



Enabling 5G

Using self-organizing mmWave to deliver
5G services

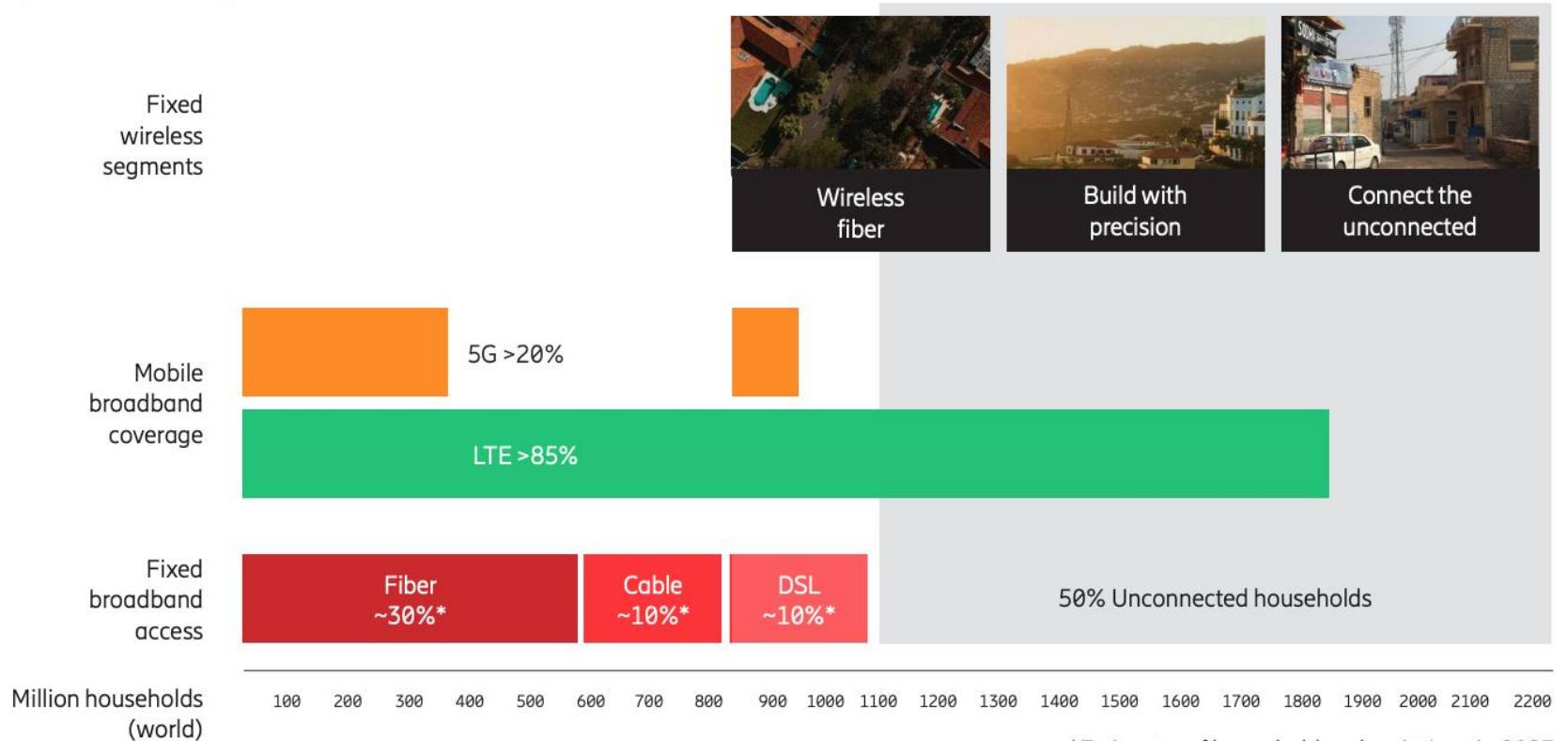
Andy Richardson Broadnet-Telecom
Jonathan Brady CCS



Company Introduction

- Founded in 2010 using experience from previous FWA companies
- Specialist in self-organising mesh mmWave networks
 - Pioneered 24/26/28GHz self-organising MPtMP and now 60GHz
- Contract manufacturing by Jabil Malaysia
- Global deployments with Tier 1 MNO's
- Based in Cambridge, UK

Fixed Wireless Access (FWA) addressing an underserved broadband market

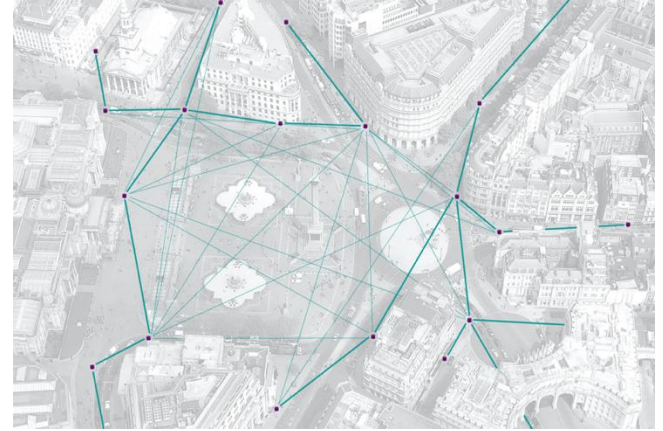


Metnet's USP

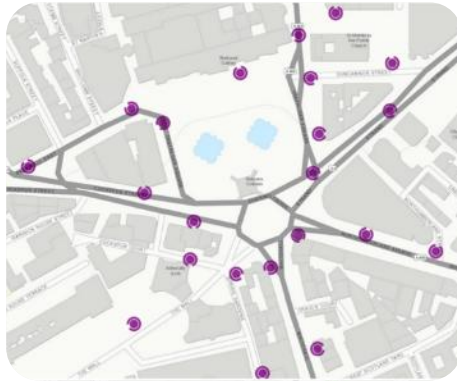
- **Metnet** with intelligent SON delivers advanced proprietary interference avoidance to manage coordination and co-existence with other radio systems.
- **Metnet** nodes **connect autonomously** to form flexible multipoint-to-multipoint (mesh) **self-organising, self-healing networks** that **dynamically reconfigure to optimise performance** and spectral efficiency as the physical environment or traffic levels change.

