

Tarana Has Created the Next Generation of Fixed Wireless Access

as an Essential Complement to Fiber in Closing the Digital Divide



Fiber is preferred for closing the digital divide, but in many cases its implementation is too slow and costly to show timely returns on either public or private investment.

Prior wireless options have not solved this problem in mainstream markets.

Tarana has created a new wireless alternative that is a long-term substitute, delivering fiber-class performance 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 multiple aspects of our lives — work, education, healthcare, and 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, unprioritized speed test statistics indicate a little over ~40% of the world's 2.3 billion households still have no fixed broadband, and 2/3 of those who do have speeds under 100 Mbps.

Given the scope, scale, and urgency of this problem, broadband service providers need a better 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, with viable network costs across a wide range of neighborhood conditions.

Optical fiber networks are the preferred tool for high-household-density markets, delivering an attractive combination of high capacity and low latency. However, last-mile fiber deployment involves long timelines and high deployment complexity and costs per subscriber in the medium- and low-density markets that include most households. Given that, pursuit of

faster progress on the divide leads to consideration of the relative ease of wireless network deployment.

Unfortunately, wireless options have not shown the ability to scale broadly in fixed access. Mobile networks (4G/5G) require expensive licensed spectrum better used for higher-margin mobile services, limiting availability for fixed, and when actually used for fixed service have typically highly varied quality and poor operator economics. Legacy fixed wireless access (FWA) networks based on re-purposed indoor wireless technology (Wi-Fi) 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. Finally, while satellite broadband networks are uniquely suited to reaching very remote areas and oceans, they will 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.

Certainly all of these wireless technologies have been contributing to closing the broadband gap, but mostly 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?





Enter Next-Generation FWA

As noted, existing FWA approaches are based on technologies that fulfill their original purpose well (4G/5G for mobility and Wi-Fi for indoor networks) but that are not as successful at scalable fixed access in mainstream residential markets. To deliver fast, affordable residential access more broadly, the industry needs 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 First ngFWA System: Tarana's G1

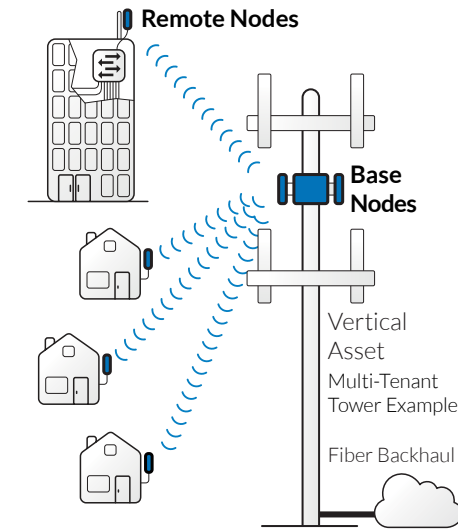
Tarana has created the industry's first instance of ngFWA, the Gigabit 1 (G1) platform. G1 is the product of over \$400M invested over a decade of ground-up R&D focused exclusively on FWA. By marrying the continued march of silicon integration with new, innovative signal processing techniques, G1 creates a completely new possibility for broadband.

G1 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 G1

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 G1 platform capitalizes on three fundamental

G1 At a Glance



Tarana's G1 platform meets all of ngFWA's requirements, delivering fiber-class service with the speed and ease of wireless deployment, in licensed and unlicensed spectrum.

advances in the state of the art for outdoor wireless networks:

- › a unique distributed real-time computing architecture (DM-MIMO) that enables unprecedented precision over the 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 path to enable 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 G1 to do things impossible with previous wireless systems. In layman's terms, G1 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.

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 networks
- › 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

G1's unprecedented performance in challenging real-world conditions has now been thoroughly validated on over 200 live commercial networks.

The platform is delivering hundreds of Mbps per subscriber despite significant obstructions and interference levels.

