



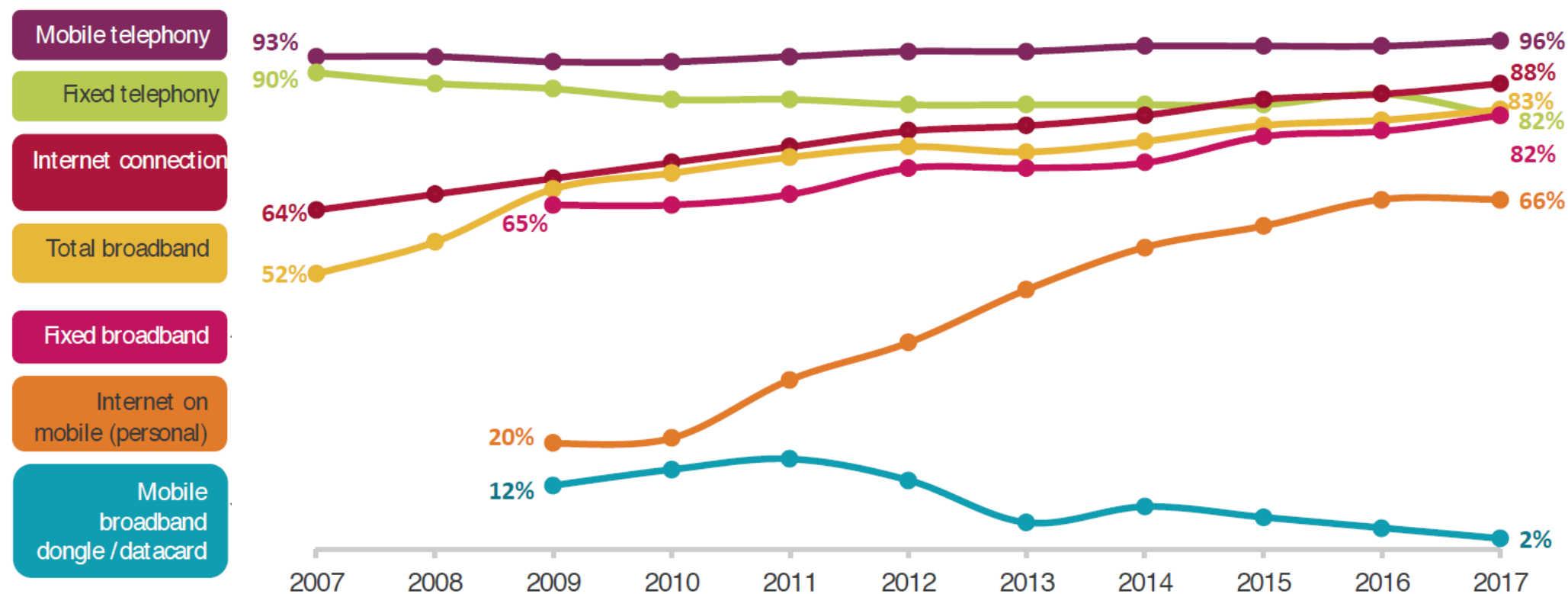
One Smart Network – Getting ready for the next decade

Howard Watson

CTIO BT Group

Barclays CTO Conference
March 2019

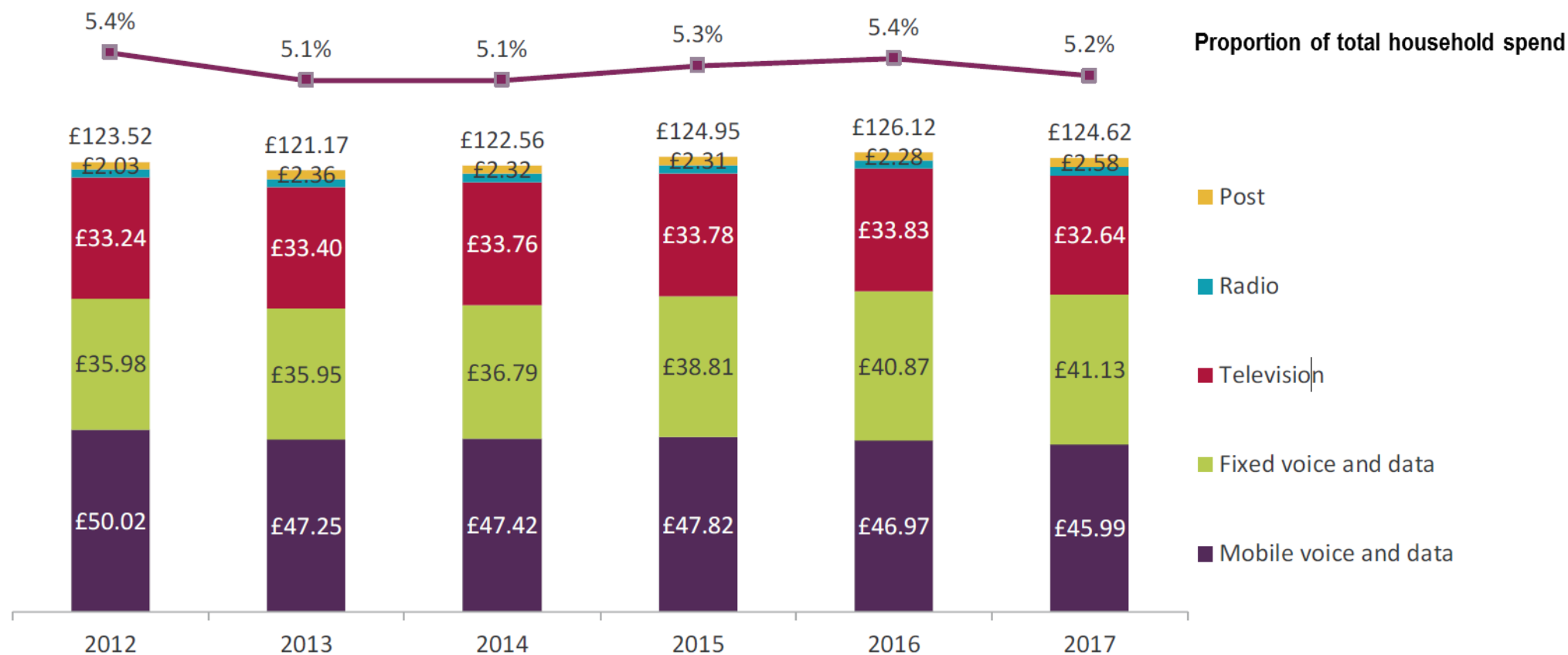
A look at the communications market



Take-up of key telecoms technologies (proportion of households / adults)

Source: Ofcom Technology Tracker. Data from Q1 of each year 2007-2014, then H1 2015-2017.

