

A background image of a Parisian street scene, showing multi-story buildings with balconies and a street view with a crosswalk and a person walking.

The Evolution of Wireless for WISPs

March 2020

David Sumi, VP of Marketing

Siklu

Company Snapshot

Founded: 2008

Employees 85; Headquarter
Israel; Presence in Americas,
CALA, EMEA and APAC



Most Comprehensive

mmWave offering

60 GHz
V-Band
PtP

60 GHz
V-Band
PtMP

70-80GHz
E-Band
PtP

Network
Planning
Tool

> 100,000

Units installed in more
than **45** countries



**mmWave
Disruptors**

- Cutting edge performance & ease of use
- FY 19 Revenue: Rapid growth rate

40

Patents



Over **250**

Smart & Safe City

projects globally

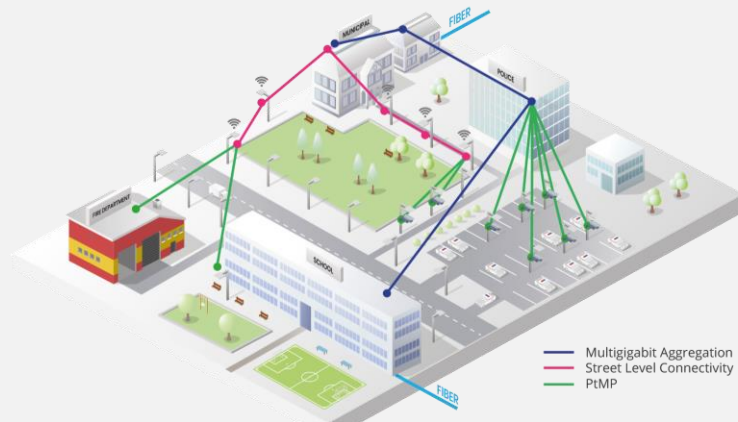
Our Expertise: mmWaves

- Strongest mmWave Team Worldwide
- Network to Chip level expertise
- Ability to innovate and execute



What is a WISP?

- Wikipedia - A **wireless Internet service provider (WISP)** is an [Internet service provider](#) with a network based on [wireless networking](#). Technology may include commonplace [Wi-Fi wireless mesh networking](#), or proprietary equipment designed to operate over open [900 MHz](#), [2.4 GHz](#), 4.9, 5, 24, and 60 GHz bands or licensed frequencies in the [UHF](#) band (including the [MMDS](#) frequency band), [LMDS](#), and other bands from 6GHz to 80GHz
- WISPs have been around since 900 MHz but really came on during the 802.11b and DSSS vs FH
- WISPs are different from operators
 - More nimble
 - More willing to try out new technology
 - Don't own frequency licenses
 - Cost conscious
 - Most grow the networks organically
- WISP equipment volume relatively low – no custom chips



The Need for Chips

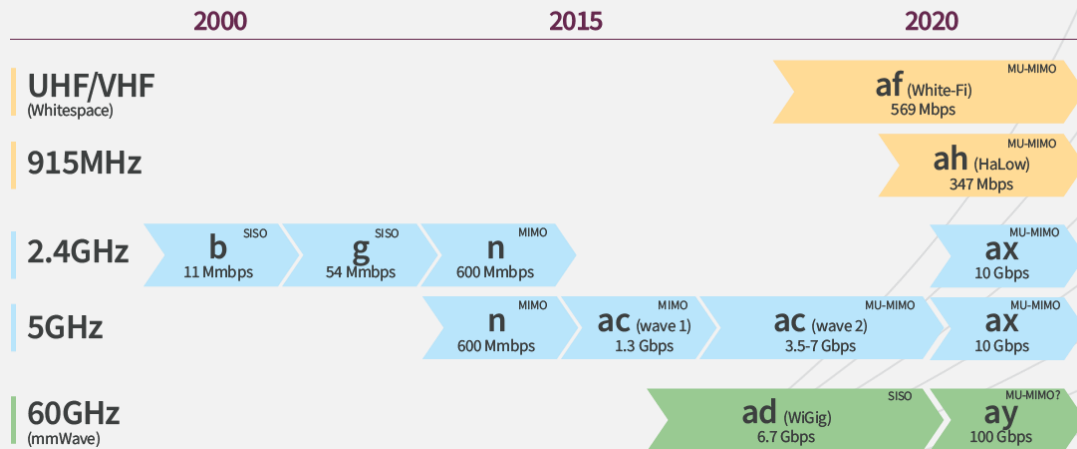
- Nobody makes a chip for the WISP market
- Market relies on chips that were designed for a different application
 - Vendors make varying degrees of customization
 - Some do nothing but re-package
 - Some change out the whole MAC
 - Some play fancy RF games in the front end or antenna
- Historically the choices have been between a WiFi based solution or a mobile carrier based solution



