# Urban Connected Community (UCC): Digital productivity acceleration programme with multicity 5G Testbed in the UK

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# Outline

- Context of UCC programme
- UCC objectives
- Complementary initiatives
- Role of Intelligent Systems & Networks research group at BCU
- Partnership

# Context: 5G in the UK

- UK 5G roll-out estimated cost: £30bn - £50bn
- UK mobile operator annual Capex: £2.5bn
- Consumer market saturated and flat revenue prospects
- Unlikely that mobile operators will be able to rollout extensive 5G networks that meet the needs of all potential use cases

***What is meant by '5G'?***

- Next generation of mobile networks – significantly faster, reduced latency, greater reliability, flexible connectivity
- Also covers 4G densification, wifi, advanced LTE, narrowband IoT

*To help to grow a competitive mobile market and support investment and innovation, the Future Telecoms Infrastructure Review (FTIR) recommends:*

1. Making it **easier** and **cheaper** to deploy mobile infrastructure
2. Supporting infrastructure models that **promote competition & investment in network densification & extension**
3. Stimulating demand and new use cases through the **5G Testbeds** and **Trials Programme**
4. Securing a diverse set of innovative 5G services through flexible future **spectrum policy**

# Context: DCMS Testbeds and Trials Programme

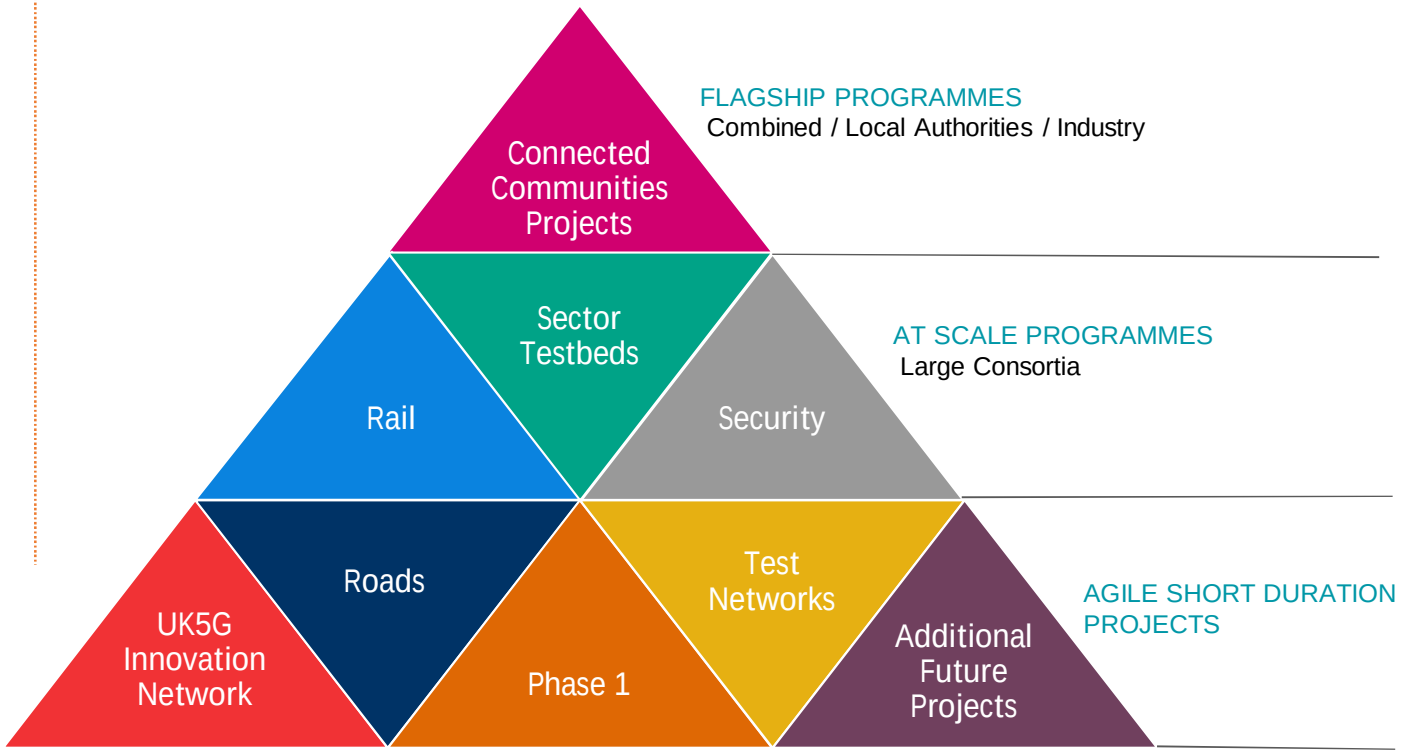
## *Vision*

*Build* - the business case for 5G by stimulating new use cases and create the conditions needed to deploy 5G efficiently

