Could Fixed Wireless Access Bridge the Digital Divide?

With the ability to be deployed more quickly than fiber at a possible lower cost – especially in rural, hard-to-reach areas – fixed wireless access offers service providers another tool to give more people access to internet connectivity.

By William Webb / *Cambridge Broadband Networks Group*

A digital divide occurs when some people have better access to the digital world than others. Many people access the digital world using mobile connectivity, so the key factor deepening the digital divide typically is home broadband. Without home broadband, people can't use mobile phones, which typically camp onto home Wi-Fi. In general, a home broadband speed of 100 Mbps or more enables unconstrained access to the digital world. Anything less results in slower services, and below 10 Mbps, some applications, such as gaming and high-definition video, may not be possible.

The digital divide is purely an economic phenomenon. After all, if electricity can be provided to a home, then so can fiber optic cables. But for homes outside urban areas, the cost of delivering high-speed broadband may be higher than the amount operators can afford to pay. There are two solutions to this, often working in parallel. One is to reduce the cost of provision; the other is for governments to subsidize it.

FIBER DEPLOYMENT CHALLENGES

Subsidies are being widely provided across many countries, such as the Rural Digital Opportunity Fund (RDOF) in the U.S. and the Gigabit Voucher Scheme in the U.K. The terms associated with these can have a strong influence on the means of provision. For example, both require the ability to deliver 1 Gbps or more, known as gigabit connectivity. They are also time-bound, creating a need to move quickly. The funds often have fiber in mind, but shortened time scales often can make fiber deployment unachievable because digging is inherently a slow process.

In this case, the only alternative that can deliver gigabit connectivity is fixed wireless access (FWA). Other solutions, such as mobile and satellite, cannot reliably deliver these data rates. FWA also has the advantage of being less expensive than fiber outside of urban areas, where buildings are spaced further apart and the distances over which the fiber needs to be "dug" are greater.

Fiber deployment is well understood and metrics to measure it, such as cost per home passed (CPHP), are used as benchmarks. Fiber costs are relatively simple – the cost is dominated by the installation of the fiber ("digging"), which tends to be measured on a per-meter basis.

A fiber cable is installed along a street, and the CPHP is the distance between homes multiplied by the cost per meter. Once a home subscribes to the service, then there is a further cost of extending the fiber from the road to the house, which is again distance multiplied by cost per meter.

For example, for homes spaced 10 meters apart, the CPHP is $300 if the cost per meter of digging is $30. If homes are spaced 5 meters back from the road, then the cost of connection might be $150 digging plus perhaps $50 for installing a socket in the home. The cost per home connected (CPHC) then depends on the percentage of homes that take the service, so if 33 percent take the service, the distance between homes taking the service is 30 meters, and the overall cost is $900 to pass the home and $200 to connect, for a total of $1,100.

The key parameters for fiber are the cost of digging, the distance between homes and the subscription rate. As areas become more rural, the distance between homes can extend significantly. In addition, more backhaul is needed between rural communities, which can become a significant component of overall cost.

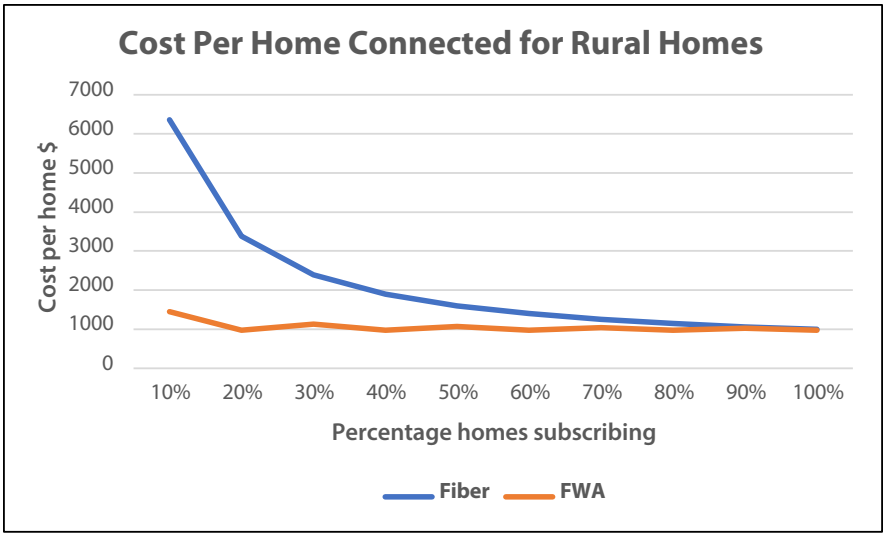
FWA ECONOMICS

The economics of FWA are so different that the simple metrics of CPHP make little sense. Simply deploying a base station, or BTS, that covers an area could be considered "passing" the home, so thousands of homes could be passed for a cost of perhaps $30,000. The connection cost involves deploying customer-premises equipment (CPE), which might cost $370 for the CPE and $130 for installation, for a total of $500. As more CPE is deployed within the coverage of a base station, the capacity of the base station may be exceeded, and more base stations may need to be built.

As such, FWA is far less dependent on distance between homes and subscription rates. The major cost is connecting a home, and this is incurred only when a home subscribes. This is known as a "success-based capex." Intuitively, FWA is increasingly advantageous compared with fiber when homes are more widely spaced and the subscription rate is lower.

However, the capacity of fiber is effectively infinite – each home has its own strand of fiber, which can deliver a continuous 10 Gbps data stream. As more homes subscribe or data usage per home grows, there is no need to upgrade a network. FWA has a finite capacity, shared among all subscribers using a BTS.

As the number of subscribers or usage grows, the BTS may need to be upgraded or split into multiple BTSs. Therefore, fiber has an advantage in places where capacity requirements are high. Fiber also has an opex advantage because it is either a buried cable or is on an existing utility pole that needs no attention. FWA systems require periodic replacement as the electronics deteriorates or become obsolete, perhaps on a 10-year cycle.



It's not possible to generically compare cost per home passed or cost per home connected (CPHC) for fixed wireless access and fiber. This graph depicts the CPHC versus the percentage subscribing for a specific rural deployment.

BROADBAND FOR ALL

When looking at ways to bridge the digital divide, fiber has a high up-front cost as cable is laid, which grows as subscribers become more rural. There is a risk that if fewer homes than expected take the service, there is no way to recover costs. However, once installed, there is little need for additional capex or opex. In comparison, FWA has a low up-front cost, which is minimally affected by how rural deployments are, and low risk if fewer homes take the service. Yet FWA needs ongoing capex to expand capacity and opex to maintain the network.

It is not possible to generically compare CPHP or CPHC for FWA and fiber. These metrics make sense only for a specific deployment in which many factors, such as distance between homes, percentage take rate for the service, typical home usage and FWA spectrum holdings, are specified. Otherwise, there is little value in comparisons.

For example, the chart above shows the cost per home connected versus the percentage subscribing for a specific rural deployment.

FWA is relatively insensitive to the subscription rate, whereas fiber is sensitive, especially at low rates.

A digital divide exists because provision of broadband is uneconomical. Both the terms of subsidy and the desires of users require relatively rapid deployment, and FWA can be deployed much more quickly than fiber. It can also cost less, especially in the areas where a digital divide is more likely to persist. ❖

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