

Capacity without complexity - scaling small cells in the UK

White paper



Introduction

The small cell market has mobilised, outdoor deployments are now growing as the UK accelerates towards 5G. Whether the ambition is to increase capacity, improve network quality or differentiate with the fastest speeds, small cells are now seen as a viable option. With the exponential growth in data usage showing no signs of slowing, mobile operators are under increasing pressure to provide more capacity at faster speeds whilst keeping monthly subscription fees relatively flat. So how will this be achieved? Evolution of network sharing and development of scalable deployment models are the key drivers that will take small cells from a niche problem solver to a nationwide industry.

To successfully deliver 5G in the UK, mobile network operators will need to densify the amount of cells in their network, it is suggested by industry experts this could be by a factor of 10 or more. This will be done by utilising small cell technology with LTE-Advanced and 5G features that promote better co-ordination between macro and small cell networks and more efficient use of spectrum. The problem operators are facing is how to deploy a high volume of small cells without significantly increasing the cost of passing data through the network.

Preparing for the growth of outdoor small cells

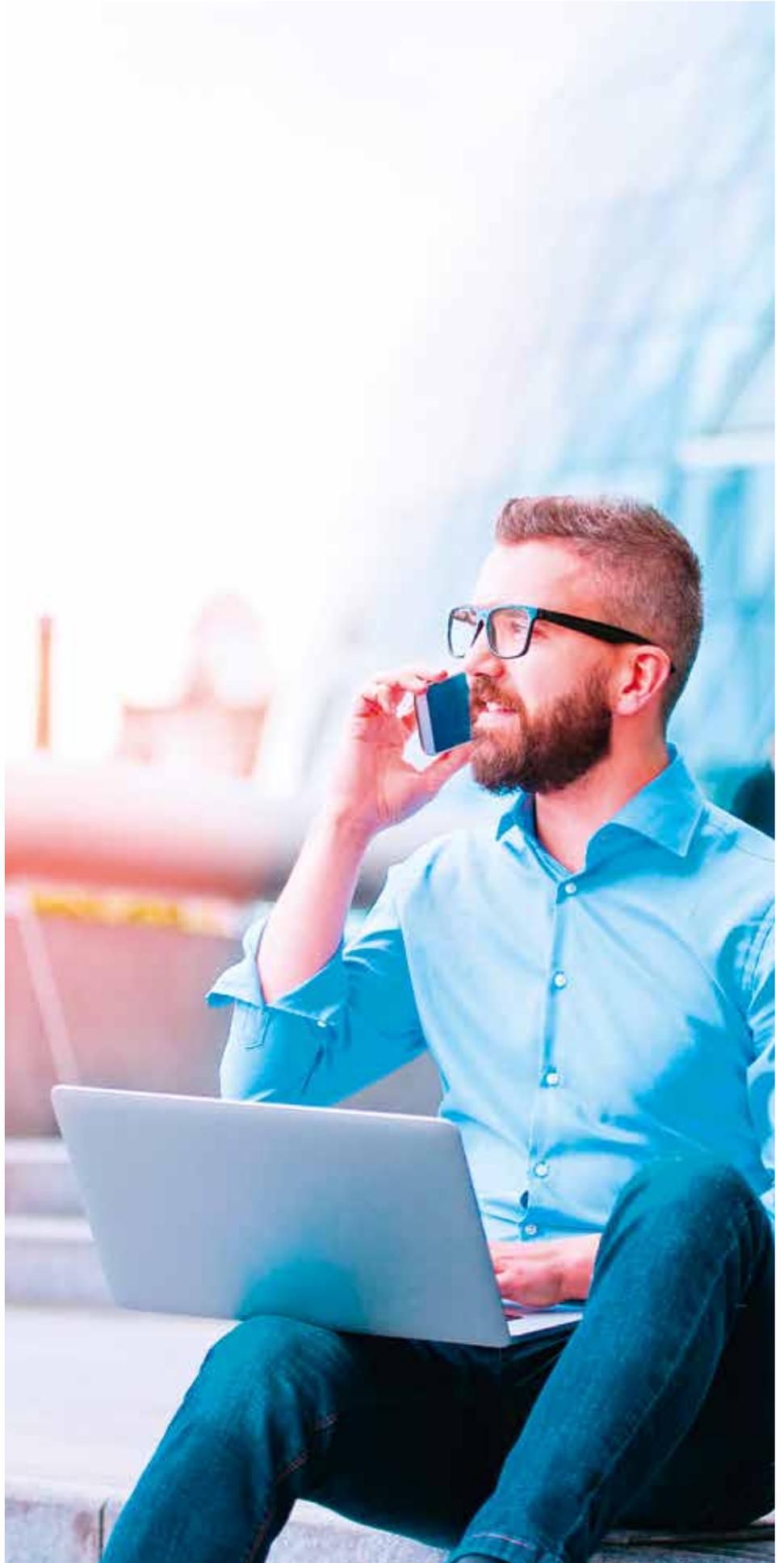
BT have been investing in small cells research and development for over 5 years. Initial demand has been leaning towards indoor femtocell solutions (enterprise and residential), which allow access to a mobile network through a standard internet connection. There have been significant advancements in technology in this field and focus on these markets has been led by both fixed and mobile operators.

