The New Rate-and-Reach Frontier

Accelerating Broadband's Reach Into Rural Communities

By Prakash Nagpal

In the United States, the Federal Communications Commission (FCC) defines broadband as a minimum of 4 Mbps of actual download speed with 1 Mbps of actual upload speed. With this definition of broadband, there are about 7 million U.S. households that are underserved or unserved. According to some estimates, serving the last 250,000 housing units would cost approximately $14 billion.[1] In Canada, the government set a target to provide universal coverage with speeds of 1.5 Mbps down and 384 kbps up. Based on this target, there are nearly 3 million Canadian households without access to broadband. The cost to provide universal broadband to these households using fiber would be more than $50 billion.[2]

Broadband has become a barometer of a region's ability to compete in a global marketplace. The rationale for governments to set aggressive targets for broadband deployments and time frames for broadband availability is that broadband has now become synonymous with economic development. In a statement released June 09, 2011, by The White House regarding the creation of The White House Rural Council, U.S. President Barack Obama said: "Strong rural communities are key to a stronger America." This statement by President Obama certainly applies not just to America, but to every country around the world.[3]

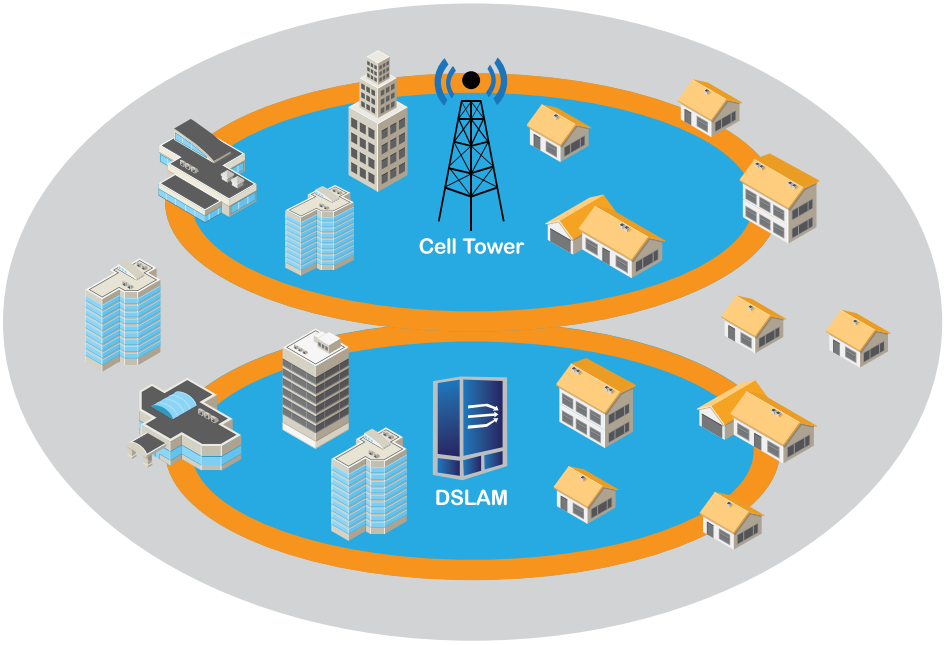
For carriers, meeting the threshold for bandwidth and coverage in urban and other densely populated areas, with or without state sponsored stimulus, is less problematic. However, the cost of reaching that small fraction of the underserved and unserved locations -- typically, the remaining 10% -- can be orders of magnitude higher than the per-unit cost of covering the first 90%. Given the difference in cost, achieving a reasonable return on investment (ROI) poses a challenge, even with government subsidies. It is interesting to note that for customers in the "last 10%" it is not necessarily about getting IPTV service, but about providing the very basic ability to book a flight online or complete a school project that requires access to the Internet.

Service Provider Perspective: Scaling to Meet Demand

Ideally, every carrier would like to provide service to every location that lies in their footprint. Their rationale is simple: Greater economies of scale maximize revenue and allow service delivery at the lowest possible cost. However, providing service requires more than just the ability to have a physical link to the customer location. The carrier must be able to provide robust and reliable services at competitive price points.

