

Tarana's Next Generation of Fixed Wireless Access

A Broadband Service Revolution Well Under Way – and an Essential Complement to Fiber in the Industry's Access Toolkit



In a Nutshell:

Fiber is often preferred for new broadband projects or upgrades, but its high installation costs and long timelines are often barriers to success.

LEO satellites can help in remote areas, but they reach capacity limits in higher-density markets.

Prior wireless options have limitations on performance or scale in mainstream markets.

Tarana has created a new portfolio of wireless solutions that is a true long-term alternative, delivering fiber-class performance at large scale – and at a small fraction of the cost and deployment time of fiber.

The Problem We're Addressing

Fast broadband connectivity is no longer a matter of just entertainment and convenience, it's an absolute necessity for many aspects of our lives – from work to education, healthcare, and even social survival.

Those who have no affordable high-speed broadband options are being left further and further behind. And there are still hundreds of millions of households in that unfortunate position today, in both developed and developing economies. ITU data and reliable speed test statistics indicate 25% of the world's 2.2 billion households still have no fixed broadband, and half of those who do have speeds well under 100 Mbps.

Given the scope, scale, and urgency of this problem, broadband service providers need a better-stocked network toolbox that gives them the ability to deploy new or upgrade existing infrastructure to achieve both high capacity and long reach, on much shorter timelines, and with viable network costs across a wide range of neighborhood conditions.

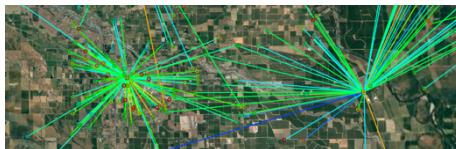
Optical fiber networks are the industry's preferred tool for high-household-density markets, delivering an attractive combination of high capacity and low latency. Unfortunately, last-mile fiber projects involve increasingly long timelines, high deployment complexity, and rising costs per subscriber in the medium- and lower-density markets that include most households. Given that, pursuit of faster progress on closing the divide and increasing consumers' choices

leads to the consideration of the relative ease and lower costs of wireless network deployment.

Unfortunately, wireless options for fixed access to date have been challenged for a variety of reasons. Legacy fixed wireless access (FWA) networks based on re-purposed indoor wireless technology (primarily WiFi) struggle with both interference from within their own and other networks as well as their inability to work around physical obstructions like other houses and trees that are common in residential neighborhoods. Using mobile 5G networks consumes expensive licensed spectrum best prioritized for higher-margin mobile services, not fixed, and when used for fixed service at scale has in some cases yielded high churn because of uneven performance and localized capacity limitations. Finally, while satellite broadband networks are uniquely suited to reaching very remote areas and oceans, they have nowhere near enough capacity to serve mainstream residential markets at scale, given their necessarily wide distribution around a globe that is 71% covered by water and their limited bandwidth per satellite in real-world operation.

Certainly all of these wireless technologies have been contributing to closing the broadband gap, but primarily at the margins of the problem. The central question remains: how can service providers deliver 100s of Mbps cost-effectively to broad populations, and much sooner rather than later?





ngFWA Defined:

- › Fiber-class (100 Mbps to 1 Gbps) per-household speeds and low latency at long range, with support for symmetric service without reduced spectral efficiency
- › High-quality service delivery in both licensed and unlicensed spectrum
- › High capacity per sector for economically scalable deployment
- › Solid connections despite obstacles in the way (like other houses, trees, and vehicles moving on the streets) and interference from other wireless signal sources.
- › Consistent service quality throughout coverage areas, to support clean subscription plan marketing, sales, and fulfillment
- › Simple installation at the home, and ideally customer self-installation

Enter Next-Generation FWA

As noted, past FWA approaches have been based on technologies that fulfill their original purpose well (4G/5G for mobility and Wi-Fi for indoor networks) but are not optimized for scalable fixed access in mainstream residential markets. To deliver fast, affordable residential access more broadly, the industry needed a next generation of FWA (ngFWA) to augment last-mile fiber by meeting a clear set of new requirements (summarized at left).

