost per Mile - 48 Strands	$2,640	$2,640	$2,640	$2,640	$2,640	$2,640	$2,640
Fiber/Cable Material Cost per Mile - 72 Strands	$3,960	$3,960	$3,960	$3,960	$3,960	$3,960	$3,960
Fiber/Cable Material Cost per Mile - 96 Strands	$4,752	$4,752	$4,752	$4,752	$4,752	$4,752	$4,752
Material Cost per Mile Feeder Cable	$2,640	$2,640	$2,640	$2,640	$2,640	$2,640	$2,640
Material Cost per Mile Distribution Cable	$2,640	$2,640	$2,640	$2,640	$2,640	$2,640	$2,640
Total Miles Feeder Cable	62	153	255	346	438	492	492
Total Miles Distribution Cable	585	1,444	2,407	3,267	4,126	4,642	4,642
Material Cost Feeder Cable	$163,674	$404,372	$673,953	$914,650	$1,155,347	$1,299,766	$1,299,766
Material Cost Distribution Cable	$1,543,214	$3,812,646	$6,354,411	$8,623,843	$10,893,276	$12,254,935	$12,254,935
Total Material Cost	$1,706,888	$4,217,018	$7,028,363	$9,538,493	$12,048,623	$13,554,701	$13,554,701
Material Cost per Mile	$2,891	$2,891	$2,891	$2,891	$2,891	$2,891	$2,891
Total Backbone Installation Cost	$13,982,455	$34,544,888	$57,574,813	$78,137,247	$98,699,680	$111,037,140	$111,037,140
Backbone Installation Cost per Mile	$23,681	$23,681	$23,681	$23,681	$23,681	$23,681	$23,681
Number Fiber Drops	7,081	21,576	45,420	77,975	124,382	147,048	152,403
Total User Drop Miles	268	817	1,720	2,954	4,711	5,570	5,773
Material Cost per Mile Home Drop	$55	$55	$55	$55	$55	$55	$55
Splicing Labor per Drop	$50	$50	$50	$50	$50	$50	$50
Test & Termination per Drop	$50	$50	$50	$50	$50	$50	$50
Total Splicing, Test & Termination Cost per Drop	$100	$100	$100	$100	$100	$100	$100
Total Fiber Drop Cost	$1,784,876	$5,438,872	$11,449,705	$19,656,166	$31,354,572	$37,068,238	$38,418,144
Total Backbone Cost	$13,982,455	$34,544,888	$57,574,813	$78,137,247	$98,699,680	$111,037,140	$111,037,140
Total Fiber Drop Cost	$1,784,876	$5,438,872	$11,449,705	$19,656,166	$31,354,572	$37,068,238	$38,418,144
Backbone Cost per User	$2,074	$1,659	$1,327	$1,062	$849	$829	$829
Drop Cost per User	$265	$261	$264	$267	$270	$277	$287
Total Fiber Installation Cost	$17,155,664	$43,413,760	$74,741,185	$105,551,746	$139,854,252	$159,130,378	$160,480,284
Fiber Installation Cost per Active End-User	$2,544	$2,085	$1,723	$1,434	$1,203	$1,189	$1,199

3.2 Electronics Build

The following is the analysis for the electronics. The model follows what we have done above.

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**
EPON Hardware & Equipment							
Sizing							
Number Users per ONU (CPE)	1	1	1	1	1	1	1
Total EOY Users	6,743	20,825	43,385	73,600	116,211	133,875	133,875
Number EOY ONUs	6,743	20,825	43,385	73,600	116,211	133,875	133,875

Number Headends	1	2	4	5	6	7	7
Number HH Passed	39,667	98,000	163,333	221,667	280,000	315,000	315,000
Avg Number of ONUs per Tap / Splice	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Number of Taps / Splices	9,917	24,500	40,834	55,417	70,000	78,750	78,750
Number ONUs per Splitter	8	8	8	8	8	8	8
Number Splitters	1,107	3,173	6,309	10,830	17,276	20,424	21,168
Number Splitters per Cabinet	12	12	12	12	12	12	12
Number Splitter Cabinets	93	265	526	903	1,440	1,702	1,764
Number OLTs per OLT	1	1	1	1	1	1	1
Number OLTs	36	109	226	384	606	698	698
Number OLTs per Chassis	1	1	1	1	1	1	1
Number Chassis	36	109	226	384	606	698	698
Number Chassis per Rack	1	1	1	1	1	1	1
Number Racks	36	109	226	384	606	698	698
Total Data Rate (Mbps)	4,126	20,595	47,968	87,394	141,798	186,827	200,023
Data Rate per Switch Control Module (SCM)	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Number SCMs	2	6	12	22	36	47	51
Number Misc. Elements (EMS, Power, etc.)	1	2	4	5	6	7	7
Pricing							
Cost per CPE	$500	$450	$405	$365	$328	$295	$266
Total CPE Capital	$3,371,667	$9,708,417	$18,845,385	$29,858,696	$43,837,129	$49,052,355	$49,052,355
Avg Cost per Tap / Splice	$175	$166	$158	$150	$143	$135	$129
Total Tap / Splice Capital	$1,735,475	$4,159,899	$6,739,650	$8,927,692	$11,006,333	$12,191,185	$12,191,185
Cost per Splitter (Incl. Install)	$650	$618	$587	$557	$529	$503	$478
Total Splitter Capital	$719,550	$1,995,305	$3,834,961	$6,354,486	$9,767,186	$11,350,496	$11,705,987
Cost per Splitter Cabinet	$500	$475	$451	$429	$407	$387	$368
Total Splitter Cabinet Capital	$46,500	$128,200	$245,976	$407,591	$626,286	$727,652	$750,440
Cost per OLT	$6,519	$5,867	$5,280	$4,752	$4,277	$3,849	$3,464
Total OLT Capital	$234,684	$662,982	$1,280,788	$2,031,659	$2,981,179	$3,335,324	$3,335,324
Cost per Chassis	$1,899	$1,804	$1,714	$1,628	$1,547	$1,469	$1,396
Total Chassis Capital	$68,364	$200,060	$400,580	$657,828	$1,001,206	$1,136,392	$1,136,392
Cost per Rack	$500	$475	$451	$429	$407	$387	$368
Total Rack Capital	$18,000	$52,675	$105,471	$173,204	$263,614	$299,208	$299,208
Cost per SCM	$145,000	$130,500	$117,450	$105,705	$95,135	$85,621	$77,059
Total SCM Capital	$290,000	$812,000	$1,516,700	$2,573,750	$3,905,633	$4,847,465	$5,155,700
Cost per Misc. Elements	$25,000	$23,750	$22,563	$21,434	$20,363	$19,345	$18,377
Total Misc. Elements Capital	$25,000	$48,750	$93,875	$115,309	$135,672	$155,017	$155,017
Installation Cost per Headend	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000
Total Headend Installation Capital	$50,000	$100,000	$200,000	$250,000	$300,000	$350,000	$350,000
Total Equipment Capital Before Discount	$6,559,240	$17,868,287	$33,263,387	$51,350,217	$73,824,238	$83,445,093	$84,131,607
Discount from List Price	0%	0%	0%	0%	0%	0%	0%
Total Equipment Capital	$6,559,240	$17,868,287	$33,263,387	$51,350,217	$73,824,238	$83,445,093	$84,131,607
PON Equip Capital per Active End-User	$973	$858	$767	$698	$635	$623	$628
Total EPON Capital	$23,714,904	$61,282,048	$108,004,571	$156,901,963	$213,678,490	$242,575,471	$244,611,891
Total EPON Capital per User	$3,517	$2,943	$2,489	$2,132	$1,839	$1,812	$1,827

