

## **WISPAPALOOZA 2021**

















## Cambium Networks – A Decade of Excellence





- Became independent after WISPAPALOOZA 2011
- Industry evolved from Mbps to Gbps
- Deep relationships with WISPs and WISPA
- Customer driven innovation
- Thank YOU for your partnership





HERO OF THE YEAR **EVERT BOPP** Disaster Tech Lab

Semper Wi-Fi EverestLink Consulnetworks DisasterTechLab Frontiir Communications Frontera Consulting Wispa pty

2017



HERO OF THE YEAR **DUDUZILE MKHWANAZI** Project Isizwe

Arnold and Peter Du Plessis American Wide Broadband

WorldLink

Easyweb Digital

Lifesource

Aristotle Inc

Sacred Wind

OmniLogic

KING IT

Project Isizwe

Wireless Applications Corp

2018



HERO OF THE YEAR **CHRIS HILLIS** Information Technology Disaster Resource Center (ITDRC)

**ITDRC** 

Consulnetworks

Countrynet

Mountain Community Network

InfoNet

CasCom

2019



**Ibersystems** Ayuntamiento de Villarcayo de MCV Maxwire Internet Resound Networks Valley Teligence **Ibersystems** 

HERO OF THE YEAR **DREW LENTZ** 

Frontera Consulting

PB Seguridad

Amplex

WorldLink

EnerTribe

Frontera Consulting

TooMuchWiFi

Elevate Technology Group FIAM WIFI

2020

Air2bite

Tizeti Network Limited

Alaska Communications

Pentanet

Burke County Public

International Children's Care

Tidal Wave Wireless Calllidus

2021

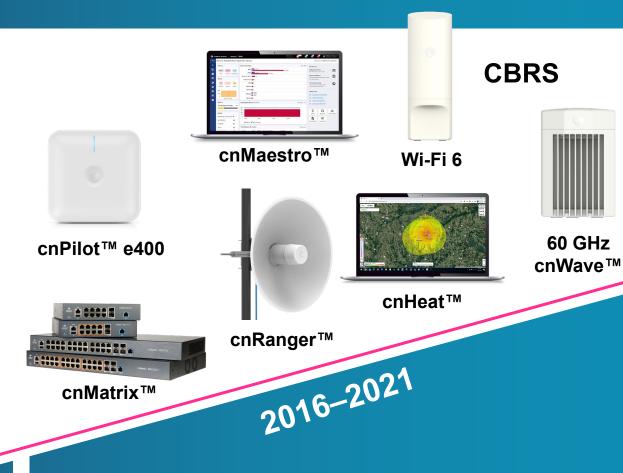


# Cambium's Key Innovations



Our portfolio of innovations and solutions is growing every year





## Investment Protection with ePMP & PMP



# **Delivering Connectivity that is Easy and Affordable**

### Maximize throughput from available spectrum

• 6 GHz development

# Achieve flexibility from software-defined radios

Extend PMP 450m to support CBRS

Leverage CBRS with leadership in Spectrum Access System (SAS) via a frequency coordinator using Priority Access Licenses (PAL)



# Grow your Business with Marketing Resources from Cambium Networks



## Marketing Resources (co-brandable)

- Case studies & videos
- Solution papers & data sheets
- Brochures/flyers
- Pop-up banner for events
- Email templates

## **Free Virtual Training**

**Qualified Leads** 

**Market Development Funds Program** 



# Optimize Broadband Subscriber Acquisition Only Market to Those You Can Serve



## **Challenge:**

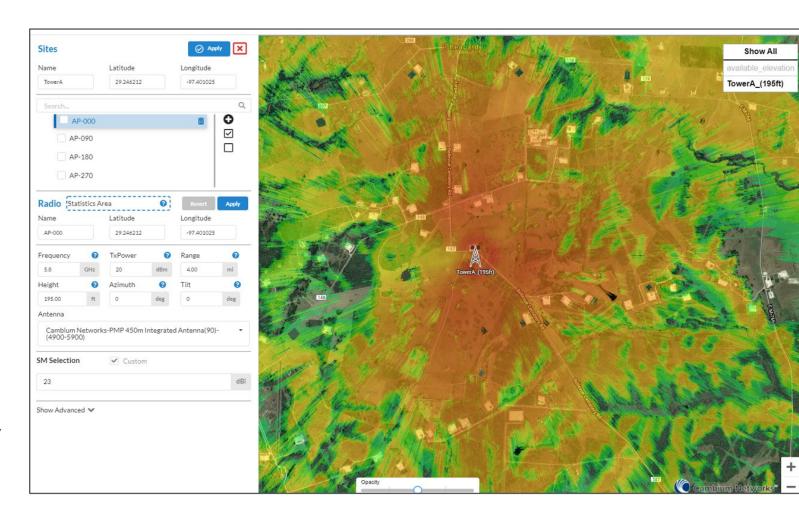
Coverage areas do not map to ZIP codes or cities

### Solution:

Send mailings to ONLY addresses you know you can cover

### How it's done:

- Deliver cnHeat results immediately
- Match results to specific customer addresses



# Cambium Networks Quality of Experience (QoE)



# Wireless Network Insight and Automation will Enable You to:

- Improve your upsell effectiveness
- Reduce support calls
- Increase customer satisfaction
- Manage rate limited plans

Ask us for a demo!



## Scaling to Serve More Customers – Stillwater, OK





#### **CHALLENGE**

Deliver professional quality internet experience to business and residential customers overlooked by other providers

#### **CAMBIUM NETWORKS SOLUTION**

ePMP with synchronization, scalability and centralized management

"Best Performing ePMP 3000 Access Points" by Preseem

- Offer meets residential needs
- Cover 55 cities, towns and communities
- 5,500 square miles
- 100 towers

## Statewide Broadband Connectivity – Arkansas





#### **USE CASE**

- Rural broadband connectivity
- Residential, business and school connectivity

#### **CHALLENGE**

- Connect nine hard-to-reach counties
- Improve Arkansas' bottom-10 rank in internet connectivity
- Extend the reach of fiber infrastructure



#### **CAMBIUM NETWORKS SOLUTION**

- PTP 850 licensed microwave backhaul
- PMP 450m fixed wireless access
- cnMaestro wireless network management system

- Up to 100 Mbps delivered
- Affordable internet provided to rural Arkansas areas

# Outdoor Wi-Fi 6 for Olympic Trials – Oregon





#### **CHALLENGE**

- Support hundreds of guests in an area with heavy tree cover
- Previous connectivity in the area was a 5-10 Mbps DSL connection

#### **CAMBIUM NETWORKS SOLUTION**

- CBRS solution: 2 PMP 450b units in PTP mode
- XV2-2T outdoor Wi-Fi 6 access point

- Aggregate bandwidth of 220 Mbps
- 157 unique devices connected to Wi-Fi
- Thousands watched the livestream online

# Expanding Customer Service Offerings – Texas





#### **CHALLENGE**

- Rural area, low density
- Customers have no available internet options

#### **CAMBIUM NETWORKS SOLUTION**

- Planning with cnHeat
- PTP unlicensed wireless backhaul
- PMP licensed and unlicensed distribution network