G1 Performance in 200+ Commercial Networks

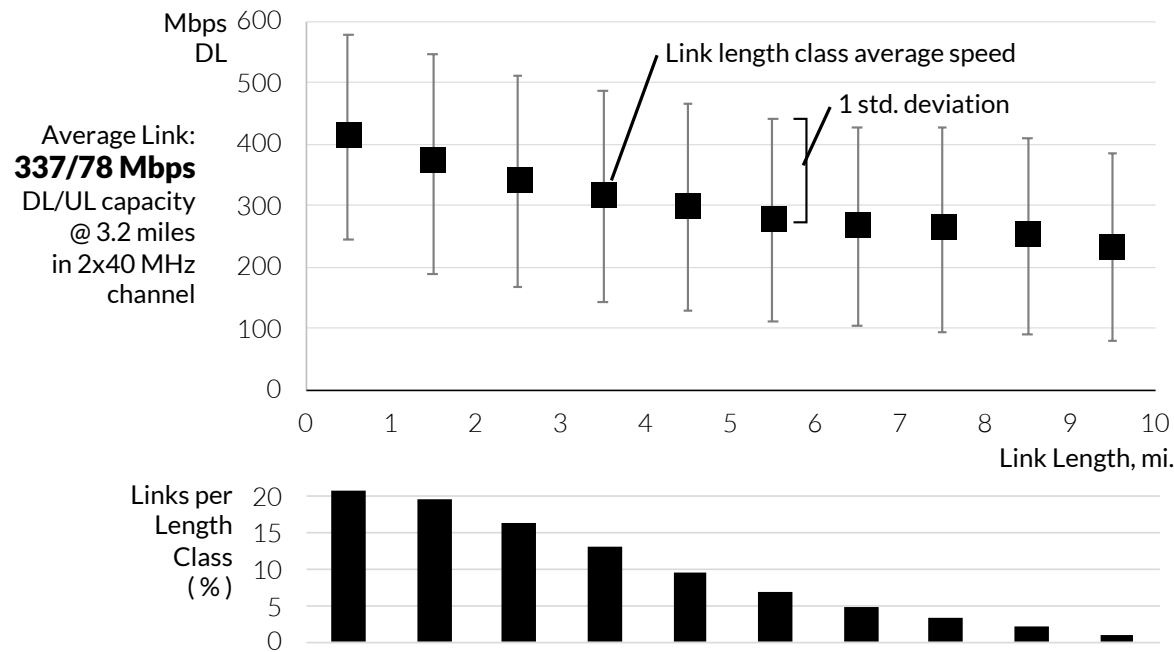
Since we launched our G1 platform in mid 2021, the potential of ngFWA has been realized in now over 200 real-world networks in 21 countries and 47 of the 50 US states. The graph below portrays the unprecedented **337/78 Mbps average DL/UL capacity** of a sample of 100,000 links operated by our leading ISPs, facing a wide range of real-world interference and obstruction conditions.

The 100k links are grouped in the profile into mile-wide length histogram classes, to show succinctly the averages of G1 link performance as a function of distance.

For customers who want to offer gigabit plans, G1's 160 MHz **x2** software upgrade can double link speeds at closer ranges.

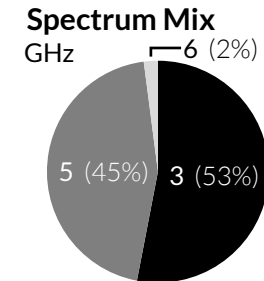
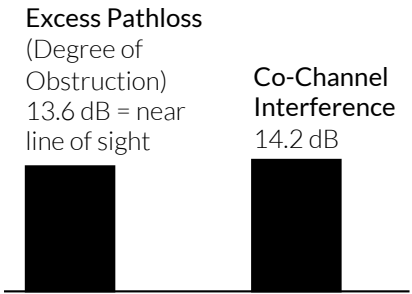
It's important to note that our ISPs are taking full advantage of the interference cancellation and non-line-of-sight performance features of G1 — as shown in the link conditions profiles below — to deliver hundreds of Mbps in the face of high levels of link obstruction and interference, an achievement that would be impossible with any other wireless technology.

