To Overbu or Unde

Municipalities Ask and Answer the Question

By Merrion Edwards

There are now more than 180 million broadband subscribers worldwide and the number continues to rise rapidly. In analyzing the distribution of broadband subscribers, it is apparent those countries that have a national policy to develop, articulate and deploy broadband development programs have seized an early lead in broadband penetration, and this is now fostering enhanced domestic education, quality of life, productivity, and industrial development. As a consequence, many municipal governments have committed to creating robust broadband networks that will enhance the economic development of their community.

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There are a number of broadband technology alternatives available for these initiatives, but the main players are hybrid fiber coax (HFC) cable, xDSL and FTTH. Up until recently, cable and xDSL have been the predominant broadband network technologies. Today, however, emerging bandwidth intensive applications and services such as multiple channel HDTV are pushing the limits of the bandwidth capabilities of xDSL and cable services. Recent studies have revealed that, even with advanced data compression schemes, a bandwidth of 35Mbps will be required per subscriber.

Consequently, FTTH, with its relatively infinite bandwidth capabilities, is becoming an ever more attractive option. Simultaneously, the continuing innovations and associated cost reductions in optical infrastructure are improving the economic viability of FTTH and the operational cost savings afforded by FTTH are becoming more recognised and understood. As a result, the industry is seeing providers today deploying FTTH as they look to enjoy the associated benefits of upgradeable Triple Play services, enhanced revenue streams, reduced customer churn and reduced operating expenditure (OPEX).

Open or Closed Access Models

There are essentially two types of FTTH market models: open access or closed/competitive access. In open access networks, the operator provides wholesale access on equal terms to service providers, including telcos, ISPs, and video providers. In closed access networks, the carrier competes for subscribers using its own infrastructure.

The two most obvious examples of closed market access are in the U.S. and Japan. In Japan there are nine competing carriers building FTTH, resulting in some redundant infrastructure. In the U.S., the telcos and the MSOs are in a fierce battle for subscribers, using various competing technologies. In both cases we are seeing that the benefits of converged services, lower churn, higher average revenue per user (ARPU), higher data rates, lower operating costs and marketing cache are providing FTTH with a competitive advantage over xDSL and cable technologies.

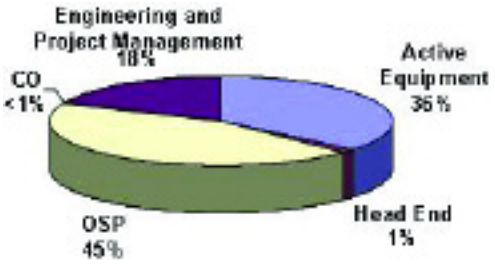
In an open access network architecture the network infrastructure is considered a utility, similar to power, water and roads. Most open access network deployments result from municipal action. The owner of the open access infrastructure (e.g., the municipal government) does not compete with the service providers, but the fiber infrastructure it owns provides ample bandwidth for a number of competing service providers, and facilitates advanced high bandwidth services and future service upgrades.

FTTH Players the U.S.

The three natural market drivers of revenue, competition, and cost, combined with the removal of the regulatory barrier, have made FTTH an attractive business to enter in the U.S. As the wireline voice market shrinks, FTTH has been adopted by many telcos in order to gain a critical competitive edge over the MSOs and to improve profitability.

In the U.S. there are four carrier segments active in FTTH:

1. As the RBOCs financial positions recover, and regulatory certainty increases, companies such as Verizon and AT&T have begun to adopt FTTH in the face of increasing MSO competition.
2. The rural LECs have been the FTTH deployment leaders and yet have only 8% of access lines. The rural LECs are financially sound and are benefiting from Rural Utilities Service loans to build networks for increased revenue and bundled service provision.
3. The home developers and the municipalities are offering FTTH in order to differentiate from the competition.



Category	Cost ($M)
OSP	$ 29.8
Equipment	$ 24.4
Head End	$ 0.9
CO	$ 0.3
Engr & PM	$ 12.2
Total	*$ 67.6*

Figure 1. Breakdown of first installed costs for Municipal FTTH deployment case study.

4. Municipal governments want broadband for their citizens in order to promote economic development. Here broadband is seen as a utility like power and water, but the regulatory support varies from state to state.

The Realities of Economics

There are three main elements affecting the first installed cost of a FTTH infrastructure. They are the passive infrastructure, the active equipment along with labor, and installation.

With increasing FTTH deployment, the capital expenditure (CAPEX) costs associated with FTTH have decreased significantly for the RBOCs and rural LECs. The cost of actives, passives, and the cost of installation labor have all decreased, to the point where a proven FTTH business case can be made for all greenfield deployments. However, the operational expenditure (OPEX) savings afforded by FTTH systems, coupled with the increased revenue opportunities enabled by the superior performance of FTTH networks, have now made a compelling business case for many overbuild networks as well.