WiFi – WiFi Alliance

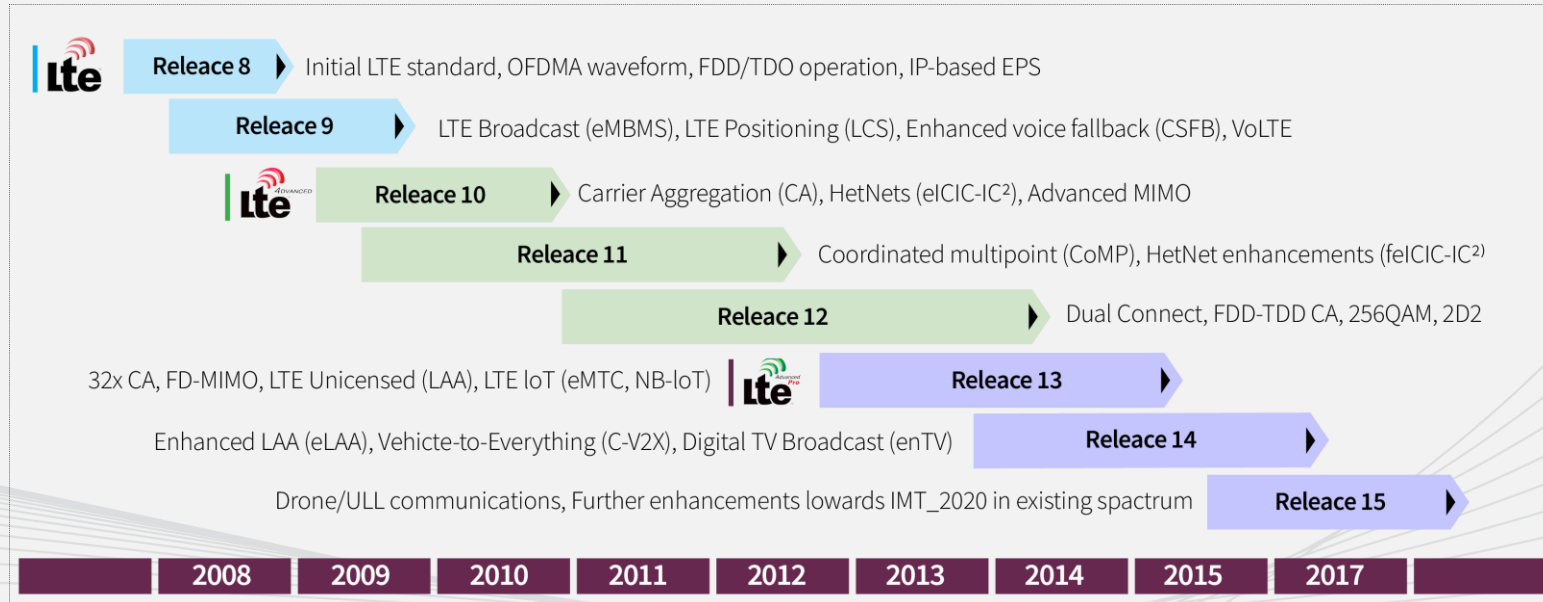
- In the beginning there was 1Mbps Wi-Fi. Then:
 - 3Mbps
 - 11Mbps
 - 54Mbps
 - 300Mbps
 - 800Mbps
 - 1.7Gbps
- For the past 10 years almost exclusively **5GHz based**