3.3 User Premise CAPEX

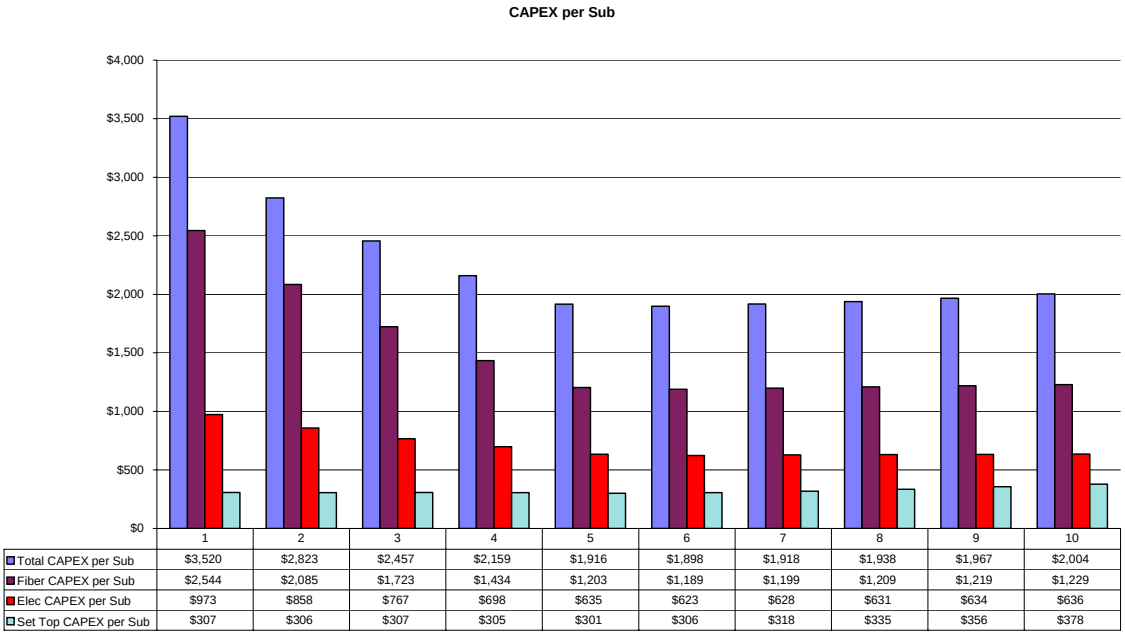
The final model is for the user premise equipment.

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Digital Set Top Box							
EOY Users Video	6,743	20,825	43,385	73,600	116,211	133,875	133,875
Percent Users Premium Programming	25%	25%	25%	25%	25%	25%	25%
Percent Additional Users with Analog TV Sets	10%	8%	6%	5%	4%	3%	3%

Total Percent Users Requiring Set Top Box	35%	33%	31%	30%	29%	28%	28%
Avg Number Set Top Boxes per User	1.1	1.2	1.2	1.3	1.3	1.4	1.5
EOY Set Top Boxes	2,597	7,938	16,522	28,229	45,210	53,146	54,510
Avg Number Set Top Boxes	1,299	5,268	12,230	22,376	36,720	49,178	53,828
Cost of Digital Set Top Box	$200	$190	$181	$171	$163	$155	$147
Set Top Box Capital	$519,400	$1,508,220	$2,982,221	$4,840,568	$7,364,766	$8,224,672	$8,013,972
2. Installation/Uninstallation							
Number Video Users with Churn	7,081	23,230	52,211	94,125	155,716	198,389	225,164
Percent Users Premium Prog + Analog TVs	35%	33%	31%	30%	29%	28%	28%
Number Users Installed	2,478	7,666	16,394	28,350	45,307	56,098	62,194
Number Users Uninstalled - Churn	4,484	15,292	35,689	65,896	110,506	145,243	170,654
Total Users Installed / Uninstalled	6,962	22,958	52,084	94,246	155,814	201,341	232,848
Installation/Uninstallation Cost per User	$40	$40	$40	$40	$40	$40	$40
Total Installation/Uninstallation Capital	$278,467	$918,305	$2,083,343	$3,769,840	$6,232,549	$8,053,648	$9,313,907
Total Set Top Box Capital	$797,867	$2,426,525	$5,065,564	$8,610,408	$13,597,314	$16,278,321	$17,327,879
New Set Top Box Capital	$797,867	$1,628,658	$2,639,039	$3,544,844	$4,986,906	$2,681,006	$1,049,559
Set Top Box Capital / User	$307	$306	$307	$305	$301	$306	$318

3.4 CAPEX Summary

The following chart is for the CAPEX per subscriber in the above model.



	1	2	3	4	5	6	7	8	9	10
Total CAPEX per Sub	$3,520	$2,823	$2,457	$2,159	$1,916	$1,898	$1,918	$1,938	$1,967	$2,004
Fiber CAPEX per Sub	$2,544	$2,085	$1,723	$1,434	$1,203	$1,189	$1,199	$1,209	$1,219	$1,229
Elec CAPEX per Sub	$973	$858	$767	$698	$635	$623	$628	$631	$634	$636
Set Top CAPEX per Sub	$307	$306	$307	$305	$301	$306	$318	$335	$356	$378

4. BUSINESS MODEL

The following analysis is the detailed analysis using the previous capex estimates.

4.1 Financial Forecasts

The 5-year financial forecast of the business is provided here.

4.1.1 Subscriber Penetration and Pricing

Please refer to Section 4.5 for an explanation on subscriber growth rate forecast and market share. The summary numbers for broadband Internet and video services are presented below.

As explained before, the following are the pricing factors:

1. Broadband Internet Access:
    a. *Installation Charge:* A one-time fee per new user of $100
    b. *Network Access Charge:* Average Revenue Per User (ARPU) of $30 per month; this includes $25 as wholesale network access charge from ISPs and $5 rental charge of CPE per user.
2. Video Services:
    a. *Basic Programming Fee:* $35 per month per user for Basic Programming and $45 for Digital Basic Programming. ARPU of $40 per month has been used in the financial model.
    b. *Premium Programming Fee:* ARPU of $15 per month, assuming an average of 1.5 premium packages per user. We forecast that ARPU will increase slightly over time as users purchase greater amount of programming, driven by availability and choice.
    c. *Video on Demand (Pay Per View):* ARPU of $5 per month, assuming one pay-per-view request per user for a movie-type program. This ARPU is forecasted to increase slightly over time as users purchase greater amount of programming, driven by availability and choice.