Solutions that achieve these characteristics can enable current operators and new entrants to expand their reach into unserved areas more quickly through lower network costs and easier deployment, along with enabling healthy competition in underserved markets.

Introducing the Industry's First ngFWA System, Exclusively from Tarana

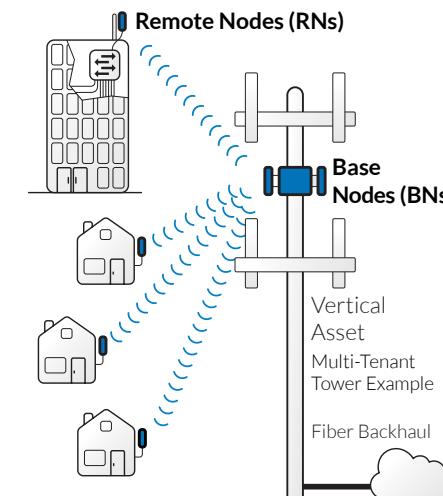
Tarana has created the industry's first instance of ngFWA. This platform is the product of more than \$400M invested over a decade of ground-up R&D focused exclusively on FWA. By marrying the continued march of silicon integration with new, innovative signal processing techniques, the platform creates a completely new possibility for broadband.

It offers all the fast-deployment advantages of FWA but now with the performance, capacity, and interference-rejection required to deliver reliable fixed broadband connections for homes and businesses at large scale, in challenging non-line-of-sight conditions, using both licensed and unlicensed spectrum, as (at last) a fully-formed wireless alternative to last-mile fiber for the long term.

Technology Fundamentals of ngFWA

Designed from scratch specifically to meet the goal of delivering fiber-class throughput and low latency with the ease and much shorter deployment timelines of long-range, cellular wireless network models, the Tarana ngFWA platform capitalizes on three

Tarana ngFWA At a Glance



Tarana's wireless platform meets all of ngFWA's requirements, delivering fiber-class service with the speed and ease of wireless deployment, in licensed and unlicensed spectrum.

fundamental advances in the state of the art for outdoor wireless communication:

- › a unique distributed real-time computing architecture (DM-MIMO) that enables unprecedented precision in control of radio waves throughout the system, fully compensating for obstructions and motion in the environment, creating the foundation for its equally unprecedented link- and network-level performance,
- › a true industry first in interference cancellation that creates a clean signal path and enables high performance even in busy unlicensed spectrum, and
- › a family of custom digital and analog signal processing chips that make installation of the processing power required to execute all these complex algorithms at every home affordable.

All of this technology allows Tarana's ngFWA platform to do things that were impossible with previous wireless systems. In layman's terms, it can "hear" distant signals even in very noisy environments. It's nearly magical — a bit like being able to converse with a person far across a crowded room by filtering out all others at will.

Tarana ngFWA's unprecedented performance in challenging real-world conditions has now been thoroughly validated on over 300 live commercial networks.