*Foster* - the development of the UK's 5G ecosystem

*Lead* - the way in 5G R&D to drive UK 5G leadership

## *Delivery approach*



# Why the West Midlands?

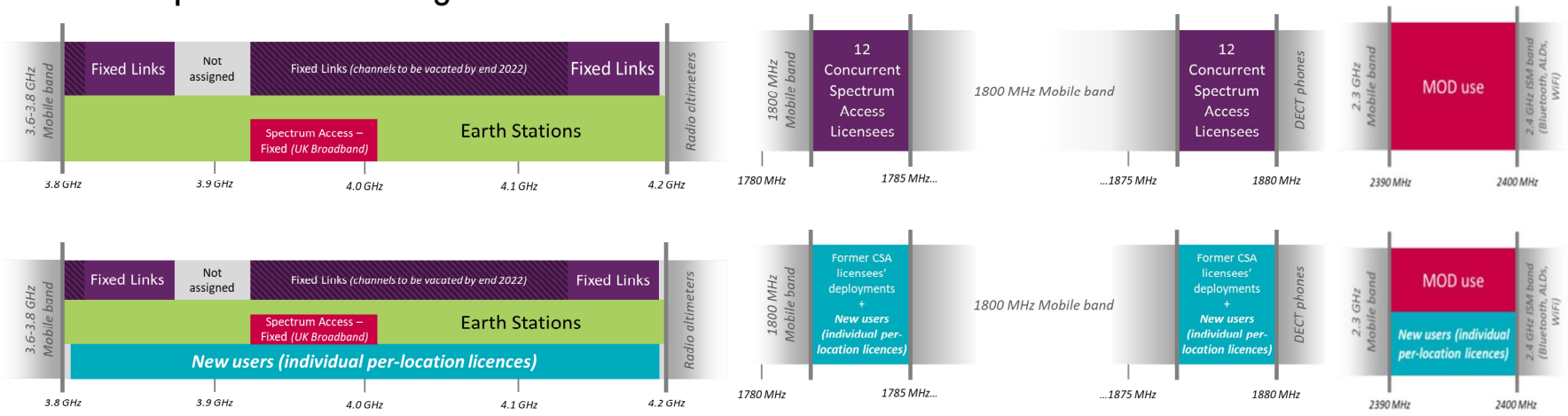
| | |
|---|---|
| Scale  | • 3 million population<br>• 3 City Centres<br>• 7 Universities<br>• Transport Infrastructure: road, rail, air |
| Use cases  | • Automotive, CAV, Mobility<br>• Industrial and supply chain<br>• Large public sector, health, life sciences & medical<br>• Events : City of Culture, Commonwealth Games 2022 |
| Governance  | • WMCA Convenes 7 Local Authorities, 3 LEPs, Fire, Police, Transport (TfWM)<br>• Public Estate - 15k buildings<br>• Estimated 500k pieces street furniture |

# UCC Objectives

- Test models for cost effective deployment of 5G infrastructure in highly populated, urban areas, and remove barriers.
    - This should help reduce commercial risks with investment.
- Explore potential for 5G to enable economic and social benefits, for example through cost savings and service improvements in the public sector.
- Develop and test new applications and services that use 5G capabilities; and commercial business models.
- Test demand for 5G and related technologies.
- Develop and test working models of infrastructure, organisation, capability (people, process, technology) and investment to deploy and operate 5G and other relevant technologies, applications and services.
    - Understand skill set requirements.
- Reduce risks associated with investment in 5G and relevant technologies.
- Inform West Midlands and National digital policy and regulation.