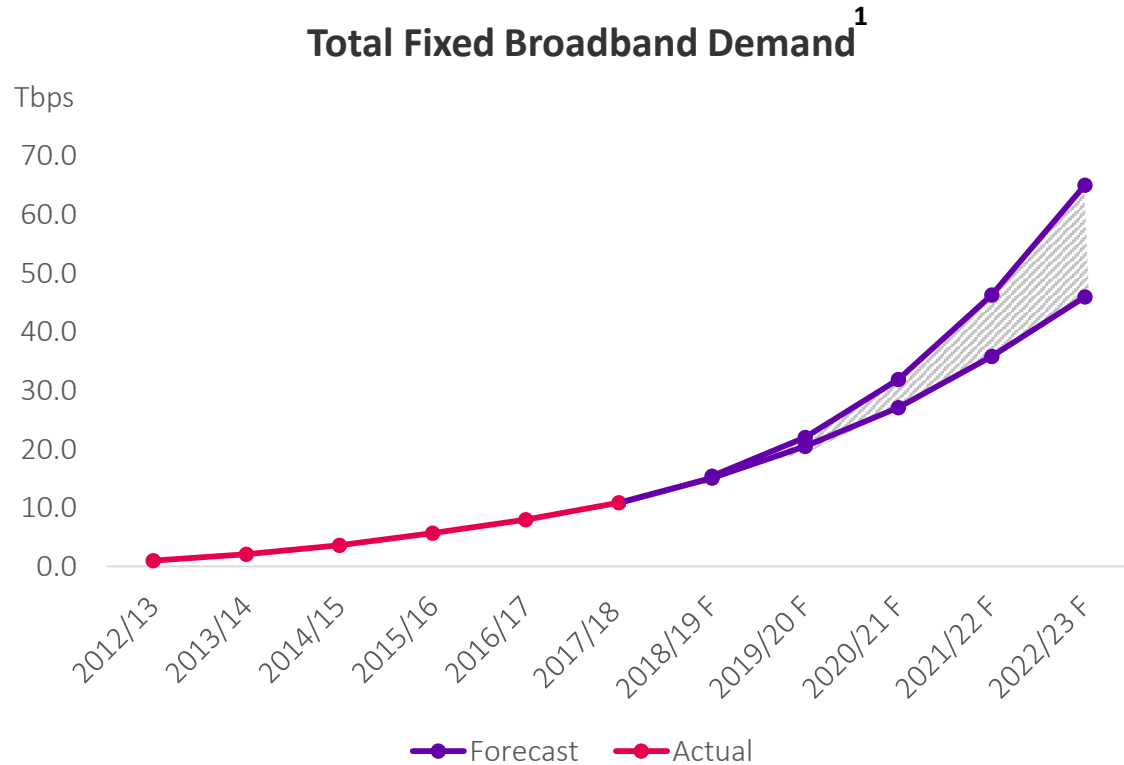
A look at the communications market



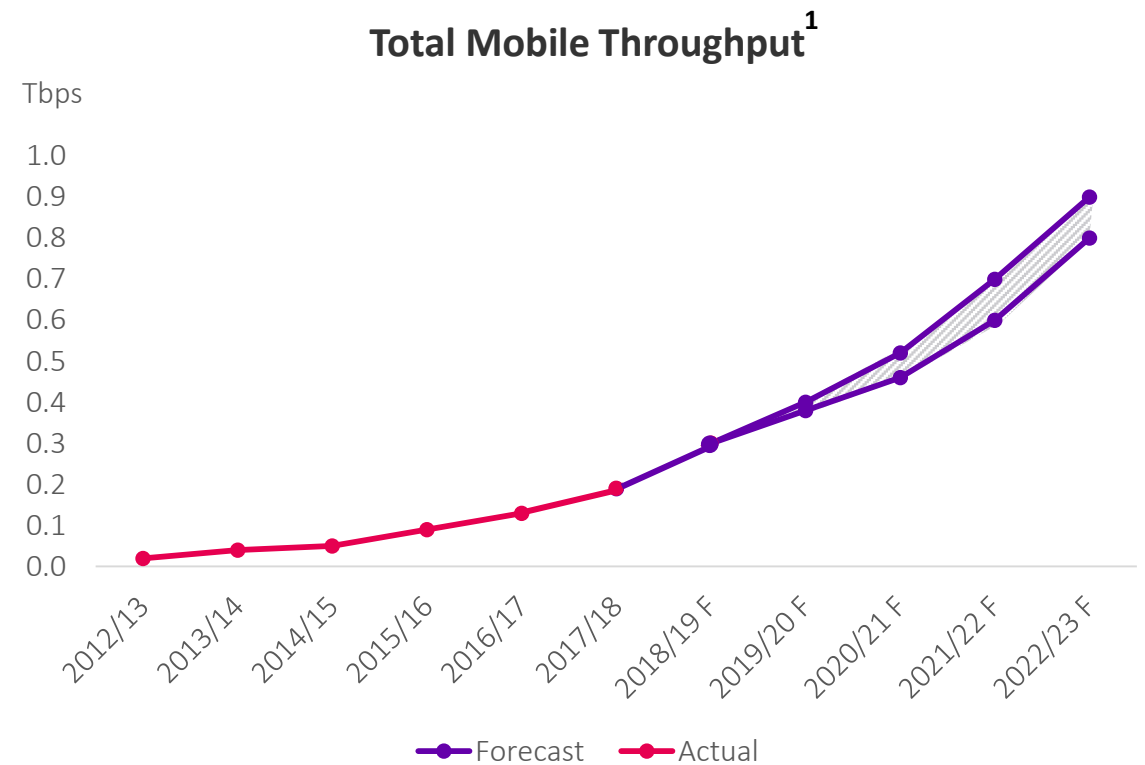
Average household spend on communications services