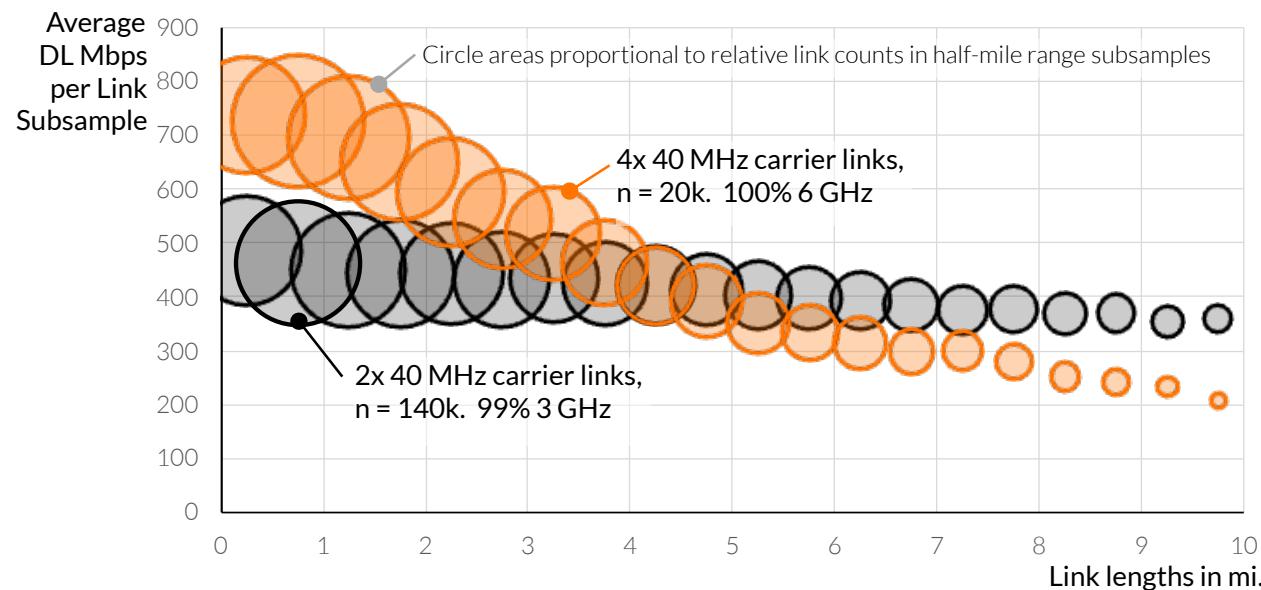
The platform is delivering from hundreds of Mbps up to 1 Gbps per subscriber despite significant obstructions and interference levels.

Tarana ngFWA Performance in 300+ Commercial Networks

Since we started volume shipments of our first ngFWA platform in 2022, its full potential is being realized now in over 300 real-world networks in 21 countries and 48 of the 50 US states. The graph below portrays the unprecedented **470/120 Mbps average DL/UL capacity** of a sample of 160,000 links operated by our leading ISPs, facing a wide range of real-world interference and obstruction conditions, as shown below.

The connections are grouped in this profile into half-mile-wide link-length histogram classes, to show succinctly the averages of link performance as a function of distance.

ngFWA Link Performance Profile – Typical Rates & Reach

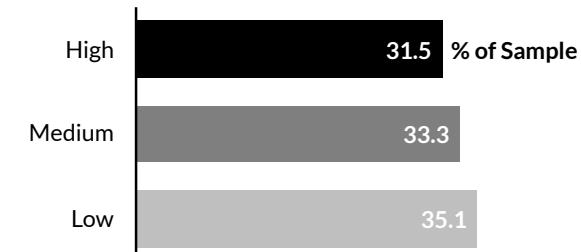


Source for all metrics: Tarana Cloud Suite

Note that the graph below includes both our original 2-carrier/80MHz G1 system and our latest 4-carrier/160MHz G1x2 and G2 systems. G1x2 doubled spectrum in 5/6GHz and G2 delivers generational improvements in spectral efficiency while supporting a fully configurable blend of 3GHz/CBRS and unlicensed 5/6GHz spectrum.

It's also important to note that our ISPs are taking full advantage of the interference cancellation and non-line-of-sight performance features of the platform in their market penetration and competitive strategy — as shown in the link conditions profiles below — to deliver share-winning speeds of hundreds of Mbps despite high levels of link obstruction and interference, an achievement that would be impossible with any other wireless technology.