Note that in our financial forecasts, we have targeted only residential customers, not businesses or public service institutions. This is a conservative assumption that we have made because the Market Survey conducted in the Target Towns was targeted at residential users only. In reality, once the network is operational, it is more than likely that there will be substantial demand from businesses to be on the FTTS network; this is substantial revenue upside.

Year	**1**	**2**	**3**	**4**	**5**
Broadband Internet Access					
Avg Number Large Businesses	0	0	0	0	0
Avg Number SMEs	0	0	0	0	0
Avg Number Households	566	991	1,204	1,294	1,332
Number Users Broadband Internet	566	991	1,204	1,294	1,332
Broadband Penetration %	20%	35%	43%	46%	47%
Installation Charge Large Businesses	$500	$500	$500	$500	$500
Installation Charge SMEs	$250	$250	$250	$250	$250
Installation Charge Households	$100	$100	$100	$100	$100
Avg Fee/ Month/ User Large Businesses	$60.00	$60.00	$60.00	$60.00	$60.00
Avg Fee/ Month/ User SMEs	$40.00	$40.00	$40.00	$40.00	$40.00
Avg Fee/ Month/ Households	$30.00	$30.00	$30.00	$30.00	$30.00
Video					
Avg Number Large Businesses	0	0	0	0	0
Avg Number SMEs	0	0	0	0	0
Avg Number Households	510	892	1,083	1,164	1,199
Total Number Video Users	510	892	1,083	1,164	1,199
Basic Video Penetration %	18%	32%	38%	41%	42%
Third-Party Video					
Number Users	510	892	1,083	1,164	1,199
Avg Fee/ Month/ User Large Businesses	$0.00	$0.00	$0.00	$0.00	$0.00
Avg Fee/ Month/ User SMEs	$0.00	$0.00	$0.00	$0.00	$0.00
Avg Fee/ Month/ Households	$0.00	$0.00	$0.00	$0.00	$0.00
Basic Programming					
Number Users Basic Programming	510	892	1,083	1,164	1,199
Avg Fee/ Month/ User Large Businesses	$0.00	$0.00	$0.00	$0.00	$0.00
Avg Fee/ Month/ User SMEs	$0.00	$0.00	$0.00	$0.00	$0.00
Avg Fee/ Month/ Households	$40.00	$40.00	$40.00	$40.00	$40.00
Premium Programming					
Number Users Premium Programming	382	669	812	873	899
Avg Fee/ Month/ User Large Businesses	$0.00	$0.00	$0.00	$0.00	$0.00
Avg Fee/ Month/ User SMEs	$0.00	$0.00	$0.00	$0.00	$0.00
Avg Fee/ Month/ Households	$15.00	$15.15	$15.30	$15.45	$15.61
Video On Demand					
Number Users Video On Demand	76	134	162	175	180
Avg Fee/ Month/ User Large Businesses	$0.00	$0.00	$0.00	$0.00	$0.00
Avg Fee/ Month/ User SMEs	$0.00	$0.00	$0.00	$0.00	$0.00
Avg Fee/ Month/ Households	$5.00	$5.05	$5.10	$5.15	$5.20

Note: the periods Year 1 through Year 5 above are the first five years of operations (after the network has been installed and turned on).

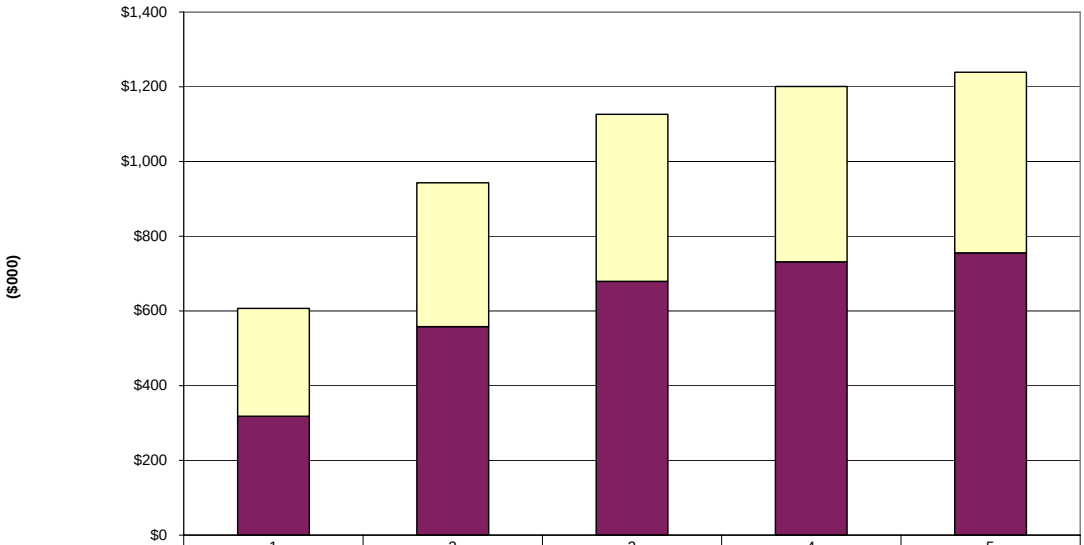
4.1.2 Revenues

The financial model presented here makes the following assumptions:

1. Company facilities are used to provide broadband Internet access and video services
2. Only residential customers in the Target Towns are targeted, 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[6] to local businesses and CLECs, etc. With the second assumption, we ignore potentially significant revenues from the entire business community in the Target Towns for the services. We have made these assumptions to provide a conservative analysis and maintain simplicity of the model.

The chart below shows the revenues over the 5-year forecasted period. Revenues increase from a total of $600,000 in Year 1 to just over $1.2 million in Year 5. The revenues are substantially driven by video services, especially in the later years.



	1	2	3	4	5
Broadband Internet Access	$289	$385	$447	$469	$484
Video	$318	$558	$679	$732	$755
Telephony	$0	$0	$0	$0	$0

4.1.3 Capital Expenditures

The System Design document clearly explains the network details and associated capital expenditures required for the plant build. The following is a summary of those results. All capital amounts shown for a given year below are considered to be as of the beginning of that year.

4.2 FTTH Fiber Plant and Electronics

The FTTH fiber plant constitutes the installation of the fiber network trunks (from the headend to the FSU), feeder lines (from the FSU to the home), and the drop (from the nearest pole into the home). The trunks and

[6] 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 on long-term contracts to businesses or ISPs/CLECs interested in gaining ownership of last-mile fiber in the town.