WiFi Mix

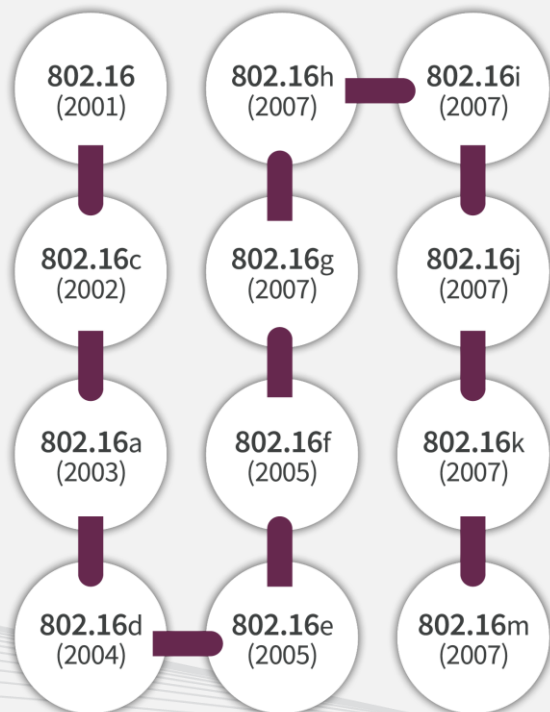


Mobile – 3GPP

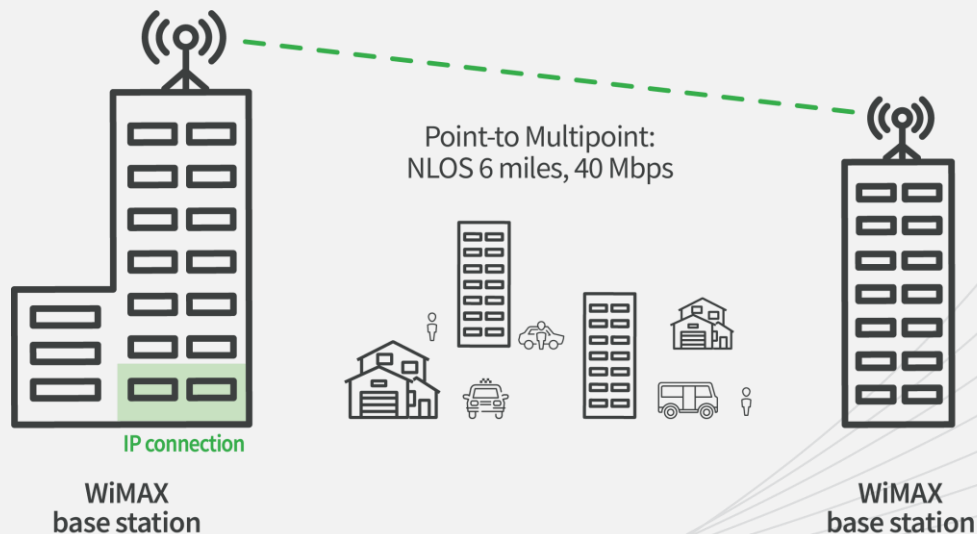
- 3GPP a GSMA Industry Standard Organization
 - Main applications have always been mobility
 - Targets carriers and others who hold licenses
 - **Until last year all-sub 3GHz**
- Mobile Technologies began with 100Kbps in 3G CDMA2000. Next up:
 - WCDMA 3G at 1Mbps
 - HSPA/+ to 200Mbps
 - LTE – 300Mbps
 - LTE Advanced -1Gbps



WiMAX – Fixed to Mobile to ...



Point-to Point:
LOS30 miles, 72 Mbps

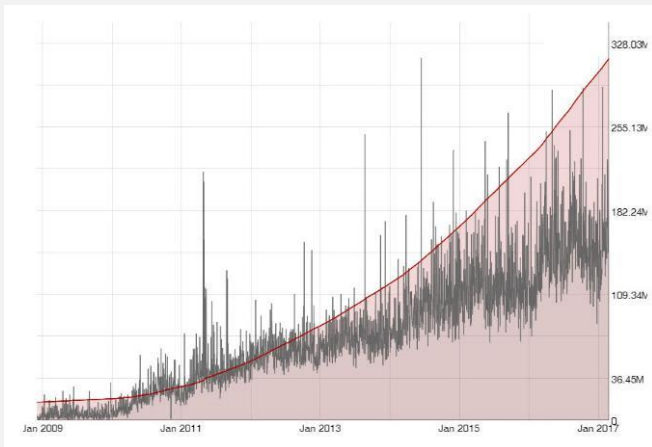


Now Is The Time for mmWave

WiFi interference is growing fast

X2 Every 2 years!

