TARANA

BROADBAND REINVENTED

G2 Wireless BEAD Solution: Delivering Scalable Broadband Where Fiber Can't Go

Dennis Stipati, Senior Director of Sales

About Tarana

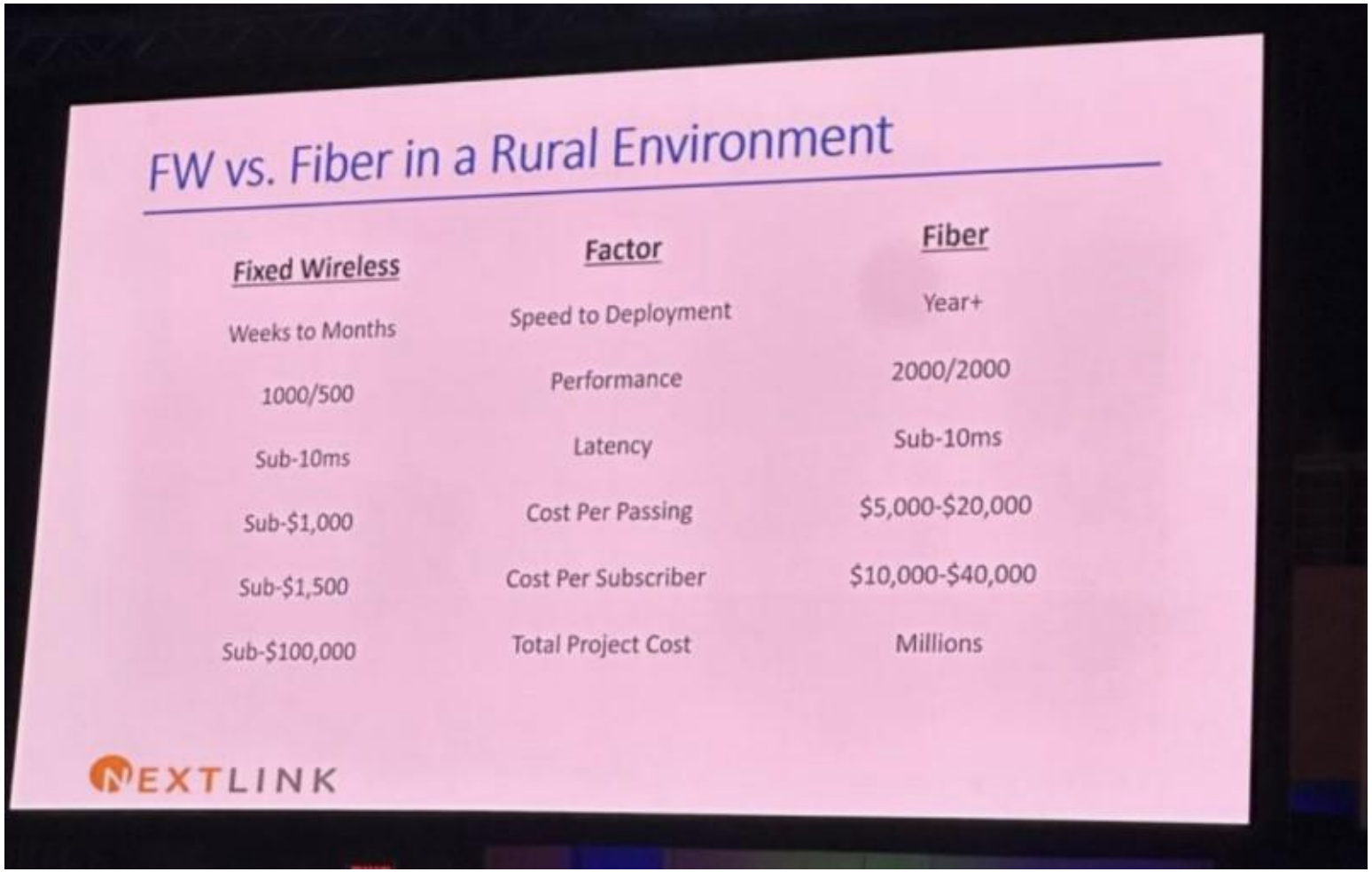
- Fiber-quality FWA broadband that's easy to deploy
- 15 years and $400M invested in R&D
- 28 patents issues and more pending
- Equipment in Multiband, 3 GHz (CBRS), 5 GHz or 6 GHz
- Unrivalled custom silicon development
- G1/G2 are designed from the ground up
- A number of industry firsts in wireless tech
- Order-of-magnitude gains in wireless:
  - Capacity
  - Spectral Efficiency
  - Capacity per Client
  - Number of Clients per Sector
  - Work in harsh RF environments

Bringing home the hardware!

Channel Vision Spotlight Award
- 2022 and 2023!

Dual Winner @WISPAPALOOZA 2022, 2023 & 2025
- Manufacturer of the Year
- Product of the Year

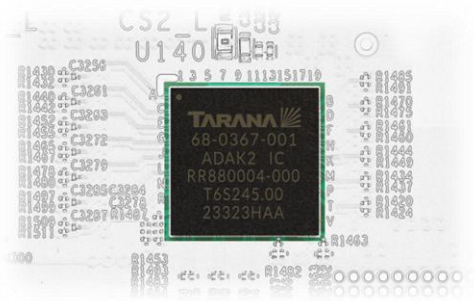
ngFWA versus Fiber in Rural Environment



#ngFWA Rethought - Thrive

- Decrease your number of towers & sectors
- Compete and win against costly fiber builds.
- Qualify for government $$$ with enhanced service offerings
- Multiple times the number of remote connections per sector vs others
- Multiple times capacity to an end user compared to existing connections
- Passover houses - Hook up the “never could connect” houses.
- Maximize your spectrum (licensed & unlicensed)

Tarana's Deep Technology Platform



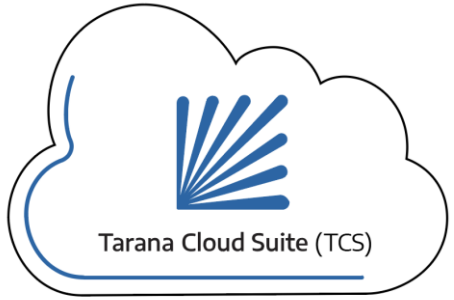
Tarana ngFWA Silicon

Three custom Tarana-designed CMOS chips from RF to packets

- Digital SoC with 2.5 Teraflops of real-time signal processing
- Hi-precision mixed-signal multichannel analog/digital converter
- Low-distortion wideband RF front-end

Base Nodes + Remote Nodes

- Powerful, fully integrated ngFWA systems simplifies installation
  - Up to 512 RNs subs per base node (BN)
  - Simple BN installation on any existing vertical assets, 48V in / 10G ethernet out
  - Single PoE cable install on each home or business served
  - Continuous self-alignment between base node and remote node



SaaS Operations

- Cloud-managed broadband offers unmatched deployment ease
  - Provision, upgrade and manage BNs/RNs across regions with ease
  - Shared visibility ensures rapid issue resolution
  - Continuous real-time feedback for monitoring and SON optimizations

A New Solution to the Persistent Broadband Dilemma

ngFWA

A complete reengineering of wireless optimized for FWA

Fundamental Advance #2

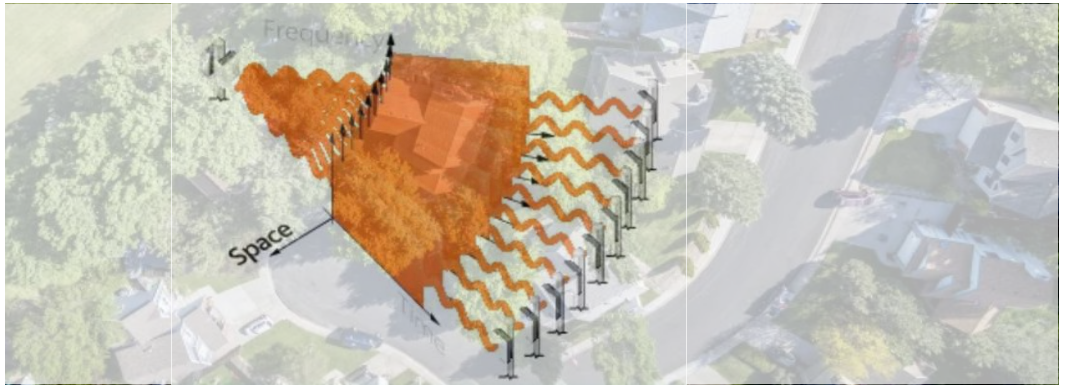
Interference Cancellation

Fundamental Advance #1

Reliable, High Speeds Without Line-of-Sight

Fundamental Advance #3

Capacity Multiplication via Advanced Spatial Multiplexing



Tarana Technical Overview

Integrated Base Node (BN)