Source: Ofcom / operators / ONS

Exponential growth in data consumption and network capacity requirements



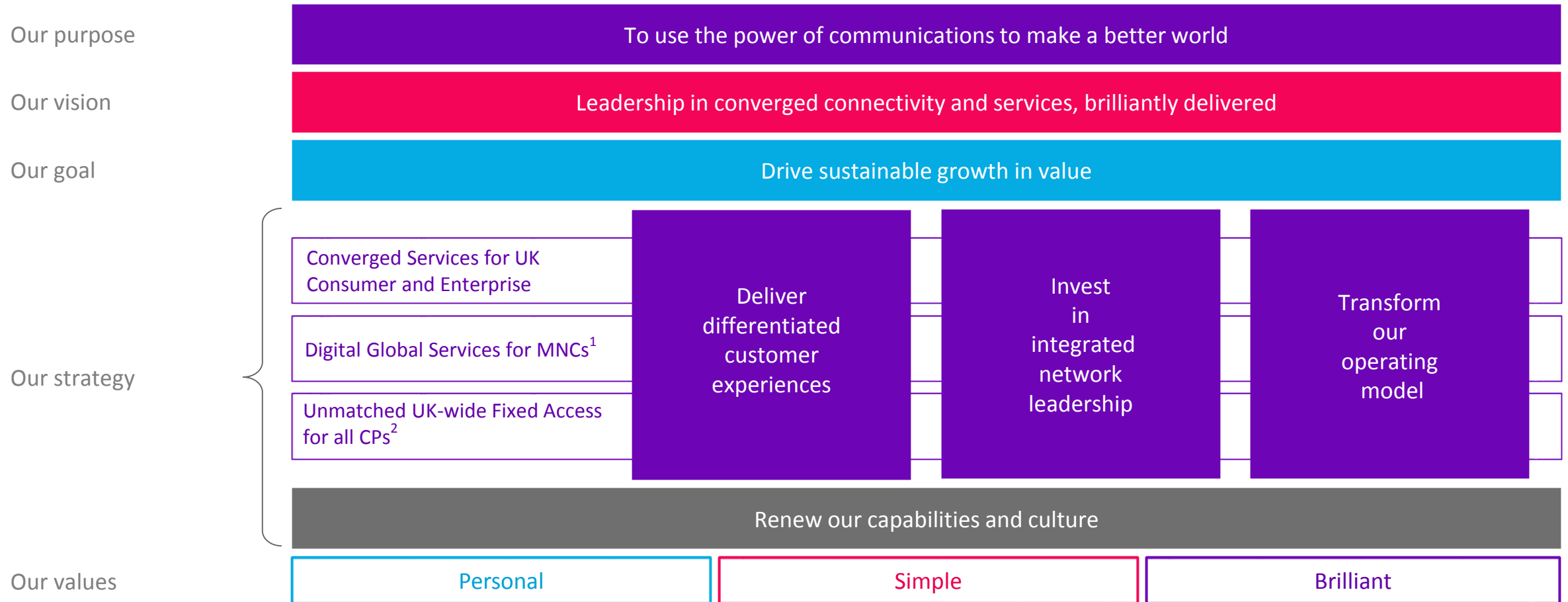
- Government and Ofcom promoting FTTP infrastructure competition
- Multiple ultrafast projects announced across the market



- Mobile data traffic growth continues
- Heavy investments in mobile infrastructure are needed in the mid-term

Source: BT
¹ actual and forecast growth on BT networks

We have evolved our strategy to focus on convergence

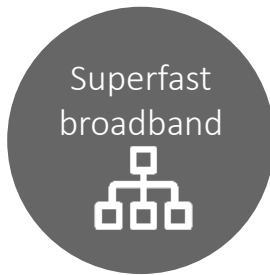


¹Multi-National Corporations

²Communications Providers

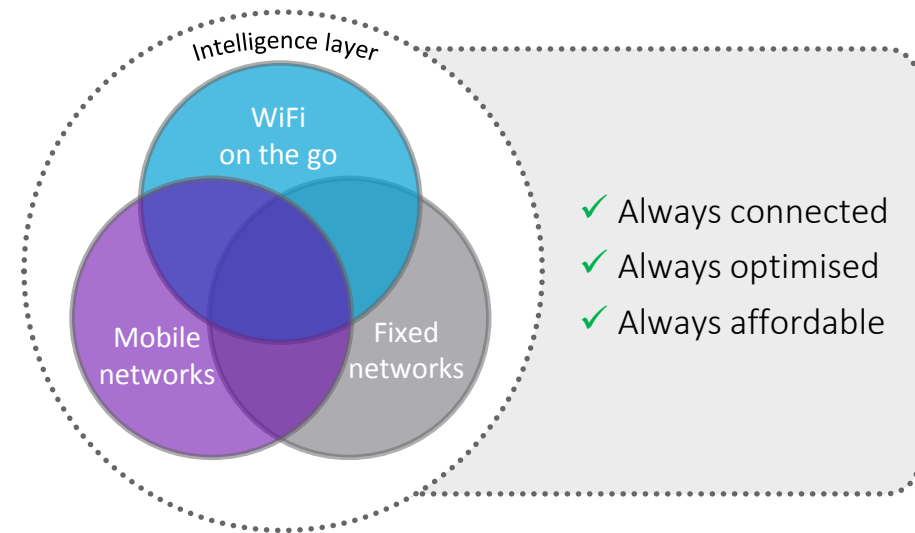
'One network to rule them all'