- Offering 25/5 service to residential customers
- Support 125 subscribers per AP

# The Future is Bright

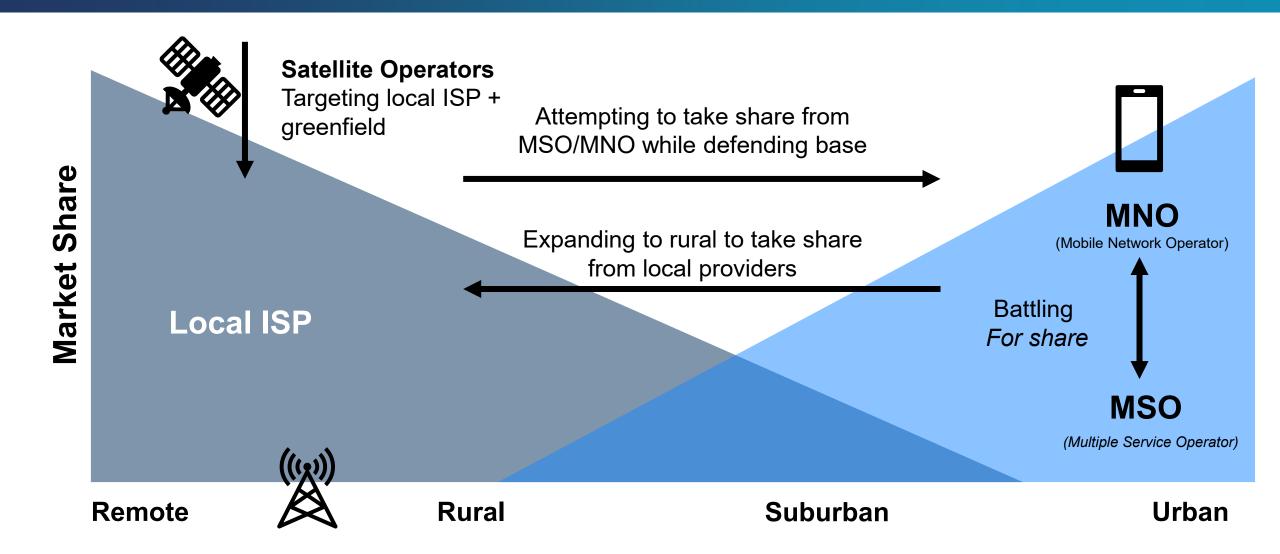






# Fixed Broadband Landscape 2021





## Poll Placeholder



- Where do you see the market going in your coverage area?
  - I will be able to grow market share from MSO/MNO competition as I expand into suburban and urban areas
  - My market share will stay the same as I defend from MSO/MNO competition
  - I am concerned that MSO/MNO competition will take market share from me

# We Can Assist You with Applying for Government Programs



# Request Cambium Networks' Assistance in Applying for Government Grants

At the national, state, and local levels, governments around the world are providing financial support and incentives to extend broadband access to unserved and underserved regions and communities.

The objectives in providing the funding range from enabling economic development to providing telemedicine to supporting remote learning, but universally governments recognize that the future demands broadband access. The applications for the programs range from relatively simple to those demanding comprehensive network designs, coverage models, and even impact studies and economic models.

Cambium Networks recognizes that the application process can be daunting for our partners and customers and may even prevent them from seeking the financial support intended for them! Cambium Networks also recognizes the challenges and is prepared to provide our expertise and support to assist with grant applications. If you would like to request support, please complete the following form, and a Cambium Networks team member will be in contact with you.

Complete the form below to request Cambium Networks' assistance in applying for government grants.

Last Name \*

Company \*

Email \*

**Snap QR to request assistance** 

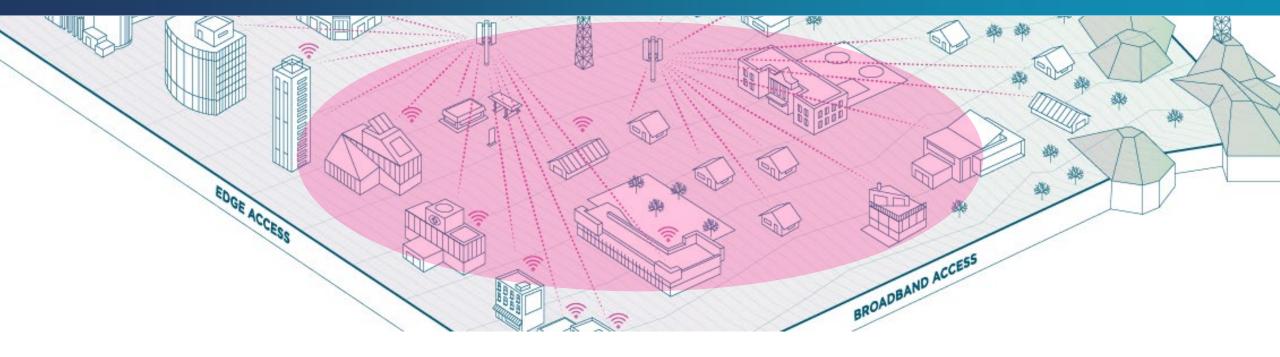
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## CBRS – Fixed Wireless Service Provider Use Case





# **CBRS Solutions**

 CBRS dubbed the "innovation band"  Most cited use cases have been slow to adopt •Fixed Wireless Access clearly a good fit, first mover, market share leader

## Cambium's CBRS Solution – A Proven Winner









- A complete end-to-end ecosystem and solution
- Operational reliability stable and exceeding expectations
- Cambium CBRS works with all major SAS providers
- Network Operator chooses the SAS they like
- Cambium enables migration from one SAS to another
- Comprehensive pre and post implementation support

#### **Proven Success**

- ~90%+ of the Part 90 installed base has now migrated to CBRS
- Over 110,000 devices operating today and networks building out at pace
- Deployed by service providers, government, and industry



# Cambium's CBRS Solution – Evolving



- Leaders in CBRS Evolution, Cambium is ahead of the curve, and influencing how the SAS Admins implement features
- Tight integration with all SAS portals and tools
- Supporting features of SAS 2.0 WinnForum standards
- cnHeat provides unparalleled coverage modeling accuracy
- cnMaestro is the one stop to plan, deploy and monitor
- Unmatched support if issues arise

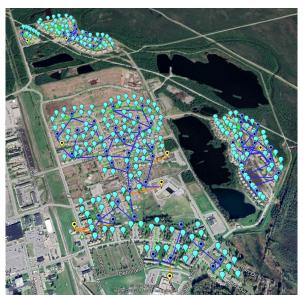


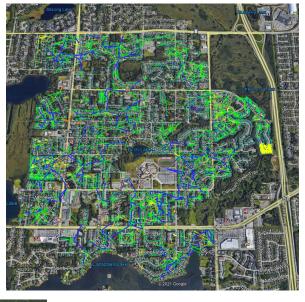




# Hybrid Fiber Network Delivering Gb to the Residential Address









#### Goals

- Competing with Cable (DOCSIS) Operator
- Deliver 50/100/250 Mbps and 1 Gbps residential services
- Upgrade existing DSL wireline network and leveraging fiber assets
- Three pilot areas ahead of network wide rollout (Eielson AFB housing, Fairbanks and Anchorage neighborhoods)