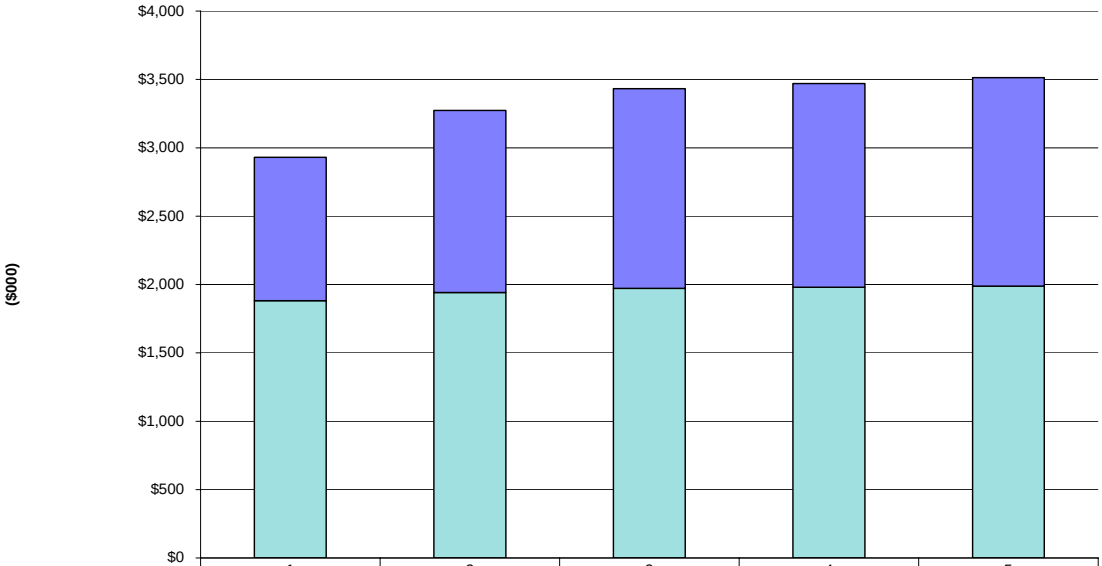
feeders have 24 strands of fiber, while the home drops have 2 strands of fiber. This is the physical fiber plant excluding the electronics.

The electronics cost is overlaid on top of the fiber plant costs to obtain the overall FTTH network capital. In the case of electronics, a **PON** architecture is assumed. As explained in the System Design document, the costs for Passive Optical Networking are not substantially different. The cost of the fiber plant especially remains the same across these technologies.

In the case of the fiber plant, most of the costs are fixed; the trunks and feeders are built along the streets to pass homes regardless of how many subscribers there would be on network. The variable cost component of the fiber plant is the home drops to users subscribing to the services.

In the case of the electronics, most of the cost is variable because the largest component of cost for a given user is the cost of the CPE (Customer Premises Equipment) that is installed when a user subscribes to the service. The fixed cost components of the electronics are the headend equipment and some fixed electronics in the field.

The following chart shows the capital expenses related to FTTH fiber plant and electronics (Gigabit Ethernet) over a 5-year timeframe. The total capital required over 5 years for FTTH fiber plant and electronics is about $3.5 million[7].



	1	2	3	4	5
GigE Electronics Capital	$1,049	$1,331	$1,460	$1,490	$1,524
GigE Fiber Installation Capital	$1,882	$1,942	$1,972	$1,981	$1,989

The following is the detail of capital expenditures related to FTTH fiber plant and electronics over the 5-year forecast period. The first period 0H2 is a 6-month construction period. Capital costs are booked to Construction Work-In-Progress during construction/installation, and then moved to fixed assets when those capital elements become operational. Please see Section 6.2.4 Depreciation Schedule for a detailed explanation of depreciation rates used.

[7] Bill of Material provided by RUS Certified (Accepted) vendor of Gigabit Ethernet access equipment. Addition Bill of Material provided by leading outside plant construction services provider in New England.

Year	0H2	1	2	3	4
1. FTTH Network Capital					
1.1 FTTH Fiber Plant					
Fiber Trunks, Feeders (Fixed Capital)		$1,699,790	$1,699,790	$1,699,790	$1,699,790
Fiber Drops (Variable Capital)		$181,729	$242,306	$272,594	$280,772
Total Fiber Plant Capital		$1,881,520	$1,942,096	$1,972,385	$1,980,562
Construction Work-in-Progress	$1,699,790	$0	$0	$0	$0
Capital Expenditures	$1,699,790	$181,729	$60,576	$30,288	$8,178
Capital Base for Depreciation		$1,881,520	$1,942,096	$1,972,385	$1,980,562
Depreciation		$93,156	$96,185	$97,699	$98,108
Accum Depreciation		$93,156	$189,341	$287,041	$385,149
Accum Capital - Accum Depreciation		$1,788,364	$1,752,755	$1,685,344	$1,595,413
1.2 FTTH Electronics					
Fixed Equipment Capital		$161,000	$161,000	$161,000	$161,000
Variable Equipment Capital		$887,502	$1,170,100	$1,298,930	$1,329,089
Total Equipment Capital		$1,048,502	$1,331,100	$1,459,930	$1,490,089
Construction Work-in-Progress	$1,048,502	$282,598	$128,830	$30,159	$34,241
Capital Expenditures	$1,048,502	$282,598	$128,830	$30,159	$34,241
Capital Base for Depreciation		$1,048,502	$1,331,100	$1,459,930	$1,490,089
Depreciation		$95,844	$122,595	$134,869	$137,787
Accum Depreciation		$95,844	$218,439	$353,308	$491,096
Accum Capital - Accum Depreciation		$952,658	$1,112,661	$1,106,621	$998,994
1.3 Project Management					
Capitalized Project Management Fee		$146,501	$17,159	$7,956	$1,917
Total Capitalized Project Management Fee		$146,501	$163,660	$171,616	$173,533
Construction Work-in-Progress	$146,501	$17,159	$7,956	$1,917	$2,133
Capital Expenditures	$146,501	$17,159	$7,956	$1,917	$2,133
Capital Base for Depreciation		$146,501	$163,660	$171,616	$173,533
Depreciation		$5,860	$6,546	$6,865	$6,941
Accum Depreciation		$5,860	$12,406	$19,271	$26,212
Accum Capital - Accum Depreciation		$140,641	$151,253	$152,345	$147,320
Total FTTH Capital		$3,076,523	$3,436,856	$3,603,930	$3,644,184
Total FTTH Capital per User		$3,621	$3,034	$2,828	$2,776

4.3 Video Headend

The capital cost of turnkey installation of a fully functional video headend facility supporting analog and digital video capabilities is about $1 million[8].

[8] Bill of Material provided by leading turnkey provider of video headends. Please see Design Document.

2. Video Headend Capital

Total Video Headend Capital		$982,000	$982,000	$982,000	$982,000	$982,000
Number Towns Sharing Headend		1	1	1	1	1
Video headend Capital per Town		$982,000	$982,000	$982,000	$982,000	$982,000
Construction Work-in-Progress	$982,000	$0	$0	$0	$0	$0
Capital Expenditures	$982,000	$0	$0	$0	$0	$0
Capital Base for Depreciation		$982,000	$982,000	$982,000	$982,000	$982,000
Depreciation		$69,560	$69,560	$69,560	$69,560	$69,560
Accum Depreciation		$69,560	$139,120	$208,680	$278,240	$347,800
Accum Capital - Accum Depreciation		$912,440	$842,880	$773,320	$703,760	$634,200

4.4 Miscellaneous Network Capital

These include minimal ancillary equipment on the FTTH network, including routers, computer control terminals, etc. Please see Section 6.2.4 Depreciation Schedule for a detailed explanation of depreciation rates used.