600 million



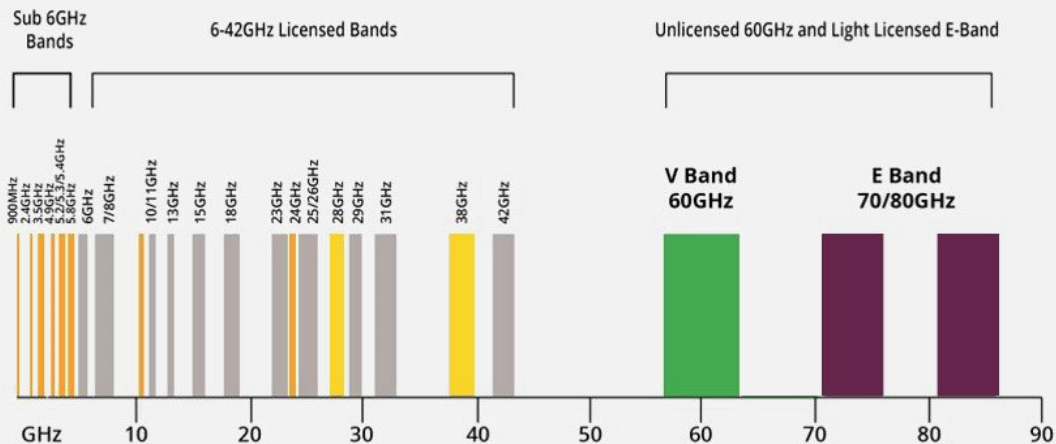
* www.wigle.net/stats

- Years of deployment in 5GHz – noise increasingly an issue
- Market and applications demanding Gbps performance
- Gbps requires massive amounts of spectrum
 - ✓ Multiple GHz required
 - ✓ 5GHz not enough
 - 300 to 600Mbps requires 80MHz to 160MHz of clean contiguous spectrum
 - ✓ WiFi 6 not enough
- mmWave offers close to **30GHz** of spectrum total
 - ✓ 14GHz of this is unlicensed
- 10GHz of spectrum available for PTP

Fixed 5G mmWave Options



5G mmWave Options



- ✓ WiFi Based Chips – 60GHz
- ✓ 3GPP Based Chips
 - 28GHz
 - 38GHz
 - 40GHz
 - Next?

WiFi Today - 802.11ad

	802.11n	802.11ac	802.11ad
Throughput	600Mbps	3.2Gbps	2.16Gbps/sector
Frequency	2.4/5GHz	5GHz	60GHz
Channel Sizes	40MHz	160MHz	2GHz
Antennas	4x4 MIMO	8x8 MIMO	Beam Steering

- Standard first published in 2012
- Targeting indoor video
- Range at 30 to 40 feet

WiFi Today - 802.11ay

- Standard completed in 2019
- Considered an extension/enhancement of 11ad
- Fundamental changes in the PHY
 - PHY changes result in Massive increase in capacity
 - Channel increased to 8.6 GHz w/ Channel Bonding
 - 256QAM
 - 4x4 MUI MIMO
 - Up to 40Gbps today, 100Gbps future
- Range ~1000 feet
- Outdoor operation a focus
- PMP Topology

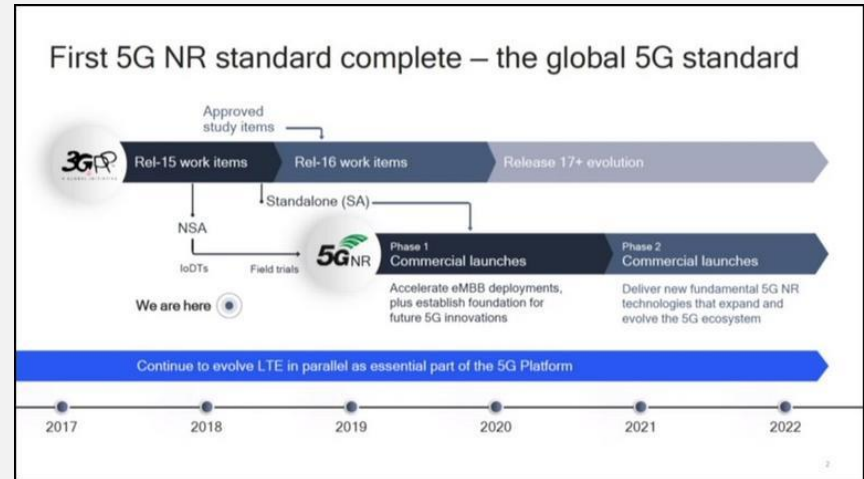


The Telecom Infrastructure Project (TIP)