Metnet self-organising network

- Flexible Multipoint-to-multipoint mesh
- Self-configuring, self-optimising, self-healing
- Intelligent interference management
- High capacity per node
- Carrier class QoS
- Low latency
- Carrier grade synchronisation
- No RF planning or antenna alignment
- Simple one unit installation



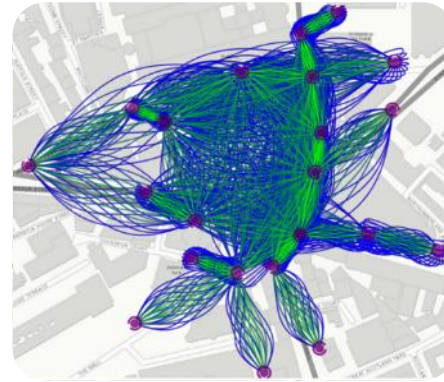
Metnet: Self-organisation sequence



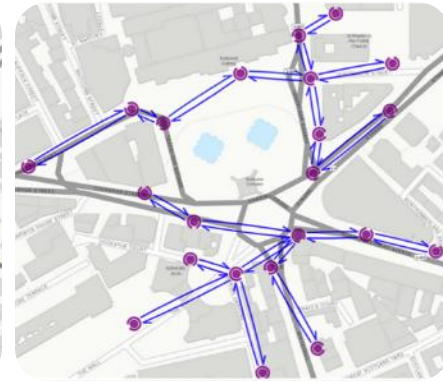
22 nodes



**99 possible
LOS links**



**1584 possible
antenna combinations**



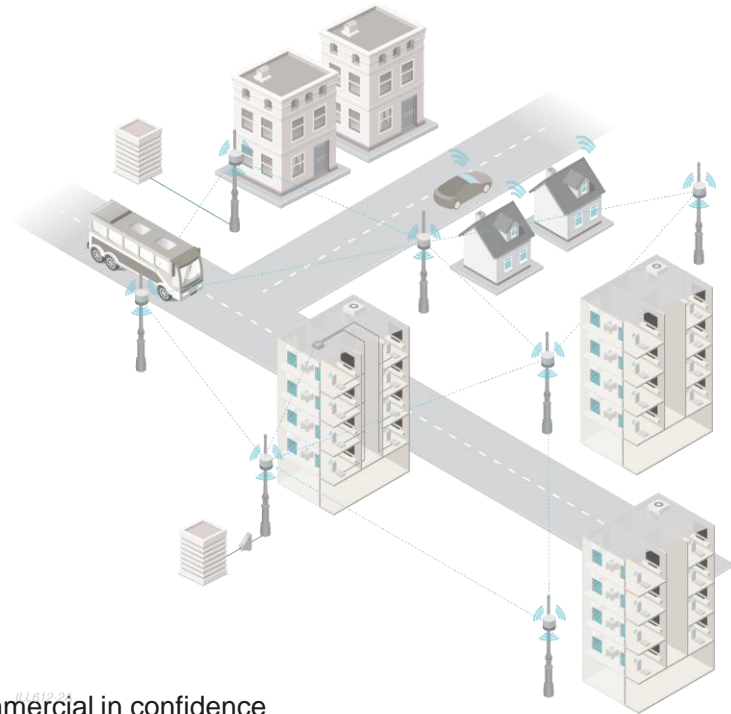
20 active traffic links
Space, time, and
frequency diversity

The Applications Metnet enables



CCS designs, manufactures and deploys mesh radio networks

Metnet radio and management system deliver unbeatable performance to address the challenges of deploying mmWave radio networks for backhaul or FWA

- FWA (Fixed Wireless Access)
- MDU's and residential access
- G.Fast/DLSAM backhaul
- Enterprise access
- Small-cell backhaul
- Public WiFi backhaul
- CCTV/Smart City



CCS Metnet products and use cases

Product	Use cases	Range	Capacity
Metnet 1200 24/26/28 GHz <u>Licensed</u> Mesh + dish 	Small-cell backhaul G.Fast/DLSAM backhaul WiFi/CCTV backhaul Enterprise FWA	< 500m mesh Up to 5km dish links	1.2Gbps shared per node
Metnet 60G 57-71 GHz <u>Unlicensed</u> Mesh + CPE 	Small-cell backhaul G.Fast/DSLAM backhaul WiFi/CCTV backhaul Enterprise FWA Residential FWA	< 500m mesh < 500m CPE	12Gbps per node shared (4 x 3Gbps per sector) 1Gbps per CPE

Telefonica London: Wifi and Small-cell backhaul

Pre 5G neutral host
backhaul network in
London's Square Mile

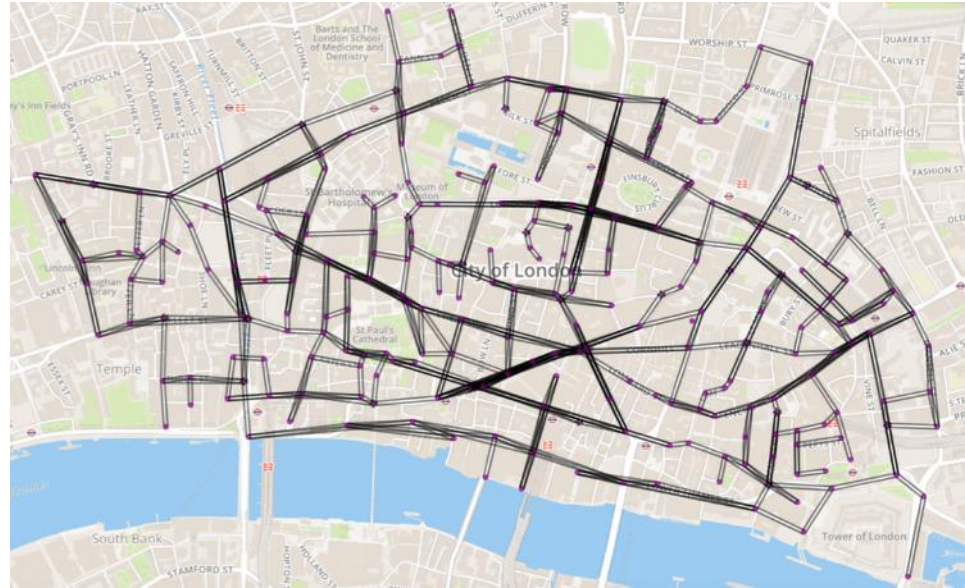


Telefonica London: Wifi and Small-cell backhaul



5G/LTE Small-cell and WiFi backhaul

- Phase I – 156 CCS nodes
- 32 fiber points 5:1 ratio
- WiFi and Small-cells
- Phase II – 350 CCS nodes
- 500Mbps peak DL/UL
- 100Mbps committed DL/UL
- Single unit per location
- Single 28GHz channel
 - 224MHz dynamic TDD