BT Wholesale have been supplying backhaul services to mobile operators for over 25 years. Our focus in relation to small cells has been on the outdoor microcell and picocell markets and we have deployed a huge amount of network across the MNO base.

These include the use of BT payphones, telegraph poles and other street furniture together with a combination of copper, fibre and radio backhaul technologies. Beyond traditional backhaul, BT also pioneered with the UK's first outdoor DAS network in Westminster.

Demand for outdoor small cells is growing and the immediate requirement is to increase capacity in densely populated areas and demand is expected to increase further as operators move towards 5G network architectures.

One of the challenges of 5G is how MNOs get more bandwidth over the air interface and this will be achieved by using spectrum in much higher frequency bands such as 28GHz mmWave. The use of these bands will ultimately drive demand for more cells which in itself carries significant challenges, not only on the technology but also the availability of suitable site assets and the complexity and costs of physical deployment.



Paving the road to 5G

Based on current industry growth forecasts for outdoor small cells (urban and rural / remote) we predict that the UK could reasonably see upwards of 40,000 outdoor small cells within the next 5 years. To hit these aspirations we feel there are several key interventions required.

Firstly there is work to be done with local councils and site providers to change perceptions about cellular equipment, the new Electronics Communications Code will help but it could take time to implement. The future of mobile is in volume deployments which are highly cost sensitive so traditional rental agreements and planning restrictions will need to be revisited. This will not only apply to the lease of the site but also to the

manner in which networks are deployed and maintained.

To reduce the costs of deployment to an acceptable level, councils will need to approve planning for multi-site deployment projects – this will require carefully considered traffic and pedestrian management to minimise disruption to the public. It will also involve councils working closely with small cell network providers to approve site designs as 'de minimis', meaning drawn out planning processes can be avoided.

