



Enabling 5G



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

CCS Metnet is providing neutral host microwave backhaul for a new ultra-fast, next-generation wireless network in the Square Mile – the world's number one financial centre. The ambitious project – which includes the single biggest Wi-Fi investment in the City to date – was delivered in a fast and seamless deployment, and is now providing high-speed, high-performance wireless services to businesses, residents and visitors across London's iconic business hub.



The project – awarded by City of London Corporation to CTIL, working in partnership with Telefónica UK – combines the fastest free public Wi-Fi in the UK and a 4G small cell network, backhauled by CCS Metnet and available to carry traffic for all UK MNOs. Metnet’s ability to deliver outstanding Wi-Fi and small cell connectivity in dense urban environments is providing a major boost to the capital – supporting London in its ambitions to become 5G-ready and enhancing its reputation as a world-leading smart city.

Iconic location, unique challenges

The City of London - or “Square Mile” – is the iconic business hub of the city and the world’s leading financial centre. More than 400,000 workers pass through its streets each day and 10 million visitors each year, alongside a resident population of around 9,000. The eclectic mix of historic buildings and contemporary glass and steel constructions that push ever skywards present considerable issues for mobile network planners. The numerous mobile black-spots across the Square Mile have been testament to its unique challenges, and the original public Wi-Fi network put in nearly 10 years ago offered patchy coverage and poor performance, with Wi-Fi backhaul that was prone to interference.

London as leader: next-generation wireless

In April 2017, the City of London announced plans to significantly improve wireless connectivity throughout the Square Mile with a free, public Wi-Fi network offering gigabit-speed internet.

The network plan also incorporated 4G small cells, to enhance mobile coverage and capacity at street level. The City of London offered around 3,000 street assets for use in a public tender for telecommunications infrastructure expansion. As part of the package, City of London required the creation of a free-to-access, next-generation Wi-Fi network. Another key stipulation of the tender was that the backhaul system deployed must be neutral host and open to all service providers.

The multi-million-pound contract to build and manage the network was awarded to CTIL, the infrastructure joint venture between Telefónica UK and Vodafone. One of the largest single investments in wireless infrastructure ever seen in London, the project is a cornerstone of the city's strategy to cement its leadership position in global finance.

The neutral host backhaul of the new network is built on CCS Metnet – the world's only self-

organising microwave backhaul – operating in the licensed area-based 28GHz band. Small cells and Wi-Fi access points have been installed on street furniture, with the "de minimis" form factor of the Metnet nodes ensuring unobtrusive deployment throughout the City's historic streets. Over 50 small cells have been deployed in the initial phase, with hundreds more planned by the end of 2018.

The new network will ultimately see hundreds of 4G small cells and Wi-Fi access points deployed on lampposts, CCTV poles and illuminated street signs, providing seamless, ultra-fast broadband that can deliver high-bandwidth services such as video-calling and video-on-demand.

There were a number of key partners required to deliver the project in such short timescales. The team pulled together and worked from planning, design, through to implementation and testing to complete all elements of the project on time.

Ecosystem players	
City of London Corporation	Municipality awarding wireless concession.
CTIL	Infrastructure joint venture between Telefónica and Vodafone. Awarded contract to build and operate network.
Telefónica O2	Telefónica UK's operating subsidiary responsible for building and managing the network, involving O2 Wireless and O2 Wi-Fi divisions.
iWireless	Systems integrator responsible for network design, site acquisition and installation.
JB Riney	City of London contractor responsible for managing street furniture.
TYCO	City of London contractor responsible for managing CCTV locations.
Cisco	Aironet 1560 Wi-Fi access point provider.
Nokia	O2 network based on Flexi Zone 4G small cell radios
CCS	Metnet self-organising microwave access and backhaul provider
Virgin Media	Fibre backhaul provider

Deployment considerations

To fulfil the network plan, CTIL proposed a hybrid combination of fibre backhaul (where readily available) and CCS Metnet self-organising microwave backhaul. Based on this approach, some of the key considerations that helped CTIL win its initial bid were:

Minimal disruption

Digging roads to extend fibre to sites, even for short distances, is simply impractical in this busy urban area. In many cases, there were no accurate maps of underground infrastructure for electricity, gas and water, and the risk of disruption to other services was high. A wireless backhaul solution was therefore more pragmatic for most sites.