External Radio Interference



Line of Sight Obstructions



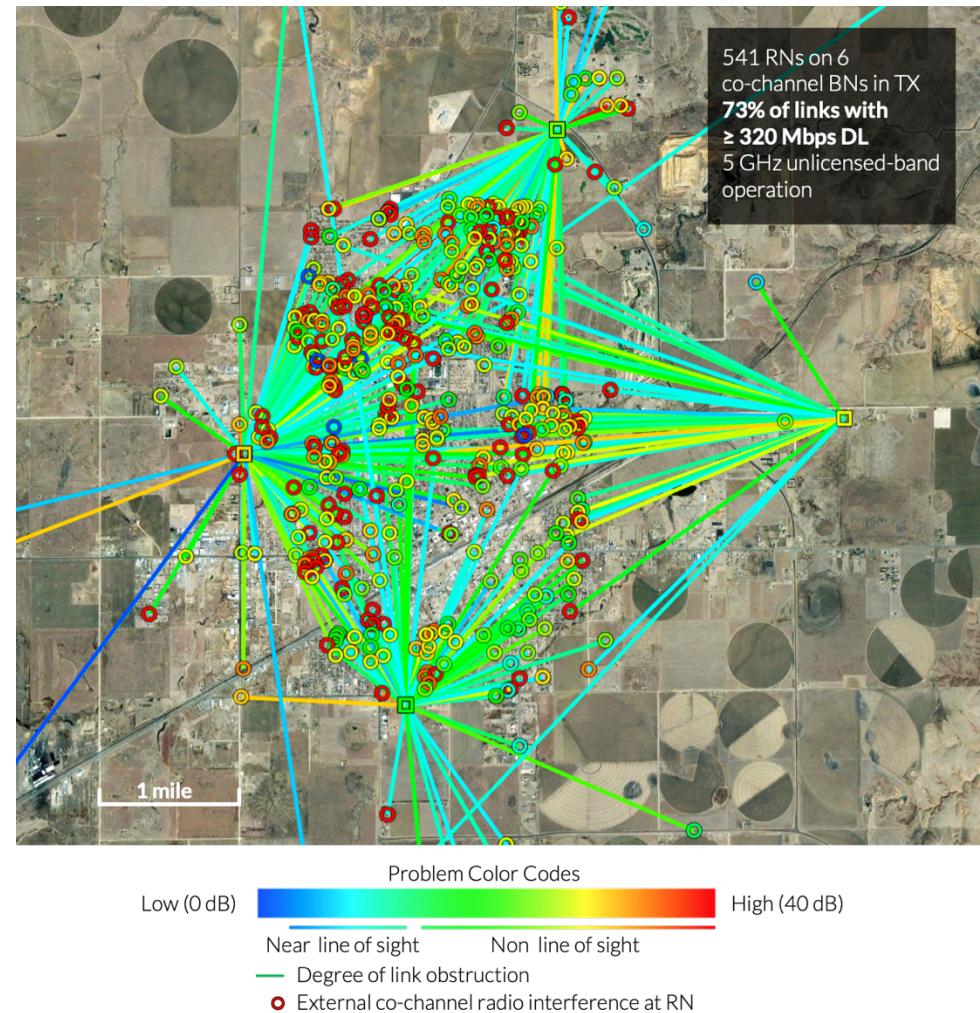
ngFWA's cooperative, autonomous, and dynamically-learned inter-cell interference cancellation enables deployment of all network elements in a single frequency band, significantly increasing spectral efficiency and eliminating the debilitating deployment complexity common to prior FWA solutions.

The final takeaway from ngFWA's real-world performance to date is clear from Tarana-powered ISPs' multi-cell installations within a single market. This raises the potential for service degradation from inter-cell interference, which is a pervasive problem in mobile networks. It has been mitigated in prior-generation FWA installations by using multiple frequency bands in alternating patterns, which is spectrally inefficient and creates significant deployment complexity. To avoid these issues, ngFWA was designed to operate all radio elements in a single spectrum band ("k=1" deployment, in the industry's parlance), enabled by precise, autonomous, and collaborative inter-cell interference cancellation by both base and remote nodes.

Resound's Tarana deployment in Pampa, Texas (shown at right) demonstrates that the platform's inter-cell interference cancellation is able to contain the capacity loss from k=1 deployment to less than 20% even in dense, conflicting conditions. This example shows ngFWA's inter-cell interference cancellation well-proven in commercial deployment.