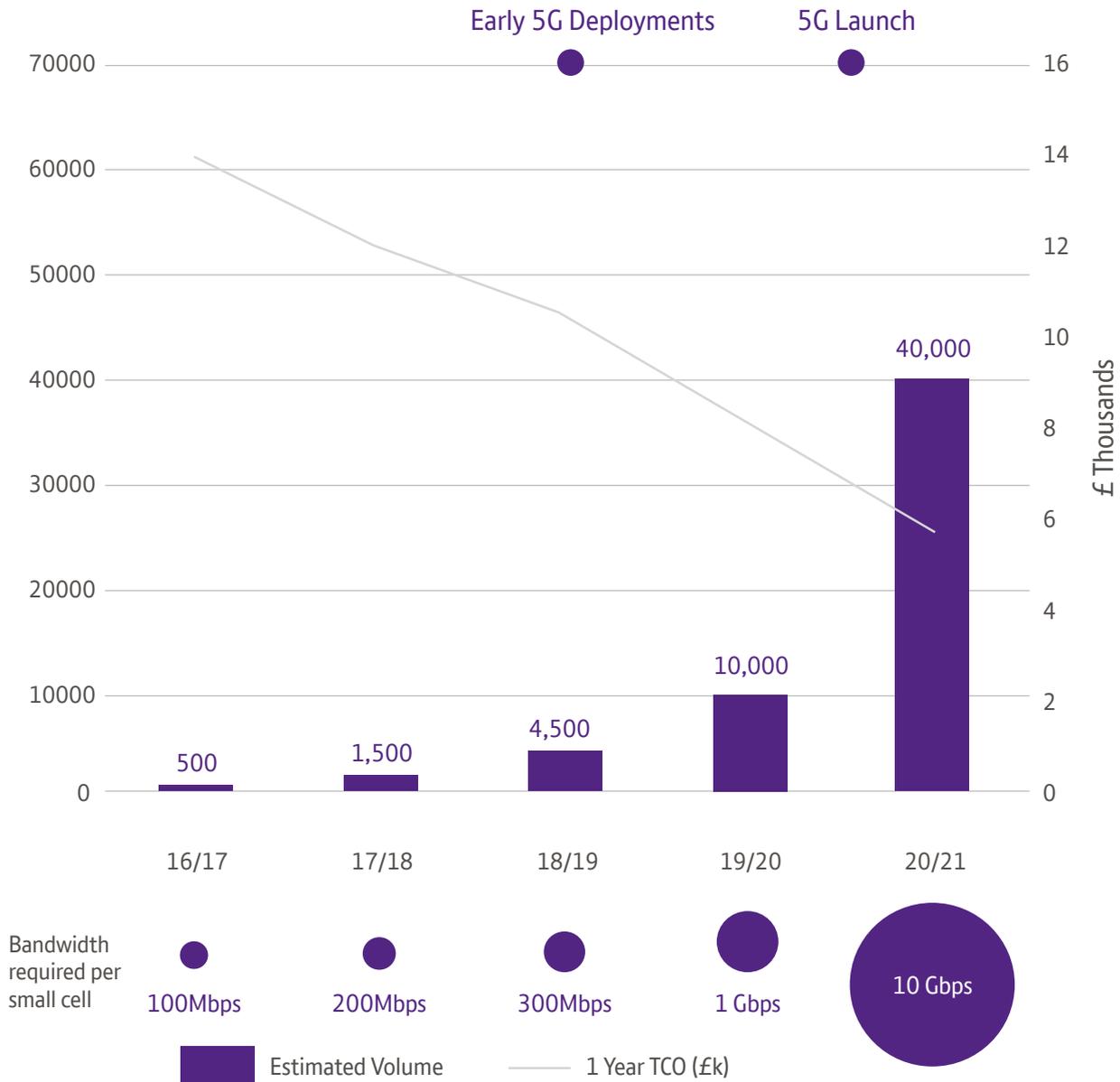
Secondly, the backhaul solution needs to be resilient and upgradeable. For 5G each small cell access link could realistically require 10Gbps of capacity at sub-1ms latency.

Outdoor small cells are expected to be the capacity work-horses of the future and if 5G aims to give consumers the bandwidth they require for 360° 8K video streaming and immersive video gaming then small cell traffic will need to be backhauled to an aggregation point capable of delivering multiple phase synchronised 10Gbps connections to small cells.

Finally, to reach an acceptable TCO for small cells (where the cost of sending a Gbyte of data through a small cell network is equal to or less than sending the same through a macro network), operators will need to think about the most effective way to share certain elements of their small cells network infrastructure.



Estimated market evolution of UK outdoor small cells



Who will share what?

'Neutral host' is a popular term, with differing meanings depending on the user. But what constitutes neutral? Does 'neutral' mean the host should be independent and have no stronger affiliation with any single operator? Can an operator act as a 'neutral' host to other operators?

