

Agenda

- 10:00 **Start of event**
- 10:10 Setting the policy context and Overview of Open Networks Fund
- 10:20 Future Open Networks Research Challenge ambitions
- 10:30 Application, timelines and structure
- 10:50 **Q&A**
- 11:10 **Pitching**
- 12:00 **End of event**



Setting the policy context

Presenter: Simon Saunders

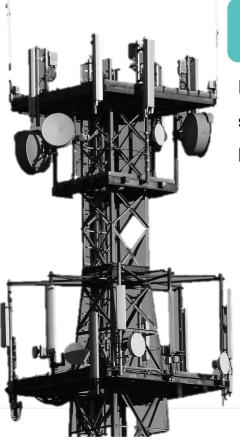


2020-21: 5G Diversification Strategy and Open RAN Principles

5G Diversification Strategy

The strategy sets out our long-term vision for a healthy 5G supply market. It is built on three core strands of activity:

- Working with incumbent suppliers
- Attracting new suppliers into the UK market
- Accelerating open-interface solutions & deployment



Open RAN Principles

Four principles of 'open-interface solutions' - for Open RAN and beyond:

- Open disaggregation
- Standards-based compliance
- Demonstrated interoperabilityand integration capability
- Implementation neutrality

2022: Open Networks R&D Fund

£250m until March 2025

Accelerate open-interface products and solutions

Incentivise and derisk accelerated deployment in the UK

Develop an internationally recognised UK telecoms ecosystem

How FONRC fits in

Challenge set for FONRC:

Ensuring sustainability of openness and interoperability in the mid- and long-term and supporting UK capability in telecoms

Ensure that future networks architectures, technologies and solutions are created with our principles of openness and interoperability in mind

Develop an internationally recognised UK telecoms ecosystem

Incentivise investment by large vendors, wider industry

Greater emphasis on IP generation and commercialisation of research

Increase UK footprint in standardsmaking

Support UK's 6G Vision and Strategy and R&D funding

(more to come later this year)



Overview of FONRC ambitions

Presenter: Freddy



Future Open Networks Research Challenge

To embed the principles of openness and interoperability in future networks architectures and technologies, thereby ensuring the sustainability of open networks beyond the current 5th generation of telecommunications.

Scope

Conduct Research in TRL's 1-5

Network focus, not applications

Enhanced interoperability performance and manageability

Consider impact of open disaggregation Abide by ORAN Principles:

Open Disaggregation Standards-based compliance Demonstrated interoperability Implementation neutrality

Objectives

Strengthen Sustain Open **UK Capability Networks UK Influence** Develop a **UK Vision** on Standards

Desired Outcomes

Established academic leadership on open networks Increased TRLs and industry investment in commercialisation

More UK-held patents, supporting UK telco industry

Increased engagement with standards development organisations

All sizes of vendors have collaborated

Increase UK retention of PhDs & post-doctoral researchers

Greater domestic and international investment in UK telecoms R&D

Identify the state of the art

Desired Outputs

Any future architecture, concept, tech, prototype or improvement

Academia and Industry are best-placed to define outputs



Application, timelines and structure

Presenters: Joshua



Challenge Timelines

Milestones	Timing
Challenge launch announcement	26/07/2022
Challenge launch announcement	<u> </u>
Fundacion of Interest (antique)	26/07/2022 > Noon 12/08/2022
Expression of Interest (optional)	[deadline]
Review and feedback of EOIs:	15/08/2022 > 26/08/2022
Challenge closes (deadline for full proposals):	Noon 03/10/2022
Assessment (no interviews)	04/10/2022 > 14/10/2022
Notification to successful projects	W/C 31/10/2022

EOI

Optional high level proposal. Detailing:

Who? What?

How much? How long?

No agreement with Large Ran Vendor needed at this stage.

High level written and verbal feedback.

Ensures early stage thinking is aligned with objectives.

Feedback is suggestive. Not indicative of positive or negative outcome.

Can submit a full proposal, without submitting EOI.

Challenge Process

Application Process





Funding Available

Eligibility Criteria & Subsidy Control



Challenge Application Process

The challenge guidance and supporting documentation are on gov.uk. Key points to note are:



- The lead organisation must submit the application for the consortium, including all the required **documentation**, including detailed financial plans that cover **up to the end of the funding** period.
- DCMS will first run an eligibility check, including ensuring that all the required documents have been submitted and that all the organisations are eligible for funding.
- DCMS assessors will then score the applications based on scoring values outlined in challenge quidance.
- The lead partner will be notified of the funding decision of their application.
- All eligible and in-scope applications will receive assessor feedback.
- Successful applicants should be prepared to enter into a Grant Fund Agreement (GFA) within 10 weeks of notification of our intention for grant funding.

Funding Available

There is up to £25m available from the Department for Digital, Culture, Media & Sport (DCMS) in this challenge for projects up to 24 months long.