Municipal networks have several routes to obtaining funding for a FTTH network in the U.S. They are cash, inter-fund loans, bank loans, Rural Utility Service (RUS), private equity or bonds. The funding route most commonly used by municialities is cash, inter-fund loans, bank loans, and bond issues.

There are several bond issue options available to municipalities.

- General obligation bonds are secured by pledging the credit of the community to support the debt. These bonds offer the lowest rate of interest available but a favorable vote from the municipal taxpayers is usually required.
- Revenue bonds are obtainable when an existing utility issues bonds and pledges its revenues to repay the debt. These bonds have slightly higher interest rates than the general obligation bonds but they do not require a public referendum, and with an investment grade utility often it is possible to use the existing bond rating.
- Telecom revenue bonds are secured using the net revenues of the telecom network; all cash flows must be pledged, and investors usually require some equity as well.

Municipal FTTH Deployment Business Case Model

To begin, let's examine a model for a municipal FTTH deployment. In this model, we use U.S. city demographics for a city of 130,000 people, similar to Naperville, Illinois or Sunnyvale, California. The model assumes there are 29,000 residences and 2,400 businesses within the city, with a 36-square-mile city footprint.

The network is a municipality PON overbuild that takes three years in the construction phase, with no existing equipment present, and 70% aerial infrastructure and 30% buried. The model assumes that the maximum penetration rate is 70% after three years. The network will offer the services of IP voice, data, and video, and it will be necessary to build a complete head end for the video services.

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Figure 1 shows the break down of the first installed costs (FIC) for this model where you can see that OSP is the biggest cost component at 44%. Within this cost, over four fifths (4/5) is attributable to labor, with the passive equipment only contributing to less than one fifth (1/5) of the OSP cost.

Active equipment at 36% of the FIC is the second most expensive part of the deployment. However, this cost element is continually decreasing as economies

Figure 2. New installation technologies, including pre-terminated cables and terminated distribution systems, are reducing the installation labor costs of FTTH.

of scale force prices lower and new suppliers and innovative architecture options continue to add to the downward price pressure. Engineering and project management contribute towards 18% of the total. This cost is widely dependant on the network installers, project management partner and their reputation, expertise and experience. This cost can be reduced if in-house capabilities in this area exist.

The head end and the central office amount to approximately 2% of the overall network cost. Included in the calculations are the antennas, descramblers, software, and test equipment for the head end, and the building of a central office to protect equipment from the environment and to provide back up network power.

Most of the above deployment cost categories, including OSP, network equipment, and engineering and project management, will change directly in proportion to the community size. However the cost of the head end and central office are mostly fixed. Consequently this cost can be challenging to very small communities.

There are three different types of cable in a FTTH networks. They are the feeder, distribution, and drop cables. Each of these impacts the cost of labor in the OSP.

There are few feeder cables in a network than distribution cables. That said, we know feeder cables have a high fiber count with the fibers shared over many subscribers. In that case, the fibers can be mass fusion spliced at connection points, thereby reducing labour costs.

Distribution cables, on the other hand, are characterised by many lower-fiber-count cables with individual fiber/fibers for each home. Each of the fibers in each of these cables has to be individually fusion spliced – and this adds significantly to the labor cost. There is one drop cable for each subscriber that must be spliced once at the interface with the distribution cable (network access point or NAP) and a second time at the network interface device (NID) at the customer's premises. Consequently, the greatest portion of the OSP labor cost can be attributed to installing the distribution cables.

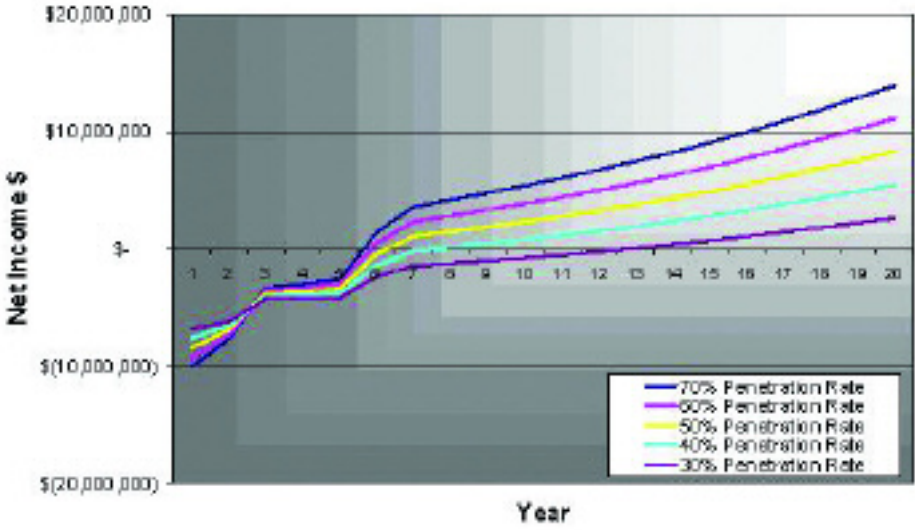

Figure 3. Increased penetration rate leads to early breakeven and increased profitability.