To meet customer demand and offer competitive services, some carriers are attempting to deploy fiber to every location. Based on recent data from industry analysts Vertical Systems Group (www.verticalsystems.com) and Heavy Reading (www.heavyreading.com), more than 70% of businesses and about 90% of residences do not have access to fiber. Fiber deployments are growing at a mere 3% a year for business customers and about 30% a year for residential customers. The numbers indicate that less than 10% of new customers will get access to fiber every year. This implies that it will take several decades and billions of dollars in each country, and hundreds of billions worldwide, before every location has access to fiber.

While some carriers are deploying fiber, others are attempting to build or upgrade existing wireless networks to 4G, WiMAX, or LTE to provide residential broadband. Carriers that want to continue to leverage the existing copper-based network are deploying additional DSLAMs to reach the fraction of households which are underserved or unserved.



Covered Areas:
Customers have access to broadband.

"The Edge":
Underserved locations: Customers cannot get sufficient bandwidth.

Last 10%:
Unserved locations: Customers cannot get any broadband.

Figure 1. Broadband Coverage in Wireline and Wireless Networks.

For all the above options, the construction costs and complexity of reaching the "last 10%" of customers make it impossible to achieve a reasonable ROI, even with government subsidies. The reach limitations of DSL technology have historically made the installation of DSLAMs necessary to cover the remaining population too costly. Fiber-to-the-Premises (FTTP) deployments are attractive from a bandwidth perspective, but cost-prohibitive to obtain anywhere close to 100% broadband coverage. Wireless has been touted as an option for broadband, but current and planned mobile technologies do

	Fiber	Wireless	Deploying Additional DSLAMs	Extending Reach of Existing DSLAMs
Bandwidth	◕	○	◔	◑
Coverage	• $10's of Billions for Ubiquity • Eliminates "gaps" by deploying fiber everywhere	• $10's of Billions for Ubiquity • Eliminates "gaps" by increasing number of cell towers	• $ Billions for Ubiquity • Eliminates "gaps" by increasing number of DSLAMs	• $ Millions for Ubiquity • Deliver broadband everywhere POTS can be delivered
Cost / Location	Highest	High	High	Lowest
Time to Market	○	○	◑	●
Operational Complexity	• High — must coexist with existing BB & POTS infrastructure	• High — must coexist with existing copper network • High — requires new & complimentary backhaul network	• Additional H/W drivers operational complexity • Large number of DSLAMs equates to overlapping coverage & inefficiences	• Low — leverages existing BB and POTS network • Minimal incremental complexity of "extending" existing network

Figure 2. Alternatives to Deploying Broadband.

not offer the throughput or reliability necessary to deliver services cost effectively. Most large operators, therefore, continue to focus their deployments in more populated urban and suburban areas that offer a much better ROI.

To understand the cost and coverage challenges, we must consider the logical architecture of a typical network and the options being evaluated to provide ubiquitous coverage. Figure 1 shows how DSL (wireline) and wireless technologies leave a gap of unserved locations, where the DSLAM or cell tower cannot provide coverage, and underserved locations, (at "The Edge" of the coverage boundary) where the DSLAM or cell tower delivers insufficient bandwidth. The question becomes: Is there technology that can cost effectively and rapidly extend coverage to unserved and underserved locations? And will such a solution provide carriers the ability to meet customer demand cost effectively and immediately?

Figure 2 compares how the alternatives fare in providing a solution that meets the needs of the unserved and underserved. It also defines the business requirements of an alternative solution that leverages existing copper infrastructure.[4]

Of course, theoretically, there is always the option for carriers to "wait and see." Emerging competition from cable MSOs and loss of revenue from the resulting increase in customer churn make offering only very slow DSL services or no service at all an unacceptable option.

The Solution: Speed and Efficacy

Given the backdrop of current infrastructure, customer needs and economics of providing a credible and affordable alternative, it is clear that:

1. Carriers cannot deploy fiber everywhere, and they certainly can't do so immediately.

Figure 3.