Massive MIMO antenna array
Multi-TFLOPs computation
Carrier ethernet switch
GPS receiver

- **Full Tx/Rx digital beamforming with TARANA IC**
- **Up to 4X40MHz Carriers**
- **Single frequency reuse**
  - **Minimize your RF Footprint**
  - **Maximize your PAL License**
- **8 spatial planes (MU-MIMO)**
- **10 Gb SFP+ backhaul interface**
- **4D Scheduler – 768 Resource Blocks**
- **Range : NP 1, 5 & 6 ~15km. NP2 ~30km.**
- **Compatible with LTE Frame Type 2, Subtype 7 (share Towers)**

275 or 425W of -48VDC Power consumption

GPS receiver

Integrated Remote Node (RN)

MIMO antenna array
Multi-TFLOPs computation

- **Up to 4X40MHz (Frequency and HW dependent)**
- **800M or 1.6Gbps**
- **Full Tx/Rx digital beamforming with Tarana IC**
- **Auto antenna alignment (5000/sec)**

PoE Powered (32 - 50W)

- **ABIC – Asynchronous Burst interference Canceller**
- **Simplified Installation Process with Phone Based Tool**
- **Models for CBRS, 5 GHz, 6 GHz and Multiband support**

BN Overview

G1 Base Node (BN)

- 3 GHz CBRS, 5 GHz, and 6 GHz support
- Up to 3.2 Gbps per BN[2]
- 250 clients per sector
- 1,000 clients per cell (4 BNs)

- Up to 30 km LoS and 5 km NLoS range
- Integrated Massive MIMO antenna array
- Multi-TFLOPS computation
- GPS receiver
- Distributed Massive MIMO on both ends
- Full Tx/Rx digital beamforming with IC
- 4D scheduler
- Compatible with LTE frame type 2, subtype 7 (share towers)
- 275 W, 48VDC power consumption
- Single frequency reuse — maximize your PAL license

G2 Base Node (BN)

- Multi-band 3 GHz CBRS, and 5 + 6 GHz support
- Up to 6.4 Gbps per BN
- 512 clients per sector[4]
- 2,048 clients per cell (4 BNs)[4]

[2] In x2 (4-carrier) mode with select 6 GHz product models

[4] With future software release

BN Family of Products

Base Node (BN)

	G1 BN-3 GHz	G1 BN-5 GHz	G1 BN-6 GHz	G2 BN-3+5/6 GHz
Frequency	3.550–3.700 GHz	5.150–5.250 GHz 5.725–5.850 GHz 5.850–5.885 GHz (STA)	5.725-5.850 GHz 5.925–6.425 GHz 6.525–6.875 GHz	3.550–3.700 GHz 5.725–5.850 GHz 5.850–5.895 GHz 5.925–6.425 GHz 6.525–6.865 GHz
Throughput (max aggregate PHY)				
Per Link	800 Mbps	800 Mbps	800 Mbps / 1.6 Gbps[2]	1.6 Gbps[1, 2]
Per BN	2.4 Gbps	2.4 Gbps	2.4 Gbps / 3.2 Gbps[2]	6.4 Gbps
Per Cell (4 BNs)	9.6 Gbps	9.6 Gbps	9.6 Gbps / 12.8 Gbps[2]	25.6 Gbps
Max Number of RNs				
Per BN	250	250	250	512[4]
Per Cell (4 BNs)	1,000	1,000	1,000	2,048[4]
Channel Bandwidth	80 MHz (2 x 40 MHz)	80 MHz (2 x 40 MHz)	80 MHz (2 x 40 MHz), 160 MHz (4 x 40 MHz)[2]	160 MHz (4 x 40 MHz)
Max MU-MIMO Streams				
Per BN	6	6	6 / 4[2]	8
Per Cell (4 BNs)	24	24	24 / 32[2]	32

[1] With the RNm [2] In x2 (4-carrier) mode with select 6 GHz product models
[3] Operators need to have an STA from the FCC to operate in UNII-4 (5.850–5.895 GHz) [4] With future software release

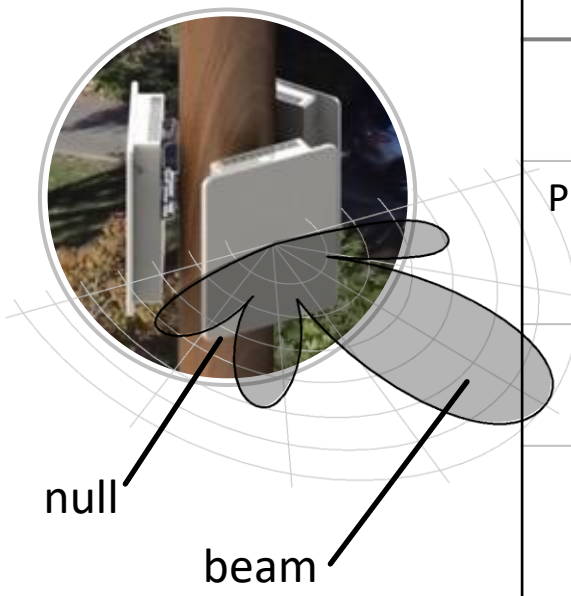
RN Overview

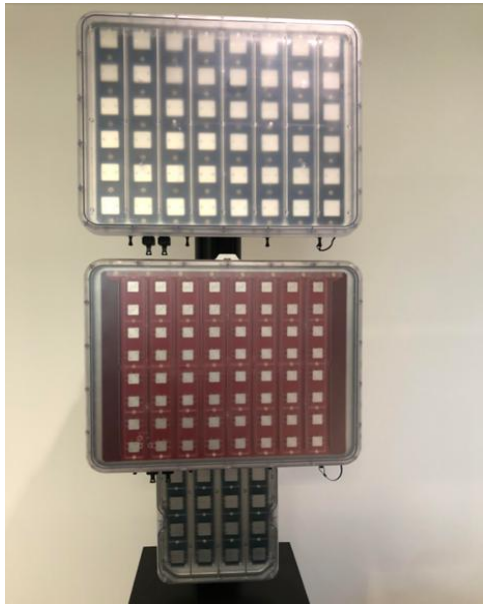
Remote Node (BN)

	RN-3 GHz	RN-5 GHz	RN-6 GHz	RNv-6 GHz	RNm-3+5/6 GHz
Frequency	3.550–3.700 GHz	5.150–5.250 GHz 5.725–5.850 GHz 5.850–5.895 GHz[3]	5.725-5.850 GHz 5.850–5.895 GHz[3] 5.925–6.425 GHz 6.525–6.865 GHz	5.725–5.850 GHz 5.850–5.895 GHz[3] 5.925–6.425 GHz 6.525–6.865 GHz	3.550–3.700 GHz 5.725–5.850 GHz 5.850–5.895 GHz[3] 5.925–6.425 GHz 6.525–6.865 GHz
Throughput (max aggregate PHY)	800 Mbps	800 Mbps	1.6 Gbps[1,2]	800 Mbps	1.6 Gbps[1,2]
Channel Bandwidth	80 MHz (2 x 40 MHz)	80 MHz (2 x 40 MHz)	80 MHz (2 x 40 MHz), 160 MHz (4 x 40 MHz)[2]	160 MHz (4 x 40 MHz)	80 MHz (2 x 40 MHz), 160 MHz (4 x 40 MHz)[2]
MIMO Streams	1x1, 2x2	1x1, 2x2	1x1, 2x2, 4x4[1,2]	1x1, 2x2	1x1, 2x2, 4x4[1,2]

