

Connecting the City of Cleveland with Next-Generation Fixed Wireless



Fixed wireless access (FWA) is the fastest way to deploy broadband, and next-generation FWA (ngFWA) does so at large scale, with higher performance, and at a lower cost than all other technologies. This is why DigitalC, a non-profit wireless internet service provider (WISP), turned to Tarana's Gigabit 1 (G1) platform to deploy high-speed broadband in Cleveland, Ohio, with a minimum of 100 Mbps / 100 Mbps service, even in heavily-obstructed locations.

Going Beyond Legacy FWA

When DigitalC reviewed what would be necessary to deploy high-speed broadband, they realized previous generations of FWA equipment would not be sufficient. Deploying across a locale like Cleveland would require excellent non-line-of-sight performance, high capacity, and great coverage at scale. "There were quite a few skeptics who told us Tarana wouldn't be able to penetrate the many trees in this area," said Jose Valdez, Chief

Challenge: The city of Cleveland is one of the least connected in the US. DigitalC plans to fix this by offering symmetric 100 Mbps fixed wireless service to the entire city. This will be challenging as most links will be obstructed by trees and buildings, as well as subject to interference both on the tower and at the subscriber homes.

Solution: DigitalC is leveraging G1's unparalleled non-line-of-sight performance and interference cancellation to deliver reliable multi-hundred megabit throughput, even in heavily obstructed areas or where there is high interference.

Results: High-speed links were tested and deployed in a variety of non-line-of-sight conditions at symmetric speeds of 100 Mbps or higher. These speeds enable Cleveland residents to stream video without buffering or long load times, play online games without lags, and work and study from home.

Speeds: From a maximum of 30 Mbps with legacy equipment to 100+ Mbps for G1 with most links capable of 400–600 Mbps, a 20x improvement.

Distance: The network is comprised of links that range, on average, between 1 and 3 miles.

Subscribers: With support for up to 1,000 subscribers per tower, DigitalC plans to cover the city completely with a total of 120 tower sites.

Radio Planning: K=1.

Operating Officer for DigitalC. “The technology performs very well through trees and is a game-changer, as it will allow us to provide city-wide coverage of high-speed internet in Cleveland, one of the nation’s least connected cities.”

DigitalC initially deployed a 5 GHz pilot environment that included multiple links in Cleveland’s busy downtown area as well as, more crucially, residential neighborhoods. Finding clean RF spectrum for a wireless network in either location was impossible. Every frequency was already in use either from nearby towers or Wi-Fi operating in residential homes. In order to operate reliably, the radio equipment would need to manage heavy interference.

Links in Cleveland — known as the Forest City — tend to be highly obstructed (non-line-of-sight) with trees and buildings between the G1 remote node located at the home and the G1 base node located at a nearby tower.



In each of these cases, legacy FWA, would be a nonstarter. Legacy FWA is typically optimized for line-of-sight and handles obstacles poorly, decreasing overall performance and reliability. Only ngFWA is designed from the ground up to solve these challenges.

The Next Generation of FWA

G1’s innovative breakthroughs create an entirely new paradigm for building and growing fixed wireless access networks. G1 features field-proven technology such as interference and noise cancellation, fine grain Tx and Rx digital beamforming distributed massive MIMO at both ends of the link, and perfect multipath integration for excellent non-line-of-sight (NLoS) and near-line-of-sight (nLoS) link performance as well as $k=1$ spectrum reuse.

G1’s unique ability to cancel interference from other radios means high-performance speeds are possible even in busy RF environments. Tarana’s Asynchronous Burst Interference Cancellation (ABIC) technology also reduces the impact of bursty interference, such as from nearby Wi-Fi transmitters. Less interference creates more reliable, higher-speed connections. Less interference also means greater capacity and the ability to support more subscribers per radio.

In the case of Cleveland’s many trees and buildings, G1 takes all transmitted signals, including bounced signals from obstacles, and combines them to recreate the original signal at the other end of the link. The ability to combine all signals (multipath) is a hallmark of ngFWA and a key feature of G1. In many cases, when the G1 remote node was turned away from the tower of its associated base node, performance actually improved thanks to

bounced signals from nearby structures. More importantly, this technology enabled high performance even when residential homes were surrounded by trees and heavy foliage. A comparison of results from a number of challenging links is shown below. In each case, symmetric 100 Mbps service can be offered and, in many cases, more.

Link Distance	Line of Sight	Downlink Speed	Uplink Speed
1.8 miles	NLoS	235 Mbps	121 Mbps
0.78 miles	nLoS	270 Mbps	146 Mbps
0.55 miles	NLoS	213 Mbps	105 Mbps
0.52 miles	NLoS	207 Mbps	100 Mbps

With planning and additional towers, a G1-powered network can offer speeds of up to 800 Mbps of aggregate capacity for subscribers, far exceeding the 100 Mbps minimum.

These kinds of speeds are changing people's lives for the better.



“My family’s experience with the upgraded equipment has been very positive. In the past, we would often experience buffering and loading especially when everyone would try to use the internet. Now, my whole family uses the internet, even all at the same time! We stream movies, play online games, and more — all without loading or buffering. My kids and I both rely on the internet for educational purposes and with the improvement to my home internet speeds, I can be confident in attending my courses at Ohio Media School online,” Celeste Barr, DigitalC subscriber who went from 18 Mbps to 327 Mbps service.

Armed with this technology, DigitalC is planning to expand their network across the entire city and surrounding neighborhoods. “Our existing customers are seeing huge gains when they switch from the legacy FWA equipment to Tarana,” said Valdez. Given ngFWA is easyfast to deploy, Valdez estimates deployment will be

quick. “We’re planning for a total of 120 tower sites for complete coverage. We estimate we can cover Cleveland in just 18 months.”

Summary

Reliable, high-speed broadband has quickly become a must-have in today's modern, digital society. DigitalC is committed to connecting the unconnected and has selected Tarana's G1 next-generation fixed wireless access platform to do the job. With G1, DigitalC is deploying transformative, next-generation FWA to bring reliable, high-performance broadband to all.

The difference between legacy FWA and G1 is striking. Unlike legacy systems that use repurposed technology, G1 was designed from the ground up specifically for large-scale FWA. This enables G1 to deliver better performance with less equipment (and less cost) than legacy solutions. G1's results are field-proven with over 250 operators worldwide. With G1 from Tarana, DigitalC is deploying transformative, next-generation FWA to bring reliable, high-performance broadband to all.

About DigitalC

DigitalC is a nonprofit technology social enterprise headquartered at the MidTown Tech Hive in the Hough neighborhood of Cleveland, Ohio. DigitalC connects communities to affordable high-speed internet through a fixed wireless network and empowers residents through technology training and social innovation. To learn more about its services, call 216-777-3859, email info@digitalc.org, visit digitalc.org, or follow them on social media @digitalc_org.

Tarana's mission is to accelerate the deployment of fast, affordable internet access around the world. Through a decade of R&D and more than \$400M of investment, the Tarana team has created a unique next-generation fixed wireless access (ngFWA) technology instantiated in its first commercial platform, Gigabit 1 (G1). It delivers a game-changing advance in broadband economics in both mainstream and underserved markets, using either licensed or unlicensed spectrum. G1 started production in mid-2021 and has been embraced by more than 250 operators in 19 countries and 41 states. Tarana is headquartered in Milpitas, California, with additional research and development in Pune, India.