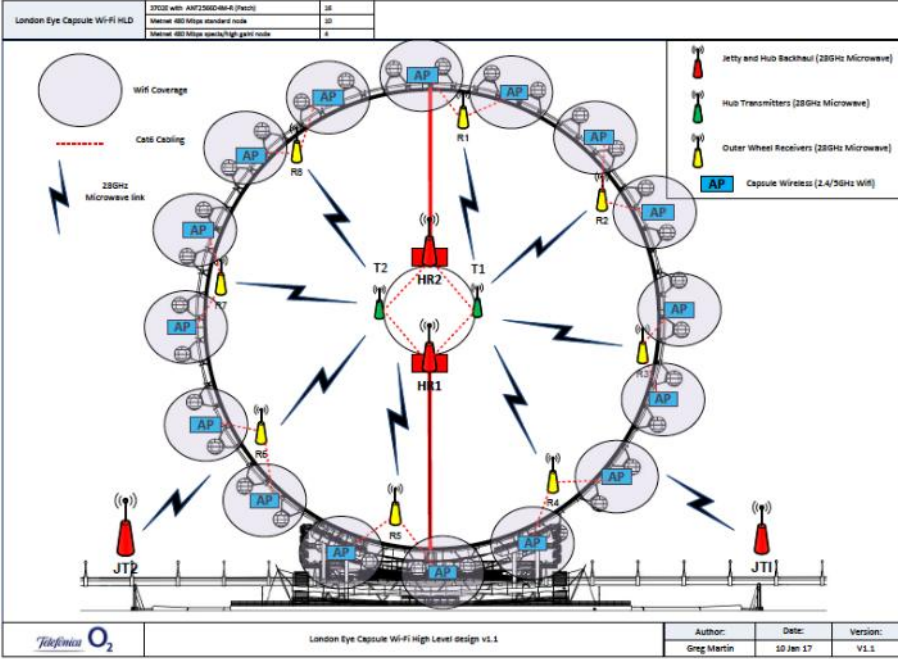
Live deployment in London

High capacity backhaul in challenging conditions

CCS delivers
backhaul for Coca-
Cola London Eye's
new WiFi service



London Eye O2 WiFi Backhaul



Next generation pre 5G FWA for rural connectivity



- PTMP/MPTMP FWA use case
- 2 x 1.2Gbps Standard nodes at BTS sites
- Automatic self-backhaul
- 600Mbps peak per customer
- Up to 5km range
- 30 customers per BTS node
- CPE optimised for FWA – PoE and GE
- Single 28GHz dynamic TDD channel

5G FWA – Integrated access and self-backhaul

- PTMP/MPTMP FWA use case
- 2 x 1.2Gbps Standard nodes at BTS sites. 4 nodes = 4.8Gbps
- Automatic self-backhaul
- 1Gbps peak per customer
- Up to 5km range
- 30 customers per BTS node
- FWA CPE – PoE and GE
- Single 28GHz channel
 - 224MHz dynamic TDD