Today: Three different networks

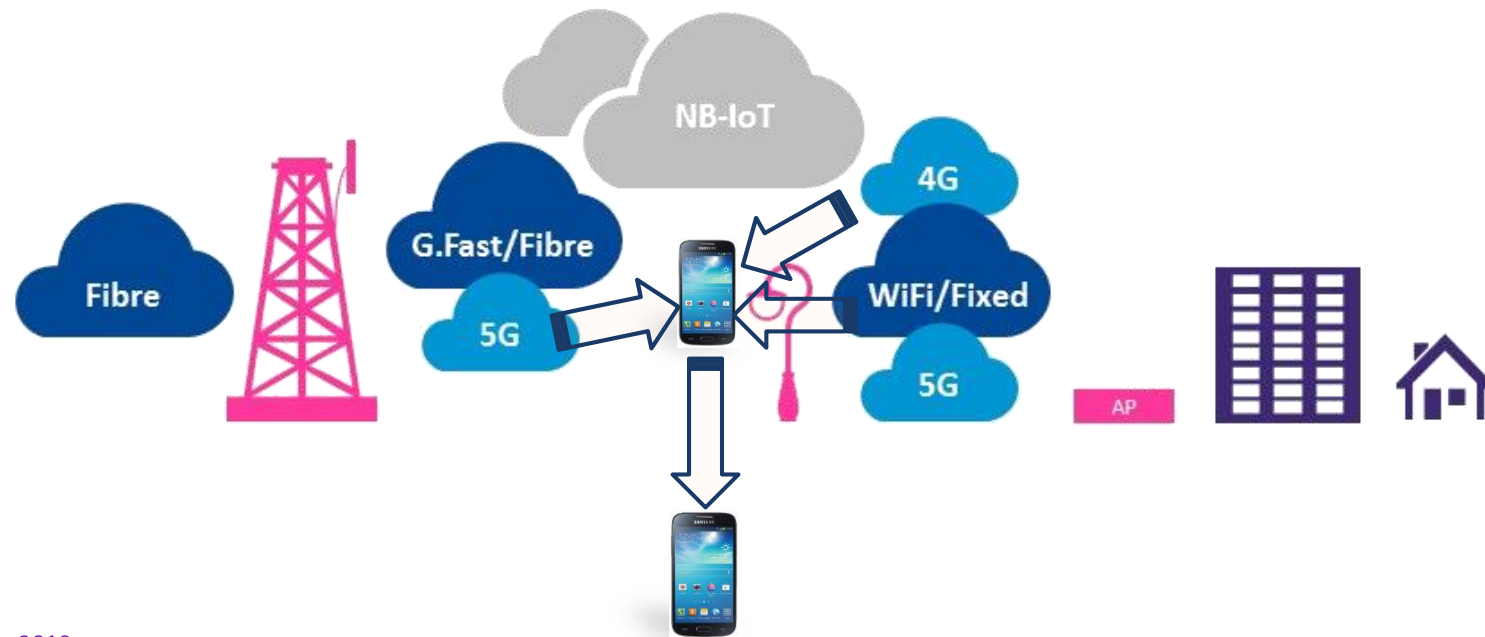
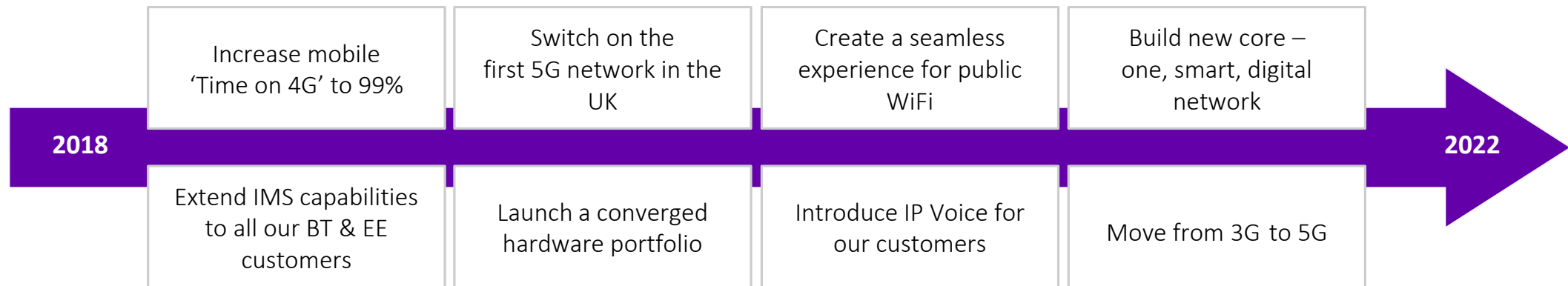


- ✗ Different usage allowances
- ✗ Complex to switch between networks
- ✗ Inconsistent coverage and speed

Tomorrow: One smart network



The journey towards one smart network



BBC NEWS Sign in

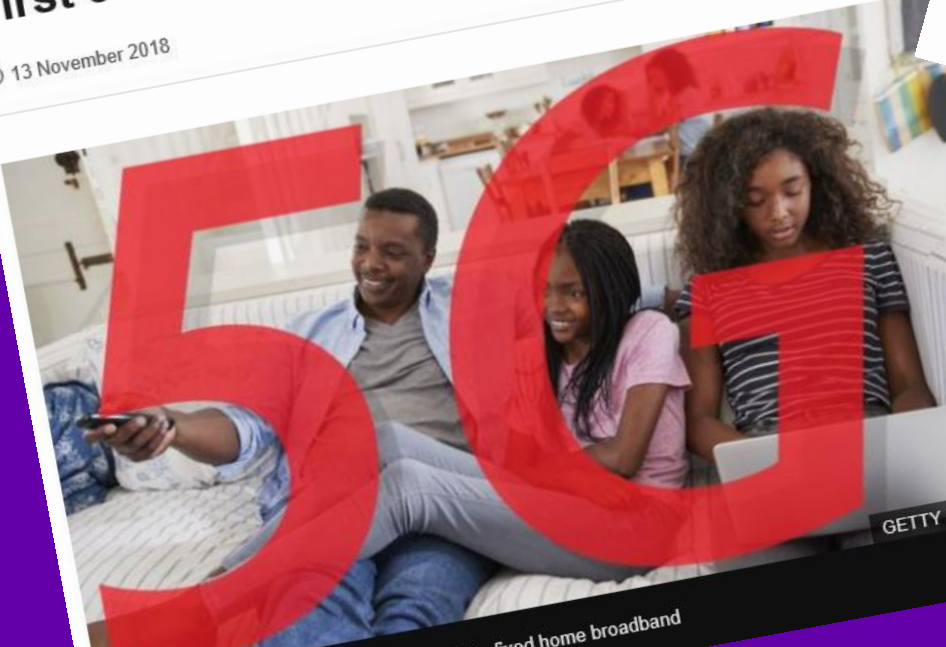
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Technology

First 5G cities in UK named by EE

© 13 November 2018



5G could also be used as a replacement for fixed home broadband

GETTY IMAGES

THE Sun FABULOUS MONEY MOTORS TRAVEL TECH DEAR DEIDRE PUZZLES

SPEED BOOST EE reveals the 16 launch cities to get 'SUPER-FAST' 5G internet in 2019

Brits are set for a major speed upgrade if they live in one of these cities

By Sean Keach, Digital Technology and Science Editor
13th November 2018, 12:00 pm | Updated: 13th November 2018, 4:28 pm

The Telegraph NEWS

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EE to roll out 5G in 16 cities next year in 'demand-led' strategy

BT has ambitious plans for 5G

EE will switch on 5G services in 16 UK cities in 2019, starting in: London, Cardiff, Edinburgh, Belfast, Birmingham and Manchester.

