What If?

Use the **Broadband Communities** FTTH Analyzers to refine business cases for deploying fiber to the home.

By Steven S. Ross / *Broadband Communities*

Fiber to the home is different. Compared with technologies that reuse as much of the existing copper plant as possible, fiber to the home requires more up-front capital. In exchange, fiber technologies "give back" in lower operating costs and offer potential for much higher revenue. Sooner or later, customers will demand the bandwidth that only FTTH can provide. So why not start enjoying the benefits as soon as possible?

As the business magazine of our industry, **Broadband Communities** has been striving to quantify the costs and benefits of FTTH since 2004, when it first emerged as a realistic alternative to copper in more than a few specialized situations. Yes, deployment costs

BROADBAND COMMUNITIES' FTTH ANALYZERS

Of the five financial models **Broadband Communities** has released to date, three are aimed at refining business plans for a build, as an aid in attracting investors:

- #1: Financial calculator for municipal and franchise-operator builds
- #2: Calculator for private cable operators, property developers, multiunit buildings and commercial structures
- #3: Calculator for rural builds.

Two others are monthly cash flow models designed to help keep operators on track once construction and operations start:

- #4: Customer monthly revenue calculator
- #5: 18-month operations cash flow calculator.

Other models are in the works, including a detailed "scratch pad" for all fixed and contract costs – any costs that are not directly linked to a customer premises or services sold to a customer. Customer-linked costs are already included in the existing models.

You can view and download the models free of charge at **www.FTTHAnalyzer.com**. We've placed these models into the public domain. Consultants and vendors can use them any way they wish. We always appreciate credit (and accept blame), but if anyone wishes to simply rebrand the models, that's fine – our goal is to grow the industry.

We've also run workshops and webinars on all the models, and we can help network builders customize them for their own needs.

were falling and becoming more predictable, but the revenue potential and the social good – the potential of new fiber infrastructure to enable new industries – were even more compelling.

To navigate this new environment in which old rules of thumb rarely applied, the magazine developed dozens of small calculation tools that helped show whether a new technology or a new use of an old technology could enable new business cases and thus spur deployment. By the fall of 2011, we started publishing full-blown computer models that combined many of these calculations. To date, we have released five models.

This article, which focuses on model 1, or the most general business case for FTTH, shows how to modify the models and their inputs to uncover key leverage points. What happens when interest rates change? When construction delays occur? When competitors cut their prices, eating into margins or take rates? Scenario analysis of this kind helps forewarn – and forearm – against unpleasant surprises.

A FEASIBILITY MODEL

Broadband Communities' models cover the first four years of a network build, by which time a network should be cash-flow positive or close to it. The models were designed for quick feasibility modeling. They are also great for showing to bankers and other potential investors. They print on one page, allowing the overall business plan to be quickly grasped. An interested investor can (and should) use the model to explore basic assumptions; this article will explain how.

A one-page model is great for exploring assumptions, but it isn't all the planning you'll ever have to do. Federal grant proposals often run 60 pages or more.

The general-case model has four sections:

- **Basics**. Figure 1 describes the size of the proposed network and anticipated number of subscribers added each year. Modeling cash flow also requires estimating the *average* number of subscribers in a given

THE PHILOSOPHY OF MODELING

A model is like a roadmap. A map cannot contain everything. A map as detailed as the real world would be the size of the real world! We already have one of those. But what detail should the map include?

Some map users want to get from point A to point B as quickly as possible. A map for them must concentrate on highways and through streets.

Other users want to pick out historical points of interest. Some will shun highways. Some need to know where to find the closest gas station or hospital.

An online mapping program or a GPS-driven device might include all possibilities, but trying to display all of them at the same time obfuscates rather than enlightens.