Example network design in rural Italy

Gigabit FWA – Rural Wales



F1 Singapore



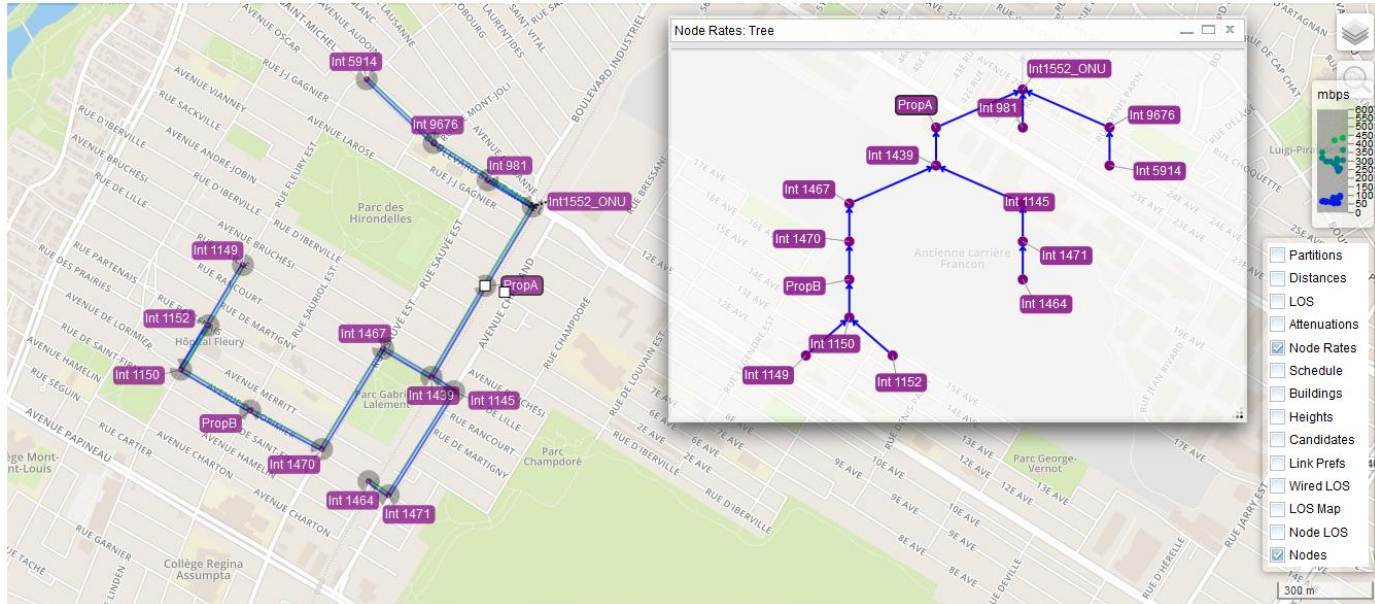
Bath 5G ST 60GHz deployment and testing



CCS Metnet 60G vs FB Terragraph HW



City of Montreal

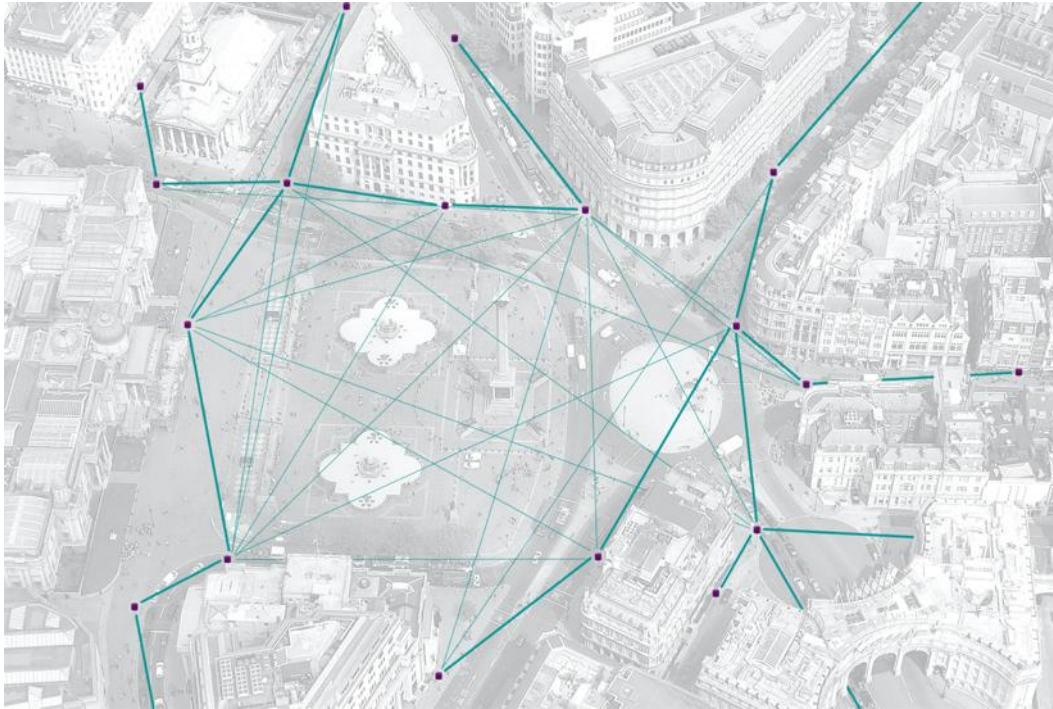


Why CCS Metnet?

- Industry leading 12Gbps capacity with SON interference management
- Enables both backhaul and access for hybrid deployments using mesh and low cost CPE radios
- SON guarantees end-to-end capacity, low latency and quality of service for carrier class
- Small form factor, single unit, easy to deploy
- No RF planning, no ongoing optimisation
- Mesh enables flexible connectivity and higher network resilience
- Faster to plan, deploy and get revenue compared to fixed wireline infrastructure



Metnet Self-organising 60GHz mesh



Any topology

- MPTMP mesh, PTMP, PTP

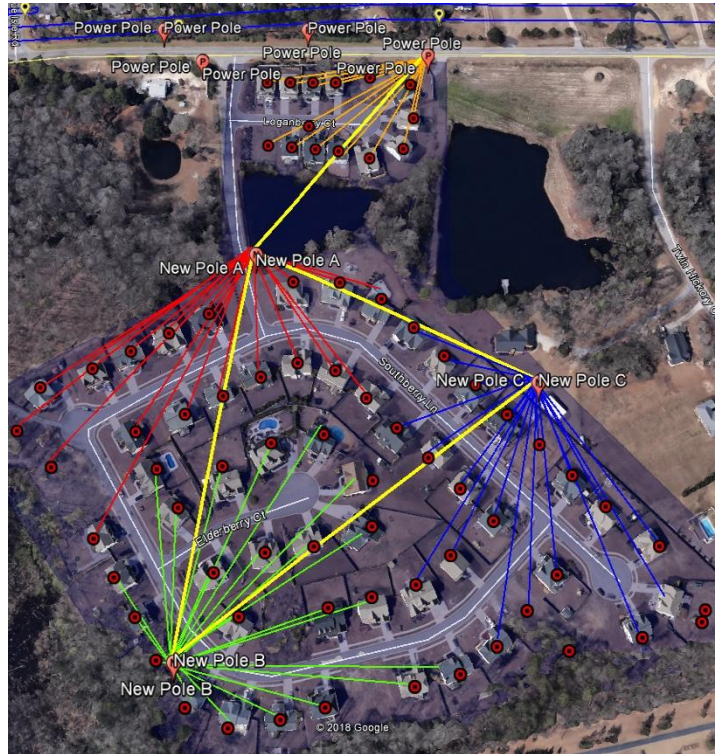
Automated

- Self-organising
- Self-optimising
- Self-healing
- No RF planning
- No antenna alignment
- Quick deployment

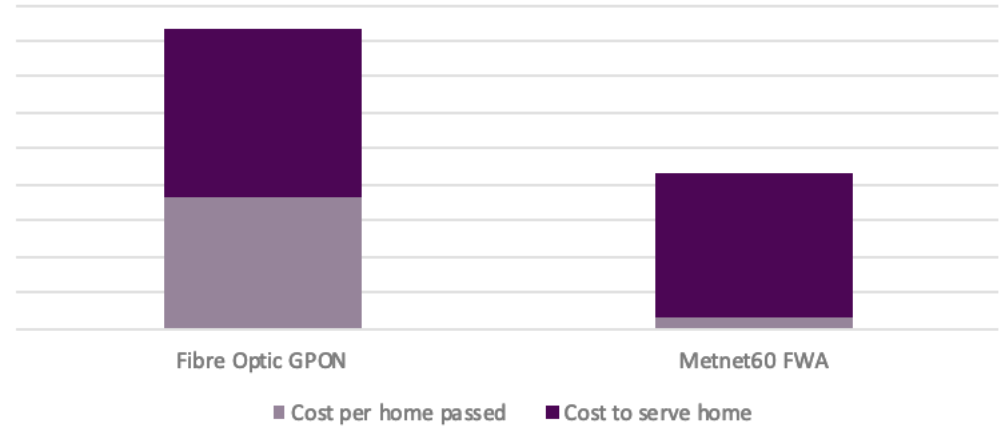
Distributed Ethernet network

SDN Mesh

mmWave FWA vs Fibre Optic Broadband



Fibre GPON vs Metnet60 FWA



- 48% cheaper than Fibre GPON deployment
- \$4M saving in a 10K suburban community
- Faster time to revenue

15 minute installation

- One person
- No antenna alignment
- Easy for non-specialists
- Automatic commissioning

[Metnet node installation video](#)