### **Solution**

- Deploy 60 GHz cnWave V5000 and V3000 with distributed configuration to handle the high-density area
- Leverage existing fiber rings and PoPs
- ACS also deploys PMP 450 CBRA and PTP 8xx licensed microwave from Cambium

#### **Status**

- 340 DN's, 1,500 Client Nodes in the initial deployment
- 6,500+ homes and businesses covered

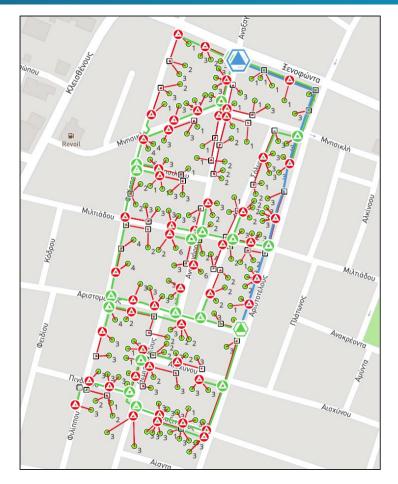
## 60 GHz cnWave Cost per Home Passed is 41% of Fiber



Wireless
Coverage
breakeven
at 14
months



**cnWave** plan showing: wireless DN and POP locations



Fiber breakeven at 30 months

FTTH Plan showing: trenches, closures, cabinets, splice points, underground cable

# Coming Soon: 5.5+ Gbps with 60 GHz Channel Bonding



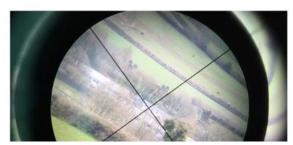
## **Actual Field Results at 1.2 km Distance**

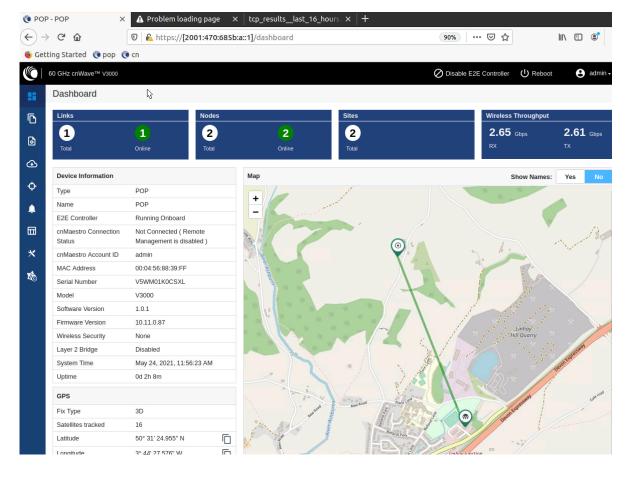












## Why is 60 GHz cn Wave from Cambium the Market Leader? (© Cambium Networks)



## **Fully Terragraph-certified Networking Your Way**

- IPv4 or IPv6: Your Choice
- Layer 2 or Layer 3: Your Choice

## **Client Flexibility and Pricing**

- V1K: Gbps in the palm of your hand
- V3K: Auto-aligning range and performance

### **Proven Distributed Networking**

- < 1 ms latency per hop</p>
- 250 ms resilience / re-convergence

## **Fast Alignment**

Graphical alignment tools and automatic beam-steering

#### **Tools for Success**

LINKPlanner, cnHeat, ANP and cnMaestro



# Gbps Changes your Business

## 60 GHz cnWave Starter Kit



#### Each starter kit contains:

One (1) V5000 Distribution Node

Two (2) V3000 Client Nodes with High-Gain Antennas

Two (2) V5000 Client Nodes

Power Supplies, Line Cords, Mounting Brackets



Snap QR to learn more about this starter kit



#### What can I do with this kit?

- Test and deploy a PTP link with 2x V3K
- Test and deploy a PMP link with V5K and 1-4x CN's
- Manage the network with cnMaestro
- Take the on-line training and become certified on the cnWave 60 GHz solution



## Poll Placeholder



- Do you plan to become or do you currently act as an MSP?
  - Yes, we are an MSP now
  - Yes, we plan to become an MSP within 6 months
  - No, we do not plan to become an MSP

# Business Need for Managed Services Gartner 2020 End Users IT Services Study



# Top factors for choosing an outsourced service provider

- Return on investment
- Meeting stated requirements
- Effective use of prebuilt assets/platforms to support service delivery, and suitability to a department or functional area

# When asked to rate the importance of various IT services for the overall success of the organization:

- 87% of users rated managed services in the top two box of a 7-point Likert scale
- 90% of global enterprises rated IT managed services as top two box choices of "very important" and "critically important"

Reliance on consulting or outsourcing providers for digital business infrastructure operations will increase over the next two years (41% "somewhat higher" and 20% "significantly higher")

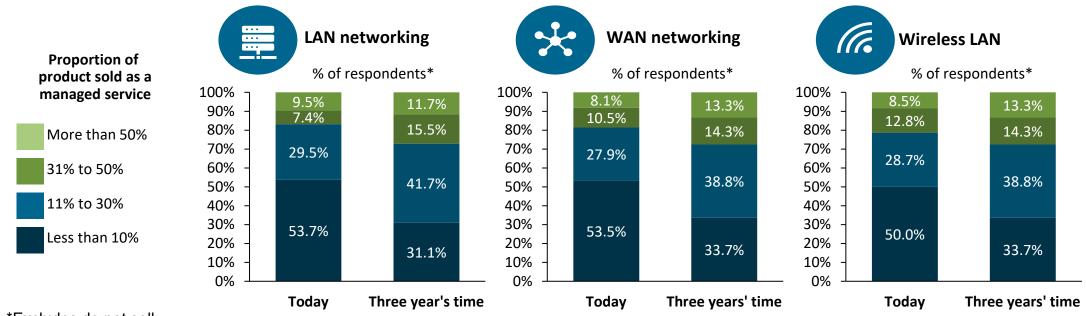
Nearly half of all respondents expect the reliance on IT services for their digital initiatives to be permanent

# Managed Services is a Growing Trend

WISPs will increase revenue and ROI by expanding to managed LAN and WLAN as an MSP, aka Indoor WISP



What proportion of the following product categories you sell **today** and in **three years' time** are part of a managed service contract sold to business customers?



