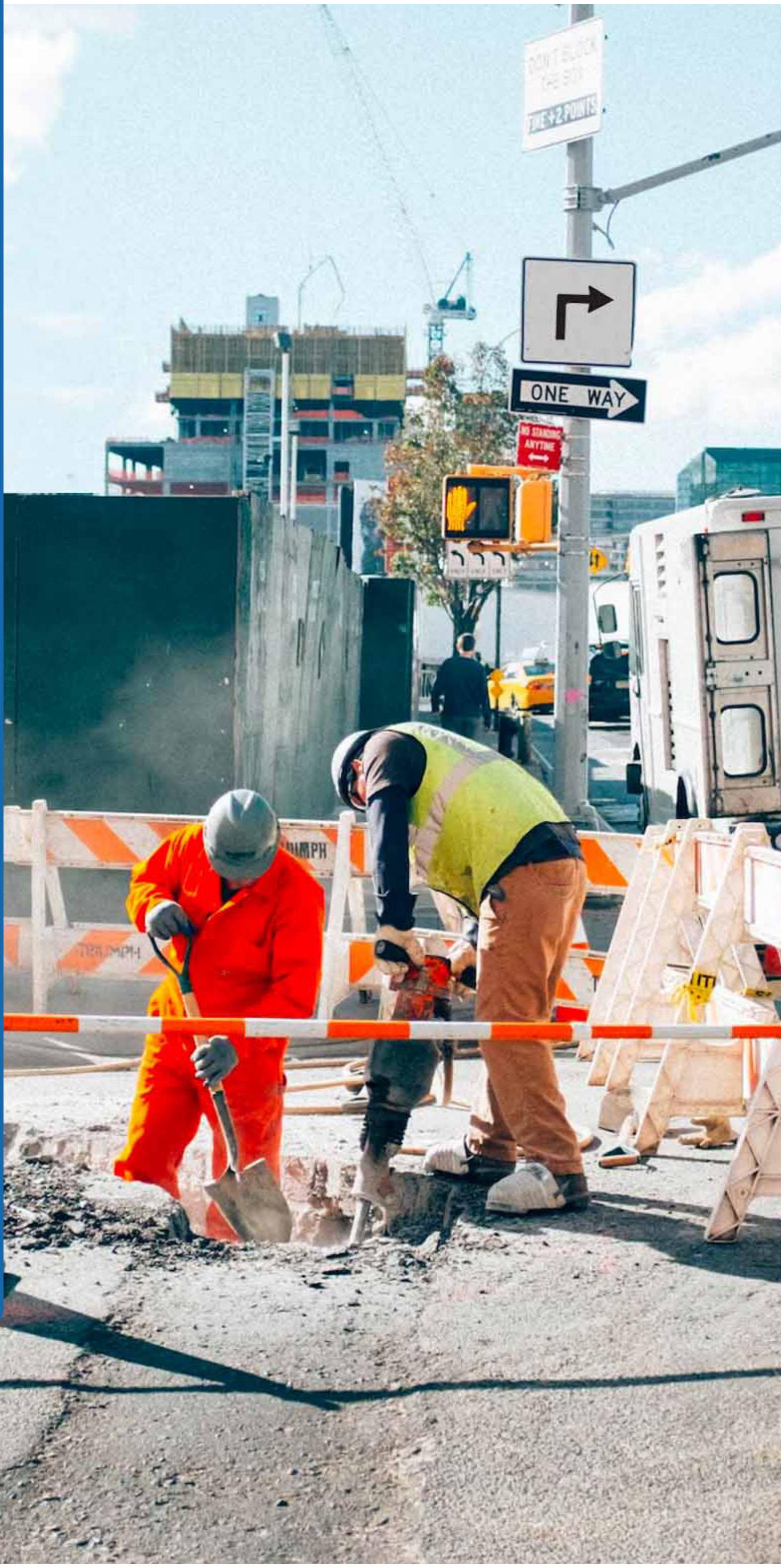
TARANA

WHITE PAPER

ngFWA vs Fiber

A TCO Analysis of Next Generation Fixed Wireless Access (ngFWA) and Fiber



Broadband network operators have a choice of technologies. When making this selection, one crucial metric to consider is the total cost of ownership (TCO). Despite the widespread view that fiber optics is the optimal solution, it is essential to examine its drawbacks, including the challenges related to deployment time, ease of deployment, and total cost.