Metnet 60G – Unlicensed 12Gbps

- 12 Gbps per node with low latency and high QoS
- Dynamic use of 57 GHz to 71 GHz (14GHz bandwidth)
- Advanced distributed SON coordinated mesh
- Zero frequency planning, interference avoidance
- Software defined networking architecture (SDN)
- 300°Horiz, 20°Vert phased array sectors
- Range approx. 300m at full rate
- 2 x 1Gbps + 2 x 10Gbps optical Ethernet interfaces
- AC, DC, PoE
- 1Gbps CPE version up to 500m range



CCS 60GHz Technology partners

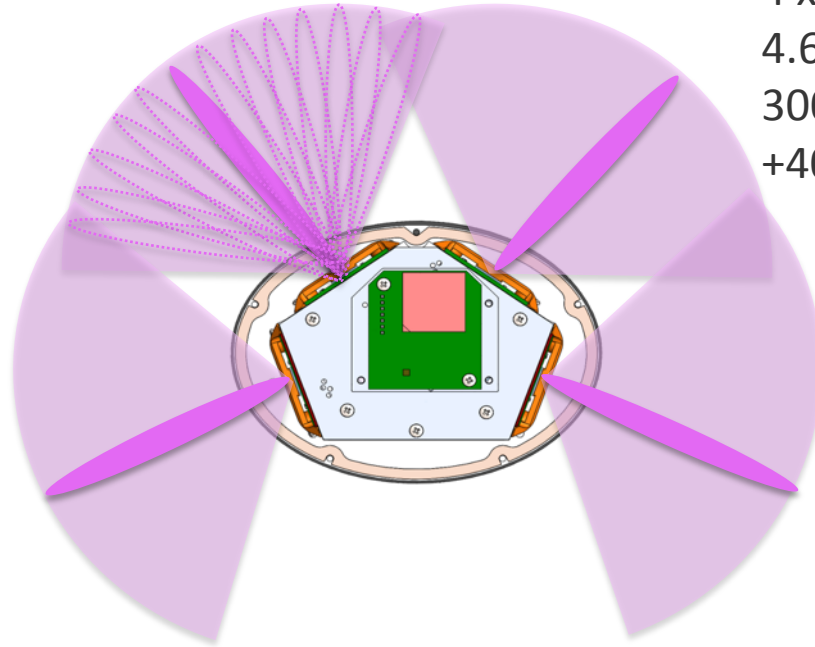
- SiversIMA
 - TRX BF01 Beamforming RFIC
 - +40dBm EIRP
 - 6 channels 57-71GHz
 - +21 dBi antenna gain
 - +19 dBm Tx power
 - +/- 45° azimuth, +/- 10° vertical
- Blu Wireless and IDT
 - Hydra 1.0 - 802.11ad baseband IP
 - IDT RWM 6050 SoC

SIVERSIMA



Multi sector Beamforming Phased array

4 x 90 degree sectors
4.6 Gbps per sector @ MCS12
300 degree horizontal view
+40dBm EIRP



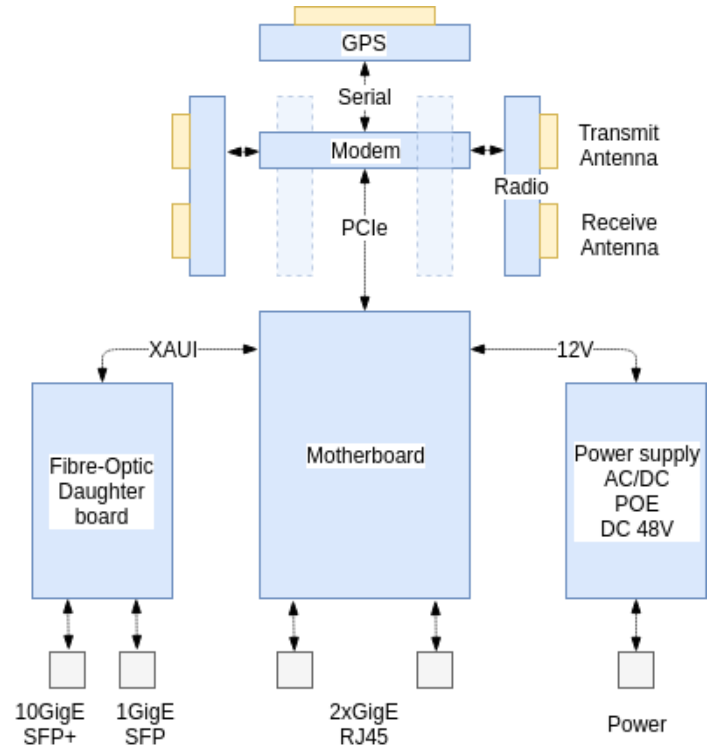
Metnet 60GHz CPE v1

- Enterprise/Residential CPE
- 1 x 1Gbps Ethernet with PoE
- Wall or Pole Mount options
- Up to 500m range
- Single phased array
- Up to 32 CPE per Mesh Node
- Dims = 245mm x 120mm x 65mm
- Weight = 1.5kg approx