Financial modeling should also highlight the information most relevant to your situation. For instance, say you need to replace a roof. You can do it cheaply, with an expectation of replacing it again in 10 years, or you can spend more now and get a roof warranted for 15 years with an expected lifetime of 20 years. What should you do? Well, that depends on the answers to a number of questions:

- Do you have money available for the best roof? If not, you have to settle for less, even if the choice is "foolish" financially.
- If you can raise the money for the best roof, what is the opportunity cost of that money? Will the interest you could earn or the return you could make investing in something else outweigh the cost of replacing the roof sooner than you might have done?
- Are you planning to sell the property before even a shoddy replacement is likely to wear out? Will a potential purchaser notice and discount the purchase price? What formula will the purchaser use for that?
- How costly is the inconvenience of frequent reconstruction to tenants or unit owners?

The financial model must include a way to project answers to all these questions. All too often, we rationalize poor decisions with wishful thinking: *Well, winters have been pretty mild lately. Maybe a shoddy roof will last longer simply because storms might be less severe than in the past decade.* A good model will expose these wishful assumptions and force you to confront and analyze them.

Suppose you are modeling the future cost of the eventual, inevitable fiber upgrade to the obsolescent copper in your network. Who knows what the cost of a fiber upgrade will be in five years? How can you tell whether you can get by with the copper for eight years? Or 10? Unless the copper is within a few years of foreseeable replacement, modeling can't tell you what you need to know, because the uncertainties will lead to a range of alternatives that is too broad.

A good model

- Helps you plan, because you have to start somewhere
- Helps determine feasibility (How close can you get to profitability?)
- Helps guide choices that increase the chance of success
- Helps predict problem areas or key leverage points.

Perhaps most important, a good model helps assure funders that you are not a dreamer without a plan.

TOOL 1: One-Page Fiber-to-the-Home System Financial Analyzer				
Example: XYZ Project: 20% Equity/80% Debt	Year 1	Year 2	Year 3	Year 4
Total homes and businesses passed	10,000	16,000	18,250	18,250
Total subscribers at year end	2,500	6,000	7,300	9,125
Average subscribers for year	1,250	4,250	6,650	8,213
Total system construction cost	16,829,954	22,093,748	24,396,793	24,396,793
Equity	5,000,000	5,000,000	5,000,000	5,000,000
Debt, principal not including financing fees (see row 33)	20,000,000	20,000,000	20,000,000	20,000,000
Cumulative cost to purchase and install customer premises equipment, using year-end customer total	2,057,500	4,794,500	5,760,400	7,048,850
Cumulative cost to purchase and install central office equipment, outside plant and fiber cable, excluding CPE	14,772,454	17,299,248	18,636,393	18,636,393
Direct costs per subscriber	823	782	743	706
Cash on hand at year-end, exclusive of investment return	6,770,046	3,586,252	1,667,207	628,757
Investment return on cash on hand	0%	1%	1%	1%
Total cash on hand at year-end	6,770,046	3,622,115	1,683,879	635,045

Figure 1: Basic network parameters and cash needs

	Year 1	Year 2	Year 3	Year 4
Analysis				
Construction Costs:				
Cost to pass one home or business	1,683	1,381	1,337	1,337
Cost to connect one home or business	823	782	743	706
Systemwide Take Rate, Year End, at least one service taken	25.00%	37.50%	40.00%	50.00%
Systemwide Take Rate, Midyear Average	12.50%	26.56%	36.44%	45.00%
Debt or Capital Cost - 100% Financing				
Term of loan, in years	15	15	15	15
Interest rate (capital cost)	12.00%	12.00%	12.00%	12.00%
Capital Cost Calculations				
Capital cost per subscriber, usung year-end totals	7,555	4,464	4,085	3,380
Capital cost to be financed (80%)	6,044	3,571	3,268	2,704
Cost of issuing debt	8.00%			
Debt per subscriber	6,528	3,571	3,268	2,704
Debt service per subscriber per year	958.40	524.37	479.82	396.97
Debt service per subscriber per month	79.87	43.70	39.99	33.08

Figure 2: Analysis section

period. After year 4, for instance, the numbers entered as examples project a 50 percent take rate, about the average for rural telephone companies. The model allows users to make any assumptions they want about sources of financing. In this case, as an example, we have assumed that 20 percent of the funds come from internal sources and 80 percent are borrowed.