Coverage will then be extended to Glasgow, Newcastle, Liverpool, Leeds, Hull, Sheffield, Nottingham, Leicester, Coventry and Bristol.

• 5G launch locations



EE's ambitious investment in 5G sites demonstrates that our city is a great place to invest in innovative and future-facing digital connectivity."

Sadiq Khan, Mayor of London

Benefits of 5G technology

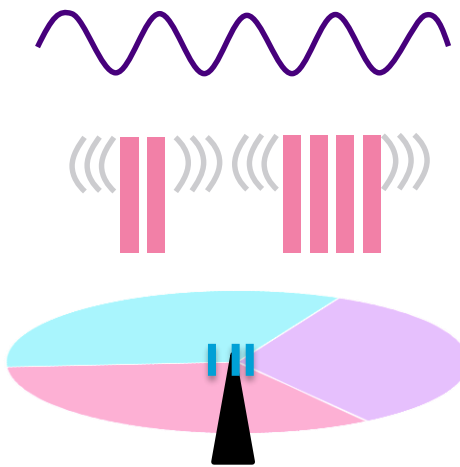
4G

Up to 20MHz blocks

2 or 4 antennas
(2x2 or 4x4 MIMO)

Typically 3 cells

Typically 1Gbps to 10Gbps, dedicated functions
connected to the fixed core



Larger spectrum blocks

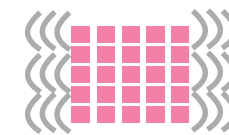
**More spectrum reuse:
antennas**

**More spectrum reuse:
cells**

More efficient core

5G

Up to 100MHz blocks

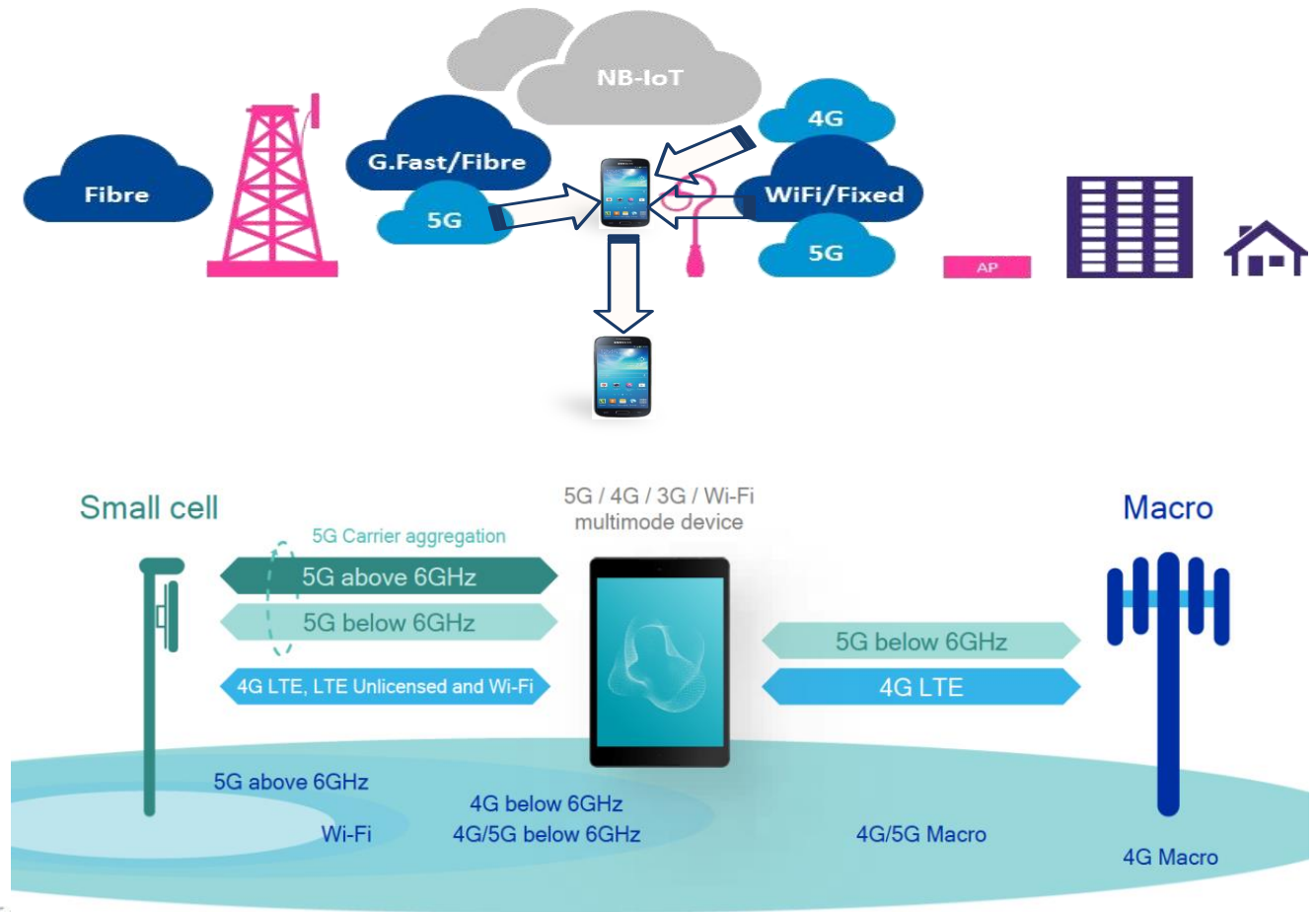
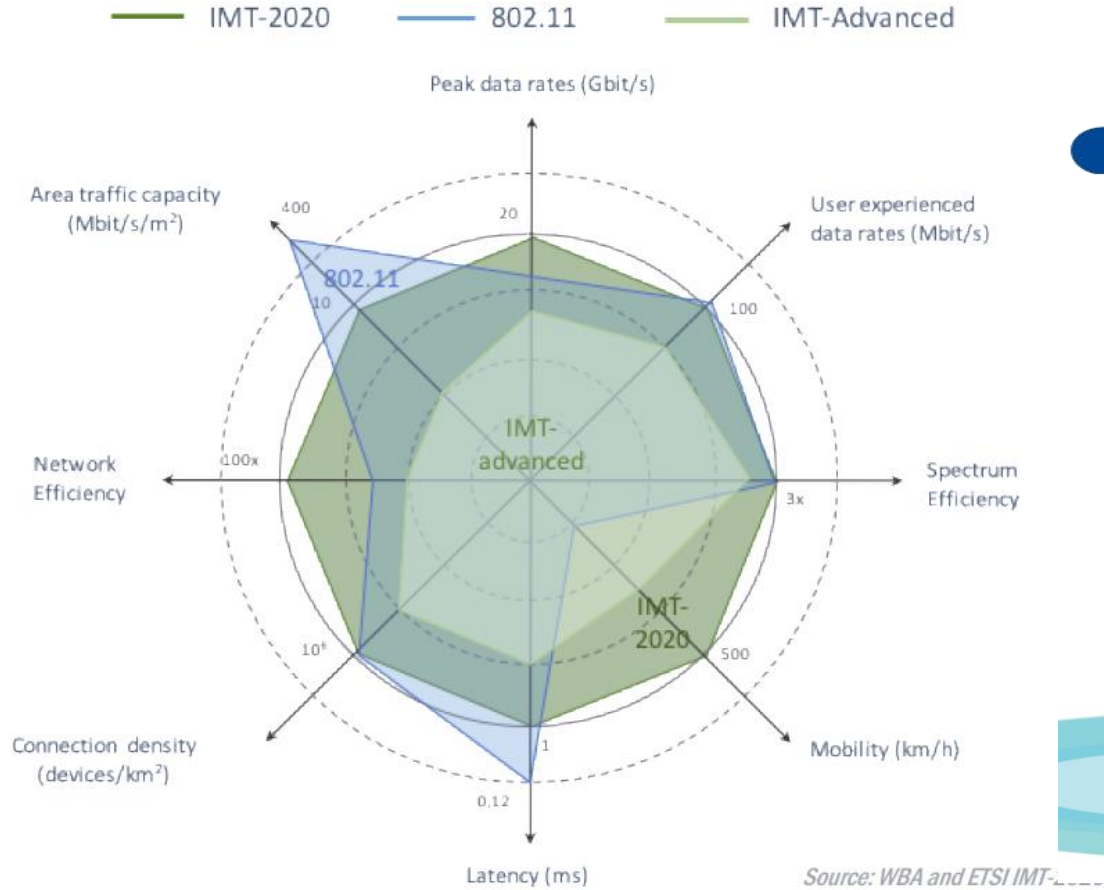