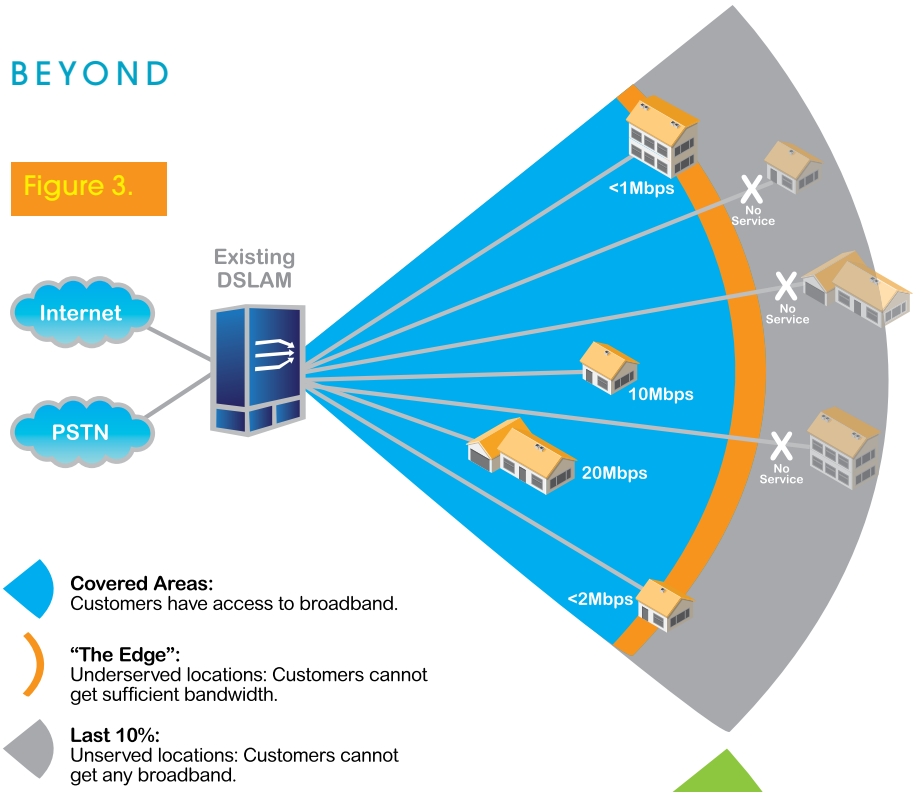


Figure 4.

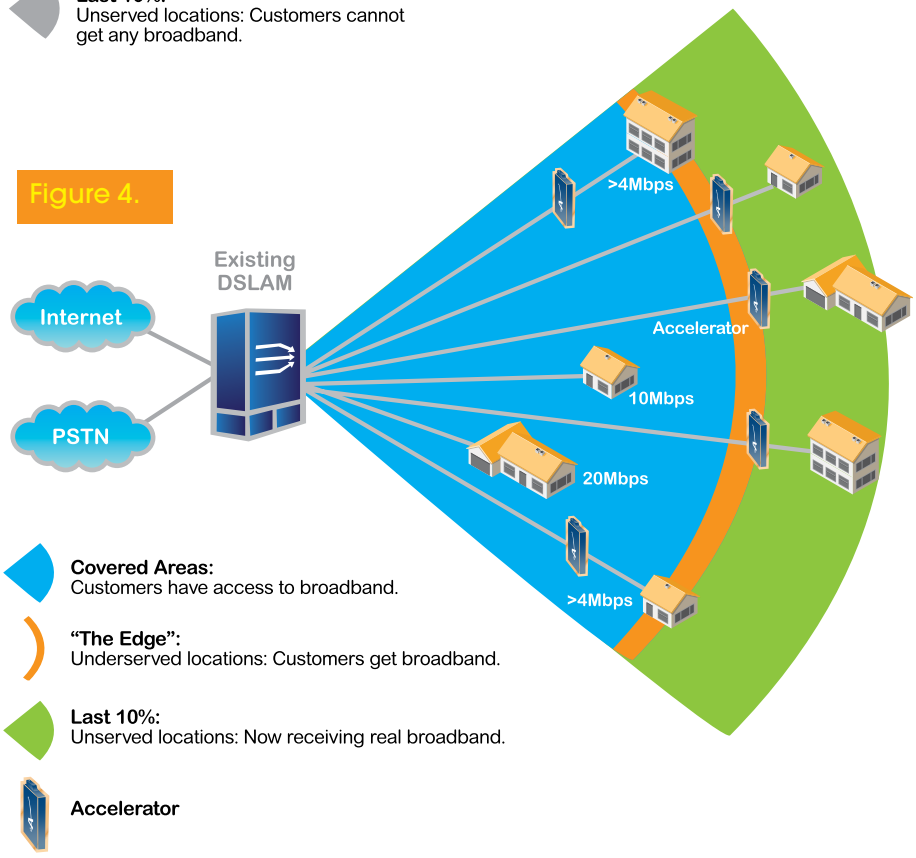


Figure 3. (TOP). Unserved and Underserved Locations Without Accelerators.
Figure 4. (BOTTOM). Providing Broadband Everywhere With Accelerators.

