The Road to 6G
A regulators perspective

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Communications & Media Technology

Overview

1. About Ofcom

2. How we're preparing for 6G & beyond

3. Our publications

collaboration EMPOWERMENT Respect agility Excellence
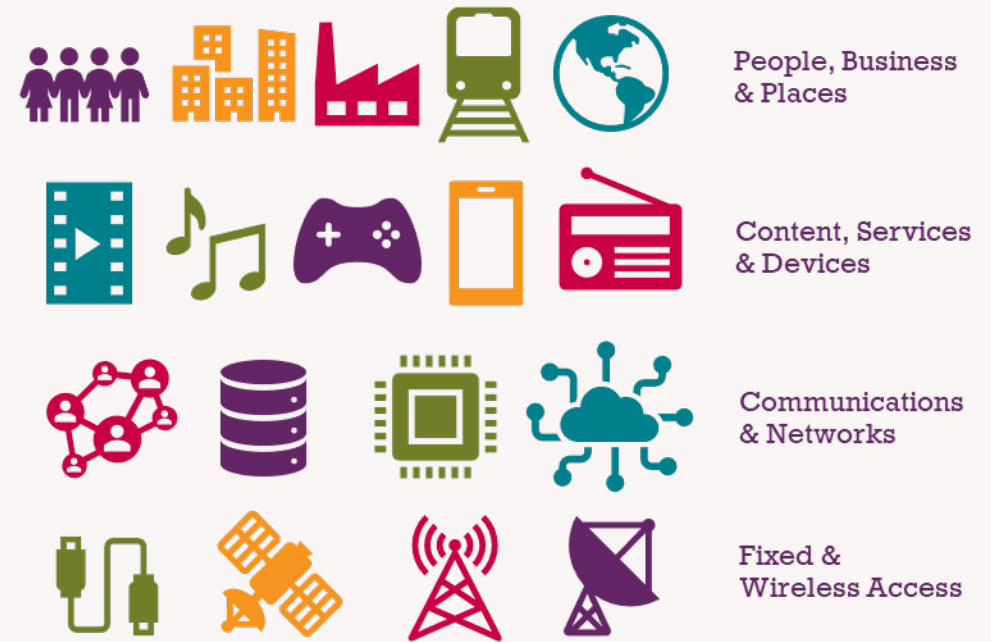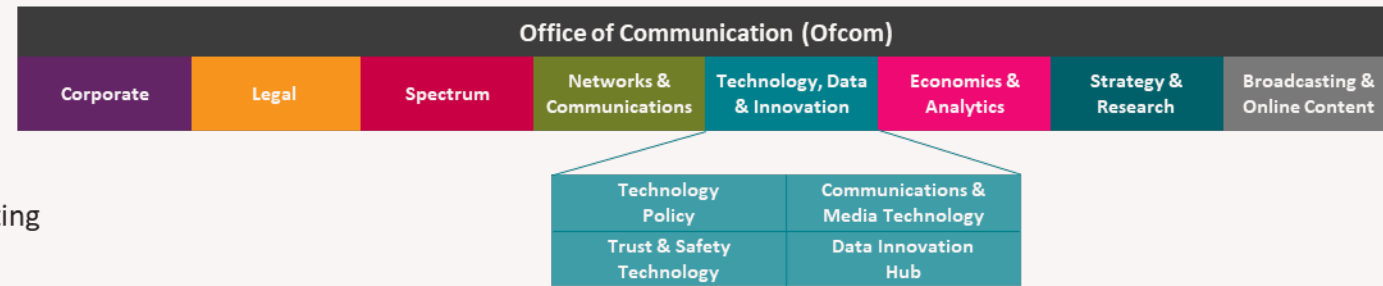
About Ofcom

Who we are

- **Regulatory & competition authority** for **broadcasting**, **telecommunications** & **postal** industries
- **Statutory duty** to represent **interests of citizens & consumers** through promoting **competition**, encouraging **investment & innovation** in relevant markets