64 or hundreds of
antennas (Massive
MIMO)

Beam forming

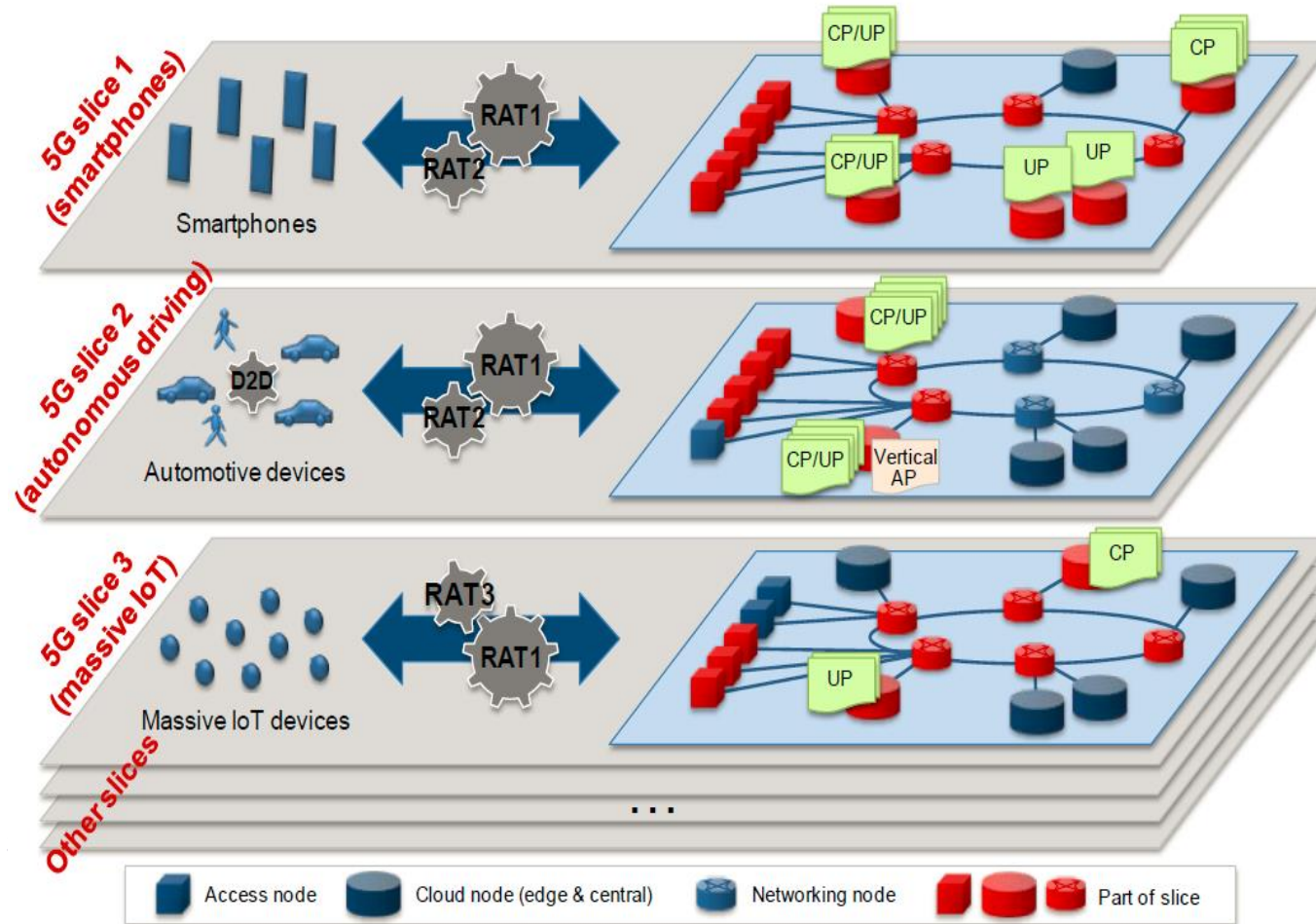
Typically 10Gbps to 100Gbps, embedded in the
fixed core