2. While wireless alternatives might eventually become viable, they do not provide a solution today or in the foreseeable future.
3. The ability to leverage existing copper-based infrastructure to deliver broadband is critical because it provides a faster path to market.
4. Carriers must offer services that can stem the loss of customers.
5. Doing nothing is not an option.

Here's What Is REALLY Needed!

Given the analysis featured in this article, carriers must consider alternatives that can extend the reach of their existing copper-based infrastructure. This might be the only option that can meet the dual goals of providing ubiquitous coverage and a reasonable ROI. The solution chosen must satisfy all the following criteria.

A. Provide adequate coverage. To justify the investment, the solution must provide coverage as shown in Figure 3. Specifically, the solution must deliver to the orange bands (underserved) and grey areas (unserved) -- meaning anywhere POTS can be provided. (See Figure 3.)

B. Provide adequate bandwidth. In addition to providing coverage, a key requirement must be to deliver adequate bandwidth to meet customer demand.

C. Provide competitive services. The cost of the solution must support the ability to price services competitively and provides a reasonable ROI. This means that the initial capital and ongoing operating expenses must be minimized.

D. Provide a rapid path to market. Since demand for additional bandwidth exists today, carriers must be able to deliver the services immediately across their entire footprint. This implies that the carrier must be able to leverage their existing copper-based network and back-office systems, without expensive upgrades or time consuming development.

E. Provide a reliable, standardized service that works with their current infrastructure. Higher bandwidth services must be coupled with the reliability required for applications that customers are using. The standards-based solution should be compatible with existing infrastructure, and have no adverse impact on existing services as well as comply with local spectral regulation.

The technical requirements of a solution (which I will refer to as an *Accelerator*) that allows carriers to deliver broadband anywhere they can deliver POTS are as follows:

1. In the residential context, carriers rely on ADSL (ADSL1/2, ADSL2+, ADSL2+ Annex M) and VDSL, so the Accelerator must support multiple variations of DSL.
2. Accelerators should fit into existing splice points of copper loops, eliminating the need for trenching or special construction.
3. Accelerators must be transparent and interoperable with existing DSLAMs and customer premises equipment, eliminating the need for special configuration or management of existing network elements.
4. Accelerators should ensure spectral compatibility with neighboring services and conform to spectral regulation.
5. Accelerators should be powered by existing POTS power, enabling low cost deployments as well as quick and easy installation, without requiring carriers to augment their existing infrastructure.

Figure 4 provides a logical architecture of how an Accelerator, which meets the business and technical requirements described above, fits into carrier networks.

Accelerating Solution Delivery: Not Letting "Perfect" Choke the Good

Surely, every consumer would like to have access to unlimited capacity at a price point that is comparable to baseline DSL offerings currently available. This might be possible when fiber is available everywhere and when wireless technology matures, but the process, as mentioned earlier, will take many decades.

Carriers could pursue the extremely expensive and time-consuming option of adding remote DSLAMs to achieve ubiquitous broadband coverage. Or, they can continue to ignore the underserved and unserved and, consequently, lose market share to their more aggressive competitors. Of course, they can also take the path of looking at alternatives that can extend the reach of their existing copper-based infrastructure to cost effectively provide broadband everywhere POTS service is delivered. With this pragmatic approach, carriers can deploy Accelerators with a promise to their customers: "If I can deliver dial tone, then I can deliver affordable broadband to you."

Endnotes

1. Connecting America: The National Broadband Plan, Page 138.

2. Based on study by Vodafone, assuming avg. distance from CO of 12kft and 2.9m households without broadband (vodafone.com/content/dam/vodafone/about/public_policy/policy_papers/public_policy_series_12.pdf).

3. Obama Administration Establishes White House Rural Council to Strengthen Rural Communities. http://www.whitehouse.gov/the-press-office/2011/06/09/obama-administration-establishes-white-house-rural-council-strengthen-ru

4. Actual numbers vary by country and depend on several factors like population density and terrain. Comparative orders of magnitude of investment required still apply.

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