We adopt a tech-first approach to regulation

- Want to **anticipate** (rather than react to) **emerging technologies/technology trends** & understand how they will impact the sectors we regulate
- Recognised as **thought leaders** both **internally** & **externally**

Our themes for 2022/23

- **Investment in strong, secure networks** to ensure high-quality & reliable broadband & mobile networks
- **Getting everyone connected** so nobody is left behind as services evolve
- **Fairness for customers** & tackling scams
- **Enabling wireless services in the broader economy** for the benefit of everyone in the UK
- **Supporting & developing UK media** helping it to evolve & meet the needs of viewers & listeners
- **Serving & protecting audiences** from potentially harmful/offensive content, while taking full account of freedom of expression
- **Establishing regulation of online safety** for our new regulatory responsibilities as the Online Safety Bill proceeds through parliament

https://www.ofcom.org.uk/news-centre/2022/confirming-our-2022-23-plan-of-work

Office of Communication (Ofcom)

| Corporate | Legal | Spectrum | Networks & Communications | Technology, Data & Innovation | Economics & Analytics | Strategy & Research | Broadcasting & Online Content |

| Technology Policy | Communications & Media Technology |
| Trust & Safety Technology | Data Innovation Hub |

People, Business & Places

Content, Services & Devices

Communications & Networks

Fixed & Wireless Access

collaboration EMPOWERMENT Respect agility Excellence

Our work in CMT will ensure Ofcom is fit to face the future

6G Themes

IMMERSIVE HUMAN-CENTRIC EXPERIENCE
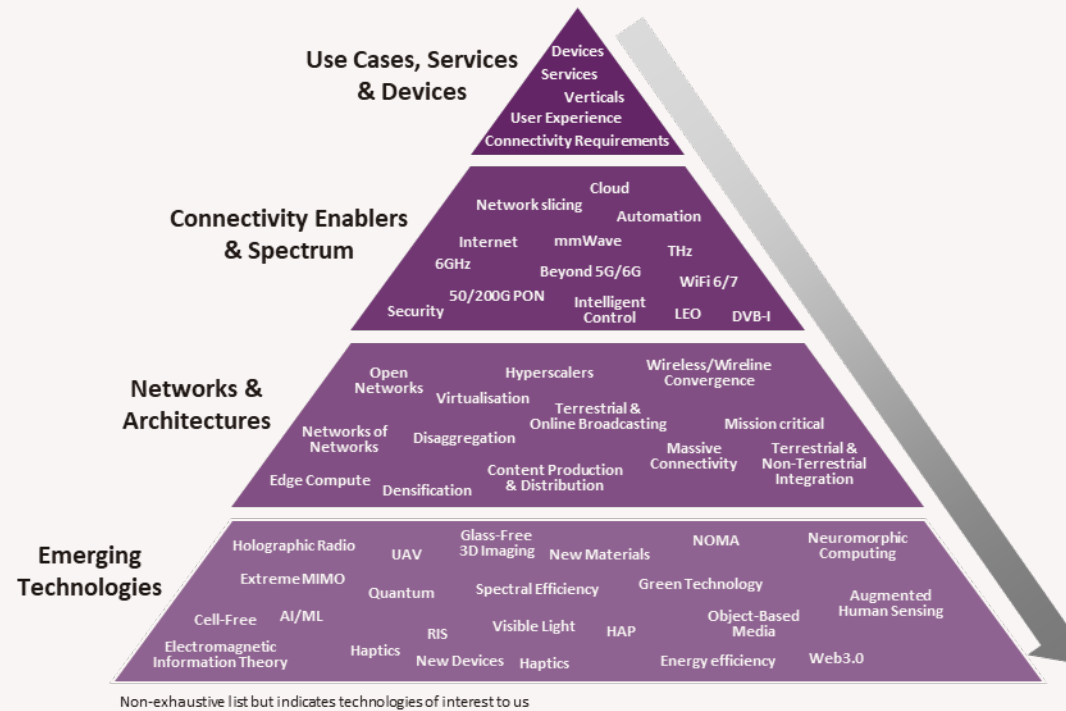
SENSING, LOCALISATION & IMAGING

INDUSTRY 4.0

SMART CITY & SMART LIFE

Technology Focus on the User

- People & businesses are front & centre of our work
- Understand user needs, connectivity requirements & technologies that will deliver them
- Knowing where technology falls short helps shape our horizon scanning