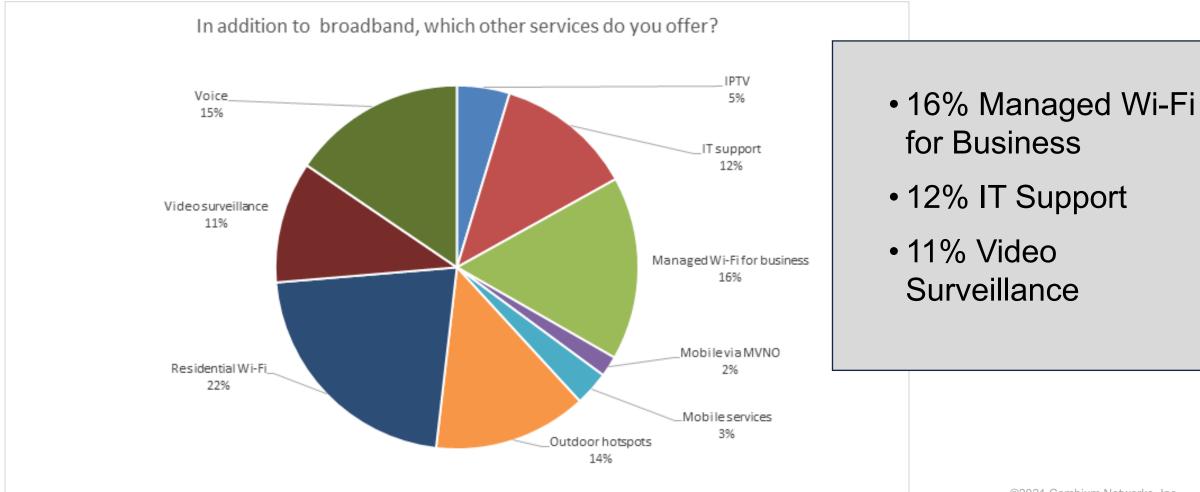
\*Excludes do not sell

Source: Candefero channel survey (127 respondents, March 2020)

# 2021 Service Provider Survey Results

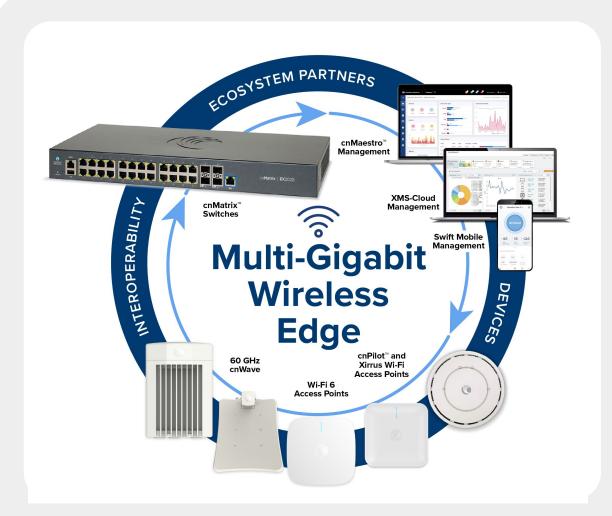


### Many of You Have Recognized the Opportunity and Embarked on the Journey



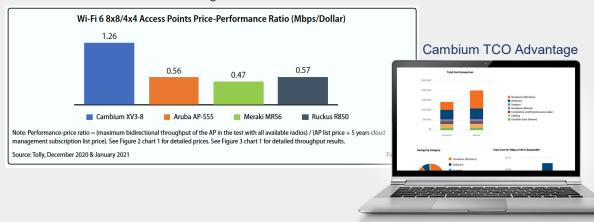
## Cambium Value Proposition





- Industry-Leading Price/Performance
- Freemium, Feature-Rich Cloud
- Platform for Business-Critical Services
- Industry-Leading TCO
- Compelling Partner Program Benefits

#### Cambium Performance Advantage



Online TCO Profiler

Tolly Performance Report: <a href="https://www.cambiumnetworks.com/download-wi-fi-6-access-point-tolly-report/">https://www.cambiumnetworks.com/download-wi-fi-6-access-point-tolly-report/</a>

TCO Profiler: Register to use at: <a href="https://viewer.mediafly.com/cambium">https://viewer.mediafly.com/cambium</a>

# Cambium Delivers Industry's Best Wi-Fi 6 Performance



## Test report by the Tolly Group compares Cambium to other major brands

### Solutions tested:

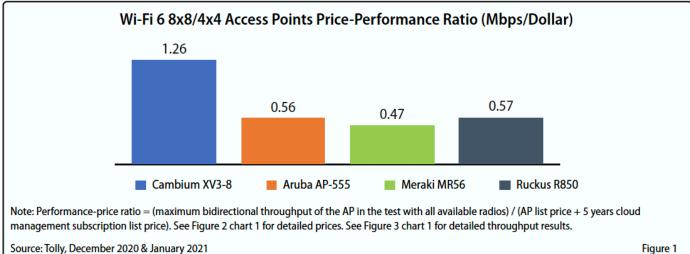
o Cambium XV3-8 & XV2-2



- o Aruba 555 & 505
- o Meraki MR56 & MR36
- o Ruckus R850 & R550



#### **Price-Performance**



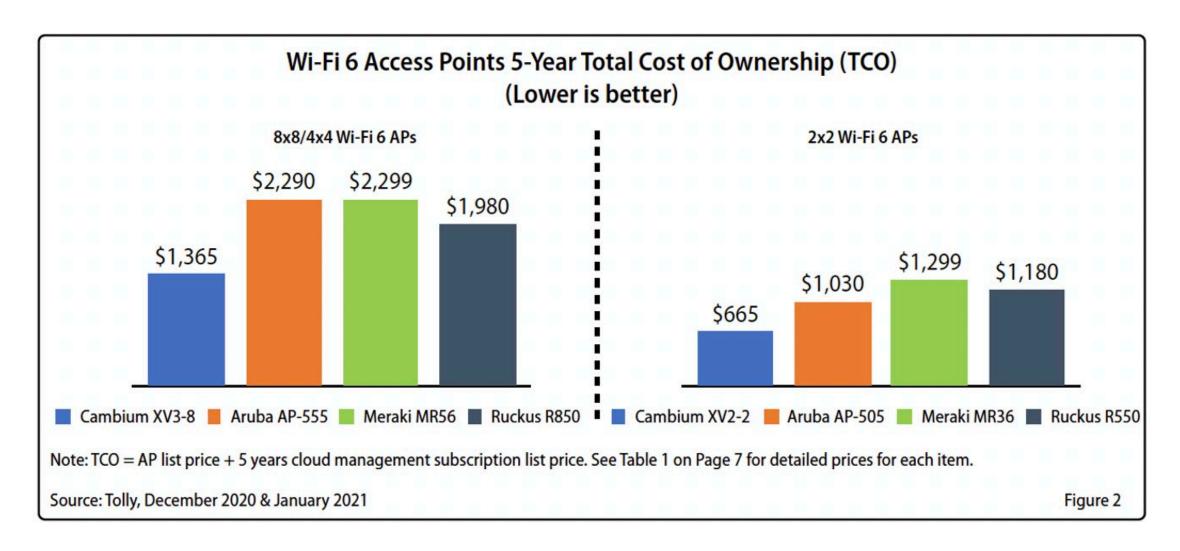
Snap QR to view report





# Cambium Delivers Superior TCO





# cnMaestro X – Optimized for MSPs





#### **Multi-Tenant Cloud Architecture**

- Role-based access control
- Customizable dashboard



### **Flexible Deployment Options**

- SaaS, private cloud, or on-premise
- Same experience across different modes



#### Persona-Based Dashboards

- MSP, tenant views, branded dashboard
- Hierarchical topology



## **Advanced Capabilities**

- 1028 ePSKs per WLAN, 50k per account
- Mac Authentication bypass for IoT devices



### **Remote Troubleshooting**

- Root cause analysis
- Accelerated Access to Level 3 Support



### **Analytics and Insights**

- 2-year data on the cloud
- Actionable insights



### **Automation and Telemetry API**

- Programmatic interface to configure AP
- 3<sup>rd</sup> party application integration



#### Webhooks

- Real-time notifications
- Out-of-box integration for web services, such as Pagerduty Slack, Zapier, Twillio, Datadog, etc.