- **Analysis**. Once the basics are entered, the model calculates the key variables, such as the average cost to pass one home or business with fiber and the cost to connect it to the network. Because the "basics" section includes the number of premises passed each year and the expected number of customers, the analysis section (Figure 2) can calculate the systemwide take rate at year-end and as an average for the year. This section also calculates the capital cost (annual and monthly) of adding each potential and actual customer to the network.
- **Cash Flow**. Figure 3 is a handy checklist of all possible revenues from the network and the costs of providing the services that generate those revenues, such as fees payable to video content providers and system overhead.
- **Investment considerations**. Many investors focus on EBITDA – earnings before interest, taxes, depreciation and amortization – to compare a borrower's assumptions to industry norms. Calculating EBITDA also offers an easy way to calculate the all-important debt-service coverage ratio, which is EBITDA divided by the debt service per subscriber, times the number of subscribers. If your ratio is somewhat more than 1, investors should be happy because you will have the cash flow to pay them off (Figure 4).

LEVERAGE POINTS

In the example shown in Table 1, the network deployer provides $5 million equity (20 percent of the total network capital cost) and raises another $20 million, all in one tranche. The network is projected to pass 10,000 premises in

Cash Flow Statement	Year 1	Year 2	Year 3	Year 4
Income per Subscriber:				
Triple play	160.00	160.00	160.00	160.00
Voice plus data		-	-	-
Security	-	-	-	-
VOD (triple-play required)	-	-	-	-
Gaming	-	-	-	-
Wireless backhaul	-	-	-	-
Smart grid benefits, rents	-	-	-	-
Other subscriber services	-	-	-	-
Other monthly income, including pro-rata subsidization from business services, fixed IP,wireless backhaul etc	-	-	-	-
Total monthly income per subscriber	160.00	160.00	160.00	160.00
Expenses per Subscriber:				
Cost of content (calculated for video package in triple play)	70.00	73.50	77.18	81.03
Payroll	19.81	21.86	19.40	19.40
Management	6.86	3.00	2.70	2.70
Debt service	79.87	43.70	39.99	33.08
Total monthly expenses	176.54	142.06	139.26	136.21
Monthly cash flow per subscriber	-16.54	17.94	20.74	23.79
Annual cash flow per subscriber	-198.44	215.31	248.88	285.43
Annual cash flow for system	-496,090	915,055	1,655,021	2,344,067
Annual EBITDA	1,903,910	3,315,055	4,055,021	4,744,067

Figure 3: Cash flows, including revenues and costs

Investment Considerations:	Year 1	Year 2	Year 3	Year 4
Annual EBITDA as percent of debt	9.52%	16.58%	20.28%	23.72%
Annual EBITDA as percent of equity	38.08%	66.30%	81.10%	94.88%
Annual EBITDA as percent of capital cost	11.31%	15.00%	16.62%	19.45%
Debt service coverage ratio	0.79	1.05	1.16	1.31

Figure 4: Investment considerations

the first year and build out to 18,250 premises over four years.

The legal and brokerage fees for the money raised, in this example, amount to 8 percent up front. This cost could be counted separately (as it is here) or charged against money raised or against initial equity. You don't have to change the spreadsheet coding – you can just adjust the amounts in the inputs and make the explicit cost of capital 0 percent.

For this model run, we keep all assumptions the same except for the interest rate. The low end of the projections, 4 percent, would be typical for a small Tier 3 incumbent local exchange carrier or a municipality that has a good management track record and something to mortgage. The high end would be more likely for a network builder that must pledge the network itself as collateral. Lenders tend not to be in the business of running networks. And they know that partially built, unsuccessful networks sell at a steep discount, if they can be sold at all.