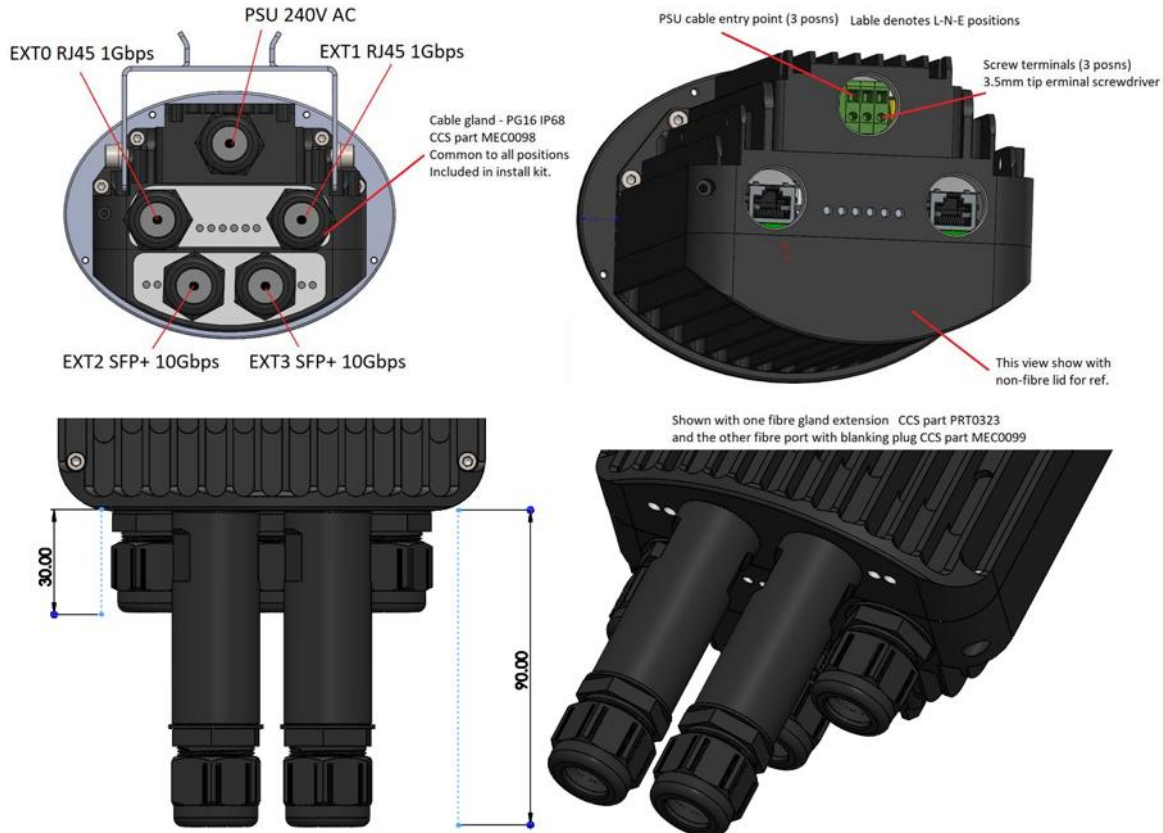


60GHz Mesh Node

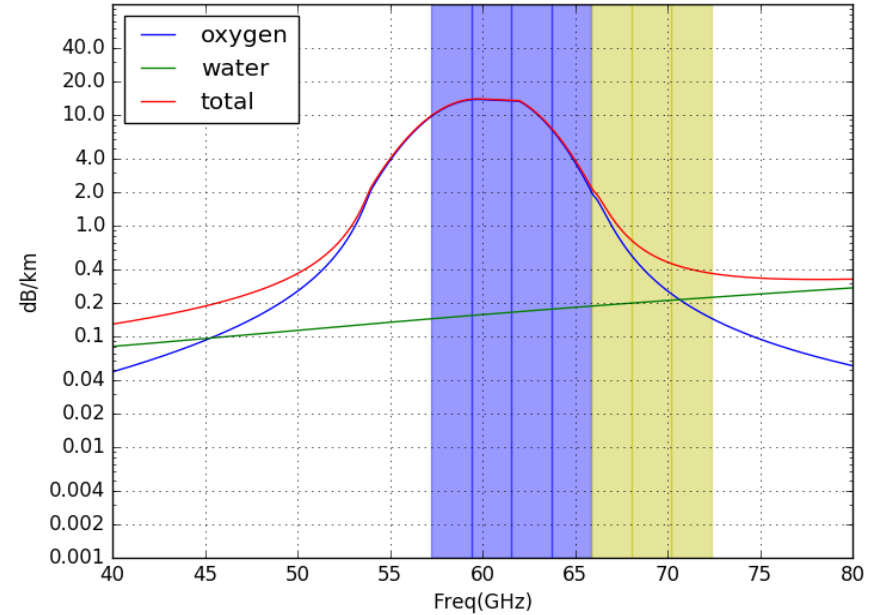
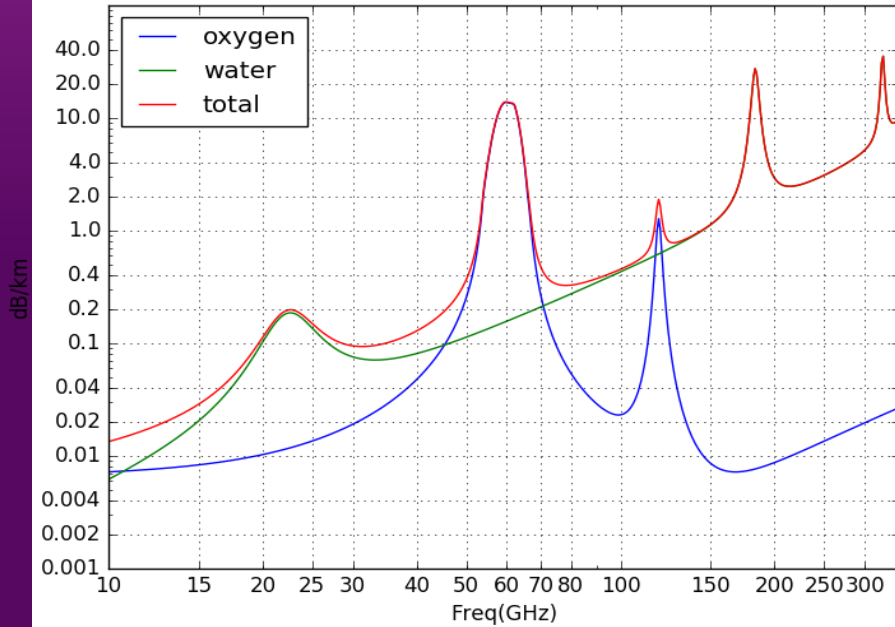
269 x 150 x 114 mm 3.3 kg