Use Cases, Services & Devices
Devices, Services, Verticals, User Experience, Connectivity Requirements

Connectivity Enablers & Spectrum
Cloud, Network slicing, Automation, Internet, mmWave, THz, 6GHz, Beyond 5G/6G, WiFi 6/7, 50/200G PON, Intelligent Control, LEO, DVB-I, Security

Networks & Architectures
Open Networks, Hyperscalers, Wireless/Wireline Convergence, Virtualisation, Terrestrial & Online Broadcasting, Mission critical, Networks of Networks, Disaggregation, Massive Connectivity, Terrestrial & Non-Terrestrial Integration, Edge Compute, Content Production & Distribution, Densification

Emerging Technologies
Holographic Radio, UAV, Glass-Free 3D Imaging, New Materials, NOMA, Neuromorphic Computing, Extreme MIMO, Spectral Efficiency, Green Technology, Augmented Human Sensing, Cell-Free, AI/ML, Quantum, Visible Light, Object-Based Media, Electromagnetic Information Theory, Haptics, RIS, HAP, Web3.0, New Devices, Haptics, Energy efficiency

Non-exhaustive list but indicates technologies of interest to us

It's not just about understanding the technology….

We are interested in the technologies that will have the potential to significantly impact at least one (or more) of the following:

- Enables the delivery of new use cases/services which are valued highly by people & businesses
- Broadens & deepens access to services
- Increases the performance of networks, improving the experience for people
- Lowers barriers to entry for providers, enabling choice for people
- Reduces the cost of delivering services, increasing access & maximising value for customers
- Changes the way we authorise & regulate networks/services
- Reduces the total environmental impact of delivery of communication services & associated activities
- Assures the security & resilience of service delivery

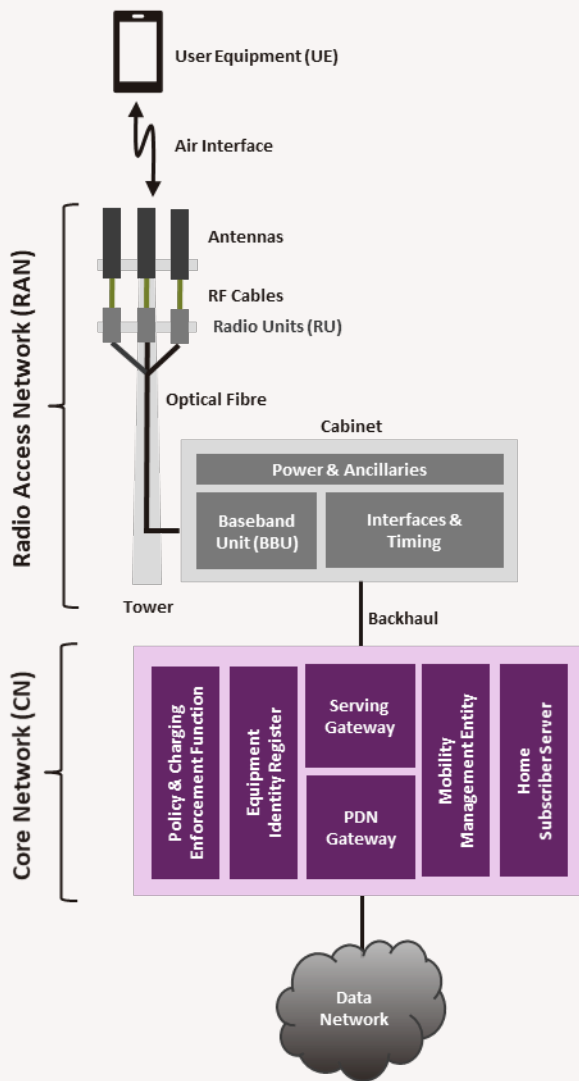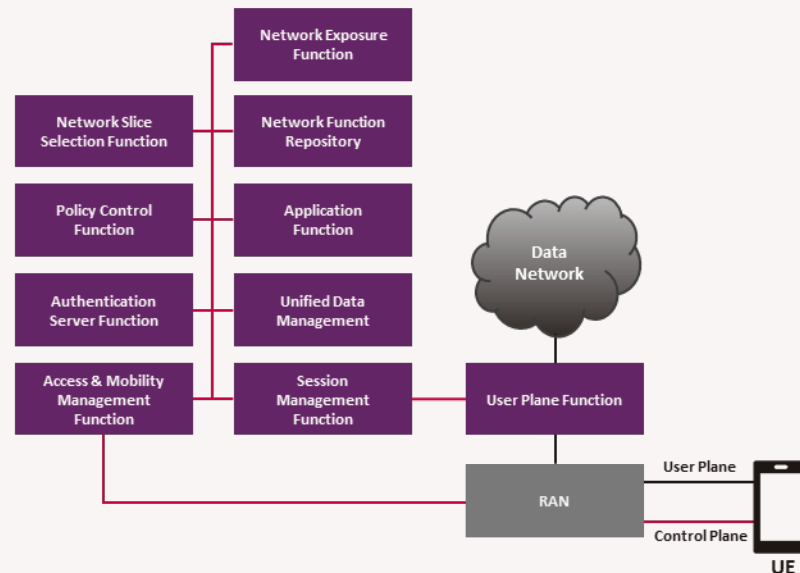# We need to understand how networks will evolve & the challenges Network Providers will face