# Cambium Managed Service Provider Program



- MSP structured pricing
- Access to enhanced technical assistance to manage complex networks
- Take advantage of other programs for hardware, software, and support as a service to avoid high upfront capital investment

Snap QR to view MSP Program Flyer





Deliver Managed Services Easier with Cambium Networks

# The Time is Right

- Network is a mission critical asset for organizations of all sizes
- Organizations with < 300 employees represent a sweet spot for MSP services
- Cambium has the solution, economics, platform, and program to help WISPs embrace the MSP movement
- WISPs have the technical acumen, the local presence, the practical experience, and a differentiated service with WAN Access





## The Cambium QoE Solution

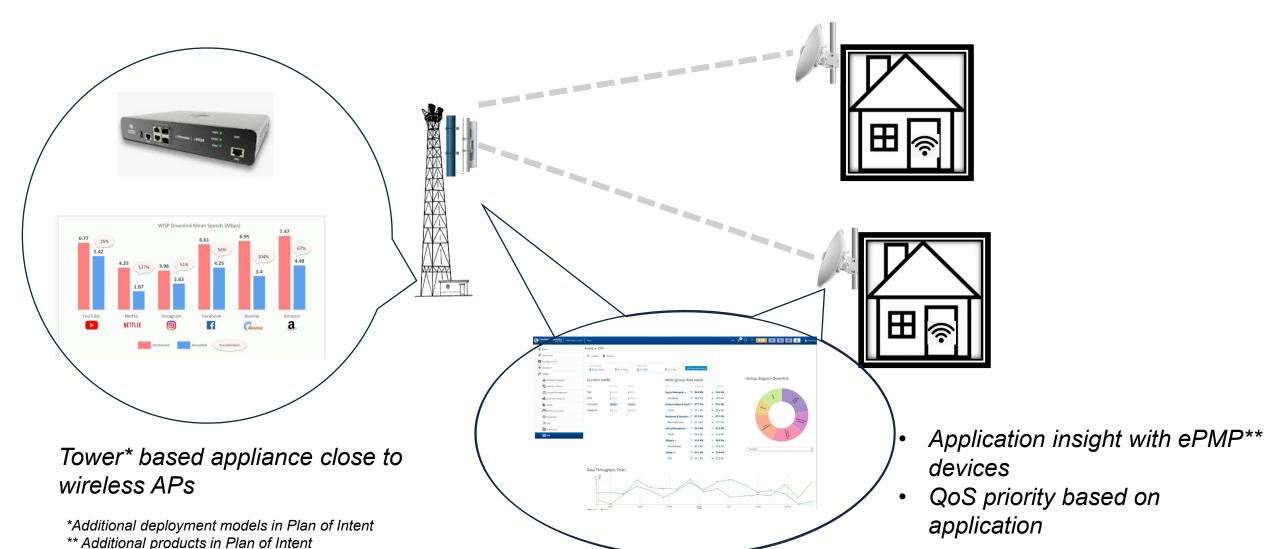


# An approach to focus on the Quality of Experience for end users in a wireless and wired network via:

- ✓ TCP optimization at the network edge, focusing on Application Quality of Experience
- ✓ Traffic shaping based on application
- ✓ Rate limiting
- ✓ Denial of Service prevention
- ✓ Application insights
- ✓ Tight integration with wireless scheduler to improve MU-MIMO performance
- ✓ Useful statistics driving quicker resolution and prevention of issues
- ✓ Integration with cnMaestro

# QoE Solution from Cambium Networks Edge Intelligence – Edge Action – Edge Impact





## The Value of QoE



# TCP Optimization at the Network Edge Focusing on Application Quality of Experience

Reduce support calls pre-emptively and lower customer churn

## **Traffic Shaping Based on the Application**

 Manage wireless bandwidth based on application needs and service packages

## **Rate Limiting**

Manage subscriber Service Level Agreements

## **Denial of Service Prevention**

• Network uptime, customer satisfaction

## **Application Insights**

Upsell based on usage patterns and consumption

# Tight Integration with Wireless Scheduler to Improve MU-MIMO Performance

Increase AP SM density and offer higher throughput packages

# **Useful Statistics Driving Quicker Resolution** and Prevention of Issues

Get insight into problem customers and address issues quicker

## Integration with cnMaestro

 Get network-wide intelligence to make proactive decisions towards customer QoE



# ePMP 4000 Platform Gigabit at the Edge with 6 GHz



## 2021

4X4 MU-MIMO AP
~700 Mbps sector
600 Mbps SM
20/40/80 MHz Channels
AX based ~1Gbps PTP

ePMP 3000, 3000L, MicroPoP, Dual Horn Antenna

300-13, 300-16, 300-19, 300-25, Force 425/400C

#### **MU-MIMO**

Flexible scheduler
Application insight (4.7)
Granular TDD ratio

## 2022

ePMP 4K 6 GHz

4X4 MU-MIMO AP

5.9 to 7.1 GHz

>2 Gbps SM capacity

6 GHz spectrum support (AFC)

ePMP 4600 AP

Force 600C, 625

5.9 to 7.1 GHz support 20/40/80/160 MHz support 1024QAM/4096 QAM OFDMA, DL & UL MU-MIMO >5 Gbps Capacity

## 2023

ePMP 4K 5 GHz 8X8 MU-MIMO 1 Gbps SM capacity

ePMP 4500 AP, integrated 8x8, 8X8 Horn

Force 4525, Force 4525L

20/40/80 MHz support 1024 QAM, OFDMA UL & DL MU-MIMO >3 Gbps AP capacity Backwards compatibility

# ePMP Force 425 and Force 400C Gigabit Last-Mile Performance



Industry-first purpose-built PTP product based on 802.11ax

## **Shipping Today**

## **Target Markets / Applications**

- High-capacity enterprise point-to-point
- Low-cost backhaul
- GPON last mile

## **Key Specifications**

- Up to 1 Gbps usable throughput
- Sub-5 ms latency
- 4.9 to 6.135 GHz an additional~230 MHz for ROW!
- 25 dBi integrated dish optional 28 dBi range extender
- IP67
- GigE and SFP port optional GPON module





Force 400C

## ePMP 6 GHz on the Horizon





- Integrated 8x8 Sector Antenna
- Freq Support 4.9–6.135 GHz
- 48V PoE/ and 4 wire DC in
- SFP+ interface
- IP67
- 636 mm x 485 mm
- 80 MHz Ch, 1024 QAM
- TX Power 25 dBm/Chain



### **Features**

- 4x4 6 GHz sector antenna
- Freq Support 5.9–7.250 GHz
- 48V PoE in
- SFP+ interface
- IP67
- Radio 235 mm x 125 mm, Antenna 594 mm x 157 mm
- 160 MHz Ch, 4096QAM support
- TX Power 24 dBm/chain