What's Next

Tarana's growing list of operators deploying ngFWA broadly showcases its unique strengths and foretells a future of high-performance wireless broadband delivered on timelines and at scales that were, until now, simply impossible.



These deployments foretell a new era for fixed wireless broadband. With Tarana's recent introduction of the G2 BN and multi-band RNm, ngFWA-powered ISPs are now in a position to expand and operate wireless broadband networks with unprecedented levels of service, reliability, and network profitability.



Tarana-Powered Operators Report ...

“With G1’s unparalleled reach, performance, and reliability that today’s market demands, Tarana created a new future for FWA. Fiber and ngFWA are now our go-to solutions fueling subscriber growth. Early field results from our G2 deployments are now confirming what we’ve believed all along – ngFWA is poised to become a key pillar of broadband access for the long haul.”

— Bill Baker, CEO, **Nextlink**

“There were quite a few skeptics who told us Tarana wouldn’t be able to penetrate the many trees in our area, but our customers are seeing huge gains when they switch from legacy FWA equipment to Tarana.”

— Jose Valdez, COO, **DigitalC**

“Tarana’s technology allow us to pursue exciting new opportunities. With significantly faster time-to-market and competitive performance, ngFWA will allow us to expand into previously unreachable markets.”

— Fuad Alnajjar, VP of Business Engineering and Wireless
Mediacom Communications

“Tarana smoked everything else we’ve tried, with 300+ Mbps through trees and 1 Gbps in near line of sight at 5 miles – unbelievable. It’s cutting our tower counts by 40% and our installation times by 50%, while giving us 6x more capacity per tower and 3x the speeds of our prior FWA gear. We can now bring competition to larger markets we would never even have considered before.”

— Tyson Curtis, CEO, **Resound Networks**



“Tarana’s gear works as advertised. This will break fiber economic models. Say goodbye to monopoly-era penetration rates for fiber.”

— Matt Larsen, Owner, **Vistabeam**

“Tarana’s really solved the technical scaling issues this industry has fought with for decades. We trialed the product last year and never looked back. G1 is amazing. We started with 3GPP tech, but now the majority of our build is Tarana. We’re covering 250 square miles from a typical installation with G1, at a total project cost of \$115k per tower, and we’re delivering on average 300 Mbps down and 55 up. We know well that getting that much coverage with fiber would have been a \$20 million project.”

— Chris Daniels, CEO, **Watch Communications**

“Customers just want high-performance that works across all their devices – they don’t really care how it is delivered. With Tarana’s ngFWA system, we get wireless economics with rock-solid reliability and incredible speeds. Most importantly, we can scale the service at a fraction of the cost and time of previous options.”

— Jonathan Kini, CEO, **Twist Broadband**

“Our investment in Tarana’s tech reflects our dedication to staying at the forefront of telecom innovation. As a Puerto Rican company, we understand our island’s unique challenges, and our customers deserve nothing less than the most advanced, reliable broadband tech available. Tarana puts us on par with fiber-optic service, delivering a seamless experience and even greater reliability.”

— Gino Villarini, President, **AeroNet Wireless**

See our companion [ngFWA Network Economics](#) introduction to learn more about why we’re gaining such enthusiastic converts.

About Tarana

Tarana’s mission is to accelerate the deployment of fast, affordable, and reliable internet access around the world. Through a decade of R&D and over \$400M of investment, the Tarana team has created and continues to enhance a suite of next generation fixed wireless access (ngFWA) technologies. Its unique ngFWA platform delivers game-changing advances in broadband economics in mainstream and underserved markets, using both licensed and unlicensed spectrum. Tarana’s ngFWA technology has been embraced by more than 300 service providers in 24 countries. Tarana is headquartered in Milpitas, California, with additional research and development in Pune, India.

Learn more at www.taranawireless.com.

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