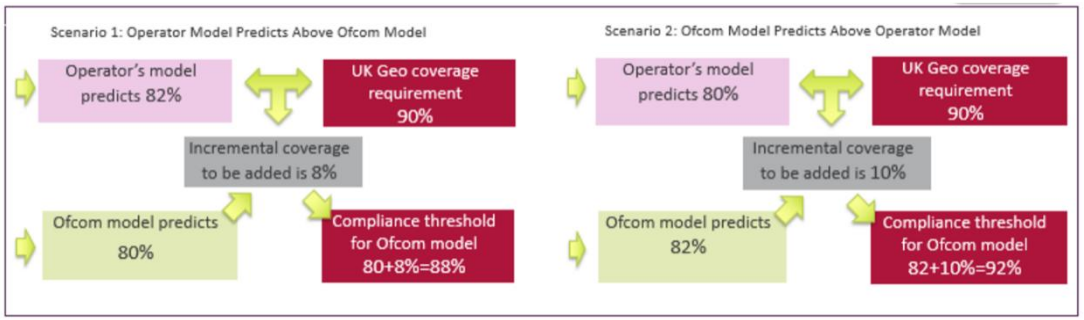
# Complementary initiatives from OFCOM

- Enabling opportunities for innovation
  - Spectrum Sharing




| Channel size | Price per channel |
|---|---|
| 2x3.3 MHz | £80 |
| 10 MHz | £80 |
| 20 MHz | £160 |
| 30 MHz | £240 |
| 40 MHz | £320 |
| 50 MHz | £400 |
| 60 MHz | £480 |
| 80 MHz | £640 |
| 100 MHz | £800 |

- Coverage Obligation to MNO:

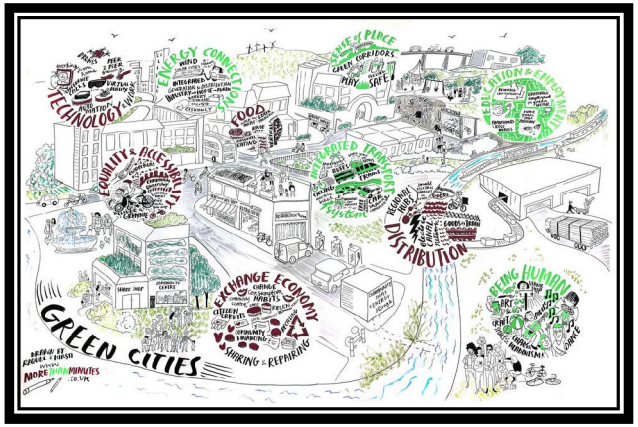



- a requirement to provide good quality service outdoors for at least 140,000 premises to which the obligation holder does not provide good coverage at the date
- a requirement to deploy at least 500 new wide area mobile sites in rural areas, to be located at least 1km from existing.
- meaning that each of the new 500 sites shall have a minimum “EIRP” of 43dBm.

# How ISN@BCU is working with UCC and the future?

- Intelligent Systems & Networks (ISN) research group:
  - Develops new technologies and innovative use cases to enhance efficiency and create wealth in our digital society.
  - This is delivered through research in optimised trustworthy connectivity, smart sensing, developing intelligent systems and infrastructure.
- Current Scope:
  - Spectrum
  - Small Cells
  - Self organising networks
  - Data Modelling
  - Data ghosting

# Building Urban & Connected community

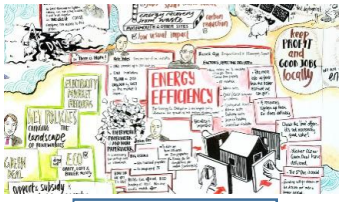



Stable ecosystem
For Urban Community

Infrastructure

Roads

Communication



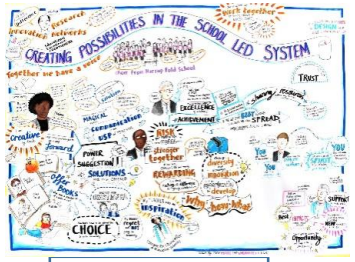

Energy

Transport

Environment

Services


Health
(Surgeries /Hospital)




Education


Local Government
services ( waste collection
& management)

Recreational/Entertai
nment/tourism

Car Parks

Challenges:

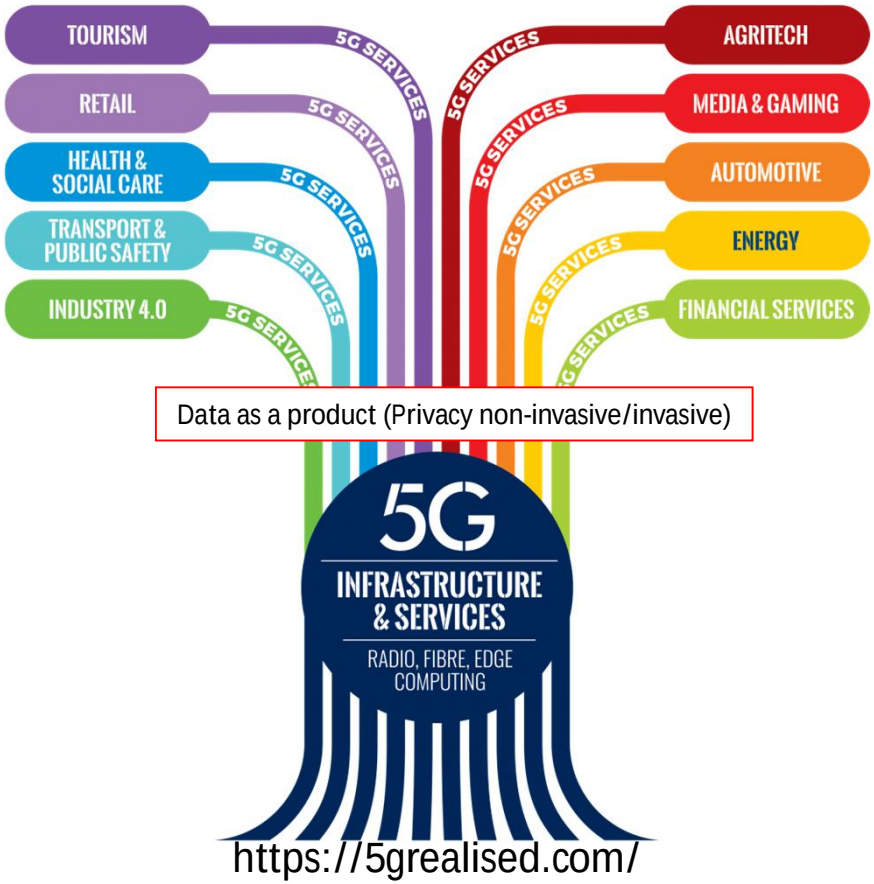
- New developments tends to un-stabilise the eco-system.
- Current low density data cannot create reliable data analytics of local knowledge for digital services, hence does not create value as expected.
- Existing fragmented data cannot create a complete data ecosystem.

Solution:

- To create high-resolution local knowledge with smart sensing HetNet;
- possibly maintained by local SMEs;
  - harvest data;
  - feed data to unified platform,
  - prove business model within phased approach.