To hardly anyone's surprise, lower interest rates lead to much more comfortable cash flow projections. A closer look, however, reveals that the

	DEBT SERVICE COVERAGE RATIO, BASE CASE			
Interest Rate	Year 1	Year 2	Year 3	Year 4
12%	0.79	1.05	1.16	1.31
11%	0.81	1.08	1.21	1.37
10%	0.82	1.12	1.27	1.44
9%	0.83	1.15	1.33	1.52
8%	0.84	1.19	1.40	1.60
7%	0.84	1.22	1.47	1.69
6%	0.84	1.26	1.55	1.78
5%	0.84	1.30	1.63	1.88
4%	0.84	1.34	1.72	1.99

Table 1: Higher interest rates mean lower debt service coverage ratios, especially in the out years.

effect of low interest rates increases dramatically over time. The debt coverage ratio in year one, at 12 percent interest, is 0.79. That is, the system has a cash flow that could in theory pay only 79 percent of the debt service. But at 4 percent interest, the ratio improves to only 0.84.

Now look at year four. At 12 percent, the system is projecting a ratio of 1.31 – comfortable but hardly exciting. At a low 4 percent, the coverage ratio is a healthy 1.99. Why? Compounding. The interest payments deferred while the system is just getting started must also be paid back. At 12 percent, interest charges amount to roughly a third of the money that must be raised in the first place!

As a system is being planned, a wise builder will take a close look at ways to structure the debt. Private builders, of course, will pay up front for a loan commitment. But the builder will not draw down the loan (and start paying interest) until absolutely necessary.

In the current economic climate, equipment vendors will usually help by deferring deliveries of equipment and providing 90 or more days' credit in their billing cycles. However, labor costs account for typically 70 to 80 percent of any build, and labor costs are hard to defer.

Municipalities have a tougher problem. Although their interest rates tend to be lower (because interest is typically tax-free to lenders in the same state), many states require all borrowing to be up front in one tranche (that is, one round of fundraising). Thus, municipalities can end up paying 7 percent or more up front while they earn 1 percent or less on the unused cash they are borrowing.

Too often, networks aren't built because their revenue potential is underestimated. Look at the conventional triple play. Voice service is a giveaway. A service provider might be able to charge $100 or more for video service, but its profit, after paying content providers, might be only $10 or $15 a month! Only Internet service is a consistent triple-play moneymaker, providing profits of $10 to $50 a month. (Milo Medin, vice president of access services for Google, recently estimated that leading cable providers earn gross operating margins for broadband Internet services that exceed 95 percent.)

However, fiber to the home can support multiple services beyond the triple play. What about video security tied to a customer's smart phone? Conventional security might sell for $20 a month, of which the network operator might pay $10 or more to a local security provider. High-end video security enabled by FTTH sells for $40 a month in many locations, and the local security provider will charge little (if any) more. That's a profit of $30 a month! True, the percentage of households that buy it will be smaller, and carriers have to pay for video uploads, but the overall profit can still rival that of video. The reliability and upload capacity of FTTH make it possible.

Video surveillance offers an added bonus: fewer false alarms. That helps control costs for the local security provider and local police.

Great opportunities are also emerging in telehealth, distance learning, home shopping and other services. Verizon reports FiOS average revenue per customer of about $150 a month, a figure that has grown over the years, even in a recession economy. Of that, we suspect a third is gross profit.

Table 2 shows the enormous difference that per-customer profit makes to the debt-service coverage ratio – a good reason to offer as many

QUICK MODIFICATION TO ROUGHLY CALCULATE OVERHEAD

You can, of course, go back to your original overhead calculations. But the prospective lender would not bother doing so for a quick analysis. Neither should you, unless there is an unusual contract provision such as a construction-contract shortfall makeup or a community-imposed performance penalty on an ILEC that does not build out as fast as expected.

	Year 1	Year 2	Year 3	Year 4
Payroll	=19.81/F53	=21.86/F53	=19.4/F53	=19.40/F53
Management	=6.86/F53	=3.00/F53	=2.70/F53	=2.70/F53

Look at Table 4 again. Turn each number into a ratio referring back to a single cell. The model would look like this example, where F53 contains the overhead ratio. If there is a 20 percent shortfall in customers in year one and this shortfall carries on all the way to year four, only 80 percent of the customers would have to carry the full overhead. The value in cell F53 in the model would be 0.80. Dividing the original base-case values by 0.80 leads to the result above.