- DCMS will provide grants to the eligible consortium of organisations which is successful in this challenge and once a Grant Funding Agreement is agreed.
- Funds must be used in accordance with the Subsidy Control approach detailed in the challenge quidance.
- Grant recipients will be required to confirm that the costs they wish to claim for are capitalised and/or treated as capital expenditure in line with UK GAAP.

Eligibility Criteria - Part 1 of 2

- Applications may be from a single university or a consortium composed of a university and any other UK-registered organisations.
- The lead applicant must be a UK registered university.
- Individual people are not eligible applicants.
- The grant amount for any individual Consortium Partner must not represent more than 50% of each non-academic consortium partner's annual income.
- Consortia members will need to have signed a collaboration agreement between themselves prior to any claim to DCMS for grant funding for the organisation.
- Companies that are not UK-registered are not eligible to receive grant funding from DCMS (Non-UK organisations may participate but will not receive grant funding).
- High risk vendors (HRVs) are not permitted to participate in consortia as a consortium partner or supplier. See NCSC Advice for more information on HRVs.

Eligibility Criteria - Part 2 of 2

- The lead applicant and/or consortium should be able to demonstrate delivery at international level.
- The lead applicant and/or consortium will need to demonstrate sufficient technical knowledge and skills to deliver the required outcomes or be able to sub-contract sufficiently for this criteria.
- Applicants must provide an appendix in your response to Section E separately identifying the following:
 - The estimated cost for each work package described in your responses to Section C. Make clear the level of any contribution from each Consortium Partner and the level of grant funding requested from DCMS.
 - The spend profile by month for year 1, and by quarter for years 2 and 3, linking the profile to milestones and deliverables as needed.
- Individual organisations are allowed to apply as part of more than one consortia bid.
- All grant awards will be made subject to successful due diligence checks.
- Lead applicants and consortia will be required to submit their own independent written legal advice of their compliance.

Subsidy Control

- DCMS has reflected upon how best to demonstrate its compliance with the subsidy control principles, established under the Trade and Cooperation Agreement for the purpose of this challenge. The Subsidy Control Act 2022 received Royal Assent in April, and will be fully enforced in Autumn.
- Applicants will need to confirm their subsidy control approach, and will be required to obtain their own independent subsidy control legal advice and, when requested to do so, commit to sharing that advice with DCMS and its professional advisers. Applicants should refer to the challenge guidance for further information.
- Before submitting an application for funding to DCMS, you must accept the terms and conditions of the grant.

Standards and IP&Patents

Standards:

- Participants have an important role to play in ensuring that the knowledge, know-how and IP generated through R&D activities contribute to and build upon relevant standards, and improve UK representation in key SDOs and activities.
- Awardees under FONRC are asked to engage with relevant standardisation efforts.
- Over the grant funding period, the requirements for standards may change depending on the current state of play within the wider standards ecosystem.

IP and Patents:

- Developing the UK's telecoms ecosystem means more patents should be generated through R&D in turn giving the UK a competitive advantage in telecoms and supporting the growth of the UK's influence both within standards-setting bodies and internationally
- Awardees under FONRC will set their own rules surrounding IP in line with standard industry practice, but are asked to create an 'IP Plan' for intellectual property/patent creation, retention, and dissemination and how this plan will help to achieve the Challenge's objectives.
- Over the grant funding period, projects will need to comply with relevant legislation and engage with government IP objectives as these evolve.

Required Documents

The Consortium Lead Partner must submit the following mandatory documents:

- This **Application Form**, with all questions answered, within the word count, plus any allowed appendices. You **must** also complete the **Supplementary Information** section, including:
 - **One Finance Summary** table,
 - the **Confirmation of Grant Agreement Terms** table; and
 - **Participation Agreement**
- 2. **Finance Forms** (for each partner, including the lead partner). These documents are used to understand how you have estimated your costs - see **Eligible Costs Guidance** for further guidance.
- 3. **Two Years of latest accounts** (in .pdf format) for each Consortium Partner and the Consortium Lead Organisation.
- 4. An appendix setting out a resourcing plan, project costs per milestone and spend profile, as per the requirement in section D of the application form.

For more information

If you have any questions or would like more clarification, please contact us by email. Your question/s and respective answer/s will be aggregated, anonymised and added to a Q&A document which will be published on the .gov website.



email: onp.enquiries@dcms.gov.uk



Q&A





Pitching



Pitching Running Order

- JET Engineering System Solutions LTD
- King's College London
- Lancaster University
- **Queen's University Belfast**
- Smart Wireless Innovation Facility (SWIFt)

- The Original Content Company
- University of Glasgow
- University of Sheffield
- University of Surrey, 6GIC
- **10**. University of York

1. JET Engineering System Solutions LTD





JET Engineering System Solutions

Our 5G buoys are the only solution for maritime connectivity enabling **Safe and Secure**, **Sustainable**, **Smart Operations**.