Value of data: https://knowtechie.com/facebook-paying-teens-for-data/

# Scalable approach: Data harvesting as business



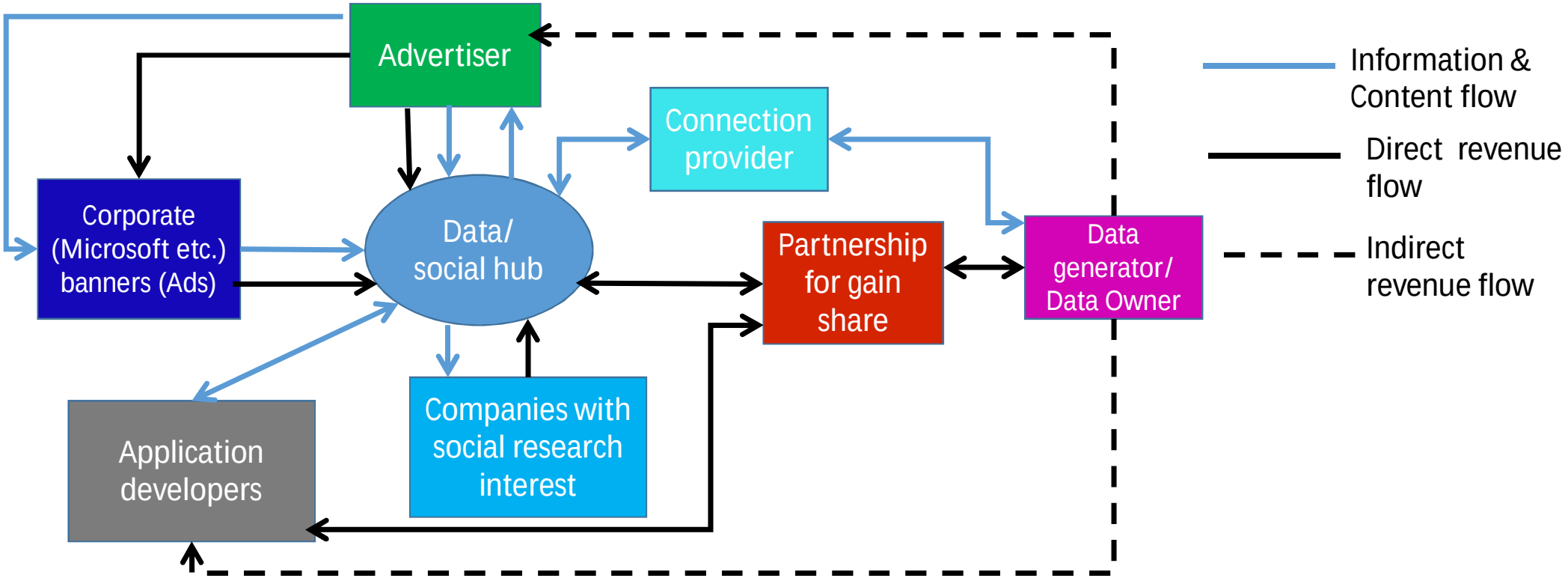

https://5grealised.com/

- Data infra for citizen safety, security and resource management.
  - Incident monitoring, reporting & reproduction (3D)
    - Public safety & investigation support (police/insurance)
  - Incident impact prediction & reporting
    - Smart road incident reporting to health and emergency services
  - Crowd control
    - Event management
  - Congestion management /transport management
    - Local government/traffic/Transport authority
- Infrastructure health management (critical/ non-critical), Examples:
  - Road (on / off) surface monitoring
  - Street furniture
  - Energy management (heat, gas, electricity, water)
  - Environment

# Current barriers of data sharing

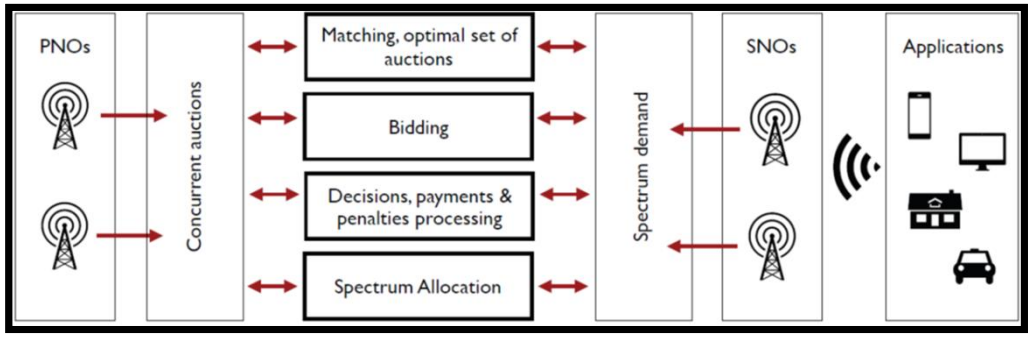
- Immature market : is often not part of its current core business strategy
- Lack of use cases: requires clear example on seller or buyer have been successful or benefited by sharing data
- Fragmented data landscape: lack of data to define a meaningful business model; often absence entangled data required to clearly identify value.
- Reluctance of data sharing: absence of the clear definition of direct or indirect financial benefit for core business.
- Skills and Competence: lack of skill to collect and prepared data for sharing; data scientists and relevant equipment are expensive.
- Absence of unified technical platform for data