- Facebook and industry leaders such as Siklu have joined to promote a new standard under the TIP umbrella - **Terragraph (TG)**
- Terragraph is a Layer 2/3 wireless mesh protocol for 60GHz networks
- Based on 11ay
- Terragraph has two primary applications
 - Gigabit Wireless Access for homes and business
 - Smart Cities
- TG represents Siklu's **Third Generation multipoint** 60GHz product
 - N366 - TG compliant Base Station
 - cTU - Industry's smallest subscriber unit



- 3GPP Release 15 = 5G New Radio
 - Larger channels → 400MHz vs 20
 - Support for mmWave at 28, 38, 40GHz to date
 - mmWave versions are TDD
 - CP OFDM upstream reduces latency
- Only supports licensed bands



The Flavors of 5G –

Fixed (GWA) and Mobile (5G NR) Summary

5G



High Speed - Gbps

Low Latency -msecs

IoT support



mmWave

Frequencies 28GHz
60,70/80GHz

Applications
Mobility, GWA

Licensed or Open

5G is here today and available to everyone – 60, 70/80GHz

GWA - Mobile Operators have no incentive, and \$\$ dis-incentives to use licensed bands for fixed applications

- \$1.8/GB vs \$0.05/GB revenue generation

Smart Cities - have a choice for their 5G networks – fixed or mobile

- Massive price premium for using 5G NR mobile networks in fixed applications

60GHz Solutions Compared

60GHz Standards

```
graph TD; A[60GHz Standards] --> B[11ad]; A --> C[11ay]; A --> D[TG];
```

11ad

- Channel Size: 2.16GHz
- MIMO: N/A
- Max Rate: 7 to 8Gbps
- Max Modulation: 64QAM
- Range: 10m*
- Topology: PMP

11ay

- Channel Size: 8.64GHz
- MIMO: 4x4
- Max Rate: 40 to 100Gbps
- Max Modulation: 256QAM
- Range: 300-500m
- Topology: PMP

TG

- Channel Size: 8.64GHz
- MIMO: 4x4
- Max Rate: 40 to 100Gbps
- Max Modulation: 256QAM
- Range: 300-500m
- **Topology: MESH**

Products & Solutions



THE MOST COMPREHENSIVE

mmWave OFFERING (Backhaul & Edge)



Roof Top High-Capacity "Backhaul" 70/80GHz Point-to-Point

- 1Gbps to 10Gbps capacity
- ≤ 3 km Range
- Rooftop or pole mounted



Street-level "Edge" 60GHz Point-to-Point

- Dual PoE-Out
- 100Mbps to 1Gbps aggregated
- ≤ 1km Range



Street-level "Edge" 60GHz Point-to-Multi-Point

- Auto alignment plus & play
- Up to 1.8 Gbps capacity
- ≤ 300m Range (90 deg. angle)
- 1 BU: up to 8 TU's