Traditional Mobile Architecture

User Equipment (UE)

Air Interface

Radio Access Network (RAN)

Antennas

RF Cables

Radio Units (RU)

Optical Fibre

Tower

Cabinet

Power & Ancillaries	
Baseband Unit (BBU)	Interfaces & Timing

Backhaul

Core Network (CN)

- Policy & Charging Enforcement Function
- Equipment Identity Register
- Serving Gateway
- PDN Gateway
- Mobility Management Entity
- Home Subscriber Server

Data Network

Service-Based Architectures

- Network Exposure Function
- Network Slice Selection Function
- Network Function Repository
- Policy Control Function
- Application Function
- Authentication Server Function
- Unified Data Management
- Access & Mobility Management Function
- Session Management Function
- User Plane Function

Data Network

RAN

User Plane

Control Plane

UE

Shift from Monolithic to Disaggregated RAN

Offsite

CN	CN	CN	CN
		CU SW HW	CU SW HW
BBU			DU SW HW

Onsite

BBU	CU SW HW		
	DU SW HW	DU SW HW	
RU	RU	RU	RU

HW - Hardware
SW - Software
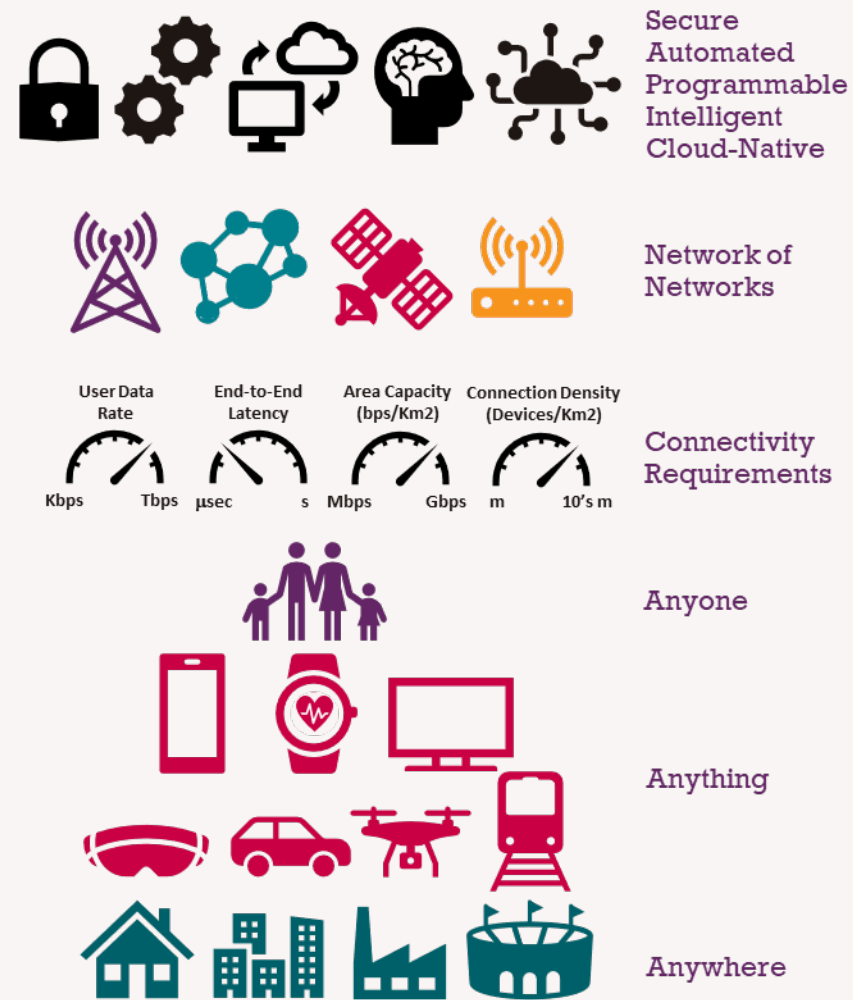CU - Centralised Unit
DU - Distributed Unit
RU - Radio Unit0
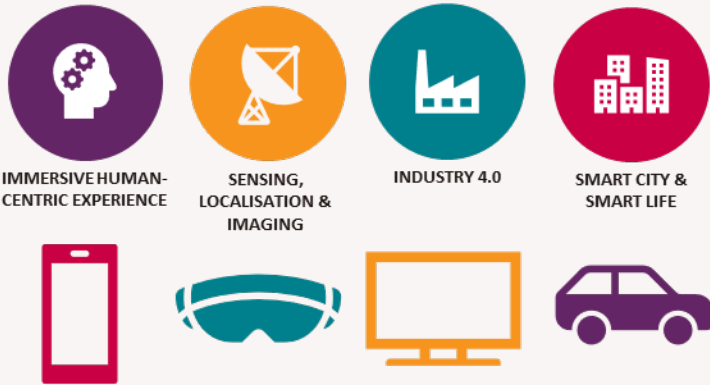
Monolithic ───────────► Disaggregated
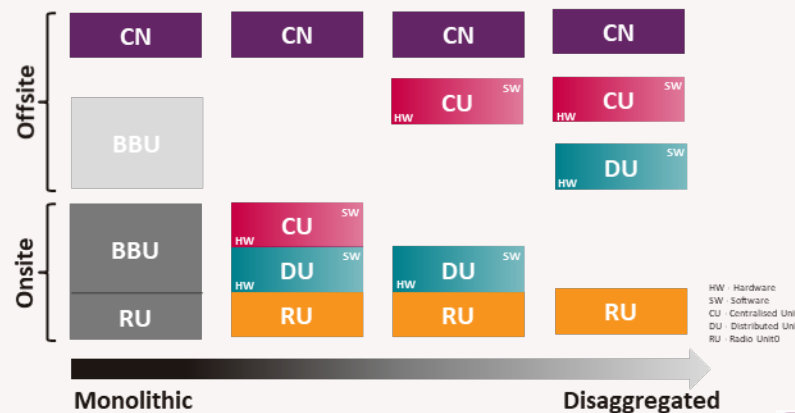
Disaggregation includes decoupling of HW/SW in addition to disaggregating network elements
Open RAN connects disaggregated RAN elements through the use of open & interoperable interfaces