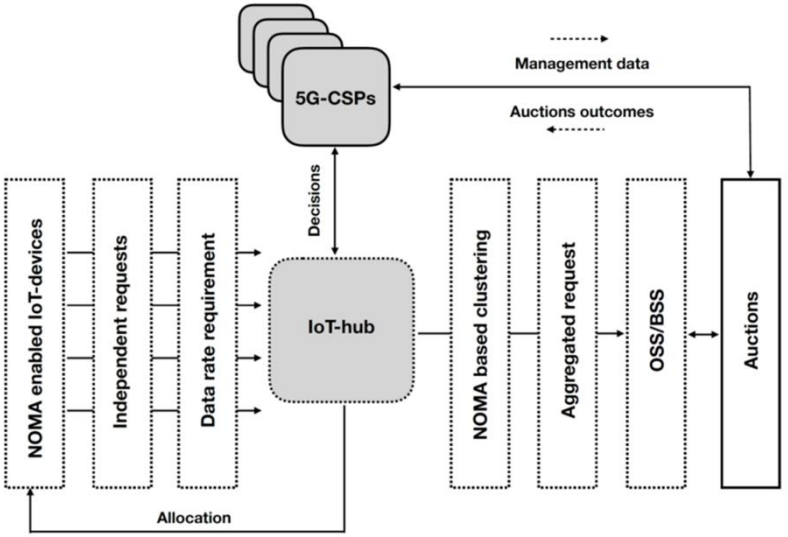
# D-Economy business models



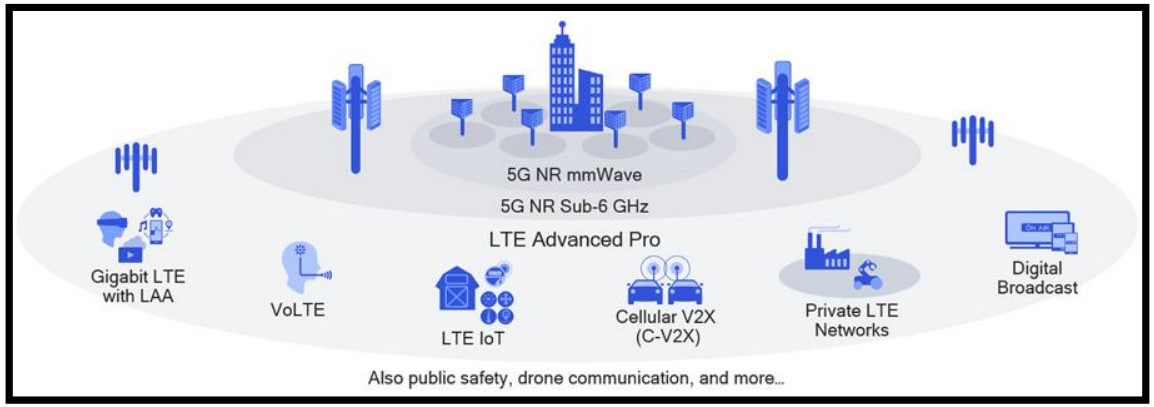
# Role of Intelligent Systems & Networks research group

- Spectrum Sharing- (premium/budgetary licenced)




- Micro-operator/ Private Networks/Neutral Hosting

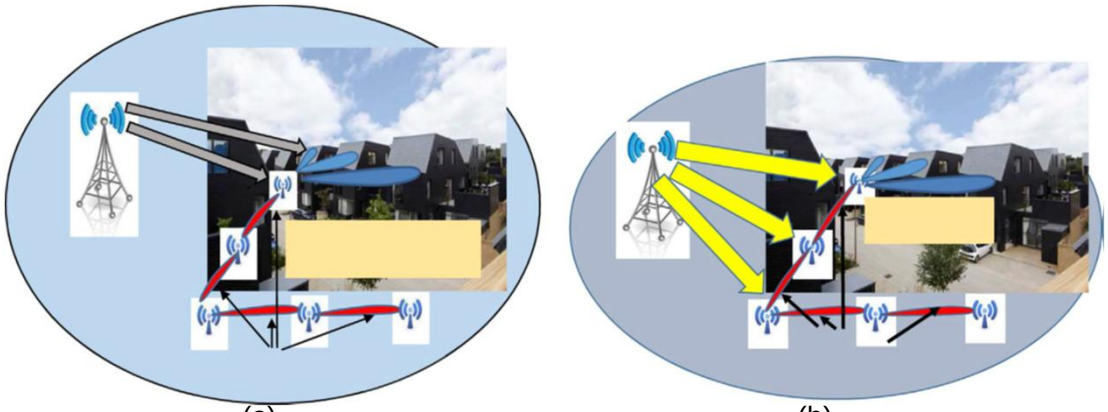



- Low cost spectrum access
- Backhaul/Front-haul/Infrastructure sharing
- Spectrum trading in spatio-temporal basis
  - Business model definition
  - CAPEX/OPEX analysis/recommendation

# Role of Intelligent Systems & Networks research group

BIRMINGHAM CITY University

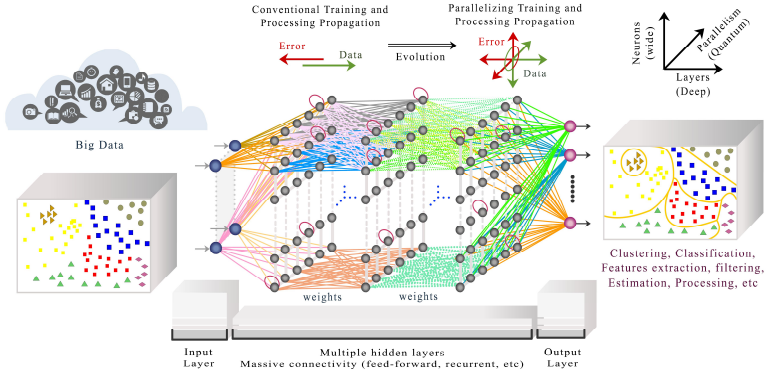
UnISCell- Universal Transceiver
-Spectrum independent LMA



(a) (b)