3. Misc. Network Capital

Network Capital as % Backbone		1.0%	1.0%	1.0%	1.0%	1.0%
Network Capital (Fixed)		$16,998	$16,998	$16,998	$16,998	$16,998
Construction Work-in-Progress	$16,998	$0	$0	$0	$0	$0
Capital Expenditures	$16,998	$0	$0	$0	$0	$0
Capital Base for Depreciation		$16,998	$16,998	$16,998	$16,998	$16,998
Depreciation		$1,700	$1,700	$1,700	$1,700	$1,700
Accum Depreciation		$1,700	$3,400	$5,099	$6,799	$8,499
Accum Capital - Accum Depreciation		$15,298	$13,598	$11,899	$10,199	$8,499

4.5 Network Operations Center (NOC)

The Network Operations Center (NOC) manages the network and each of its elements in a real time fashion. Operating entities, at all levels of operation, will have the capability of being monitored as to operational effectiveness, network performance, and affect their interconnecting network elements. The NOC will be able to determine the locations of any and all outages or system degradation points in the network, or in any other network that a customer may have access to.

The NOC is a one-time cost of capital. The key components of the NOC for capital budgeting are computer workstations, computer monitors and terminals, software, office supplies, Automatic Call Distributor, audio and visual failure alarms and generators/UPS. All these are fixed capital costs. The incremental costs are related to interface equipment per town.

Year	**0H2**	**1**	**2**	**3**	**4**	**5**
4. Network Operations Center (NOC) Capital						
Number NOCs		1	1	1	1	1
Number Towns Sharing NOC		1	1	1	1	1
Fixed NOC Capital		$106,000	$106,000	$106,000	$106,000	$106,000
Variable NOC Capital		$5,000	$5,000	$5,000	$5,000	$5,000
Total NOC Capital per Town		$111,000	$111,000	$111,000	$111,000	$111,000
NOC Capital per User		$131	$98	$87	$85	$82
Construction Work-in-Progress	$111,000	$0	$0	$0	$0	$0
Capital Expenditures	$111,000	$0	$0	$0	$0	$0
Capital Base for Depreciation		$111,000	$111,000	$111,000	$111,000	$111,000
Depreciation		$11,100	$11,100	$11,100	$11,100	$11,100
Accum Depreciation		$11,100	$22,200	$33,300	$44,400	$55,500
Accum Capital - Accum Depreciation		$99,900	$88,800	$77,700	$66,600	$55,500

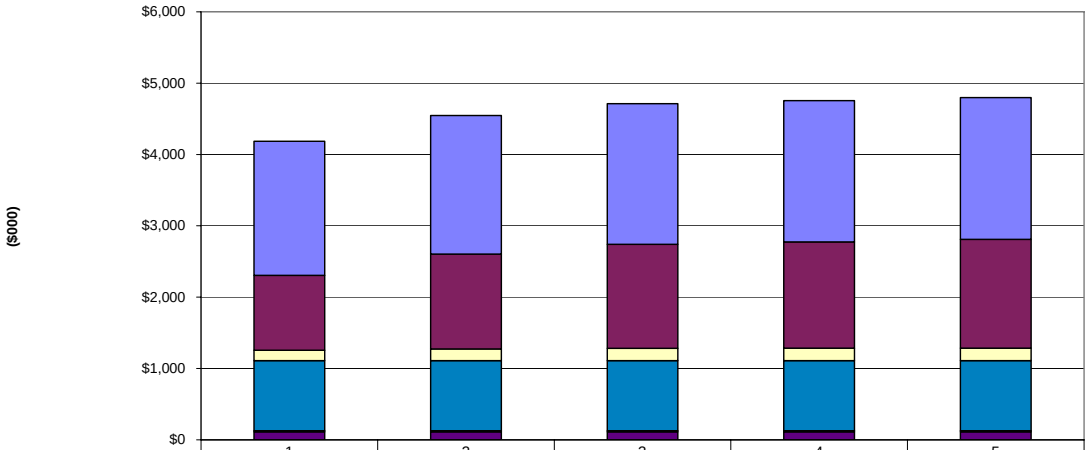
4.6 Equipment Replaced Capital

This is the cost of replacing equipment that has exceeded its useful life. From above, the primary categories of equipment are as follows: (i) FTTH electronics, (ii) Video headend equipment, (iii) Miscellaneous network equipment, and (iv) NOC equipment.

Given that the useful life of these equipment might be less than the forecasted period used in the budget (20-years), the budget presented here takes into account the capital costs of replacing such equipment after their useful economic life. In other words, equipment is replaced on a rolling basis starting the end of their useful life. This matches the economic life calculation. It is also assumed that the cost of replacing equipment at the end of their useful life is substantially lower that the cost of buying that equipment today, taking into account that technological advances lead to falling prices in telecom equipment of a given capability. It is forecasted that any replacement capital will be funded by the cash flow generated by the business.

4.7 Capital Costs Summary

The following is the summary of total capital anticipated over 5 years.



	1	2	3	4	5
FTTH Fiber Plant	$1,882	$1,942	$1,972	$1,981	$1,989
FTTH Electronics	$1,049	$1,331	$1,460	$1,490	$1,524
Project Management	$147	$164	$172	$174	$176
Video Headend	$982	$982	$982	$982	$982
Misc. Network Capital	$17	$17	$17	$17	$17
NOC Capital	$111	$111	$111	$111	$111
Equipment Replacement Capital	$0	$0	$0	$0	$0

The timing of capital expenses incurred over a 5-year period is shown below, along with the related depreciation summary. The period 0H2 is the construction period prior to the first year of operations. The total capital expenses over 5 years is $4.8 million. This is the amount to be financed. Any capital expenses after 5 years is forecasted to be paid from cash flows from the business.

Year Ending	**0H2**	**1**	**2**	**3**	**4**	**5**
In Thousands of Dollars ($000)						
Capital Expenditures	$4,005	$481	$197	$62	$45	$44
Accumulated Capital	$0	$4,187	$4,547	$4,714	$4,754	$4,799
Depreciation	$0	$277	$308	$322	$325	$329
Accumulated Depreciation	$0	$277	$585	$907	$1,232	$1,561
Accumulated Cap-Accum Dep	$0	$3,909	$3,962	$3,807	$3,522	$3,238

4.8 Depreciation Schedule & Economic Life

The detailed depreciation rates used for various elements of capital, and the calculation of Composite Depreciation Rate and Economic Life is shown in the table below. The depreciation rates used are based on industry standards as well as the RUS Median Rates for Telecommunication Plant Categories[9].