Discreet installation

The City of London was very sensitive to the appearance of equipment on street furniture in terms of the size and number required. Metnet's small form factor more than satisfied the planning constraints, and each Metnet node has a wide 270-degree field of view, so only one unit is required per site, unlike other gigabit wireless backhaul solutions.

Commercial feasibility

The primary driver for the new network has been to improve mobile data capability as widely as possible throughout the Square Mile, but with a pragmatic view on costs. Backhaul is key to enabling the deployment of such a system, but costs need to be

carefully managed. Metnet resolved any potential cost and performance issues by offering simple, low-cost scalable installation thanks to the unique zero frequency planning and self-organising nature of the system. Metnet also offered the required combination of improved performance in terms of high capacity (1.2Gbps) and very low latency (~150uS per hop), with high availability and interference-aware resiliency delivered via its mesh architecture.

Foundation for 5G

The City of London aims to be an early adopter of 5G and more technically advanced than other global financial centres. Metnet's self-organising, self-optimising capability over a mesh architecture already offers many of the attributes of a 5G system, with high capacity and very low latency to meet future service requirements. Its use of the licensed 28GHz band, which is also being earmarked for 5G in other parts of the world, provides carrier-class backhaul to replace the heavily contended Wi-Fi backhaul, while paving the way for an integrated access and backhaul solution for 5G FWA in the future.

“ CCS Metnet was really ground-breaking, because it took all of the data that was being backhauled over the 5GHz spectrum and used the completely separate 28GHz spectrum, which meant all of the spectrum interference issues went away, leaving us with an open channel for public access Wi-Fi.”