Multi-connectivity for optimal experience



Network Slicing

Multiple logical networks dedicated to different services/service types



Rapid deployment of new services

- End goal is fully automated deployment of new network slices with no disruption

Support for different operational models

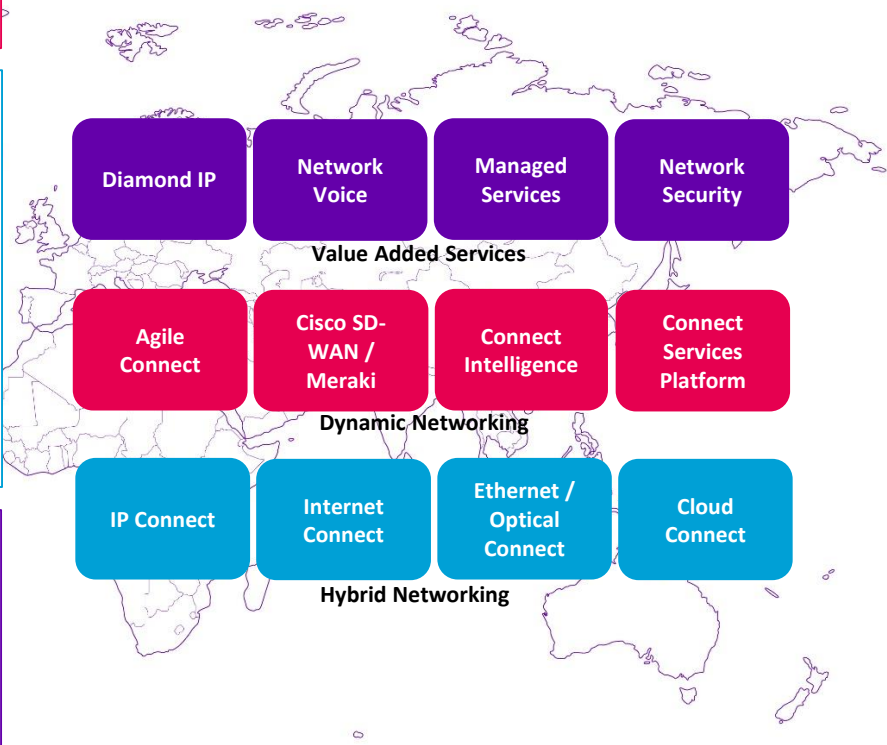
- Different SLAs (e.g. security, reliability etc.), require isolation between different slices

Conflicting functional requirements

- Optimisation of each slice for the specific functionality, some requirements may be mutually exclusive

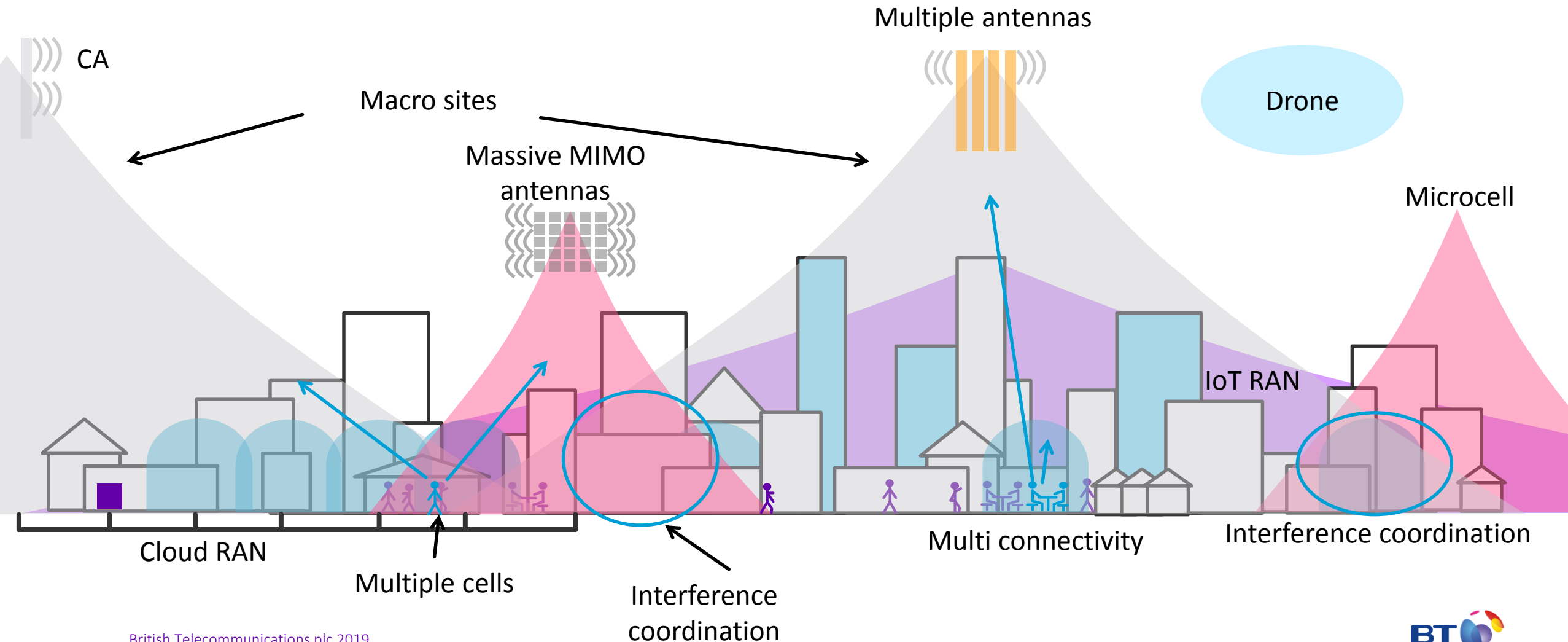
Dynamic Network Services delivered on our Global network