As has been discussed in previous papers, next-generation fixed wireless access (ngFWA) technology is capable of meeting even the most challenging broadband demands, while offering favorable economics and scalability. In our model of a rural U.S. deployment, we found that **deploying Tarana G1 would cost 30% of an all-fiber approach over a period of 50 years**, making it an appealing option either as an alternative or complement to fiber optics.

Total Cost of Ownership Example

To illustrate how ngFWA operators can deploy fiber-class wireless broadband at an affordable cost, we will examine a rural setting that comprises roughly 750 households spread over 25 square miles of hilly, sparsely populated terrain, with a population density of 30 households per square mile. Considering the distance and challenging terrain, we estimate the cost of deploying fiber to the premises to be $10,000 per household. On the other hand, for next-generation fixed wireless, we will install three towers, each with four sectors. These estimates provide a basis for comparing the costs of deploying fiber to the premises versus ngFWA in rural areas with challenging terrain.

When calculating the cost for fiber to the home (FTTH), the following formula from the Cartesian report "FTTH Study 2019"[1] was used:

$$C_{pass} = \$7{,}549 - \$2{,}161 * \log_{10}(\text{density per mile}^2)$$

According to this formula, the estimated cost of passing a household in an area with a density of 30 households per square mile is $8,000. However, since this formula was developed in 2019 and does not account for challenging terrain and inflationary market forces, we will add a 25% increase to arrive at a total cost of $10,000 per household in rural settings. While some areas may incur lower costs, many other locations may face significantly higher costs. For instance, a recent article analyzed data from the U.S. Department of Agriculture (USDA), and found that bringing fiber to an Alaskan community would cost $204,000 per household, while in a Texas location, the cost per passing would be $77,000. In comparison, our estimates are more optimistic. We also add $2,000 to connect a passed household.

1 https://docslib.org/doc/3079870/ftth-study-2019-summary-findings
2 https://www.fiercetelecom.com/broadband/cost-running-fiber-rural-america-200000-passing

To estimate the cost of deploying ngFWA, we will use three towers with four sectors each, providing a total coverage area of 62 square miles. We assume the use of two existing towers and construction of the remaining one. To calculate the cost per household passed, we will divide the total cost of the base station and tower by 750 households. For the sake of simplicity, we will not consider the operating costs of either fiber or FWA, nor the costs associated with central office equipment such as switches and backhaul.

	Fiber	**ngFWA**
Cost per household passed	$10,000	$509 (12 sectors + 1 tower @ $250,000 each)
Additional cost to connect household	$2,000	$600
Total per household connected	$12,000	$1,109
Grand Total (750 HH connected)	**$9M**	**$831,750**

For the initial year of deployment, an ngFWA network will cost 9% that of an all-fiber solution while still delivering reliable gigabit speeds.

In rural areas, the terrain is often challenging, and this can increase the costs of deploying both fiber and wireless networks. Assuming twice the cost for fiber, which is still significantly lower than the high costs quoted earlier, and twice the number of towers for ngFWA, the cost difference between the two technologies remains stark.

	Fiber	**ngFWA**
Cost per household passed	$20,000	$1,685 (24 sectors + 4 towers @ $250,000 each)
Additional cost to connect household	$2,000	$600
Total per household connected	$22,000	$2,285
Grand Total (750 HH connected)	**$16.5M**	**$1.7M**

Even in this case, the wireless network is still only 10% the cost of a fiber network. This underscores the cost advantage of wireless networks, which can be deployed more quickly and economically in rural areas, even in challenging terrain. The $20,000 value is validated by a recent grant[2] from the NTIA of $73M to connect

2 https://www.telecompetitor.com/ntia-awards-73-million-in-tribal-broadband-funds/

3,107 unserved Native American households, which uses a rate of $23,500 per household.