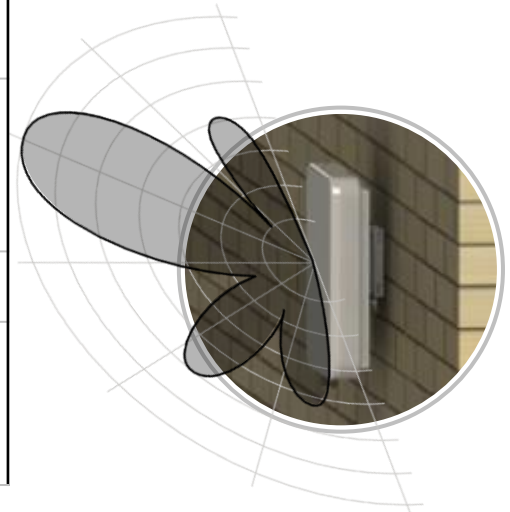
[1] With the RNm [2] In x2 (4-carrier) mode with select 6 GHz product models
[3] Operators need to have an STA from the FCC to operate in UNII-4 (5.850–5.895 GHz) [4] With future software release

Tarana's whole new approach to RAN design drives performance



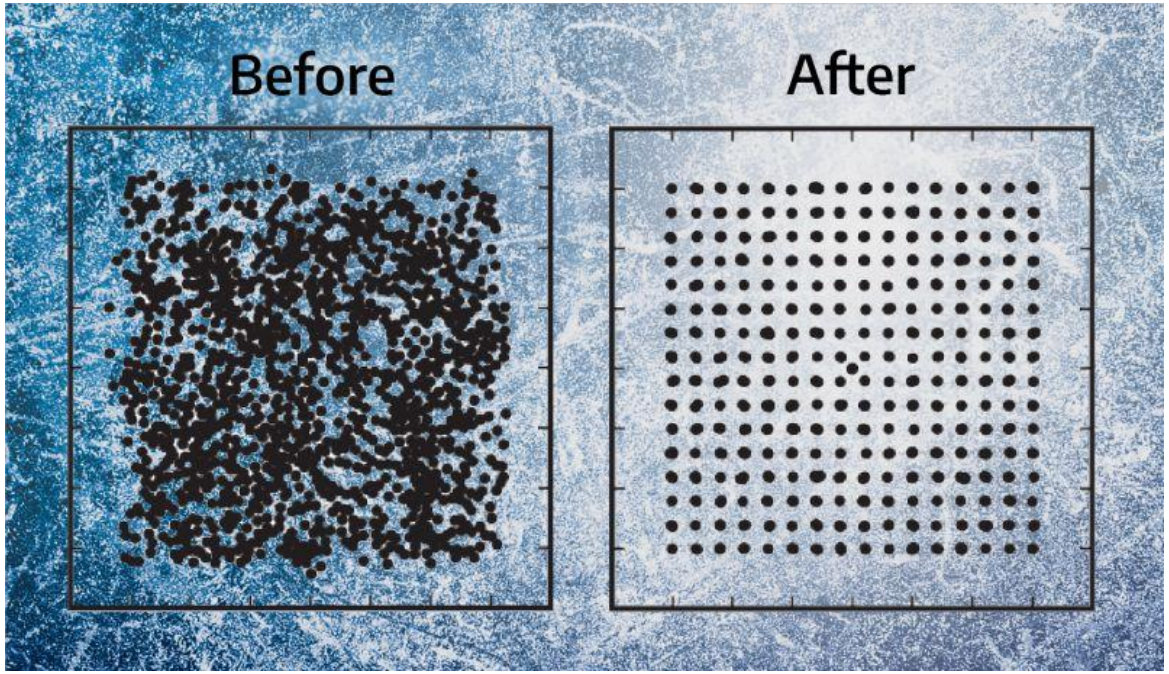


Unique Elements	Performance Benefits
Distributed massive MIMO (DMM)	Large antenna array digital processing at both base and remote radios
Precise digital beam- and null-forming on both Tx and Rx	The foundation of all that follows: extremely well-controlled distribution and reception of radio energy only where productive
Closed-loop beamforming adaptation	Collaboration between base and remote nodes further improves digital beamforming accuracy
Multipath equalization and combining	Applying signal processing across time, frequency, and spatial domains yields perfect channel even with the most complex diffraction, reflection, and motion effects
Autonomous, adaptive self-interference cancellation	Huge spectral efficiency gains through dense co-channel link operation
Spatial multiplexing with perfect layer orthogonalization	Massive spectral efficiency compromising individual link quality
Spatially-aware 4D scheduler	Most efficient capacity distribution
Continuous unlicensed interference cancellation	Yields licensed-class reliability in unlicensed spectrum & other shared spectrum



ABIC Asynchronous Burst Interference Cancellation

Asynchronous Burst Interference Cancellation removes Wi-Fi transmitter interference in the UNII-1 and UNII-3 bands that occur in the payload symbols of Tarana's frame structure. The inference cancellation is so effective, that performance in the unlicensed bands approaches the performance of licensed bands.



The before and after constellation. On the left shows the signal before ABIC where the signal looks like a big blobby mess. The right image shows a clean 256-QAM constellation where each bit of the signal (dot) is crisp and cleanly transmitted with no errors.

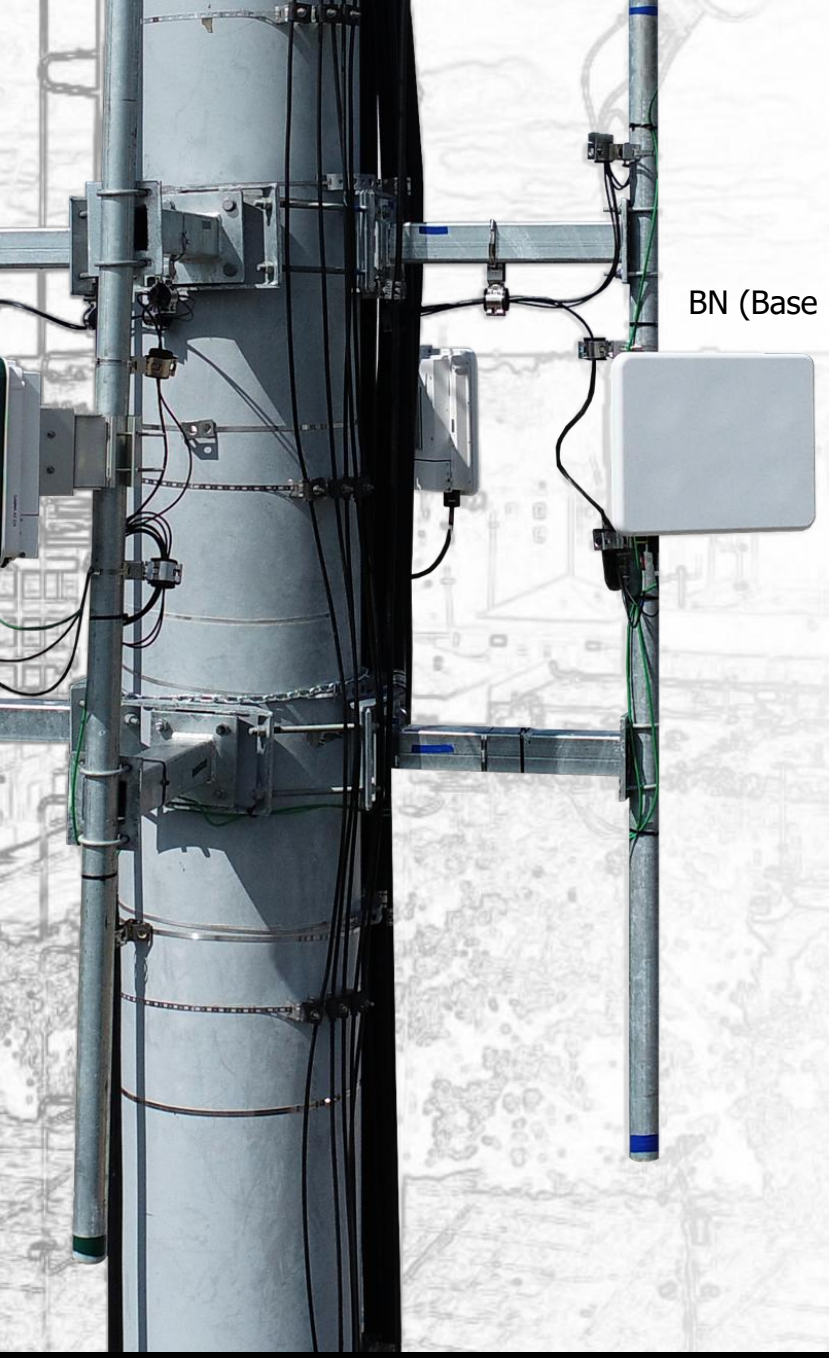
Noise Cancellation - ABIC

What all other radios hear in busy, unlicensed bands

What G1 radios hear — enabling unprecedented, full, unfettered use of the spectrum (results may vary)

Fiber's awesome,
and sometimes hard to do.