## ePMP Force 400 Subscriber Modules



### 6 GHz PTP/SM



#### **Features**

- Supports RFE Twistport
- Freq Support **5.9–7.250 GHz**
- 48V Active PoE in
- SFP+ interface
- IP67
- 256 mm x 125 mm
- 160 MHz Ch, 4096 QAM
- TX Power 24 dBm/Chain
- Internal GPS

#### 6 GHz SM



### **Features**

- 25 dBi Antenna
- Freq Support 5.9–7.250 GHz
- 48V Passive PoE in
- IP55
- 450 mm Diameter
- 160 MHz Ch, 1024 QAM
- TX Power 24 dBm/Chain
- USB GPS Accessory

### 5 GHz SM



#### **Features**

- 25 dBi Antenna
- Freq Support 4.9–5.9 GHz
- 48V Passive PoE in
- IP55
- 450 mm Diameter
- 80 MHz Ch, 1024 QAM
- TX Power 25 dBm/Chain

## 5 GHz SM (ROW)



#### **Features**

- 25 dBi Antenna
- Freq Support 4.9–5.9 GHz
- 30V Passive PoE in
- IP55
- 450 mm Diameter
- 80 MHz Ch, 1024 QAM
- Peak tput of 400 Mbps
- TX Power 25 dBm/Chain

# PMP 450 Platform The Path to Higher Order MU-MIMO and Fixed 5G



2021

1.2 Gbps sector300 Mbps SM40 MHz Channels

450 MicroPoP (omni, sector, connectorized)

450b High Gain, Mid-gain, Retro, Connectorized

Nomadic mode
Intermediate Modulation Modes
BPDUGuard Filter
MAC Filter

2022

Next Gen 450 6 GHz Spectrum Support

450v 6 GHz AP (4x4)

450v 6 GHz SM (2x2)

5 to 7 GHz support
5 to 200 MHz channel bandwidth
2 Carrier Aggregation
Interoperable with other 450
>1 Gbps Capacity

2023

Next-Gen cnMedusa™

6 GHz support, hardware 5G capable Next Gen SM (5G-NR)

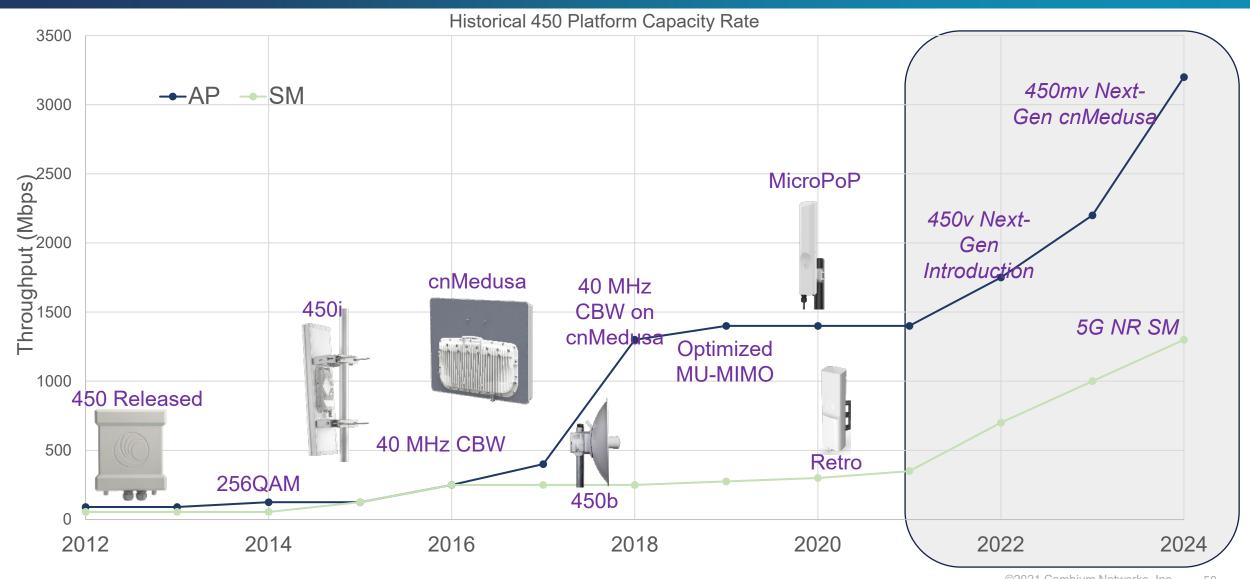
450mv cnMedusa (22x22)

450v2 SM (5G-NR)

5 to 7 GHz support
24x24 MU-MIMO
Supports all 450 hardware
>3 Gbps Capacity
System can migrate to 5G NR
operation
Subscriber Densification
Enhanced Latency

# 450 Platform Performance Steps







# Using 24-30 GHz Band for Fixed Wireless Access



## Most Common 5G NR Bands Worldwide

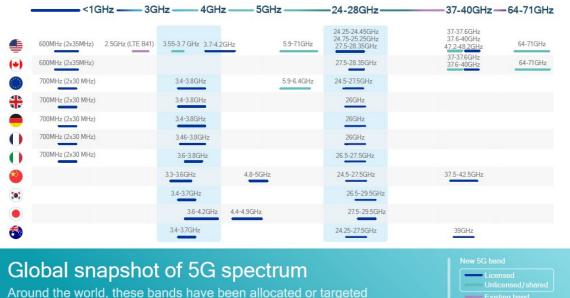
- 24.25–29.50 GHz (TDD)
  - o n257 (26.50 29.50 GHz), 28 GHz, TDD
  - o n258 (24.25 27.50 GHz), 26 GHz, TDD
  - o n261 (27.50 28.35 GHz), 28 GHz US, TDD
- UMFUS Bands in the US (Auctions 101 & 102)

## Commercially

- Wide spectrum enables high-capacity network
- Security of licensed spectrum
- 5G NR has driven investment in cost-optimized, integrated RF front-end modules (chipsets)

## **Technically**

- Propagation allows **5+ km range** even in rain condition
- Medium antenna aperture results in high antenna gain → better range/coverage



nd the world, these bands have been allocated or targeted Existing bar

# Using 5G NR as the Air Interface



## **Future Proof Investment**

- Standard 3GPP 5G air interface
- Cambium SDR architecture enables future enhancements

## 5G NR / 3GPP Release 15

- Designed for mmWave frequency ("FR2")
- More suited to FWA than 4G / LTE

# **Enables Cost-Effective CPE Based on 5G Chipsets**

- Cambium BTS will support Cambium and third-party 5G NR CPEs
- Multiple types of CPEs can co-exist in same sector



# **Key Differentiators**



## **Optimized End-to-End for Fixed Wireless Access**

- Benefits from cnMedusa™ world-class MU-MIMO expertise and field-proven performance
- No Mobility lower cost and complexity solution with laser focus on FWA
- Optimized to exploit good signal quality and provide high throughput

## Simple to deploy and operate

- Cambium 5G NR network infrastructure is a simple as 450 Series!
- BTS can be stand-alone, no SIM card required on CPE
- Mobile operator core network not required!