			>200 countries	>3,400 customers served	4 global service hubs	>5,200 PoPs
Core SDN	Bandwidth on demand	IPCG (MPLS) – flex port speeds via My Account portal ICG (Internet) – usage based billing On Demand enhancements to Connect Portfolio				
Network Virtualisation	Cloud Service Nodes Connect Services Platform SNAP	NFV from the cloud: Firewall , Infovista, Riverbed, DDOS protection, Internet Gateway Connect Edge - Cisco ENCS + alternative white box Connect Services Platform - Virtual Network Functions (VNFs) including Cisco SD-WAN, Checkpoint, Fortinet, InfoVista, Riverbed plus own use VNFs Service & Network Automation Platform, fully integrates partner solutions and extend orchestration from the core network to major third-party cloud data centres and LAN/DC-LAN				
SD-WAN	Agile Connect Connect Cisco SD-WAN /Meraki InfoVista/Riverbed	SD-WAN overlay based on Nokia Nuage solution, integrated into BT's network platform and portal SD-WAN solutions based on Cisco technology (Viptela/Meraki) integrated with BT's platform with additional reporting capability SD-WAN features available from Riverbed/InfoVista solutions, BT first to market with As a Service solutions				

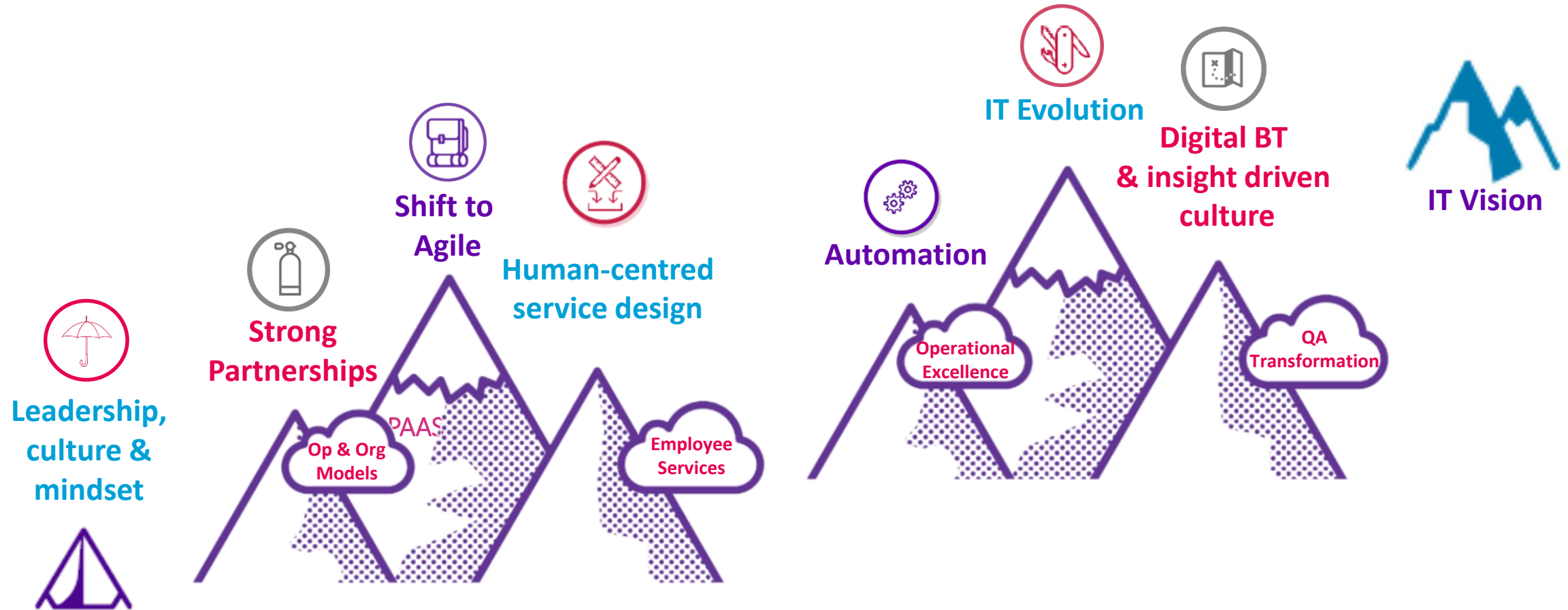


An exciting journey – but a complex one

Increased technology complexity needs to result in LESS complex customer experiences



We're transforming our culture, approach and mindset



Glossary

ONS	Office for National Statistics
FTTP	Fibre to the Premise
5G	The next-generation standard for wireless communications—are scheduled to follow (but not replace) current 4G networks with vastly increased capacity, lower latency, and faster speeds
4G	Fourth generation of broadband cellular network technology, succeeding 3G.
IMS	IP Multimedia Subsystem or IP Multimedia Core Network Subsystem is an architectural framework for delivering IP multimedia services. Historically, mobile phones have provided voice call services over a circuit-switched-style network, rather than strictly over an IP packet-switched network
IP Voice	Technology for the delivery of voice communications and multimedia sessions over Internet Protocol (IP) networks, such as the Internet
MIMO	Multiple-input and Multiple-output, method for multiplying the capacity of a radio link using multiple transmission and receiving antennas
G.Fast	Delivers ultrafast broadband speeds of more than 100Mbps
IMT	International Mobile Telecommunication system
CP/UP	Control Plane carries signalling traffic User Plane carries network user traffic

RAT	Radio Access Technology
Vertical AP	Vertical Application
D2D	Device to Device, communication refers to a radio technology that enables devices to communicate directly with each other
SLAs	Service Level Agreements
IPCG	IP Connect Global network, lets you connect different sites with different needs, locally, nationally and around the world
MPLS	Multiprotocol Label Switching is a routing technique in telecoms networks that directs data from one node to the next based on short path labels rather than long network addresses
ICG	Inbound Contact Global, a voice service where you can route your callers all over the world to the most suitable agent or automated solution
POPs	Point of Presence is the point at which two or more different networks or communication devices build a connection with each other
RAN	Radio Access Network is part of a mobile telecommunication system
IoT	Internet of Things, refers to the concept of extending Internet connectivity beyond conventional computing platforms
NFV	Network Functions Virtualization is an initiative to virtualize network services