	Rate Used	Economic Life (Years)	Category $ Amount (5 Years)
1. FTTH Network			
1.1 FTTH Fiber Plant			
Aereal Cable - Fiber, Engineering & Construction	5.00%	20.00	$1,221,953
Underground Cable - Fiber, Engineering & Construction	4.00%	25.00	$91,975
Pole "Make-Ready"	5.00%	20.00	$385,862
Fiber Drop to Subscriber	5.00%	20.00	$289,195
1.2. FTTH Electronics			
1.2.2 Gigabit Ethernet (GigE)			
Customer Premises Equipment (CPE)	10.00%	10.00	$1,009,691
Remotes, Housing, Power Systems	8.00%	12.50	$301,671
Concentrators, Housing, Power Systems	8.00%	12.50	$21,398
Headend Threads	8.00%	12.50	$30,569
Headend Switching, Housing, Power Systems	8.00%	12.50	$133,000
Headend Engineering & Installation	4.00%	25.00	$28,000
1.3 Project Management			
Project Management	4.00%	25.00	$175,666
2. Video Headend			
2.1 Analog Headend			
Satellite and Demodulation Equipment	8.00%	12.50	$40,000
Modulators, Stereo Encoders and Processors	8.00%	12.50	$280,000
Spares	8.00%	12.50	$20,000
Signal Management Equipment	8.00%	12.50	$2,000
Services and Documentation	8.00%	12.50	$50,000
2.2 Digital Headend			
Control Components	8.00%	12.50	$130,000
Content Components	8.00%	12.50	$90,000
Communication Components	8.00%	12.50	$40,000
Rack Hardware and Labor	8.00%	12.50	$30,000
Services and Documentation	8.00%	12.50	$50,000
2.3 Satellite Dish Station			
Simulsat Antenna, Feed Assemblies, Construction	4.00%	25.00	$150,000
2.4 Video on Demand			
VOD Servers	8.00%	12.50	$0
2.5 Miscellaneous Capital			
Design, Racks, Wiring, etc.	5.00%	20.00	$100,000
3. Miscellaneous Network Elements			
Network Capital (Routers, Servers, etc.)	10.00%	10.00	$16,998
4. Network Operations Center (NOC)			
Computer Workstations	10.00%	10.00	$30,000
Computer Monitors	10.00%	10.00	$6,000
NOC Software	10.00%	10.00	$30,000
Office Supplies	10.00%	10.00	$10,000
Automatic Call Distributor	10.00%	10.00	$10,000
Audio and Visual Failure Alarms	10.00%	10.00	$10,000

[9] RUS Form 493(a & b), rev. – 11-2002

	Rate Used	Economic Life (Years)	Category $ Amount (5 Years)
Generator, UPS, etc.	10.00%	10.00	$10,000
Interface Equipment	10.00%	10.00	$5,000
5. Equipment Replaced Capital			
Electronics and Equipment Replaced	10.00%	10.00	$0
TOTAL			**$4,798,979**
COMPOSITE ECONOMIC LIFE - YEARS		**16.19**	
COMPOSITE DEPRECIATION RATE	**6.85%**		

The Composite Economic Life of the capital being financed is approximately 16 years.

4.9 Cost of Service and Operating Expenses

The operator will incur the following costs of service and operating expenses.

4.10 Cost of Service

The following are the categories of costs of service.

1. Maintenance – FTTH Fiber Plant

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 24 X 7 force, which can establish repairs in less than 2-6 hours. This is achieved through the NOC. The fiber maintenance costs are about 0.5% of total fiber plant capital per year.

2. Maintenance – FTTH Electronics

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. The costs are about 3%-4% of the installed base annually.

3. NOC Backhaul

The NOC will be interconnected to the Headend of the town network covered by NOC services, as well as the FLM systems of associated fiber and electronics vendors. The capacity requirements for such interlinks are small, and so are the associated direct costs. In the case of the Target Towns, the NOC will likely be co-located with the headend; therefore, no NOC backhaul costs are anticipated.

4. Point of Presence (PoP) Connectivity

The operator could establish and operate a regional Point of Presence, PoP, to provide operational and backbone support services to the town. The direct costs of such a facility are mostly real-estate lease expenses, and are usually small, especially in suburban areas. At this time, it is expected that such costs will be incurred by the ISPs providing Internet access over the network; hence, there are no direct PoP related costs anticipated.

5. Programming and Content

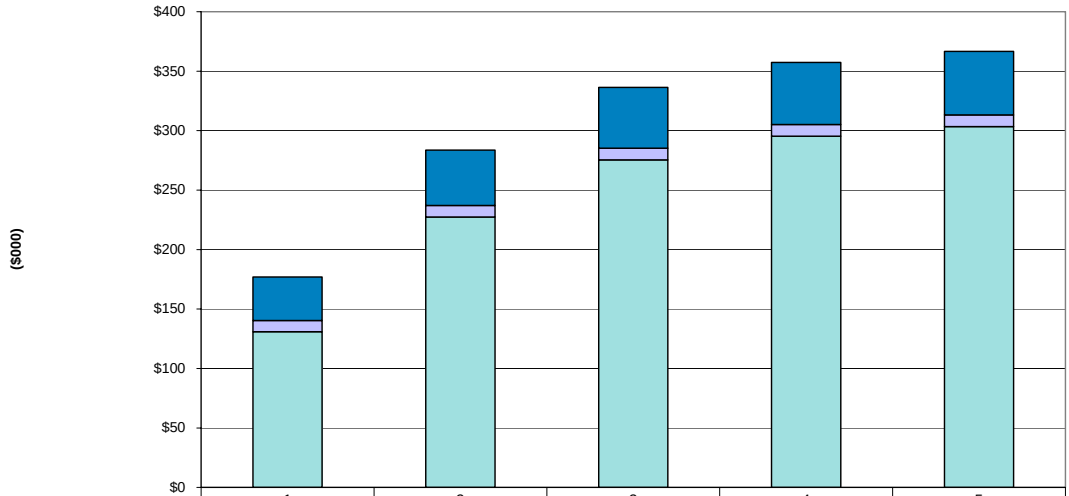
This is the major component of cost of service with video services. This is the cost of programming content (channels) for basic, premium and video on demand packages. The operator could purchase packages of content from entities like the National Rural Telecommunications Cooperative (NRTC) who sell bundled

packages of channels, and selling such programming branded as the operators video services over the FTTH network. Based on the prior experience of the managers of operator as well as on examination of the economics of other competitive video systems in New England, it is estimated that the gross margin that will be achieved by reselling video programming will be 50%-60%.

4.11 Costs of Service Summary

The following is the summary of cost of service forecasted over 5 years.

The following is the summary of cost of service forecasted over 5 years.



	1	2	3	4	5
Maintenance - Electronics	$37	$47	$51	$52	$53
Maintenance - FTTH Fiber Plant	$9	$10	$10	$10	$10
NOC Backhaul	$0	$0	$0	$0	$0
PoP Connectivity	$0	$0	$0	$0	$0
Programming & Content	$131	$227	$275	$295	$303

4.12 Operating Expenses

The following are the elements of operating expenses.

1. *Network Operations Center (NOC)*

It is anticipated that the actual operations of the NOC will be outsourced at about $2.00 per active user per month.

2. *Video Headend*

This is the cost of running the video headend. Since these are highly automated and self-contained systems, the costs of operating and maintaining the video headend is not substantial. Based on estimates provided by leading vendors of headend systems, the operating costs of the video headend is forecasted to be about 2% of installed capital annually.