## Cambium's 5G Fixed Outlook



Myths about Purpose-Built Solutions

Facts about Mobile 5G Systems Micro

# Purpose-Built, yet Standards-Based

- SDR architecture enables future enhancements
- Elimination of complexity to support mobility
- TDD system optimized for range and throughput
- Enables support for low cost 5G chipset CPE when available, including standardsbased CPE that can co-exist

n CPE cost which is a

nnection and mmW to

for next 18/24 months



# **Unified Management Platform**



# cnMaestro provides an integrated, intelligent, easy way to manage your network in the cloud or On Premise



Easy onboarding - Claim devices in the cloud or on-site



**Configure devices –** Automatically provision devices upon registration, or group devices and apply configuration parameters across your network



**Monitor your entire Cambium network –** Leverage hierarchical dashboards, statistics, and maps to view status and drill into problem areas



**Intuitive end-to-end troubleshooting –** Visualize tower-to-edge device health and evaluate real-time client network connectivity



# Day Zero to Day N Holistic Management



## Day **Zero**: Pre-adopt, pre-configure, pre-assign

- Pre-adopt devices one at a time, or in bulk using a CSV file import
- Pre-configure the AP Group and the Site
- Pre-assign devices to the proper Group and Site

## Day One: Deployment Day

- Monitor devices as they come online and on-board with cnMaestro
- Verify correct configuration and operation

# Day N: Any day after that, if ever the need arises...

- Run reports
- Remotely check RF conditions; noise floor, channel utilization
- Remote packet capture, remote network diagnostics



# cnMaestro X: Delivering Operational & NW efficiencies



## cnMaestro Essentials

Comprehensive Network
Management

- Device onboarding and discovery
- Configuration template push
- Firmware upgrade

## cnMaestro X

Comprehensive Network
Management and
Improving Network
Capacity While Delivering
Operational Benefits

- Device onboarding and discovery
- Configuration template push
- Firmware upgrade
- Concurrent jobs
- API and Webhooks
- PMP installation summary (Q4 2021)
- Self-Optimizing NW (Q4 2021)
- Scheduled Spectrum Scan (Q2 2022)

# Extending cnMaesto X to the Ecosystem





- Intelligent exchange of data
- Elimination of data entry errors
- Efficient operations
- Superior outcomes
- Service Provider and Enterprise Ecosystem Partners in flight

# cnHeat Plan with Confidence, Market with Results



#### cnHeat 2.0

- Direct input of site information and kick off prediction
- 3D heat map and covered buildings count provided
- Rerun as frequently as needed
- Plan sites with confidence

## **Best-in-Class mmWave Planning**

ANP <-> LINKPlanner <-> cnHeat 2.0

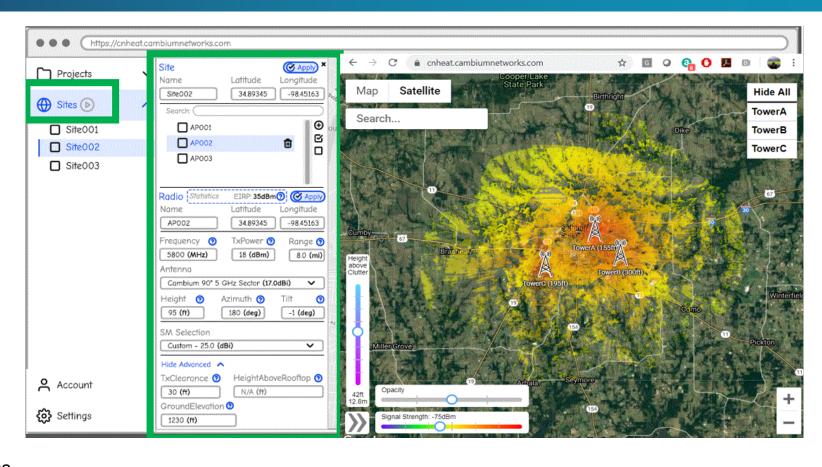
# Free IDENTIFY building locations marketed via Market Broadband.com

# **Subscriber Module Location Heat Maps (Q1 2022)**

Coverage for specific Subscriber Module locations

## Website Marketing (Q1 2022)

- cnHeat heat map embedded in WISP web page
- End User Submission entered after verifying coverage



## Poll Placeholder



- Which marketing services would you most likely utilize if it were available from Cambium?
  - Advise clients on the best package for them based on their actual usage
  - Simplify marketing by integrating your subscriber data into digital marketing tools
  - Easily customize Cambium Networks collateral for your brand
  - Tips and tricks for managing marketing agencies

# cnArcher Accelerating Deployment and Accurate Data Capture



- ✓ Supports PMP 450, ePMP, and cnRanger
- ✓ Upgrade, Configure, Align and Link Test the Subscriber Module
- ✓ Automatically Populate GPS Coordinates on the Subscriber Module
- ✓ Onboard Subscriber Module to cnMaestro

### **Enhancements on the Horizon**

- 60 GHz cnWave support November 2021
- Upload installation summary to cnMaestro X November 2021
- Unified app for Android and iOS with feature parity Q1 2022
- Download workorder from cnMaestro X 2H 2022



## Pursuit of Excellence



- Investing in spectrum and regulatory advocacy
- Supporting access to government funding programs and initiatives
- Complete solution enablement from concept to service delivery to customer delight
- Expanding WISP business opportunities beyond concentration in rural broadband residential access
- Taking advantage of standards to enhance, and proprietary innovation to accelerate and differentiate, superior wireless networking solutions for our customers





A DECADE OF EXCELLENCE

















# 5 GHz PMP Transition Enabling Gb to the Edge













### Goals

- Deliver Gigabit speed by overlaying an existing UBNT 5 GHz network
- Complete coverage of the greater Perth metropolitan area
- Leverage 300 km+ of dark fiber around Perth

### **Solution**

- cnWave 60 GHz distributed network architecture
- PTP 8x0 licensed for backhaul
- Exercising dark fiber throughout the network deployment

#### **Status**

- 40 operational towers and growing
- LoS to 32% of addresses in the Perth metro area
- Deploying one > DN per day and > 130 CNs per month

# 6 GHz ePMP 4000 Preliminary Specifications



#### 6GHz ePMP 4000 headline data rates for UDP

MCS11, 1024 QAM	HE160	HE80	HE40	HE20
AP capacity (4X4)	4083	2042	975	487
SM capacity (2X2)	2042	1021	487	244
MCS13, 4096 QAM	HE160	HE80	HE40	HE20
AP capacity (4X4)	5431	2715	1296	647
SM capacity (2X2)	2715	1357	648	323

### **Hardware Specs**

- Proven ePMP air interface
- Qualcomm 802.11ax family of chipsets
- 4x4 MU-MIMO AP w/ 90° beamforming sector
- 6 GHz band: 5.925 7.125 GHz
- 20 / 40 / 80 / 160 MHz channel bandwidth
- 1024 QAM / 4096 QAM
- Ethernet ports:
  - 1G RJ-45
  - 10G SFP+ for AP and F600C
- PoE IEEE 802.3at 56V
- GPS on AP: built in and external
- Optional external GPS Rx on SM to comply with AFC