As our customers will attest, in those cases, fiber + Tarana is even better.



BN (Base Node)

RN (Remote Node)

Tarana NLOS Deployments

Case Study: VTX1

- **Challenge**: VTX1 needed to upgrade its aging DSL and legacy FWA infrastructure quickly and cost-effectively while staying competitive and reducing churn.
- **Solution**: Use Tarana and E-ACAM to deploy fiber-class infrastructure at a fraction of the cost and time of an all-fiber approach.
- **Results**: Successfully turning down DSL network. Reduced churn from 12% to less than 2% while improving speed offerings by 100X and reducing deployment time and costs.

"Our Tarana customers are just as happy as our fiber customers. For them, there is no difference."

- Sebastian Ivanisky, CTO, VTX1

Case Study: Centracom

- **Challenge**: CentraCom needed to upgrade it's aging legacy DSL and fixed wireless infrastructure to remain competitive, meet E-ACAM funding requirements, reduce churn and improve operational efficiency.
- **Solution**: Tarana's ngFWA platform delivered fiber-class broadband at a fraction of the cost and time of pure fiber.
- **Results**: CentraCom has increased speeds up to 25x for subscribers, reduced churn to nearly zero, reduced tower infrastructure by 3x and successfully taken E-ACAM funding to furthrt accelerate network development.

"With Tarana, CentraCom was able to roll out service quickly, covering previously unreachable areas and deliverying speeds well above the E-ACAM thresholds. 80% of our E-ACAM was Tarana."

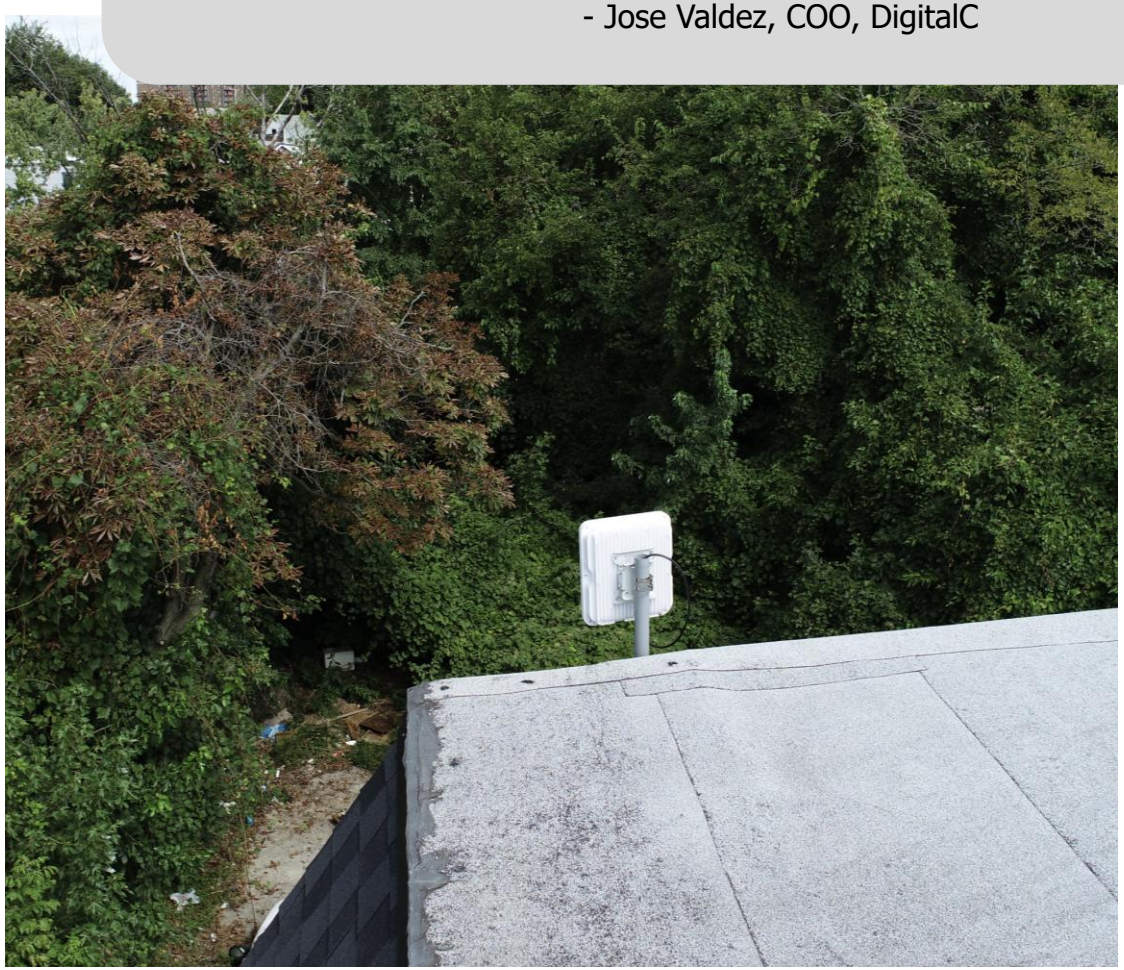
- Brad Welch, COO CentraCom

Case Study: DigitalC

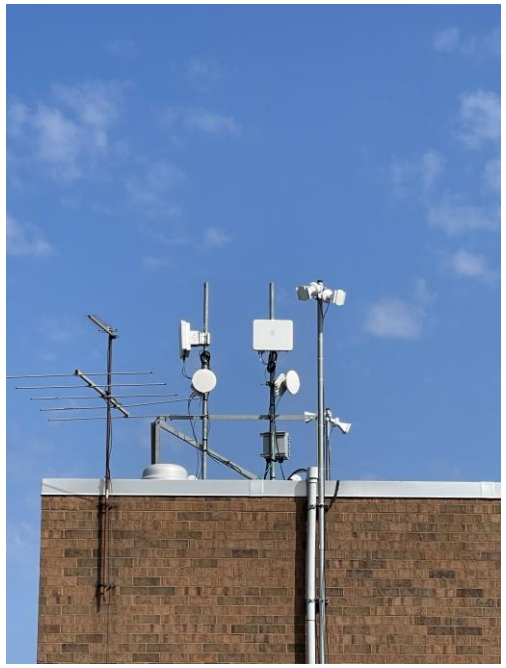
- **Challenge**: The city of Cleveland is one of the least connected in the US. Most links will be obstructed by trees and buildings, as well as subject to interference both on the tower and at the subscriber homes.
- **Solution**: DigitalC is leveraging G1's unparalleled non-line-of-sight performance 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 lag, and work and study from home.

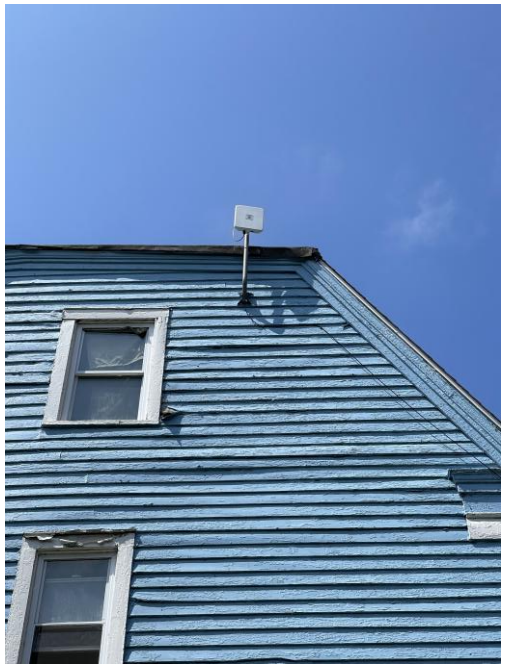
"The technology performs very well through trees and is a game-changer."