Another analysis[3] has examined the cost of closing the digital divide in the U.S. using an all-fiber approach. The study analyzed the average cost per household served in 132 state-funded fiber broadband projects and found that a significant number of projects were at or above the $10,000 mark, with some significantly higher. Based on this data, the total cost of deploying fiber to every U.S. household is estimated to be around $700 billion. While the cost of an ngFWA-driven approach would also be substantial, it pales in comparison to the total cost of deploying fiber.

Fiber proponents often argue that fiber has a longer lifespan than other technologies, commonly cited as 50 years. It's worth noting that fiber also incurs upgrade costs, such as the electronics that need to be regularly replaced at each end of the fiber connection. If we take these costs into account, the cost disparity between an all-fiber network and a next-generation fixed wireless network is still significant. Including the cost of upgrading fiber and electronics 3 times (roughly every 15 years) at both ends of a fiber link (at a total cost of $300 per subscriber) adds an additional cost of $675,000, bringing the fiber total over 50 years to $17.2M.

	Fiber	**ngFWA**
Cost per household connected	$22,000 + 34 x $300 (upgrades)	$2,285 + 5 x $952 (upgrades)
Cost over 50 years (750 HH connected)	$17.2M	$5.3M

As the calculations above demonstrate, even if ngFWA equipment is replaced every 10 years, it would still be 70% less than half the cost of fiber over the same 50-year period.

The Cost of Time

The time required to deploy fiber can be significant, even in areas with favorable terrain — which is rarely the case in the most rural areas of America. In more urban areas, which are often considered ideal for fiber installation, there are still long lead times for deployment due to the need for permits and construction to cross busy intersections, rivers, roads, parks, and other obstacles. This can lead to a significant amount of time not spent on connecting subscribers.

A manufacturer specializing in fiber optic installation estimates state-of-the-art microtrenching and infill techniques allow for up to 820 feet of fiber installation

3 https://www.taranawireless.com/fiber-study/

per day, or one mile every 6.4 days, for a total of 57 miles per year for a single crew. Other estimates range from 1,000 to 2,000 feet per day, or up to 138 miles per year. These numbers assume crews work 365 days, which is rarely the case, making the realistic achievable total route miles per year significantly lower. Of course, microtrenching is not always possible. In cases where traditional trenching is required, installation time drops to a third of the speed offered by microtrenching.

If the goal is to quickly deploy high-speed broadband at gigabit speeds in months instead of years, next-generation fixed wireless access is the clear and financially responsible option.

Summary

To ensure reliable and affordable high-speed broadband deployment, operators should consider using G1 technology to future-proof their networks. With G1's next-generation fixed wireless technology, operators can achieve endgame broadband that rivals all other broadband technologies in terms of speed, reliability, and total cost of ownership:

- 8-10% the total cost of fiber capex for first 10 years of deployment, as modeled here; 30% of the cost of fiber over 50 years.
- Aggregate link speed of 800 Mbps, with upcoming 1.6 Gbps operation (available as a software only upgrade), amply meets need for multi-megabit and gigabit service.
- 2.4 Gbps site capacity, with planned future base nodes that will nearly triple capacity; easily servicing the next decade of peak busy hour growth (from 4 Mbps to 25 Mbps).
- Each base node is scalable up to 256 subscribers per sector.
- Cancels RF interference that would severely impact legacy wireless links.
- Backward compatibility across multiple models and modes of operation.

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Tarana is on a mission to accelerate the deployment of fast, affordable internet access around the world. With a decade of research and more than $400M of investment, the Tarana engineering team has created a unique next-generation fixed wireless access (ngFWA) technology instantiated in its first commercial platform, Gigabit 1 (G1). G1 delivers a game-changing advance in broadband economics in both mainstream and underserved markets, using both licensed and unlicensed spectrum. G1 started production in mid-2021 and has been sold to more than 200 service providers globally. Tarana is headquartered in Milpitas, California, with additional research and development in Pune, India.
Visit www.taranawireless.com for more on G1.

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