### **Performance Specs**

- Concurrent 4x4 MU-MIMO & DL/UL OFDMA
  - Double spectrum efficiency with MU-MIMO
  - OFDMA efficiently uses bandwidth for short transmissions
- Higher efficiency of AX with less overhead
- Three QoS Levels: VoIP, High & Low
- Priority-based air-fairness scheduling with starvation avoidance
- TDD scheduling with GPS Sync
  - 5 & 2.5 ms frame duration
  - Flexible duty cycle (DL/UL) from 75/25 30/70
- TDD Scheduling w/o GPS sync
  - Flexible frame duration
- AFC support based on GPS/GNSS geolocation.
- ACS (Automatic Channel Selection)

# cnMatrix TX2000 Series - Purpose-Built Tower Switches



### **Tower Switches: TX2000 Series**



- 8-port, 16-port, 24-port Models
- PoE & Passive PoE, High Power PoE (90w) Options
- Dual Redundant Field Replaceable Power supplies
- Cambium (GPS) Sync dual sources
- Hardened with extended temperature range: -10°C to 65°C

### **Switch Capabilities**

- Enterprise-grade, non-blocking architecture, comprehensive Layer 2-3 features
- Dual Redundant AC/DC Power Options (400-1000W)
- Comprehensive & Intelligent PoE Modes
  - > 802.3af/at/bt up to 90W
  - > Passive 54V up to 90W
  - > Passive 24V up to 15W
- Full Control and Statistics

Purpose Built

#### **Policy Based Automation**

- Enhanced Security: Automatic device profiling, network segmentation, policy enforcement. Automatic port configuration clean-up on device disconnect
- Extreme Simplicity: Zero-Touch Provisioning, Zero Touch Adds, Moves, Changes eliminates the need to color code ports
- Error-free operations: Reduce time, effort and human errors by eliminating the need for manual configuration

Simplified Operations

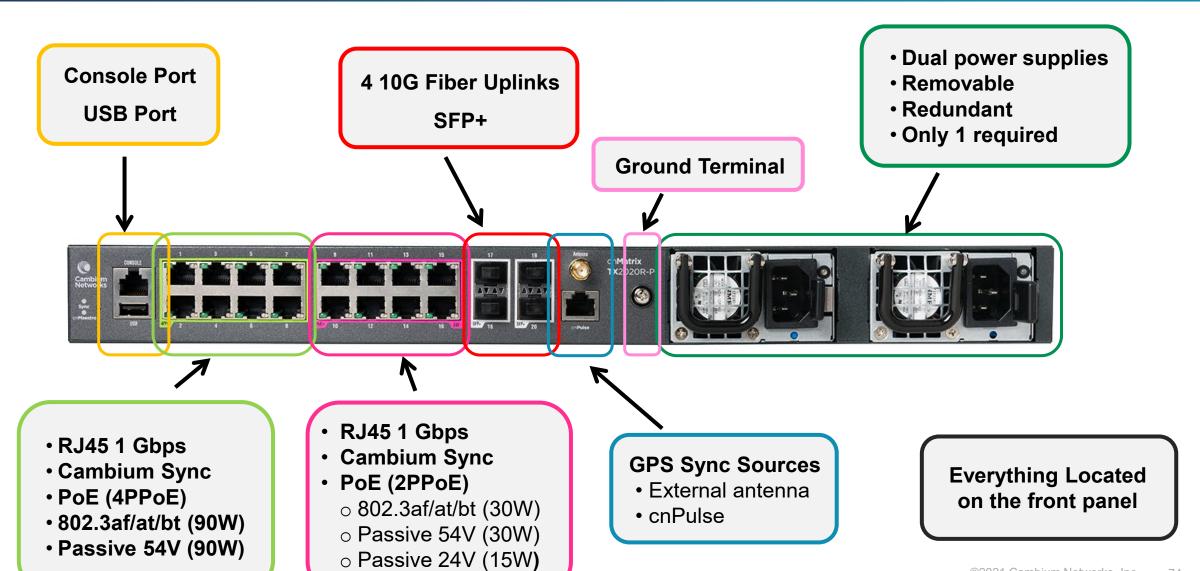
#### **Best in Class TCO**

- Free Cloud, Swift Mobile App Management, Competitive Hardware Pricing
- Intuitive Cloud Dashboard & Automation reduces OPEX

Reduced Cost

## cnMatrix – TX2020R-P – Front Panel Interfaces





# cnMatrix TX Series – Purpose-Built Tower Switches





Coming Dec 2021

TX2	በኃ፬	DE	· D
	UZO		ъг.



Madala	Ports			Dual Power	
Models	1 Gbps RJ45	1 Gbps Fiber SFP	10 Gbps Fiber SFP+	Supplies	
TX2012R-P	8	0	4	No	
TX2020R-P	16	0	4	No	
TX2028RF-P	16	8	4	Yes	

# Highly Scalable Architecture



#### **New UI Architecture**

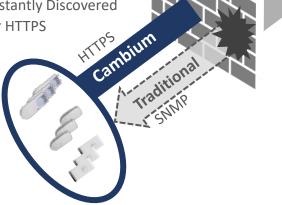
• Support of Various Devices



### **Instant Discovery of APs**

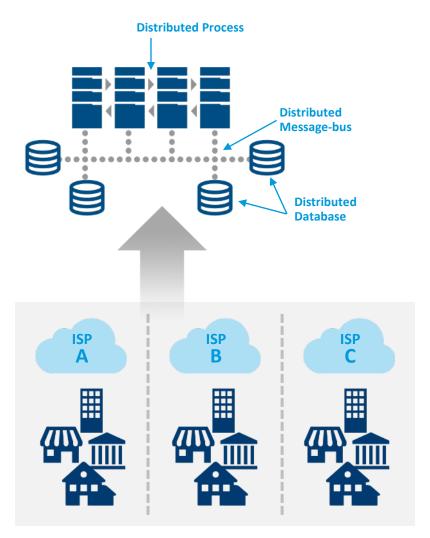
 Traditional SNMP Discovery is Slow and Requires Firewall Configuration

 Cambium Devices Instantly Discovered Communicating over HTTPS



#### **Multi-Tenancy**

- Cambium Cloud Serves Multiple ISPs Securely
- ISPs can Serve Multiple Networks and Customers with Privacy and Security



# cnMaestro: Freemium Cloud or On-Premises Platform

Dashboard view for alarms, key performance metrics

Essentials and X



cnMaestro X

(Subscription)

cnMaestro Essentials

(Included with Hardware)

End-to-End status visualization for Wireless Broadband, Wi-Fi and Switching  Detailed network statistics		✓	
			✓
Regular functional and performance		Scan, Packet Capture	✓
		ized portal management	✓
		figuration and site reports	✓
			✓
•			
enhancements to both			

Payment Gateway	✓
Unique PSKs supported: 1,024	✓
Number of Guest Portals: 500	✓
Max number of login events: 2,000 event records for 1 year	✓
Maximum session limit: 10,000	✓
Number of Management Users: 100	✓
Cambium Care Pro – 24/7 technical support, accelerated access to L2 engineers and software updates/upgrades	✓