Steven Bage

Strategic Infrastructure Advisor for the City of London



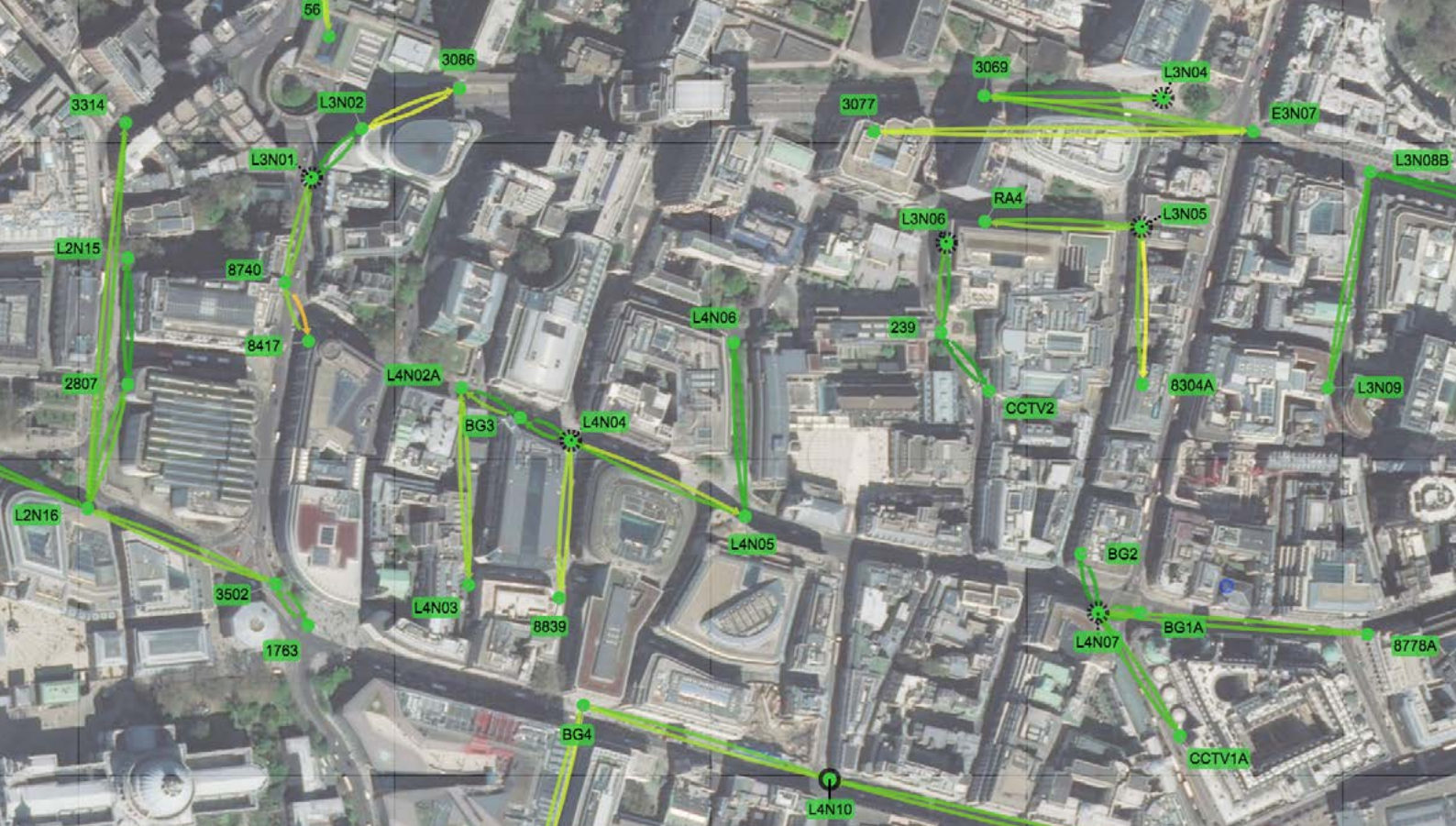
Network Siting

Around 3,600 street-level sites were made available by the City of London for the deployment, including 122 sites used for the original public Wi-Fi network. The deployment team focused first on finding fibre-connected sites and then in-filling with CCS Metnet node locations to link back to the fibre and create the wireless mesh.

To enable rapid deployment, the City of London team had to work hard to ensure that internal processes that take many weeks could be enacted in a much shorter time.

Given the complexity of the environment, CCS conducted site audits in conjunction with iWireless, O2's system integrator responsible for site acquisition, network design and installation, and JB Riney, the contractor responsible for street furniture. This entailed simple visual checks to confirm line of sight (LOS), rather than using lasers or telescopes, as PTP microwave systems would require.

With construction work ongoing in the Square Mile, and scaffolding going up and down, LOS can be affected from one week to the next. The ability to flexibly adapt the backhaul network – or operate in some NLOS situations – has therefore been key, helping to overcome these changing parameters.



The CCS Metnet Element Management System (EMS) view of the network

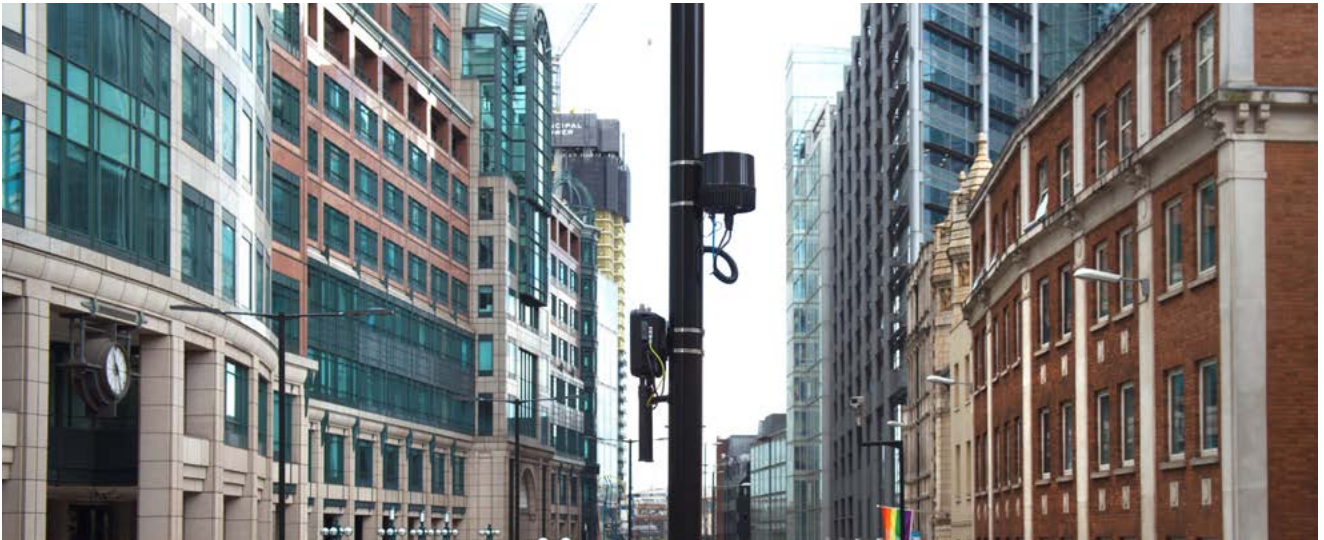
The key technical challenges in the planning/deployment phase involved achieving:

- Core backhaul connectivity where fibre was not available at the point of presence node (POP)
- Robust connectivity with no line of sight (LOS) between some nodes
- Robust GPS-derived timing in the presence of multi-path and jamming signals

The first two issues were readily resolved thanks to Metnet's SON capability. The delays in finalising fibre locations meant that initially around 7 out of 35 wired nodes could not be connected. This was no issue when using Metnet, as the orphaned nodes were automatically adopted by other neighbouring connected nodes. Some of these unplanned connections were NLOS, but using Metnet's unique wide field of view leveraging multiple antennas and link discovery algorithm, the system was able to detect stable multipath reflections which could be used as primary links. This ability to self-organise meant that all Wi-Fi small cells were connected from day one.

Based on a unique self-organising mesh architecture, Metnet is quick to deploy, easy to scale, and offers high capacity and low latency coupled with high availability and resilience, robust synchronisation and lowest total cost of ownership. CCS Metnet operates in a single frequency channel with no radio frequency planning required. Frequency reuse in the entire network is 1. Each node has a wide 270-degree field of view, so only one unit is required per site, rather than multiple radios. Metnet eliminates the need for any manual alignment, and each node supports multiple connections for higher resilience.

As fibre is brought to the 7 unconnected POPs the network will self-organise to ensure the new capacity is delivered to the backhaul network and sub-optimal transmission paths will revert to the optimal planned connections.



The ideal situation would be that every connection between nodes was LOS. The reality, however, is that when at street level, there are many obstacles to achieving LOS, with trees, bridges, signage, and traffic, all conspiring to make the planning job difficult. Again, the ability of Metnet to dynamically adapt to the best possible connection means that deployments can be made in challenging situations.

The GPS-related timing issues are resolved by Metnet's robust distributed GPS timing protocol, which delivers:

- local master SyncE and 1588v2 PTP clock to the small cell (G.826x/G.827x)
- 1588v2 Transparent Clock (G.8273.2)

- SyncE and 1588v2 recovery from core network

In several locations, access to stable GPS is difficult to achieve, due to the nature of the environment and multipath reflections from the satellite downlink in the urban canyon. CCS Metnet overcame these issues by using its distributed GPS feature to share the synchronisation between nodes to deliver accurate frequency and phase to the small cell devices.

“ CCS provided the mesh hubs and the installation, providing us with a completely self-managing network, which is great.”

Derek McManus
COO, Telefónica O2

Rapid deployment, ease of installation

The City of London district was very supportive with planning assistance and scheduling site access. Equipment was attached using cherry pickers outside business hours to minimise disruption, and electrical termination was completed during the day. Security in the City is understandably very tight, with strict controls on personnel allowed to access the sites and CCTV monitoring throughout the process.