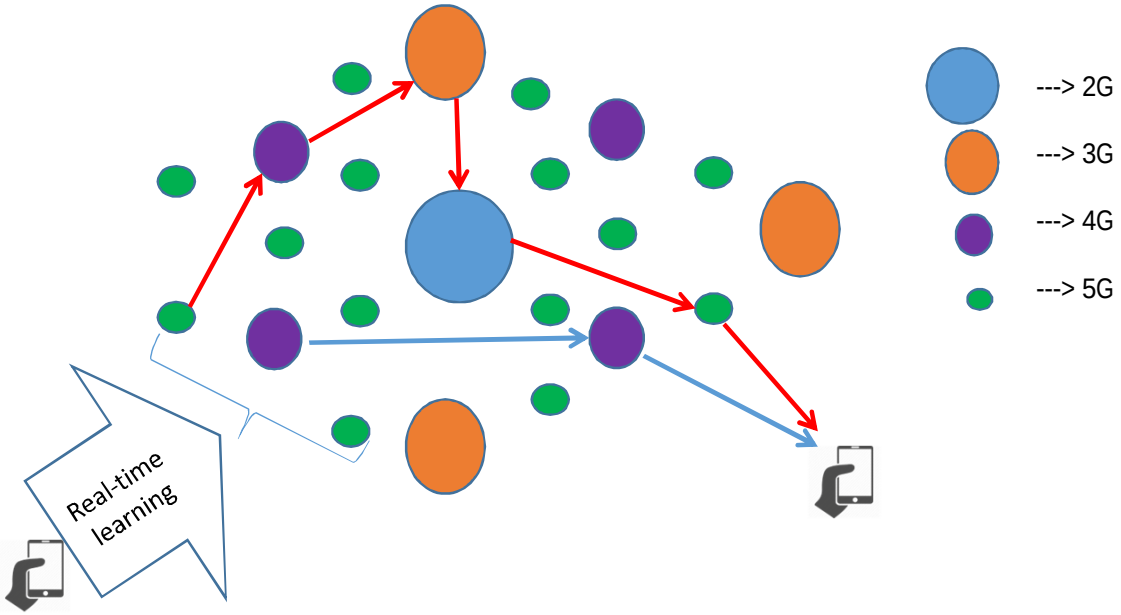
(a) Deployment model for universal/fixed coverage assignment
(b) Deployment model for on-demand/dynamic coverage assignment.

Quantum ML
- Learning & demand based network interoperability & reconfiguration

# Role of Intelligent Systems & Networks research group- 5G+

- Learning based Forward-Backward compatibility -




- How?
  - DSS/DSA
  - Software defined network
  - Multiple access for Multi-RAT networks
  - Universal CODEC

- Benefit
  - Coverage reliability
  - Optimum CAPEX/OPEX
  - Efficient uses of spectrum & physical resources
  - Cheaper connectivity

- Challenges:
  - Latency management
  - Transceiver design
  - Learning based connectivity atlas derivation
  - Time & application dependency