Converged & Metaverse-Ready Networks

Secure Automated Programmable Intelligent Cloud-Native

Network of Networks

Connectivity Requirements

User Data Rate	End-to-End Latency	Area Capacity (bps/Km2)	Connection Density (Devices/Km2)
Kbps — Tbps	μsec — s	Mbps — Gbps	m — 10's m

Anyone

Anything

Anywhere

Understanding a broad range of future use cases & enabling technologies is vital for our work

Use Cases, Services & Devices

IMMERSIVE HUMAN-CENTRIC EXPERIENCE

SENSING, LOCALISATION & IMAGING
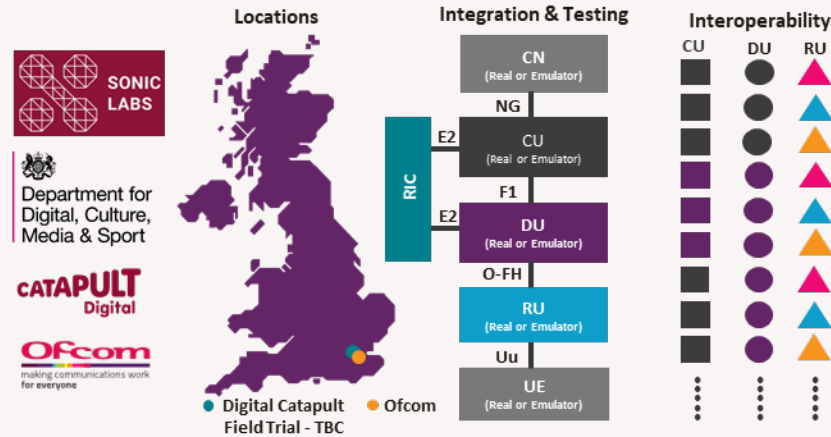
INDUSTRY 4.0

SMART CITY & SMART LIFE

Continuous activity to understand use cases & services - understand user needs & gain early insight on potential regulatory/policy impacts

Compare QoS/QoE requirements against technology capabilities - gaps shape horizon scanning activities

Understand content production & distribution techniques

Map out evolution of devices used to enable & access new services

Sustainability

Understand sustainability challenges & enablement effect of technology
Energy efficiency, network slicing, private networks, edge compute, etc.

Open Networking Solutions

Locations

SONIC LABS

Department for Digital, Culture, Media & Sport

CATAPULT Digital

Ofcom
making communications work for everyone

● Digital Catapult Field Trial - TBC ● Ofcom

Integration & Testing

CN (Real or Emulator)
NG
RIC
E2
CU (Real or Emulator)
F1
E2
DU (Real or Emulator)
O-FH
RU (Real or Emulator)
Uu
UE (Real or Emulator)

Interoperability

CU DU RU

Our current focus is 5G Open RAN, however, open networking solutions spanning Core, Transport & RAN likely to play a key role in the deployment of 6G & beyond