- Jose Valdez, COO, DigitalC

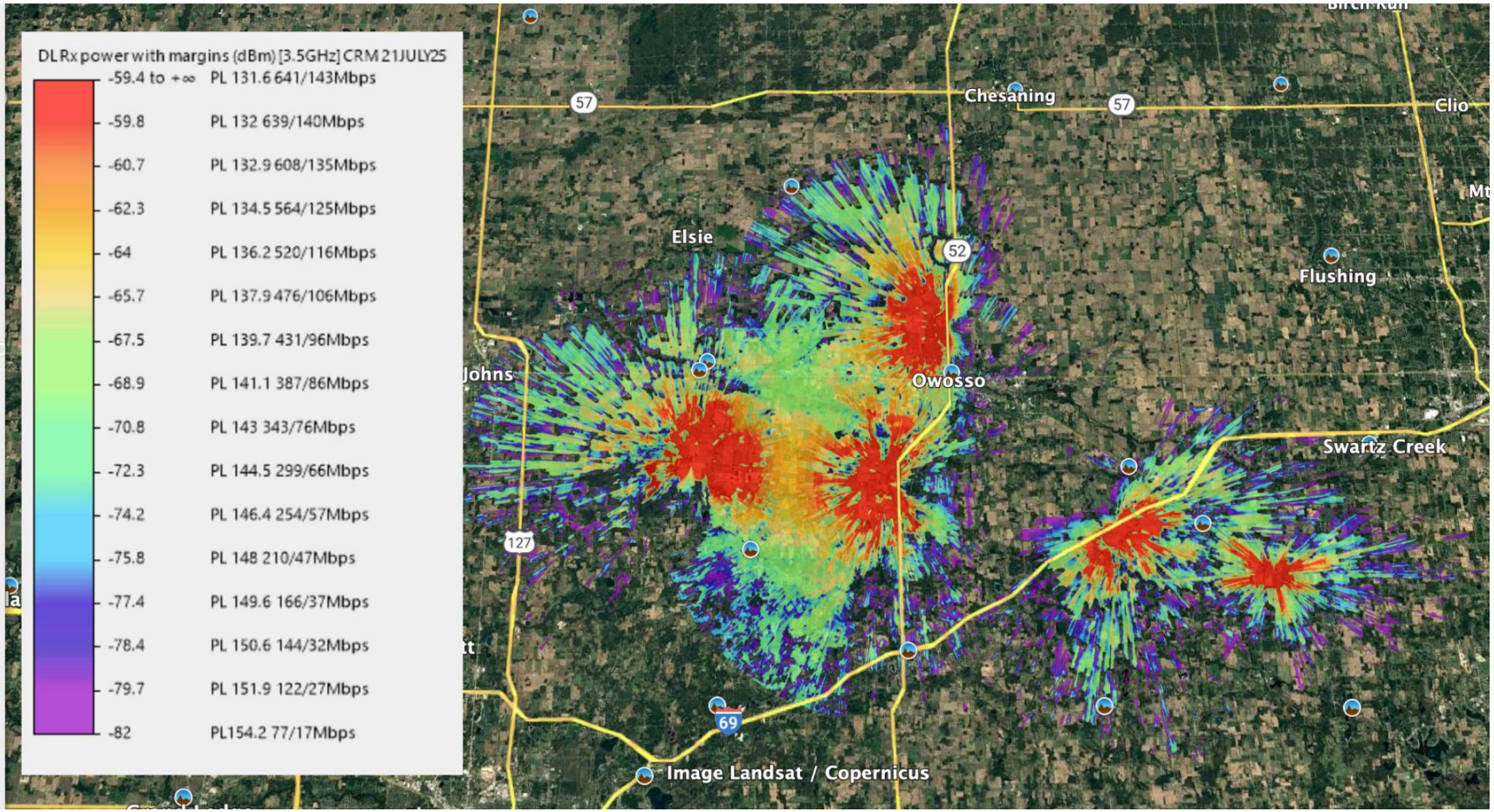


DigitalC City Wide Deployment in Cleveland





Planning



Using and evolved planning software from Siradel, Tarana engineers perform complex analysis of geographical areas to provide accurate propagation models to clients.

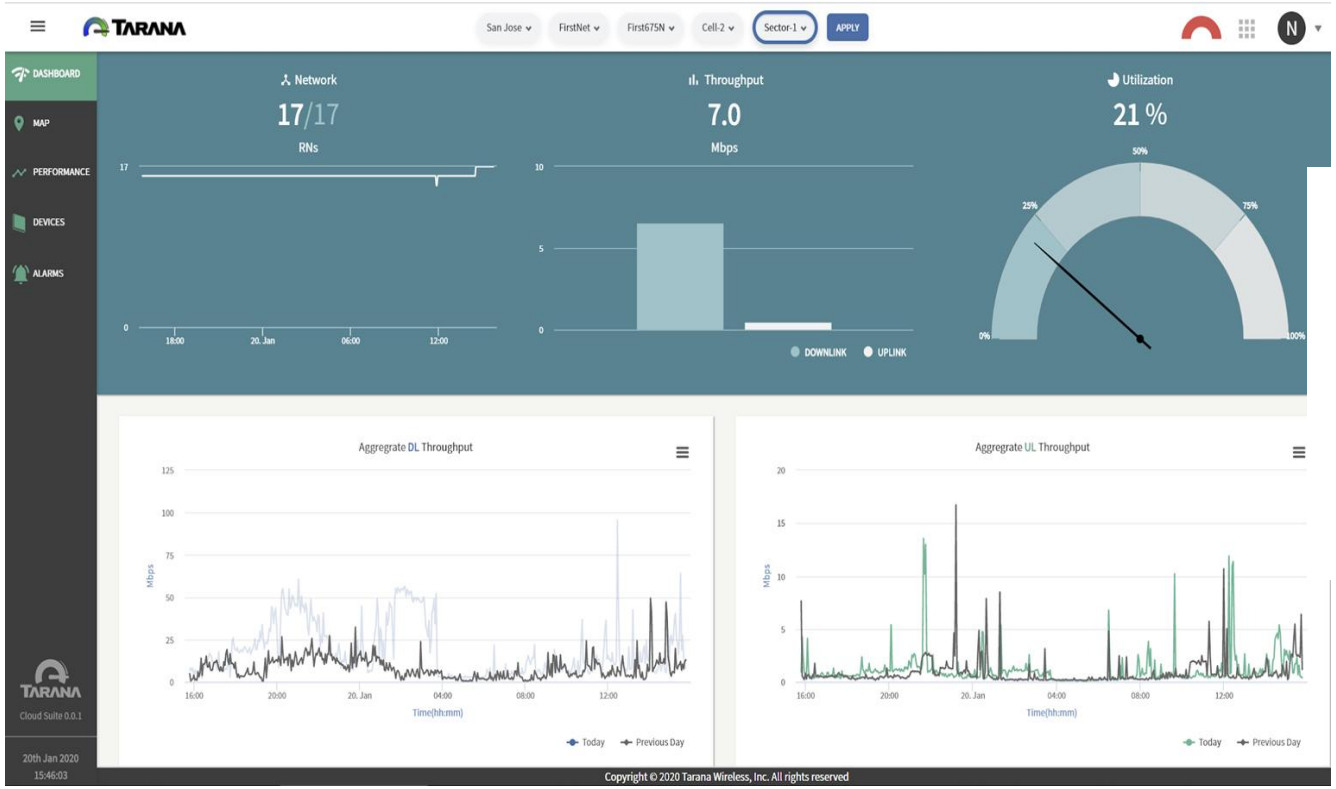
Additional reporting outputs can analyze receive signal strength and provide capacity predictions for end user locations

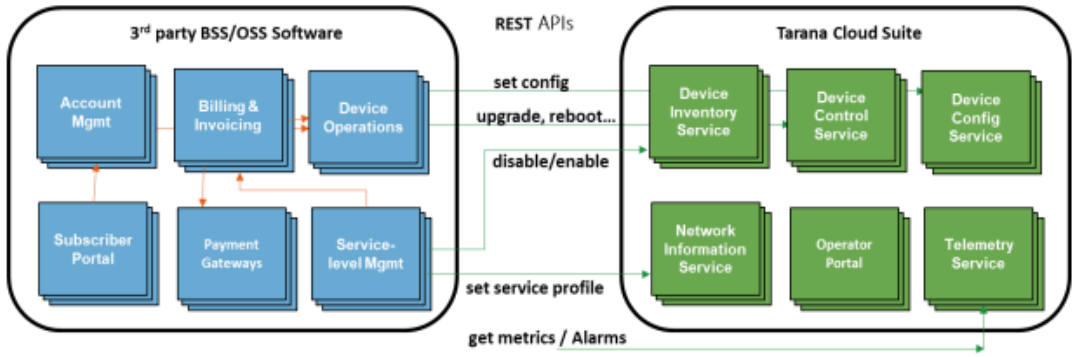
Software Management and Support (SMS)