# Role of Intelligent Systems & Networks research group -5GonWheel

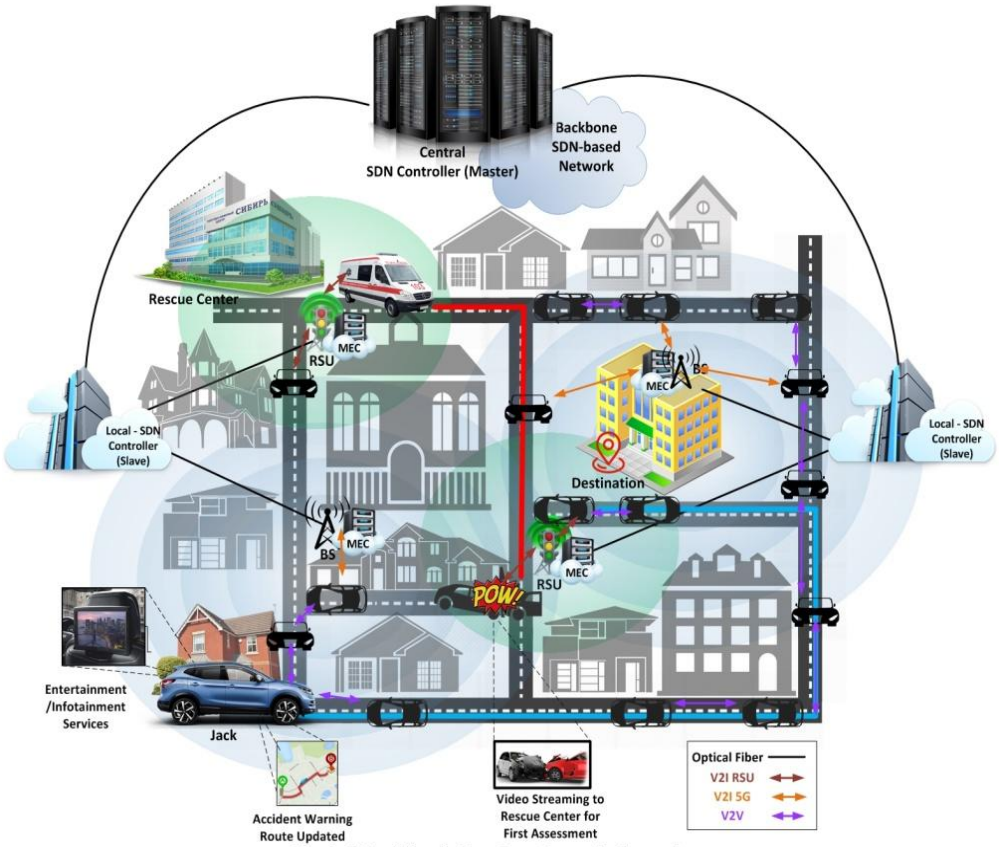



Fig. 1. 5GonWheels Use-Case Scenario Example

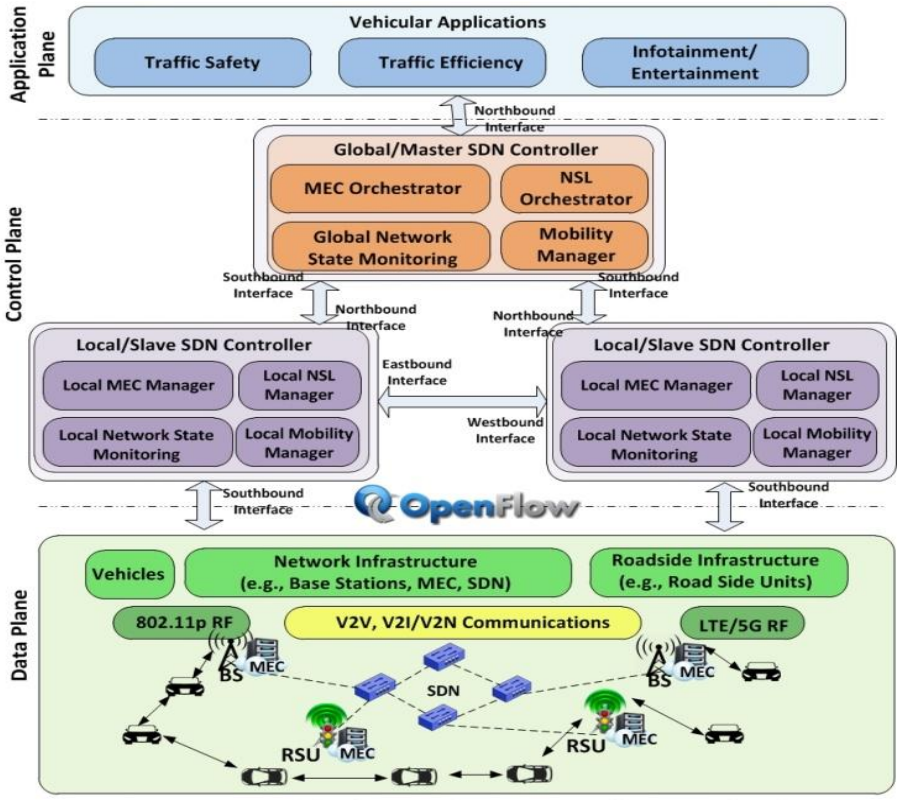



Fig. 2. Simplified Logical Structure of 5GonWheels

# Use Case Scenario

- Jack's car is a connected vehicle being connected to the 5GonWheels infrastructure.
- drop his kids to school.
- Connected to 5GonWheels traffic management system
- The Entertainment services will enable the kids to watch educational videos on their way to School.
- However, a traffic accident takes place on their path to destination which triggers the 5GonWheels infrastructure to define and enable a congestion area alert and disseminate it to the vehicles using V2V and V2I communication.
    - Jack's vehicle will receive the accident warning message that will trigger the route update to avoid the congested area.
    - Additionally, the 5GonWheels infrastructure will trigger the fast traffic accident rescue mission, which involves disseminating accident-related information from the involved vehicles sensors as well as real-time video streaming of the accident to the rescue center for a reliable initial assessment of the severity of the accident.
    - This will enable the rescue center to prepare an efficient rescue by sending the appropriate equipment and expertise to the crash site and increasing the survivability chances of the injured people.
    - Moreover, the 5GonWheels infrastructure will enable a fast rescue route for the emergency vehicle which involves prioritizing the emergency traffic by setting a dedicated shortest path as well as proactively informing the vehicles on that route to make room or clear the area for the rescue vehicle.

# To participate

- Potential verticals:
  - Industry 4.0
  - Health & Emergency services
  - Urban Mobility
- Process:
  - Use Case
    - proposition/definition/validation/optimization/ commercialization
    - Ownership


# Thank you!