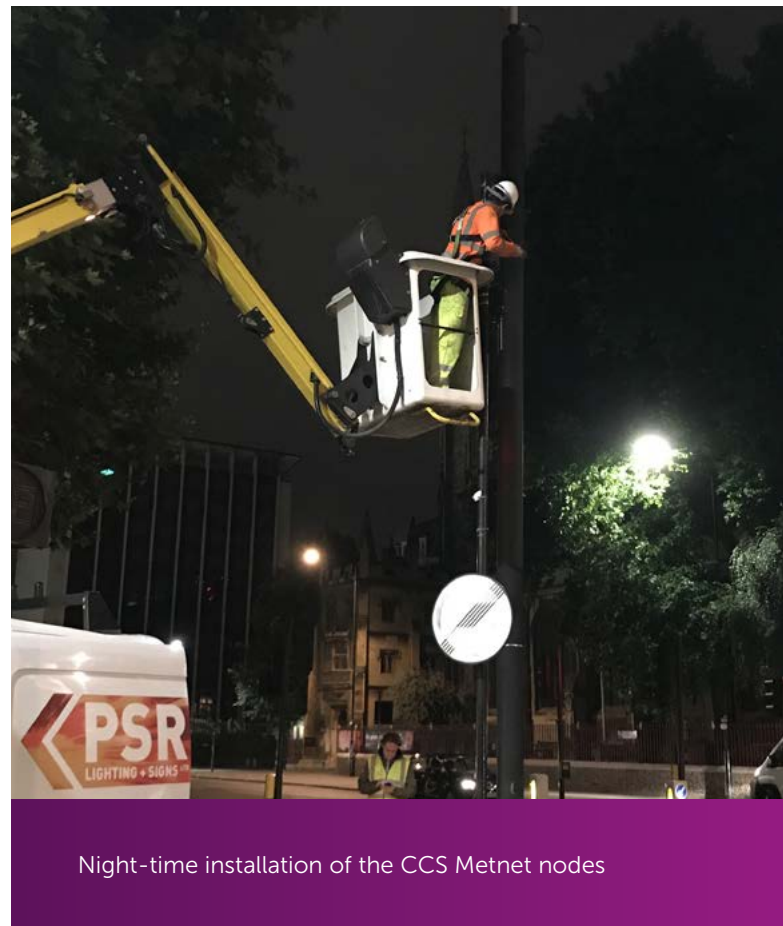
A two-person crew took only two hours on average to install both the Aironet 1560 Wi-Fi access point and Metnet backhaul node at each site. The Metnet node is installed at the top to ensure the best possible connectivity between sites.

Phase one launch

This first phase of the network formally went live in October 2017, offering – at launch – the fastest free-to-access public Wi-Fi in the UK. The installation of the new high-speed service was completed swiftly and easily – taking just 28 weeks from start for finish. Uptake of the new service has been high, with consistently positive feedback from users.

Phase two go-live

Phase Two of the deployment went live at the beginning of 2018, with Nokia Flexi Zone small cells added on some sites to densify O2's 4G RAN. Over 50 small cells have been deployed in the initial phase and are performing well, successfully boosting coverage and capacity in key areas, and more installations are planned by the end of 2018.



Night-time installation of the CCS Metnet nodes

“ With 10 million visitors passing through the Square Mile every year, the need for a better public Wi-Fi service in the area was clear. With this next-generation small cell network now live and delivering high-speed wireless service across the Square Mile, the results have been obvious and immediate. The backhaul service provided by CCS Metnet has been absolutely key to this project, overcoming the technical and operational challenges of deployment and delivering on the promise of high-speed wireless data services for users.”

Derek McManus

COO, Telefónica O2



A blueprint for 5G deployment

Metnet's unique capability is serving one of the world's most demanding and data-heavy networks in one of the most complex urban environments. The foundations have been laid for what will become one of the world's densest deployments of mobile and Wi-Fi coverage – ensuring the City of London is 5G-ready and providing a strong, future-proof platform for London's continuing evolution as a world-leading smart city.

“ This is an exemplary success story for London, and for the ability of Metnet to deliver reliable and high-performance neutral host Wi-Fi and small cell connectivity in dense urban environments. We are proud to have delivered this project – in conjunction with Telefónica UK, CTIL, the City of London and the entire project team – which is optimising the quality and performance of wireless across the country's key business hub, and to be supporting the City of London in its ambitions to boost the capital's reputation as a world-leading smart city.”

Steve Greaves
CEO, CCS

Speak to our team

If you'd like more information on our Metnet self-organising mmWave access and backhaul solution, please don't hesitate to contact our team.

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