Wireless-Wireline Convergence

3GPP BBF

Mobile

FWA CPE

Hybrid CPE

Fixed CPE

Radio Access Network

Fixed Access Network

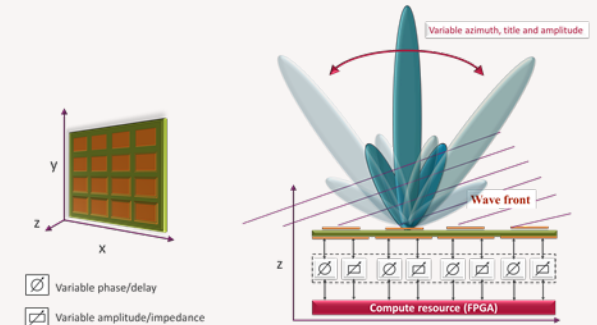Converged Core Network

Data Network
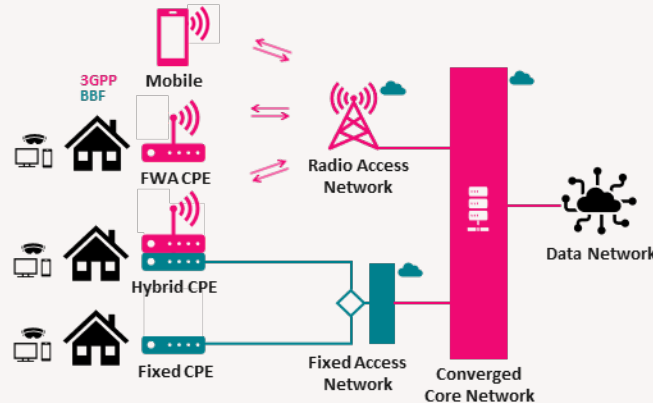
Understand commercial, operational & consumer benefits
Starting point for Network of Networks, Terrestrial/Non-Terrestrial Integration, etc.

AI/ML

Understand commercial, operational & consumer benefits
Understand potential security/privacy risks, etc.

Reflective Surfaces & MIMO Evolution

Variable azimuth, title and amplitude

Wave front

$\varnothing$ Variable phase/delay

☑ Variable amplitude/impedance

Compute resource (FPGA)

Understand spectrum impacts & deployment challenges of RIS
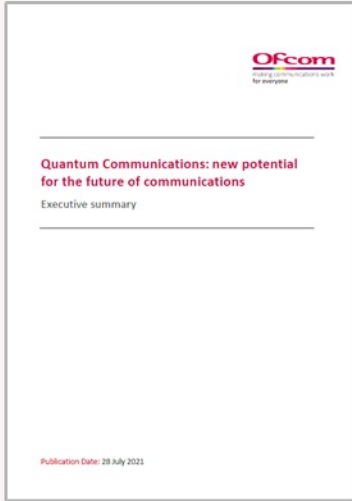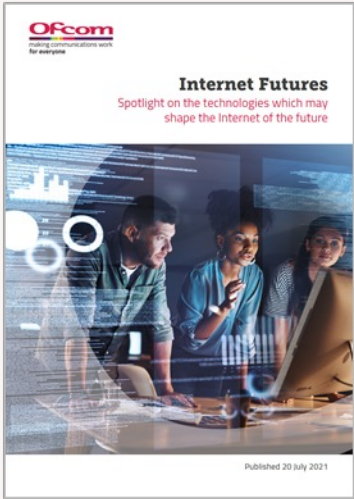Examine Cell-Free & MIMO evolutions for metaverse-ready networks
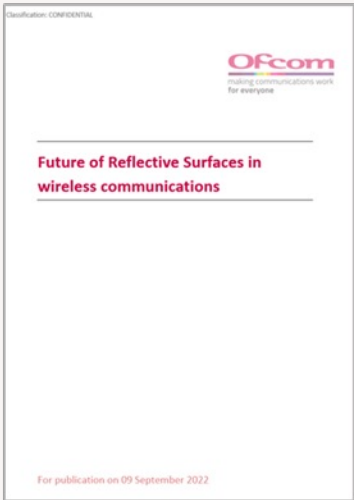
Joint Communications & Sensing
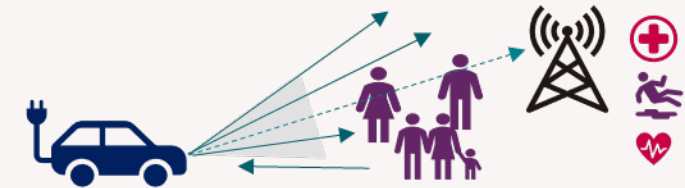
Understand spectrum requirements for sub-1m resolution, potential security/privacy risks for CSI-based sensing, etc.

Note this represents a snapshot of our current areas of focus

We are becoming a respected & recognised thought leader through impactful publications

Issued

Pipeline

collaboration   EMPOWERMENT   Respect   agility   Excellence

Thank you!