3. *Customer Service*

For broadband Internet access service, there will be no customer service related expenses because the Internet subscribers are owned by the ISPs who bear the cost of customer service.

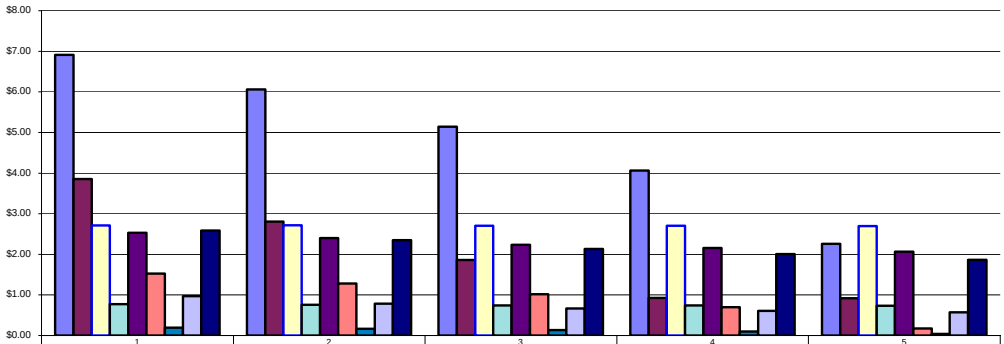
For video services wherein the operator would own the end-users, the operator would incur customer service costs. It is anticipated at time that the customer service function will be outsourced to a vendor. Based on the prior experience of the operator's managers in operating such systems, it is forecasted that customer service would cost about $3.00 per customer per month.

4. Billing and Collections

For broadband Internet services, billing requirements are minimal.

For video services, retail billing is involved. It is anticipated that the billing function will also be outsourced to a vendor and the estimated cost of gaining billing capability is about $2.00 per subscriber per month.

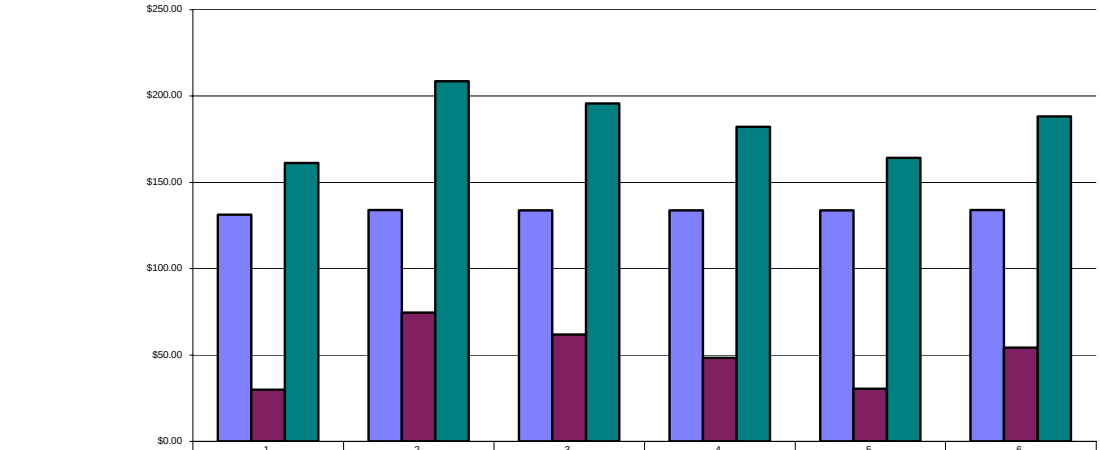
5. OPEX Summary



	1	2	3	4	5
Sales Expense	$6.91	$6.06	$5.14	$4.07	$2.26
Promotion Expense	$3.85	$2.81	$1.86	$0.93	$0.92
CSR Exp	$2.71	$2.72	$2.70	$2.70	$2.69
Bill/Coln Exp	$0.77	$0.75	$0.74	$0.74	$0.74
Network Operations Expense	$2.53	$2.40	$2.24	$2.16	$2.06
Install Exp	$1.53	$1.28	$1.01	$0.70	$0.17
Inventory Expense	$0.19	$0.17	$0.13	$0.10	$0.04
Admin Exp	$0.97	$0.79	$0.67	$0.60	$0.57
OH Exp	$2.58	$2.34	$2.13	$2.00	$1.87

4.13 Sales and Marketing

The most critical element is the sales management and development. For example, the establishment of agreements with ISPs and the management of that relationship for broadband Internet access. Retail marketing of broadband services is an ISP function. Therefore, sales and marketing costs are expected to be low on the broadband Internet side of the business.



	1	2	3	4	5	6
Sales Exp/New Customer	$131.41	$133.89	$133.81	$133.77	$133.77	$133.91
Promotion Expense per New Customer	$29.84	$74.68	$61.96	$48.42	$30.43	$54.25
Total Sales Cost per New Customer	$161.24	$208.58	$195.78	$182.19	$164.20	$188.15

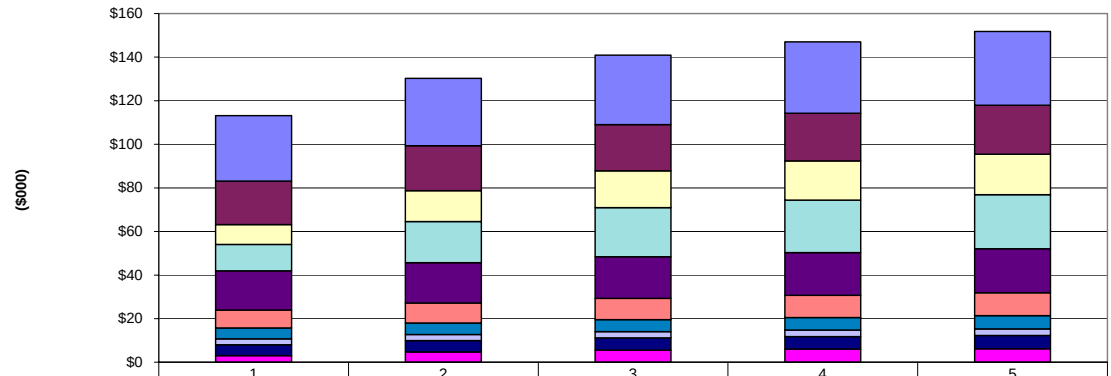
4.14 Administration and Overhead

This includes administration of ; engineering, legal, accounting, rent, benefits, insurance, utilities, supplies and equipment, bad debt and development costs. Again, it is anticipated that overhead and administration expenses will be minimized by leveraging the existing resources of third party providers.

The breakout of administration and overhead expenses is shown below. Please note the following:

a. The operator provides most of the management and manpower support required for operations.