And what is being hosted? The access, the backhaul, a site asset, small cell hardware, spectrum, core network?

In reality all are viable options, there are lots of ways operators can, and have been sharing elements of their networks. Mobile operators commonly co-locate on sites, and there have been huge MORAN roll-out programmes implemented in UK.

Lots of different names are attached to sharing of network assets; Co-location, Site Sharing, Multi-tenant, Multi-operator, RAN sharing, Neutral Host. Yet they aren't

universally understood and this leads to confusion and lots of talking at crossed purposes, therefore the first stage of any neutral host discussion should always be ensuring everyone is talking about the same items.

Moving to a shared network without diluting the MNOs spectrum assets

Our experience in outdoor networks tells us that operators want to retain control and management of their spectrum. Being able to manage transmit powers, coverage footprints, performance data and being able to access sites to lock, unlock and check alarms is important. As is the ability to assure the coverage of the extensively planned radio access network.

There are 3 types of network sharing defined by 3GPP; MORAN, MOCN and GWCN. These involve sharing the RAN hardware, the spectrum or even some elements of the core network. MOCN is a potentially cost

effective network sharing solution for small cells where separation between operators is achieved using PLMN codes, but the MNO is forced to either share their own spectrum or use another's. This can work well for indoor solutions but UK operators are more apprehensive to build outdoor networks using this technique.

ut there could be an alternative neutral host solution for operators that provides a way of sharing CAPEX and OPEX costs whilst retaining the control and visibility of a single operator solution.

- Shared Site Asset – (Single site asset – leased as Multi-Tenant)
- Shared Backhaul – (Shared fibre link, with separate logical flows to each customer over a common network)
- Shared Hardware – (Single physical unit – shared antennas)

To the operator it feels like they have their own cell site with visibility and control over spectrum but they get the commercial benefits of a shared network.