G1 Network Performance Profile – Sample of 100k Links



Source for all metrics: Tarana Cloud Suite

Average Link Conditions



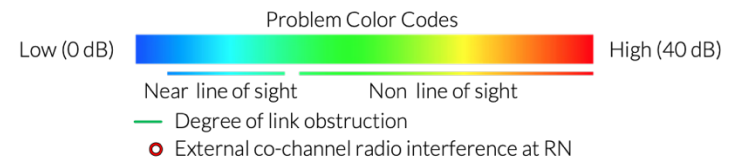
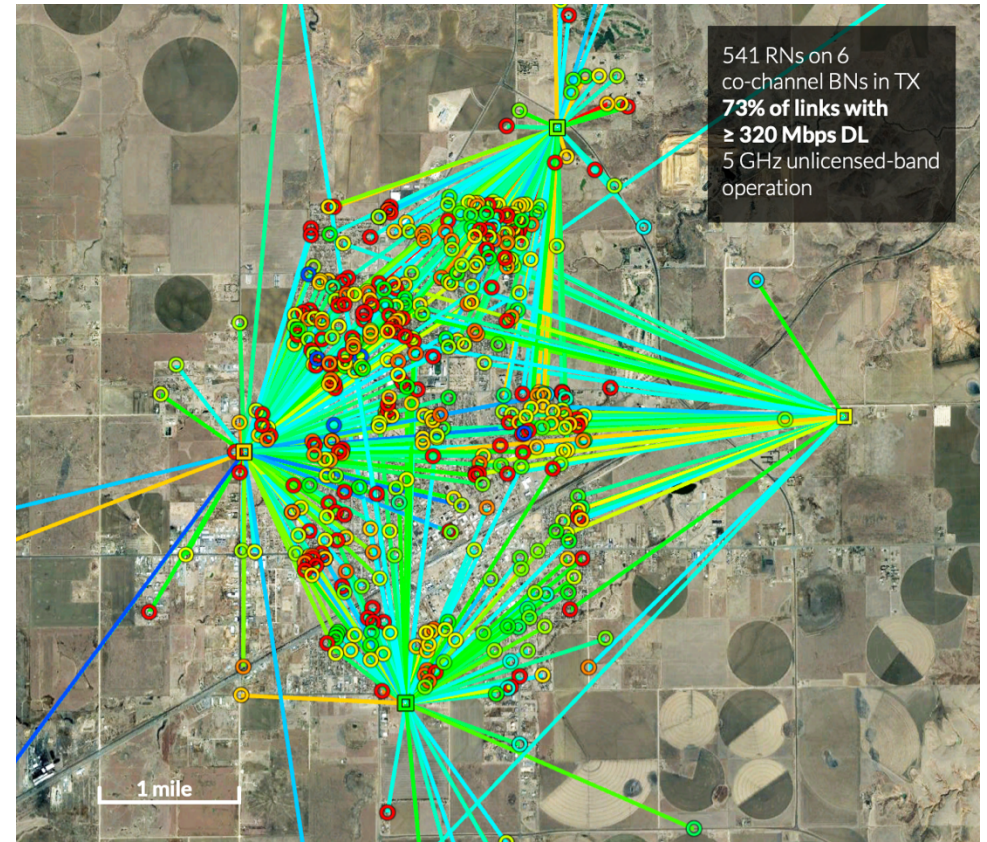
G1's cooperative, autonomous, and dynamically-learned inter-cell interference cancellation enables deployment of all network elements in a single frequency band, significantly increasing spectral efficiency and eliminating the debilitating deployment complexity common to prior FWA solutions.

The final takeaway from G1's real-world performance is clear from our 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, G1 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 notes.

Resound's G1 deployment in Pampa, Texas (shown at right) demonstrates that the G1 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 G1's inter-cell interference cancellation well-proven in commercial deployment.

What's Next

The world needs more and better broadband, but getting it to the home has long been challenging. Tarana's rapidly growing list of operators deploying G1 broadly showcases ngFWA and foretells a future of high-performance broadband on timelines and at scales that were, until now, simply impossible. We welcome new ISPs to the G1 community every week.



G1 is just the beginning of a new era for fixed wireless broadband. Now that the foundational techniques that power G1 are well proven, extending the platform to offer 1 Gbps and 3 Gbps services broadly in both licensed and unlicensed spectrum is well within reach and under current development by Tarana.



“Tarana allows us to affordably and efficiently increase the data capacity on our network to enhance our Home and Business Internet offering for customers. We look forward to more people experiencing the benefits and cost savings of having their wireless provider as their internet provider.”

— Mike Irizarry, EVP & CTO
UScellular

“Tarana’s performance is just mind-blowing. It lets me flip the script on my business. Now we can seriously compete in urban and suburban markets where the incumbent ISPs are neglecting their clients. It’s great to be able to offer urban and suburban markets another choice for their internet service.”

— Nathan Stooke, CEO
Wisper Internet

“G1 enabled us to do gigabit performance in fixed wireless and allowed us to accomplish faster deployments over much larger service areas. A couple years ago, no one could do that.”

— Bill Baker, CEO
Nextlink

“G1 works as advertised. This will break fiber economic models. Say goodbye to monopoly-era penetration rates for fiber.”

— Matt Larsen, Owner
Vistabeam Wireless Internet

Tarana will 100% change how we attack markets.”

— Ryan Grewell, Managing Director
SmartWay Communications



“Tarana’s really solved the technical scaling issues this industry has fought with for decades. We trialed the product last June and never looked back. G1 is amazing. Our CAF II build-out started with 3GPP tech, but now the majority of our build is going to be 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 be a \$20 million project.”

— Chris Daniels, CEO
Watch Communications

“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. We’re planning to cover all of Cleveland in just 18 months.”

— Jose Valdez, COO
DigitalC

“G1 smoked everything else we’ve tried. Impressive feats — 300 Mbps plus 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 have even considered before.”

— Tyson Curtis, CEO
Resound Networks

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 internet access around the world. Through a decade of R&D and over \$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 since been embraced by over 200 service providers in 21 countries. 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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