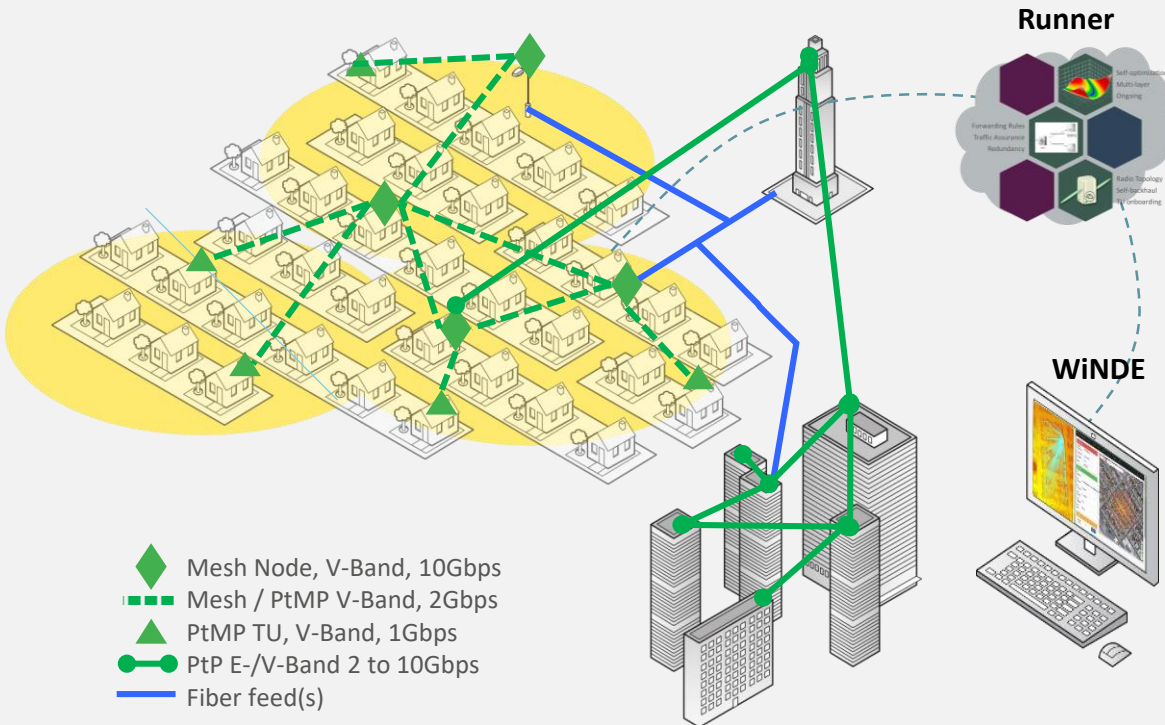
Siklu TG Compliant Products

- N366 – Mesh Node
- cTU-TG – Client Device
- Capacity
 - Per sector: +3.5Gbps L2
 - Per node: 10 Gbps
- Channels
 - 4 channels, CBW 2.1GHz,
- Interfaces
 - 10GbE SFP+ or 1/2.5/5/10GbE copper(802.3bz/an)
 - 1GbE (copper)
- SmartHaul™ WiNDE & Runner



Siklu Vision for the Access Network

- **Complete Neighborhoods**
 - SFU, MDU, SMB, IOT
- **Self-organizing (SON)**
 - Self-install, self-healing
 - Simple implementation
- **Fast, Flexible, Pay-as-you-grow**
 - Redundancy
 - Backhaul
 - Access
- **Siklu “How To” Cookbook**
 - Topologies
 - Methodologies
 - Products (HW & SW)



The image is a split-screen graphic. The left half features a light blue background with a faint, low-contrast city skyline and a network of white lines connecting dots. The right half shows a more vibrant, high-contrast city skyline with a similar network overlay. The text 'SmartHaul™' is centered on the left side, with 'SaaS' below it. A solid green horizontal line is positioned under the 'SaaS' text.


SmartHaul™

SaaS

SmartHaul™

Link Budget Calculator

- Calculates availability & throughput at different link distances & locations
- Provides RSSI (Receive Signal Strength Indicator)



Hi alex.d@siklu.com

Home Report Activity Help Logout

Settings

Product: EtherHaul-600T/TX

Channel Width: 500 [MHz]

Center Frequency: 57.375 [GHz]

Antennas:
 A: ETSI/FCC [0.5/16cm] 36dBi
 B: ETSI/FCC [0.5/16cm] 36dBi

Antenna Polarization: Vertical

Oxygen Absorption: 11.1 [dB Km]

Tx Power: 5 [dBm]

User Spare: 2 [dB]

Capacity Ratio: Aggregated

Link Length: meters
500

Length Range: ☐

Product Range: ☐

Location


Rain Zone: E

Rain Intensity: 0 [mm/hr]

City: USA-Calif., Los Angeles

Coordinates:
 Latitude: A:34.05 B:34.05
 Longitude: -118.25 -118.25
☐ Same as antenna A

Map: Satellite



Google Map Data 100 km Terms of Use

Expected RSSI [dBm]	-53					
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Availability	99%	99.9%	99.95%	99.99%	99.995%	99.999%
Annual Downtime of Modulation Profile	3d 15h 36m	8h 46m	4h 23m	52m 33.6s	26m 16.8s	5m 15.36s
Rain Rate[mm/hr]	0.73	5.74	9.06	24.95	36.13	68.25
Rain Attenuation[dB]	0.31	1.48	2.09	4.49	5.94	9.62
Capacity [Mbps]	1000	1000	1000	1000	1000	700

Profile	Capacity [Mbps]	Availability	Rain Rate [mm/hr]	Annual Downtime of Modulation Profile	Fade Margin [dB]
QPSK1	20	100.000000%	345.07	0s	29
QPSK2	85	99.999999%	225.87	0.34s	23
QPSK3	350	99.999977%	153.87	7.28s	17
QAM16	700	99.999756%	99.52	1m 16.92s	12
QAM64	1000	99.997955%	51.72	11m 35.5s	7

Throughput (Mbps)							
Length (m)	Availability	99%	99.9%	99.95%	99.99%	99.995%	99.999%
500		1000	1000	1000	1000	1000	700