- **Annual Per RN subscription of ~$47/year**
- 24X7X365 - BN and RN remote maintenance and technical support
- Software subscription for the BN and the RN – ie G1 x2 Software and the Service Prediction Tool
- Multi-homed AWS hosted Tarana Cloud Suite (TCS), providing:
  - TCS Software subscription plan (bugs fixes and minor features)
  - Auto-config of RNs
  - Alarm management
  - Event management
  - RN and BN automated software upgrades
  - Performance monitoring and statistics
  - Powerful REST APIs
  - Subscriber Service Activation

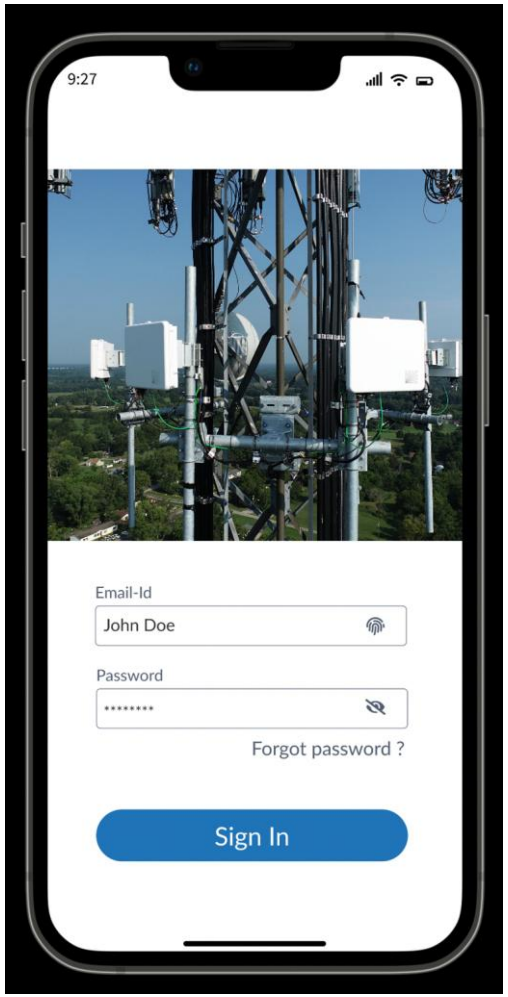
TARANA CLOUD SUITE (TCS)

- TCS makes it easy to plan, install, provision and manage Tarana's radio network infrastructure, while enabling partners (operators) to manage their business operations, and their end-users to manage their own accounts. TCC provides network management, business operations and control-plane functions, and it can be shared among multiple operators/partners, as a multi-tenant SaaS offering. The TCS northbound interfaces connects to the operators OSS/BSS through various APIs.