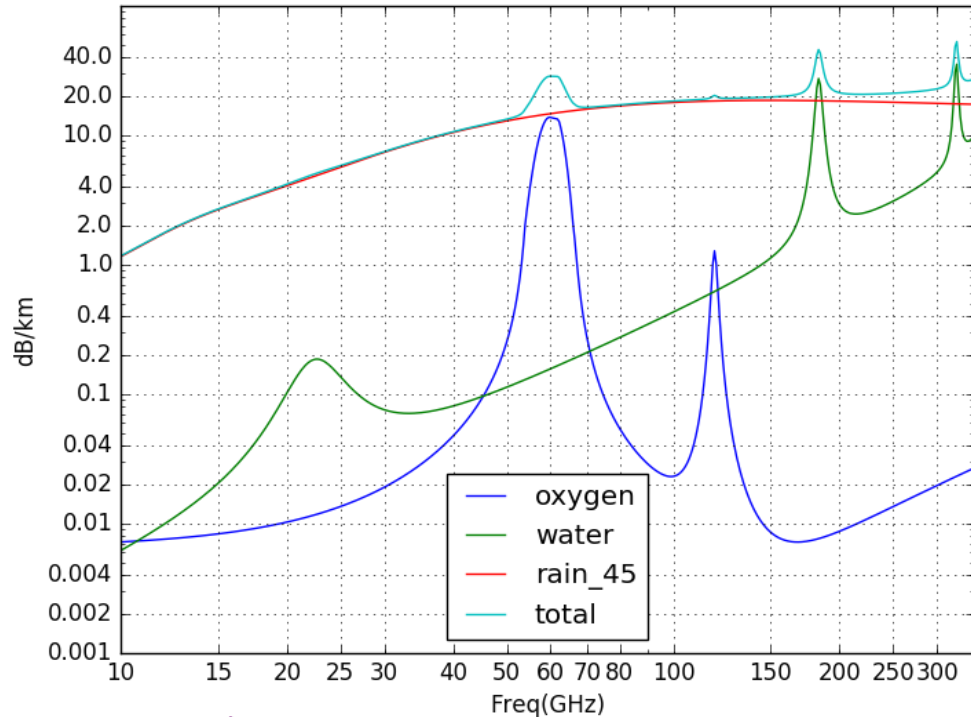
60GHz Mesh nodes ports



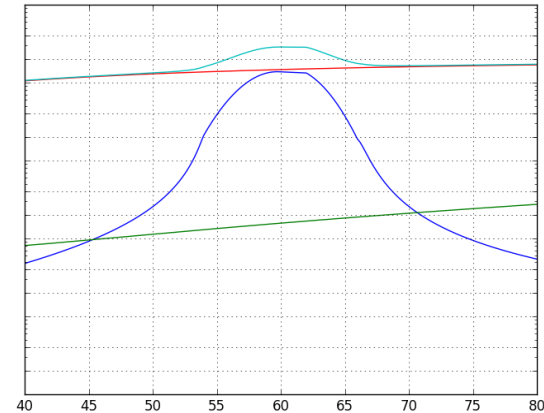
Oxygen Absorption vs Frequency at 60GHz



Rain fade over frequency



- Total fade incl rain at 45 mm/hr



WiGig channels

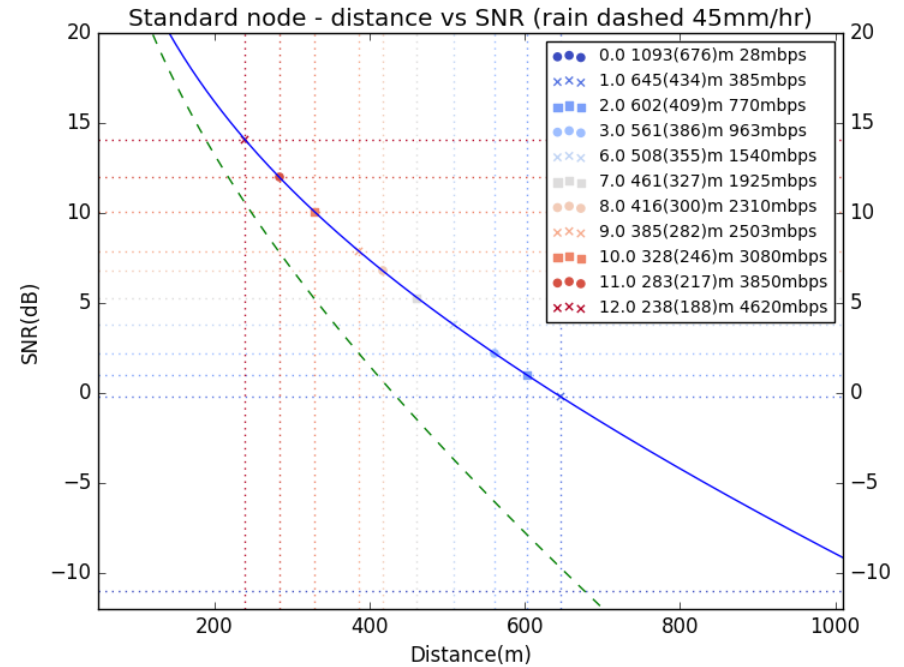
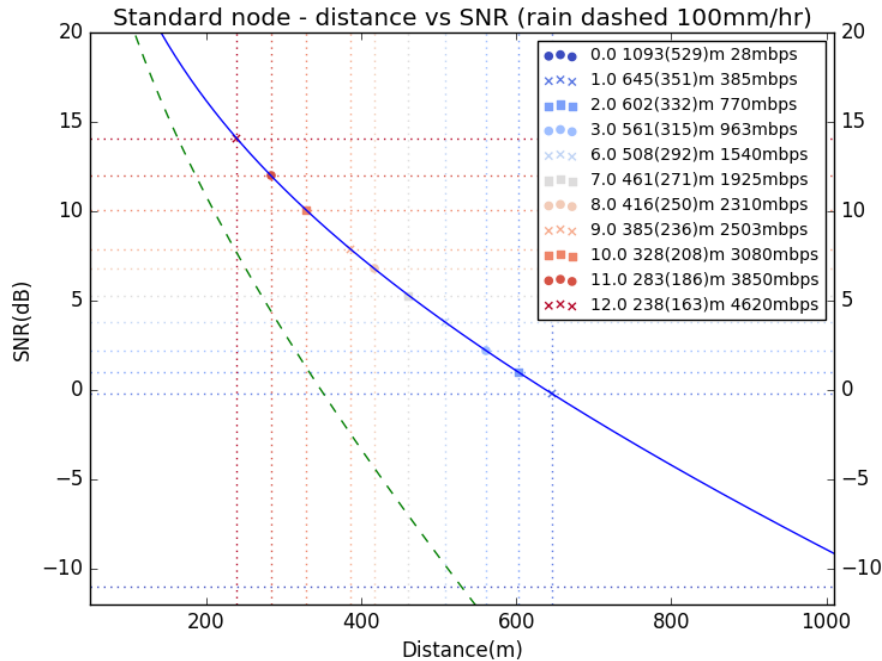
Channel	Centre GHz	Min GHz	Max GHz	Bandwidth GHz	O2 Absorption dB/km
1	58.32	57.24	59.4	2.16	12.91
2	60.48	59.4	61.56	2.16	15.01
3	62.64	61.56	63.72	2.16	12.25
4	64.8	63.72	65.88	2.16	4.36
5	66.96	65.88	68.04	2.16	1.1
6	69.12	68.04	70.2	2.16	0.44