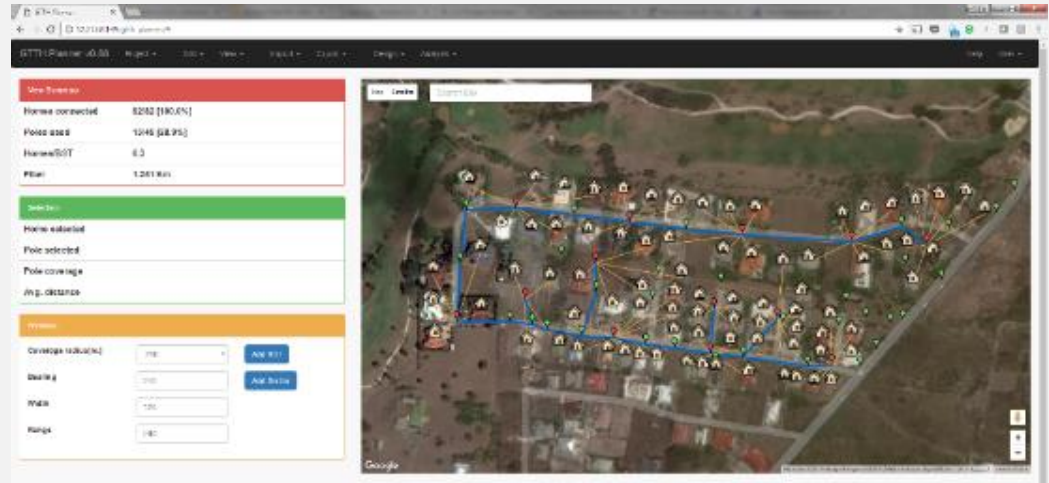
SmartHaul™ EMS

Management Engine

- Unified management umbrella
- Reduce OPEX
- Complete lifecycle management
- Maximize network performance
- Faster time-to-resolution of problems
- Scalable – from small size to large scale telco network
- Multiple Deployment scenarios – cloud, on-premises