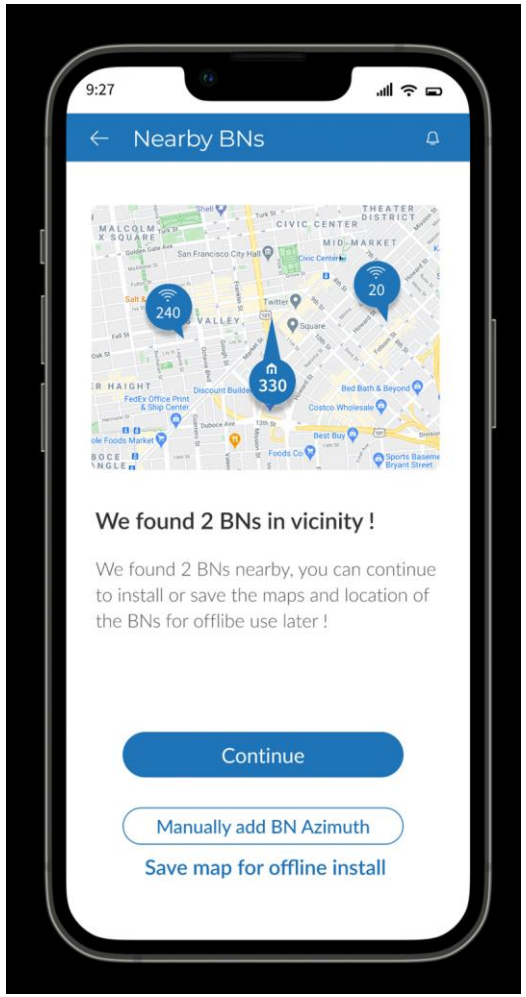




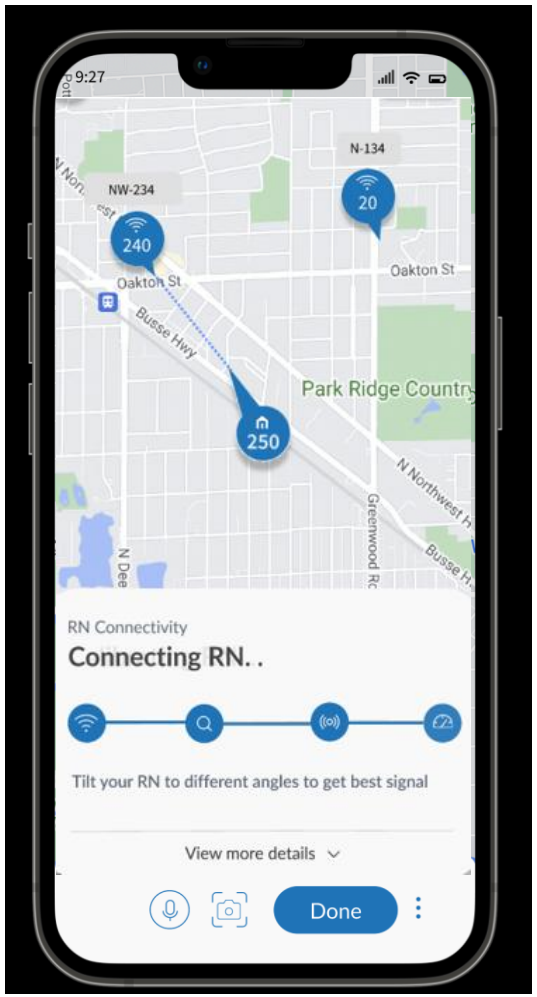
Install App



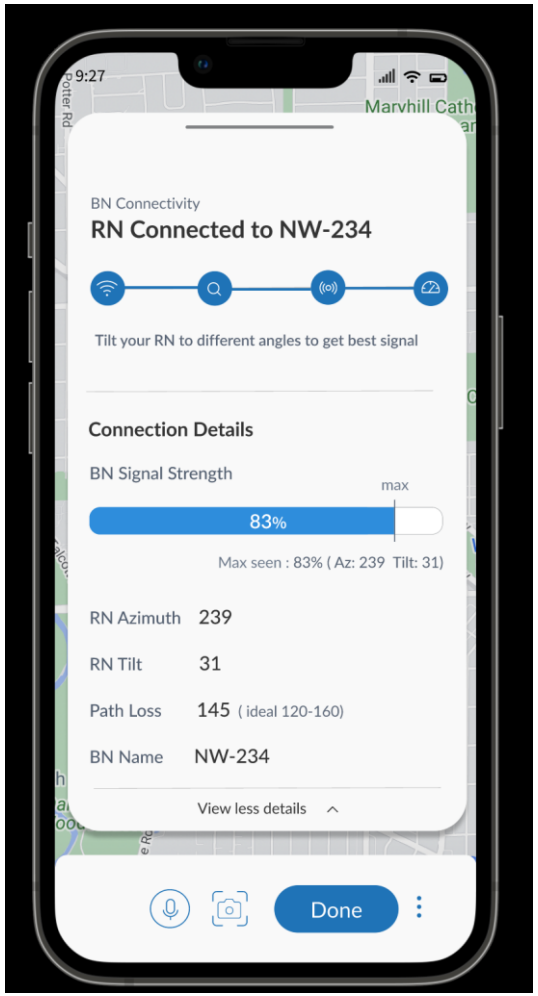
Login



Search BN's

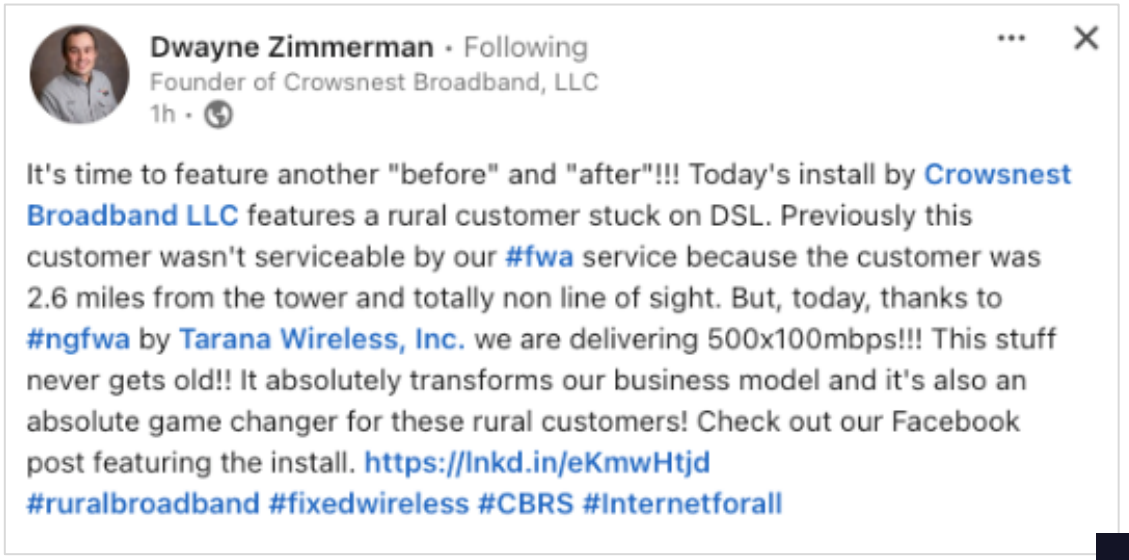


Connect



Align

Absolutely Transforms Business Models



Dwayne Zimmerman · Following
Founder of Crowsnest Broadband, LLC
1h ·

It's time to feature another "before" and "after"!!! Today's install by Crowsnest Broadband LLC features a rural customer stuck on DSL. Previously this customer wasn't serviceable by our #fwa service because the customer was 2.6 miles from the tower and totally non line of sight. But, today, thanks to #ngfwa by Tarana Wireless, Inc. we are delivering 500x100mbps!!! This stuff never gets old!! It absolutely transforms our business model and it's also an absolute game changer for these rural customers! Check out our Facebook post featuring the install. https://lnkd.in/eKmwHtjd
#ruralbroadband #fixedwireless #CBRS #Internetforall

Seeing is Believing

Ryan Grewell
· December 2, 2021 ·

I know I tend to gush about Tarana (because it's been great for me) but I had to share a positive story. I have a customer that's been with me for around two years. They were on a Baicells Cat6 14.5 dbi cpe. The reason they were on LTE vs my traditional UBNT LOS deployment is that there are two trees in the way of the tower. Today the customer called and said their connection had been getting pretty poor and they wanted to know if we could resolve that / give them more speed. We took a Tarana 5ghz RN out to see what it would do. They connected at a 27 out of 30 on the Setup Link Score. I did a 518mbps speed test right off the rip. Game changer for the customer as they were previously on a 30mbps plan.

Ryan Grewell
Just now ·

4 pallets of Tarana goodies showed up to our warehouse today. We just tuned up a new deployment with massive potential. While the gear they sell is pricey, when properly implemented it works like nothing else.

Today we tested at our county courthouse just to see. A few miles from the tower and with no line of sight whatsoever I was not confident our 5ghz deployment would connect from chest height on the ground. Boy was I wrong. Pointed in the direction of the tower the numbers were low, too low to install. I told my tech to pan the radio and I would check signal levels. As he panned to nearly 180 degrees of the tower I was connected at almost the same numbers that I'd see in a line of sight application.

I tested at that moment and had over 300mbps down and 96mbps upload. I'm blown away. I have gig fiber to my house but am in the coverage zone of this deployment. I had my home installed on wireless and disconnected my router from the fiber. I ran it all weekend like that. No difference noticed by me nor my bandwidth craving gamer kids.

I'm a believer in their product. It's certainly not perfect nor is it the 100% to every problem we face but it's damned good and something I'm pushing toward in markets that make sense.

Magic

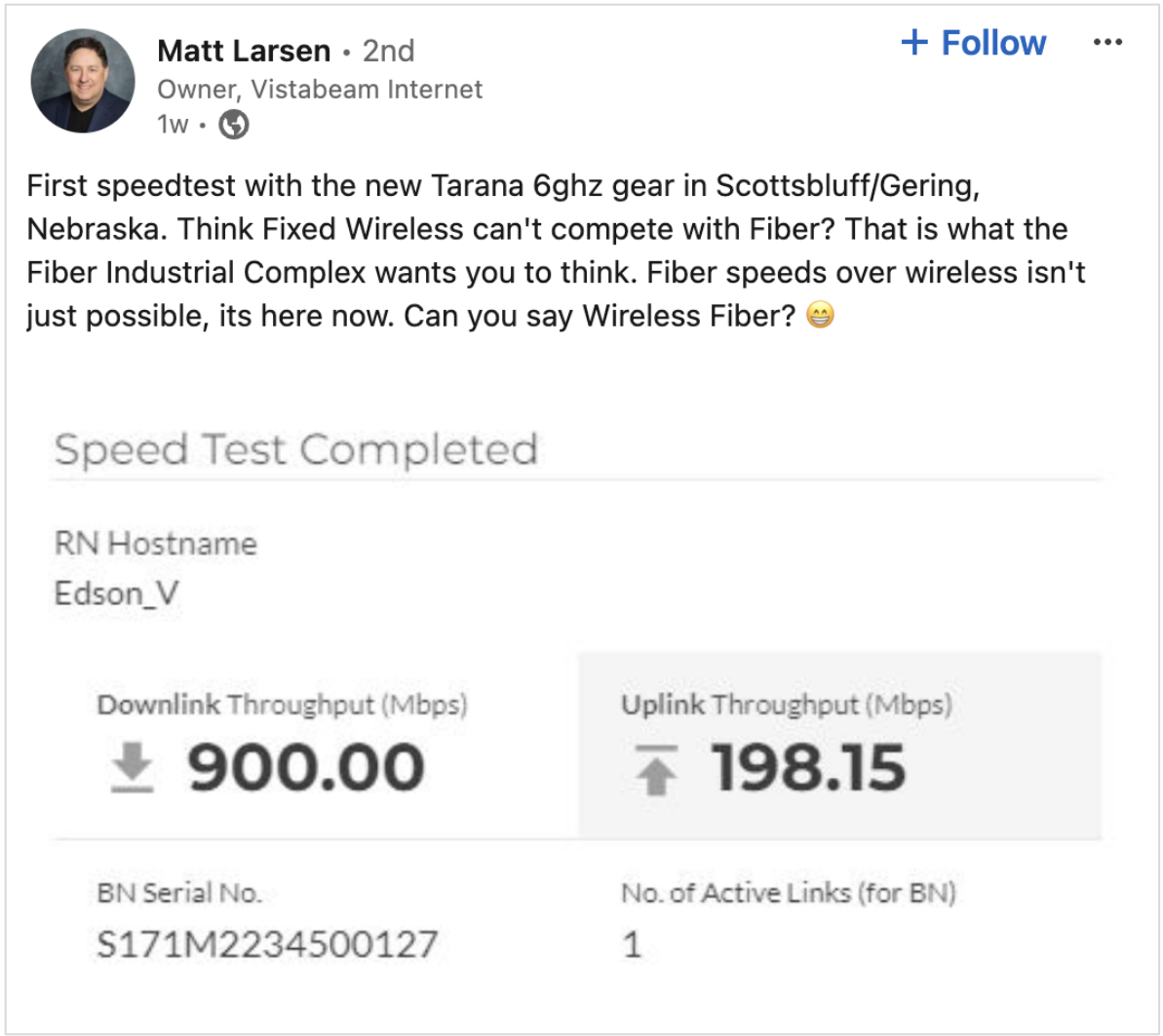
6 GHz is Insane

Wisp Talk
Dwayne Zimmerman · 1h ·

Finally testing 6ghz Tarana! Hotdog this stuff is insane! First test point was 1.5 miles and clear line of sight. 900+ by 250+ on every single test. Then moved out to 3 miles with pretty decent obstruction. I was also situated higher than the tower, I actually was looking down at the tower and the AP is aimed down into town. Still getting gig🔥💯

Who thought this was possible a few years ago? Can't wait to load this sucker up.

Wireless Fiber?