	Year 1	Year 2	Year 3	Year 4
Payroll	24.76	27.33	24.25	24.25
Management	8.57	3.75	3.37	3.37

different services as possible. The model actually underestimates the effect of multiple services because it does not account for lower churn (customers are "stickier" when they purchase more services).

Sometimes a model looks *too* good. Consider Table 3. The first row considers the base case, 2,500 new customers in year one (an average of 1,250 for the year), growing to 6,000 in year two, 7,300 in year three and 9,125 in year four as the system is built out and as take rate improves from 25 to 50 percent. However, something is clearly wrong. Even at 60 percent below the projected base case, the debt service coverage ratio, though hardly healthy, is around 0.60 in years two through four.

This shows the value of testing the model with projections of severe shortfalls and great successes. In this case, the debt service coverage ratio appears unrealistically high because the model does not calculate overheads directly. It depends on users to calculate the overheads on a separate worksheet and insert simple values, not formulas, into the model itself.

The system per-customer payroll and external management fees have been inserted with the assumption that customers are being added at the base rate. It looks like Table 4.

But what if the customer base is below the original estimate and the system operator makes no adjustments? Then, the payroll will have to be assumed by fewer customers and the amounts per customer will rise. The effect may not be linear. That is, a 20 percent drop in customers may not lead to exactly a 20 percent rise in per-customer overhead. For instance, there will likely be fewer maintenance calls, and if maintenance is handled by a third party, there will be some savings to the system operator. Likewise, a customer database contractor might charge an up-front fee plus $1 or $2 per customer per year.

But a linear approximation is a good start. You can be sure that a savvy lender will test your model that way. In this case, the linear approximation (see box) leads to the more realistic set of projections in table 5. Notice that even a 20 percent shortfall leads to disaster! Fine-tuning the calculations to include some nonlinear assumptions is not enough; the need for a serious reduction in overhead becomes apparent. ❖

	DEBT SERVICE COVERAGE RATIO, BASE CASE			
Profit per Customer per Month	Year 1	Year 2	Year 3	Year 4
$50	1.63	1.62	1.91	2.14
$40	1.49	1.43	1.66	1.83
$30	1.35	1.25	1.40	1.53
$20	1.21	1.07	1.15	1.22
$10	1.07	0.89	0.89	0.92

Table 2: Monthly profit per customer has a large effect on debt service coverage ratio (this example assumes a 10 percent interest rate).

	DEBT SERVICE COVERAGE RATIO			
	Year 1	Year 2	Year 3	Year 4
Base Case (2,500 new customers in Year 1)	0.82	1.12	1.27	1.44
20% Below Base Case	0.68	0.95	1.03	1.19
20% Above Base Case	0.95	1.27	1.49	1.68
60% Below Base Case	0.38	0.58	0.50	0.60

Table 3: The initial model run shows a surprisingly low effect of construction delays on the debt service coverage ratio (assuming 10 percent interest rate and $30 customer monthly profit).

	DEBT SERVICE COVERAGE RATIO, BASE CASE			
	Year 1	Year 2	Year 3	Year 4
Payroll	$19.81	$21.86	$19.40	$19.40
Management	$6.86	$3.00	$2.70	$2.70

Table 4: Management overhead per customer.

	DEBT SERVICE COVERAGE RATIO			
	Year 1	Year 2	Year 3	Year 4
Base Case (2,500 new customers in Year 1)	0.82	1.12	1.27	1.44
20% Below Base Case	0.60	0.86	0.92	1.05
20% Above Base Case	1.03	1.36	1.60	1.81
60% Below Base Case	0.14	0.28	0.12	0.13

Table 5: The second model run shows a more severe effect of construction delays on the debt service coverage ratio.

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