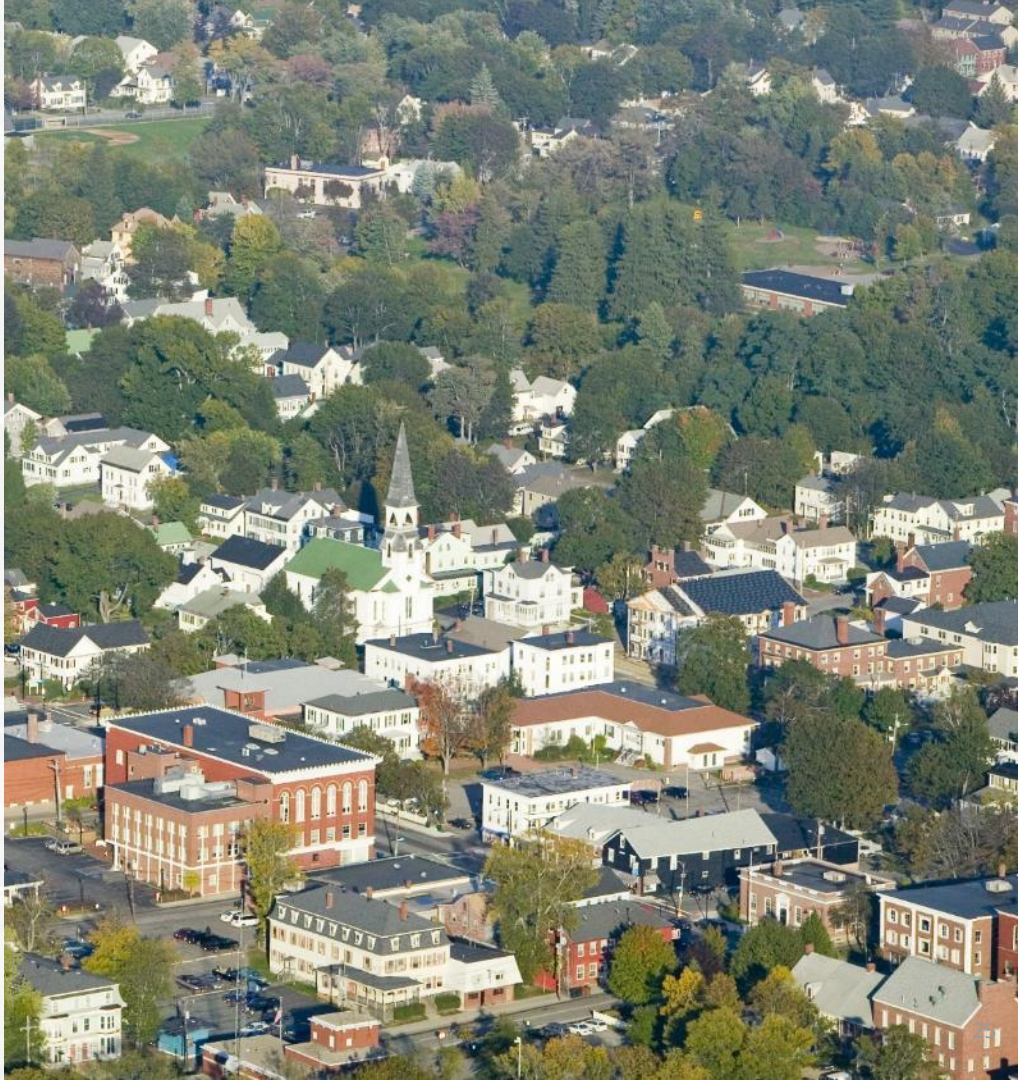


- Supports all GTTX scenarios
- Topology automation
- Deployment automation
- Business case analysis



SUMMARY

- Next Generation Technology for the WISP is mmWave
- WiFi offers the best chip solution for the WISP market
 - 14GHz of unlicensed spectrum
- 11ay and TG solutions hitting the market this year
 - Star topology
 - Mesh topology
- 11ay and TG designed for outdoor use
- Virtually zero interference now and the future
- Siklu has the widest mmWave product portfolio



**THANK
YOU**



What is 5G?

5G is the Next Generation wireless technology



High Speed –
Gigabits per second



Low Latency –
from tens of ms with
LTE to single digit
latencies with 5G



IoT -
connecting massive
numbers of “things”
or machines/devices
to the network

The Flavors of 5G –

Fixed (Gigabit Wireless Access) and Mobile (5G New Radio)

GWA

bands - V and E

- “V band” – Unlicensed 60GHz point to multipoint or ptp
- “E Band” – Lightly Licensed 70/80GHz ptp only

Both bands are “Open to all”

5G NR

bands -28/38GHz - requires a license \$\$

- 28 and 39GHz bands –licensed only, allocated for mobile networks
- Acquisition via auction and costing \$B

Dominated by nationwide mobile operators

Frequencies, Applications and Users Summary

Frequencies	Primary Use Case	Open/Licensed	Who
28, 39GHz	Mobility	Licensed only	Mobile Carriers
60, 70/80GHz	Fixed Gigabit Wireless Access (GWA)	Open	All

5G NR and 5G Fixed vs GWA

GWA best served by 5G Fixed Wireless → 60,70/80GHz networks

5G NR can be used for GWA, but why?

- Fixed Service Providers charge on average \$0.05/gigabyte
- Mobile operators charge on average \$1.80/gigabyte

A premium of 37x top line revenue over fixed tariffs

And... Add to this the cost of license that has to be paid back – **no incentive for mobile operators to put fixed application on their very expensive and lucrative 5G NR networks.**

<https://www.fiercewireless.com/wireless/industry-voices-mun-mobile-pricing-drops-from-9-gb-to-1-80-gb-just-1-year>



Connectivity Options

FIBER

- + Secure
- + Multi Gigabit capacity
- Expensive
- + Very Low Latency
- + Reliable
- Slow time to market

LEGACY (5.xGHz) WIRELESS

- Easily hacked
- Limited capacity
- + Low cost
- High Latency
- Interference
- + Fast Time to market

Mobile 5G

- + Secure
- + Multi Gigabit Capacity
- High cost – Monthly Fees
- + Low latency
- + No Interference
- Time to Market - carriers

mmWave WIRELESS FIBER

- + Secure
- + Multi gigabit capacity
- + Affordable
- + Very low latency
- + Reliable, Immune to interference
- + Fast Time To Market

Siklu Technology and Leadership - 40 Patents

Custom Components



RFIC Design

Delivers extended range

Beam Steering Antenna

Small size, high gain and directivity

Systems and Boards



Siklu High Performance / Cost Effective

Modern

Channel agility, low power and low cost

Antenna Design and Mnf

Reduces antennas csot by 50%