Pushing the Envelope

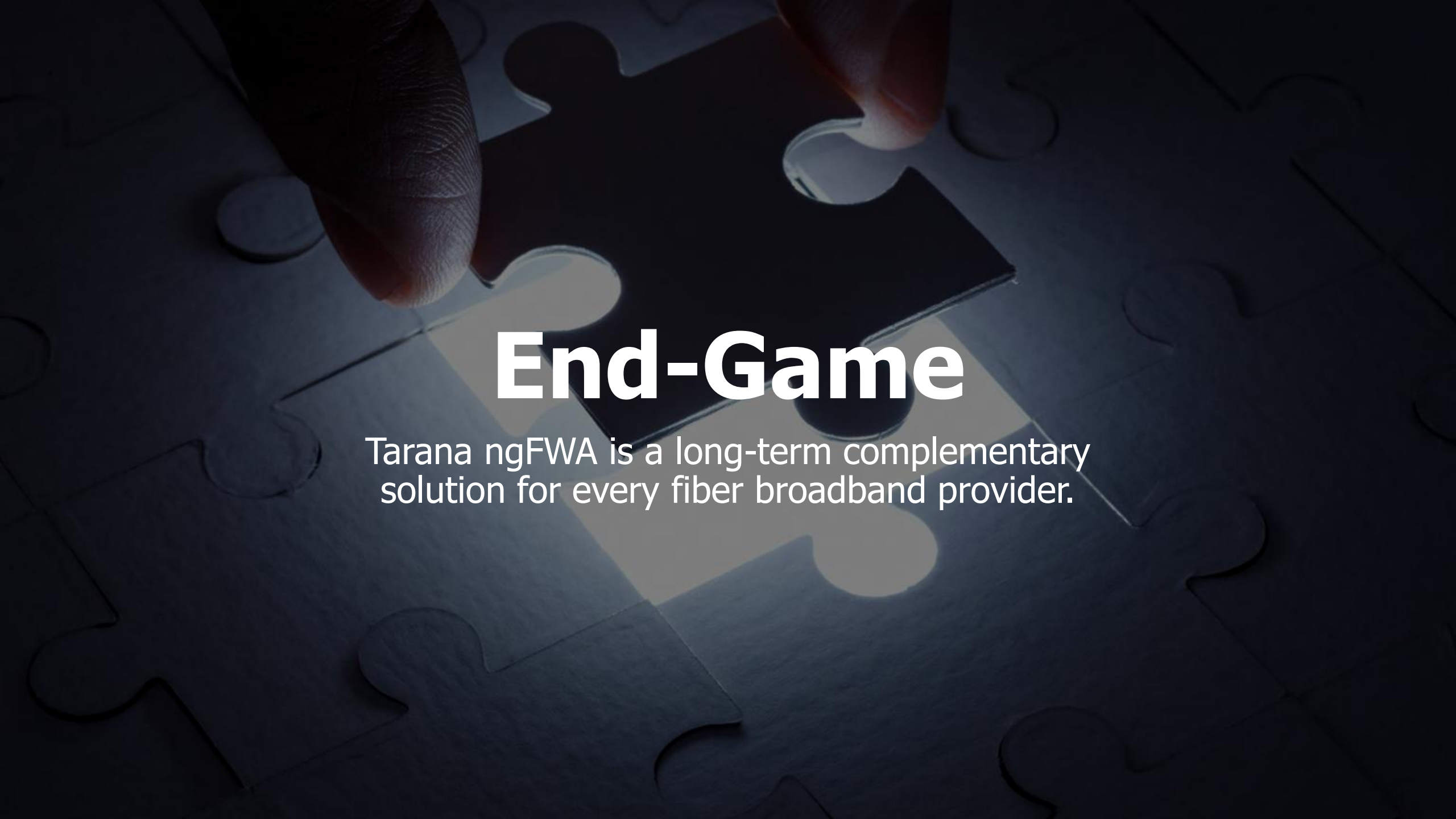
Rock Solid Internet - A VTX1 Company
228 followers
1mo •

+ Follow

Technology in the #WISP industry has come a long way. Eight years ago, we were delivering 3 Mbps x 1 Mbps packages. Today, we're offering 400 Mbps x 25 Mbps packages and continue to push the envelope, thanks to Tarana Wireless, Inc.

Excited to share that #RSI has completed our first 6GHz Tarana deployment in Medina County.

Here is the speed test results from our first Tarana 6GHz install.
Distance 2.9 Miles
Two hops from a fiber connection
#Tarana #TaranaWireless #Wireless #RuralAmerica #Broadband #VTX1



End-Game

Tarana ngFWA is a long-term complementary solution for every fiber broadband provider.

G2 Takes ngFWA to a New Level

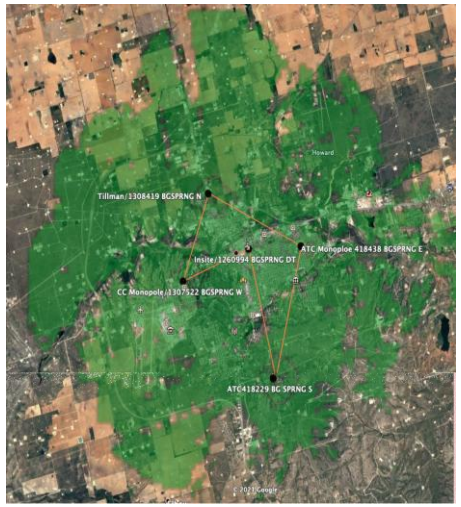
	G1	G2
RF Bands	Single band RF array	Multi-band RF array
RF chains @ BN	32 RF chains (16 antennas x 2 carriers)	64 RF chains (16 antennas x 4 carriers)
Digital Signal Processing	7 Tflops	20 Tflops
Packet Switching	Carrier grade switch with 2,048 HW queues	Carrier grade switch with 4,096 HW queues, advanced features including AQM
Spectrum	(2) 40 MHz carriers (80 MHz) with full carrier aggregation (4 carriers in 5/6 GHz only, x2 mode)	(4) 40 MHz carriers (160 MHz) with full carrier aggregation
Carrier Flexibility	Separate BNs for 3 GHz, 5/6 GHz	Single BN 4 flexible carriers anywhere in 3 GHz, 5/6 GHz
Spectrum multiplication	6 streams delivering 18-25 bps/Hz per sector (field)	8 streams delivering 24-33 bps/Hz per sector (field)
Beamforming	768 beams calculated every 200 us with independent modulations	2,048 beams every 200 us with independent modulations
Nullforming	7.2M nulls per second	19.6M nulls per second
Scheduler	3D scheduling in time/freq/space	Intelligent scheduling across low- & high-power carriers

Churn Analysis

- Methodology
  - Look back over past 12 months
  - An RN active for 30 days that becomes inactive for 30 days considered churned
- RMAs
  - Churn rate includes RMAs with this approach
  - Last 12-month RN RMA rate subtracted to yield monthly churn
- Typical Industry Churn Rates
  - Fiber: 0.8% - 1.5%
  - Cable: 1.5% - 2.5%
  - 5G/LTE FWA: 2.0% - 4.0%
- Overall Tarana Churn Rate (exclusive of RMAs): 0.88%

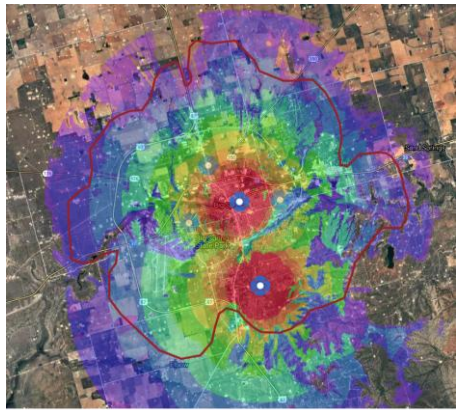
More with Less

- Reach: More houses covered with less towers, rapid deployment
- Subscriber scale: less towers, less complex spectral management
- Noise Cancelling: makes consistent, clean spectrum available
- Noise Cancelling: frequency reuse of 1, doubles the value of PAL investment
- Noise Cancelling: consistent service across entire service area (no cell edge)
- Spectral Density: high speeds available throughout service area. Protects against over builds.
- NLOS: Faster installs, less failed installs, more houses covered.



Competitors Solution

- 5 Towers
- 800 Users (40 subs/radio, 4 radios per tower)
- 100Mbps downloads



Tarana Wireless

- **2 Towers**
- **1200 Users**
- **100/20Mbps**
- ***Up to 500Mbps downloads