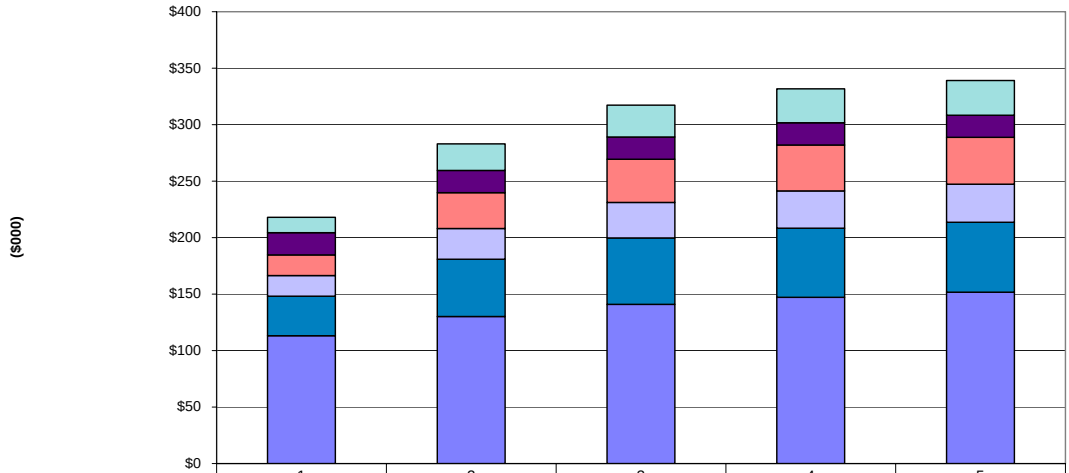
b. The administration and overhead expenses shown below are conservative estimates of such additional costs anticipated.



	1	2	3	4	5
Executive/Admin	$30	$31	$32	$33	$34
Engineering	$20	$21	$21	$22	$23
Legal	$9	$14	$17	$18	$19
Accounting	$12	$19	$23	$24	$25
Rent	$18	$19	$19	$20	$20
Benefits	$8	$9	$10	$10	$10
Insurance	$5	$5	$6	$6	$6
Utilities	$3	$3	$3	$3	$3
Supplies & Equipment	$5	$5	$6	$6	$6
Bad Debt	$3	$5	$6	$6	$6
Development	$0	$0	$0	$0	$0

4.15 Operating Expenses Summary

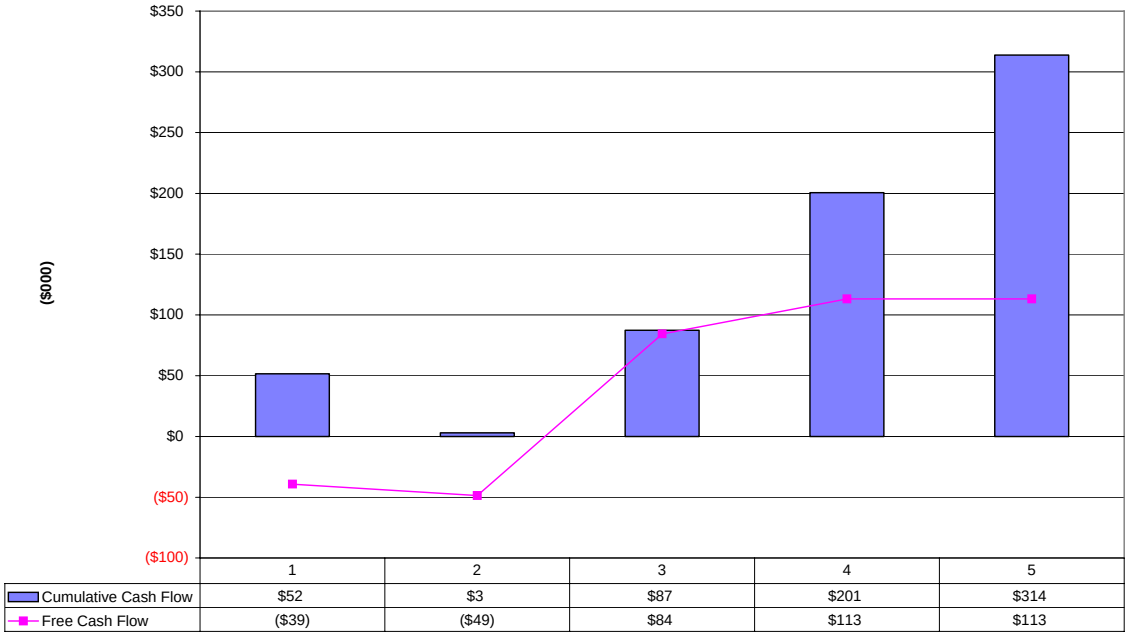
The following is the summary of operating expenses of the business.



	1	2	3	4	5
Network Operations Center (NOC)	$14	$24	$28	$30	$31
Video Headend Opex	$20	$20	$20	$20	$20
Customer Service	$18	$32	$38	$41	$41
Billing & Collections	$18	$27	$31	$33	$34
Sales & Marketing	$35	$51	$59	$61	$62
Administration & Overhead	$113	$130	$141	$147	$152

4.16 Cash Flow

The chart below summarizes the net cash flow and cumulative cash balance of the business during the forecast period. The project is cash flow negative in the first two years of operations, and becomes cash flow positive in the third year.



	1	2	3	4	5
Cumulative Cash Flow	$52	$3	$87	$201	$314
Free Cash Flow	($39)	($49)	$84	$113	$113

5. CONCLUSIONS

This paper is based upon actual deployment costs of a FTTH system deployment in New England. The towns were identified, competitive bidding employed and actual detailed engineering completed. In contrast to the Verizon numbers we arrive at dramatically higher costs. In addition certain costs have not been expressly included:

1. Franchise costs can as we have stated are significant. In fact we concluded and have documented that they are the deal breakers in any deployment of FTTH in the United States. In fact the US is the only country in the world with the process at the local level and as seen its position in FTTH is lagging accordingly.

2. Home converters can dramatically add to the cost. IP video is most likely the way to proceed but such a method requires an IP Video set per TV per HH. At the current prices this is a great cost not included in toto.

3. The wiring of homes with CAT 5 wire is also not included. Wireless will not work as currently deployed and the wiring will be required as cable had to do years ago. This will add hundreds of dollars per HH.

4. Penetration is the key. It is no longer a monopoly and the cable companies will aggressively compete on services and price. Also cable is now a politically stronger force and they own and control content. To have any chance of survival the telco must get rapid and significant penetration. With identical service price will become the only factor. There will be a price war and this will lead to dramatic negative cash flows for the telcos. As with the end of the 1990s and the telco price wars this may lead to another collapse of the telecommunications industry. This time of the large player.

5. Wireless has a great price advantage, albeit not with the bandwidth. Thus wireless becomes an alternative competitor and a wild card.

6. Open networks cannot be achieved with the current designs of the telcos. Thus content is bottlenecked and demand will not grow. The telcos abhor any form of open networking and this factor alone may doom them.

7. To build these networks a significant amount of capital will have to be raised. Debt has been the telcos means. With the decline in the wireline business and with the spectra of FASB 121 hanging over their head we believe that their cost of capital will sky rocket and that they will have even less of a chance to obtain a return.

For these reason and many more we have little belief that success will ensue.

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