US FCC 47 CFR Part 15.255
UK Ofcom IR2078

MCS Encodings and Capacity

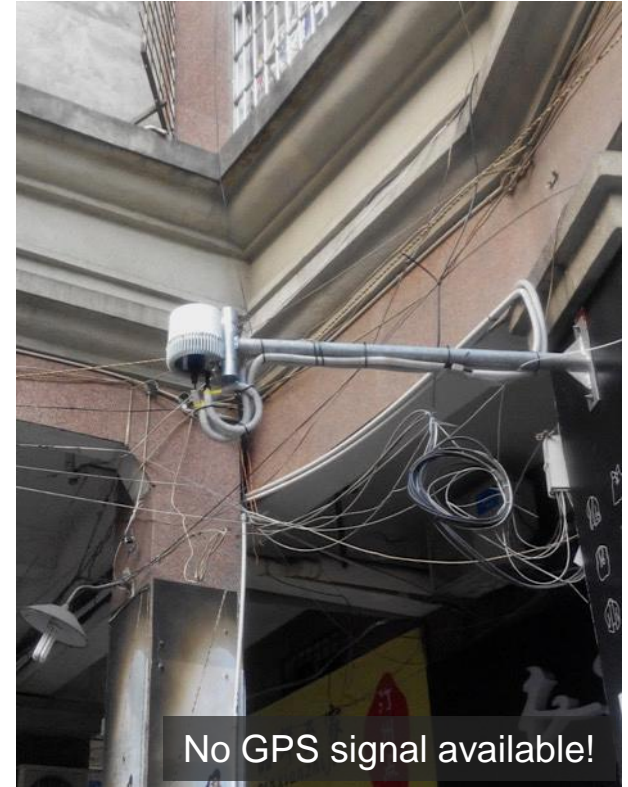
MCS	Mod	FEC	SNR dB	RSL min dB	L1 Gross Rate (after FEC) Mbps	L2 Line Rate Mbps
0	DSSS	12	-11	-84.52	28	22.4
1	BPSK	1/2	-0.2	-73.72	385	308
2	BPSK	1/2	1	-72.52	770	616
3	BPSK	5/8	2.2	-71.32	963	770.4
4	BPSK	3/4	3.6	-69.92	1155	924
5	BPSK	13/16	4.5	-69.02	1251	1000.8
6	QPSK	1/2	3.8	-69.72	1540	1232
7	QPSK	5/8	5.3	-68.22	1925	1540
8	QPSK	3/4	6.8	-66.72	2310	1848
9	QPSK	13/16	7.9	-65.62	2503	2002.4
10	16QAM	1/2	10.1	-63.42	3080	2464
11	16QAM	5/8	12	-61.52	3850	3080
12	16QAM	3/4	14.1	-59.42	4620	3696

Range vs MCS encoding (Mesh to Mesh/CPE Node)

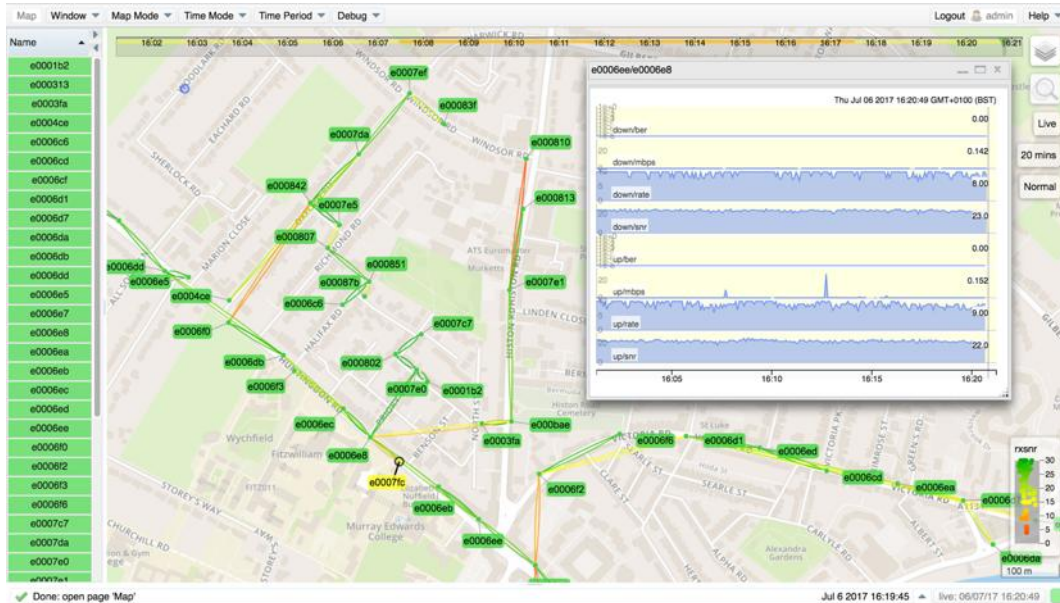


Metnet synchronization

- Robust distributed synchronisation - better than GPS
- GPS module on all nodes
- Nodes without available GPS use radio physical layer synchronisation
- Synchronisation as a service
 - Providing local master SyncE and 1588v2 PTP clock to the small cell (G.826x/G.827x)
 - 1588v2 Transparent Clock (G.8273.2)
 - SyncE and 1588v2 from core network



Metnet EMS – Live network view



- Dynamic live/historic map view
 - Scalability to 1000's nodes
- Web based application
- Remote node configuration
- North/Southbound interface
 - SNMP v2, v3, REST API
- Backup and restore functions
- Active/standby redundancy
- Remote SW/FW upgrades
- User account management
- LDAP, RADIUS authentication

Global deployments



MTN SA



Sprint USA



3UK



China Mobile Fujian



Cambridge University



Vodacom SA



Telefonica London



Telefonica London Eye



Softbank Japan



M1 Singapore F1



China Mobile Beijing



MTN Nigeria

Why Metnet?

High performance	Faster deployment	Higher resilience	More flexibility	Reduced TCO
High capacity	No RF planning	Mesh (MPTMP)	Dynamic bandwidth	One unit per site
Low latency	Small discreet node	Self-organising	Scalable capacity	Lower site rental
Self-optimising	No alignment	Self-healing	Synchronisation	No RF planning
Spectral efficiency	15 minute install	Robust sync	Enabling 5G	No alignment
High QoS	Easy to scale	Interference aware	Future-proof	Fewer site revisits



Enabling 5G

Metnet: Self-organising mmWave
backhaul and access

www.ccsi.com