Fortunately, new installation techniques are continually focusing of reducing OSP labor costs, particularly for the distribution and drop cables. For drop cables, pre-terminated terminals, pre-terminated drop cables, and pre-terminated NIDs have reduced installation time, and have allowed the use of lowered skilled and less expensive labor. For distribution cables, terminated distribution systems are now also available, which reduce the splicing time while increasing the rate of deployment. (See Figure 2.)

FTTH Networks and Operational Expenditures

For an open or closed network, there are six key elements contributing to long-term operational costs:

1. Staff
2. Network maintenance and promotion
3. Office expenses
4. Tooling and transport
5. Power for CO/HE
6. Truck roll repairs

The largest OPEX cost factor is employees. By reducing the amount of actives in the field, FTTH networks require less maintenance staff, and so OPEX is significantly lower. In this respect, a passive optical network may have an advantage over VDSL and HFC network architectures.

Making FTTH Profitable

The profitability of a telecommunications operator will be determined by revenues after OPEX, depreciation, and interest and taxes have been deducted. The biggest factors in determining provider profitability are the revenues and the operational expenses related to a choice of network architectures.

In the case of FTTH, revenues are influenced heavily by the service penetration rate. This is illustrated in Figure 3, where a high penetration rate leads to an early break even in financials. This figure also shows that a 30% penetration rate is required to ensure operator profitability within a reasonable timescale.

However, penetration rates can vary widely depending on the market and the services provided. A recent Render Vanderslice study indicated that penetration rates can be as low as 33% in highly competitive areas where two or more competing companies exist for non RBOC triple play service offerings. Whereas, in non-competitive overbuild scenarios, the penetration rate is typically near 65%, and greenfield sites penetration rates can be as high or higher than 75%. (See Figure 4.)

In order to ensure early profitability, municipal builds must make great efforts to minimize their OPEX and to maximize their penetration rate. FTTH offers lower OPEX rate, and facilitates increased penetration rates by offering leading edge

service packages including offerings such as HSD, voice, HDTV, VOD, PVR, and home security. Effective sales and marketing, efficient customer services, and astute pricing structures can all improve penetration rates further.

With broadband networks and subscriptions continuing to grow at a rapid pace, new infrastructure is required to meet the bandwidth demands. With product innovation and economies of scale, FTTH has become a seriously viable option for broadband network deployment. What's more, municipal governments see the possession of a robust broadband network as a critical element contributing to future economic success for their community.

With labor being the greatest component of FTTH first installed cost, the key for municipalities and LECs alike is to employ innovative installation techniques that significantly reduce labor requirements. By reducing OPEX and delivering highly attractive service offerings, providers and municipalities can yield increased revenues and reduce churn for their residents and customers.

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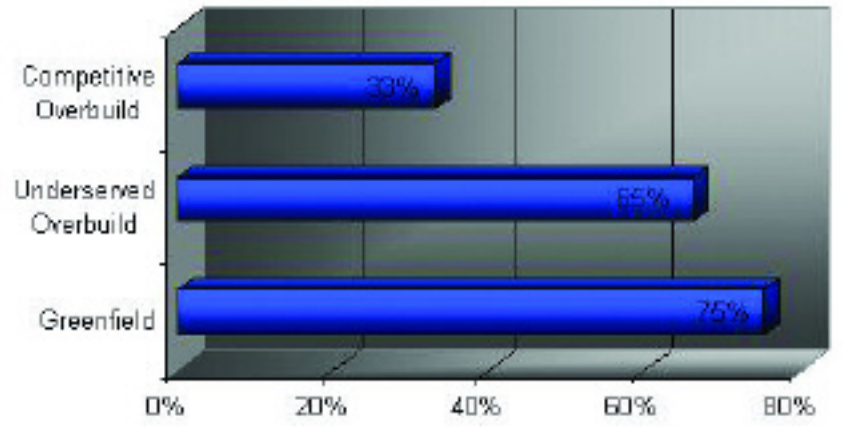

Figure 4. Penetration rate by market case (non RBOC North American Triple Play). Note: take rates vary above or below these averages depending on local variables, including marketing strength. (Source: Render, Vanderslice and Associates LLC)