Small Cell Multi-Operator Solution

Shared Site Asset

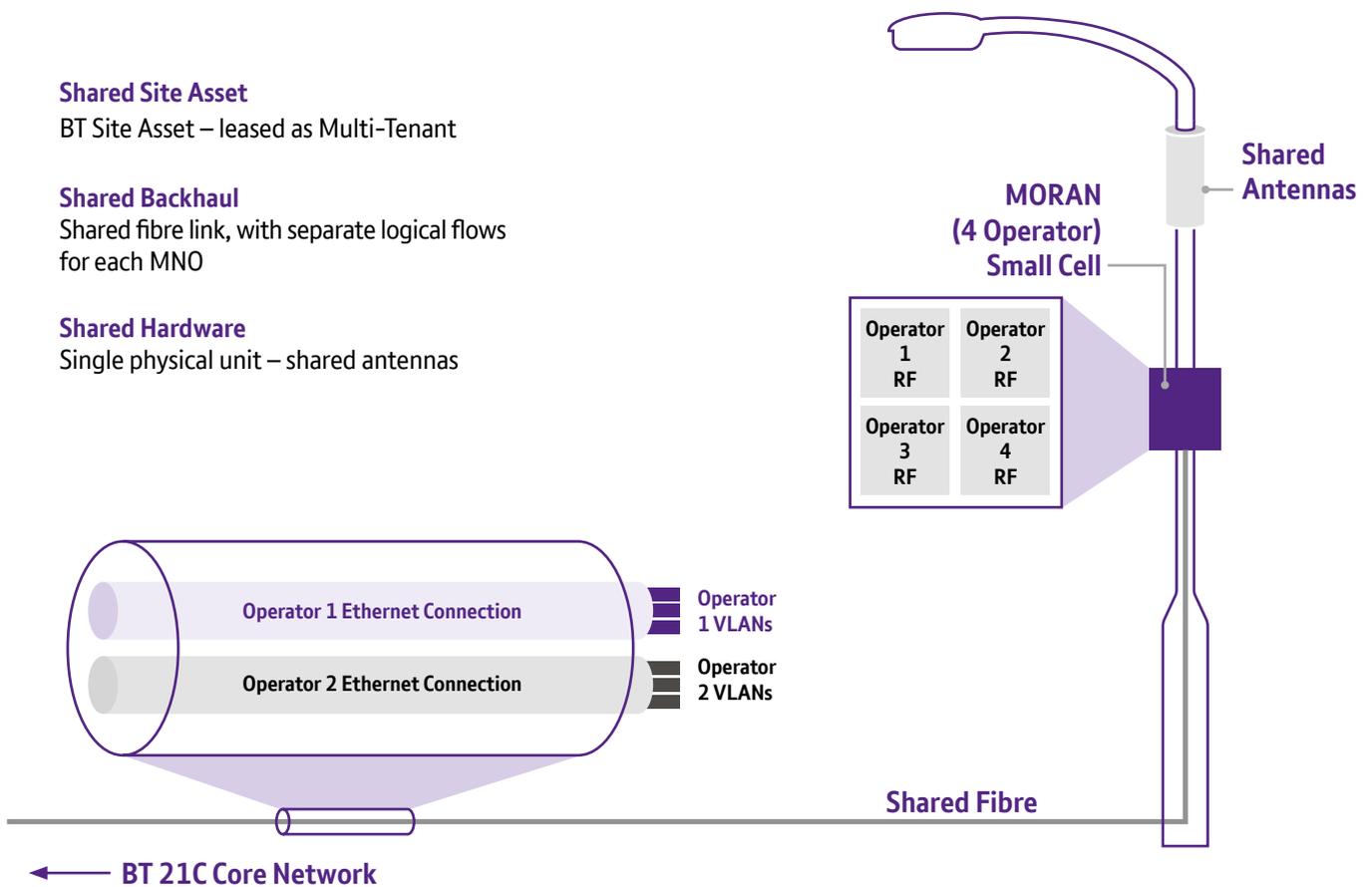
BT Site Asset – leased as Multi-Tenant

Shared Backhaul

Shared fibre link, with separate logical flows for each MNO

Shared Hardware

Single physical unit – shared antennas





Making it work in the real world

The market is starting to emerge for single box small cells that support 4 operator MORAN at 4x4 MIMO although the current available technology is quite large to mount on a typical street asset.

However, a dual operator solution can already be achieved using this type of model and could give a potential saving of 40% whilst providing the feel and control of a single operator service.

BT Wholesale has a unique capability to deliver this type of model for 3 reasons. Firstly, because our resilient and secure 21C core and MEAS access networks are already utilised at scale by the mobile operators who will continue to benefit from the savings that are achieved through shared investment in the network. Secondly, our investment in IP VPN services sets us apart in the market for seamlessly integrated mobile backhaul services.

Finally, our extensive portfolio of site infrastructure and scalable managed service teams give us the opportunity to offer customers a true end-to-end service from site asset lease to managed deployment and backhaul delivery.

In Summary

Demand for outdoor small cell networks will continue to grow and many organisations including communications providers, local councils and landlords will need to work more closely and challenge traditional perceptions of mobile networks

to make the UK a leading global player in wireless connectivity.

Significant cost reductions can be achieved through adoption of neutral host and network sharing models. BT Wholesale are

actively working to make these solutions a reality and we will continue to innovate in this space and help our customers get to the commercial tipping point that will make outdoor small cells a scalable proposition.

Glossary of terms

3GPP 3rd Generation Partnership Project - Global mobile broadband standards body

BBU Base band unit

DAS Distributed Antenna System

GWCN Gateway Core Network

IP VPN Internet Protocol Virtual Private Network

LTE-A Long Term Evolution - Advanced

MEAS Managed Ethernet Access Service

MNO Mobile Network Operator

MOCN Multi-operator core network

MORAN Multi-operator radio access network

PLMN Public Land Mobile Network

RAN Radio Access Network

TCO Total Cost of Operation (CAPEX + OPEX)

Offices worldwide

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