Our journey so far





Business formation

JET ESS business launched and R&D kick

Supported multiple
DCMS projects on 5G
SA developing own UE

Grant funded Proof of Concept

Worlds first floating 5G, proven in 7 months

Key relationships formed

Deployment and Testing

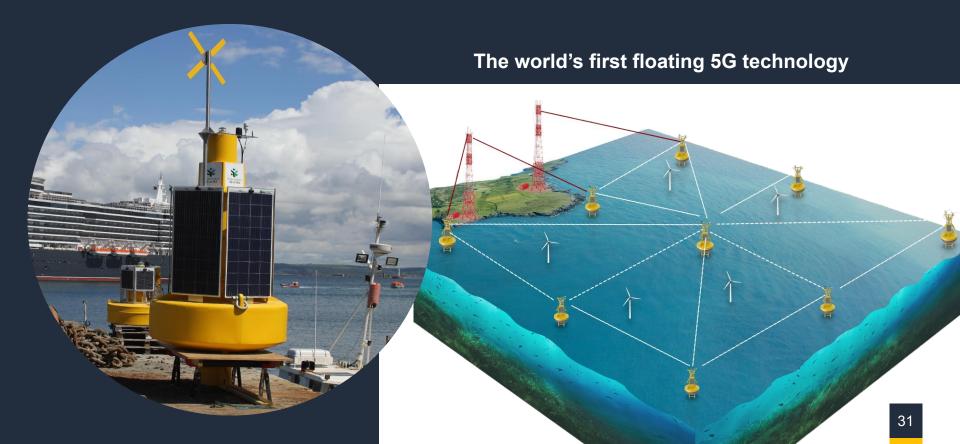
Deployment of 5G network at sea (working Core, CU, DU, and UE)

commercial agreements in offshore wind, and security sectors

Network Operation

- Development of enterprise grade commercial 5G networks
- Commercial deployments of 5G networks at sea

Our Vision



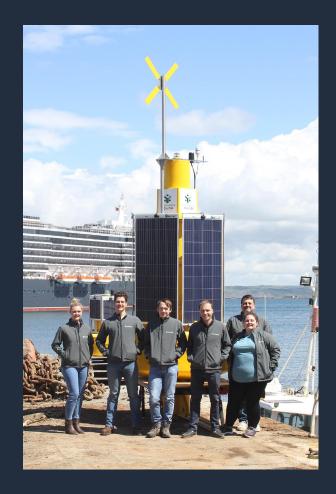
Work with us

Seeking;

- University partners
- Major RAN vendors

Delivering

- OpenRAN
- Neutral Network hosting
- Interoperability
- Fibreless connectivity





Please get in touch with us to discuss working together





Izzy Taylor Head of BD izzy@jet-eng.com



James Thomas CEO james@jet-eng.com

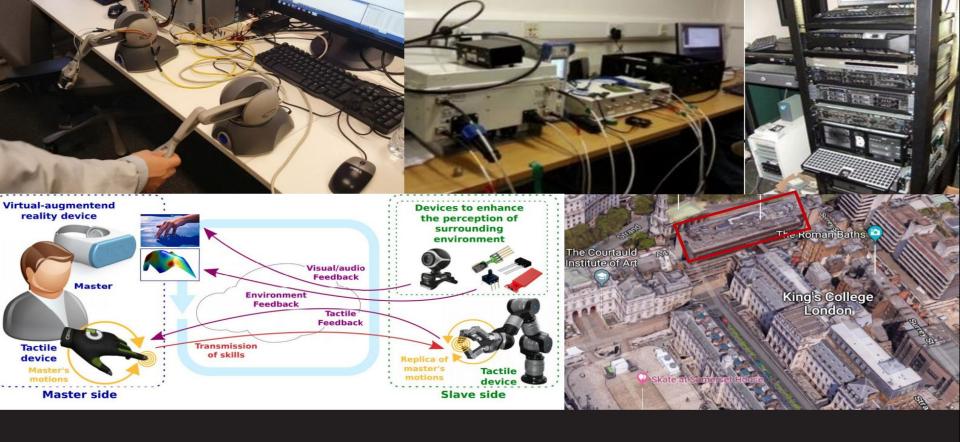


2. King's College London



- The centre was established in 1994, as one of the first centre of excellence for telecom in the UK.
 - ➤ Currently 10 academic staff, ~100 researchers, and growing.
- Extensive research contribution and portfolio in 2G, 3G, 4G and 5G mobile communications, networking, and applications.
 - Scientific contribution as well as standard, innovation and proofof-concept.
 - > Active collaboration with national and international industries.
 - Some of the first-in-the-world concept demonstrations.
- Founding member of 6GFutures

Centre for Telecommunications Research



Pioneering the *Internet of Skills*5G, programmable Network, and tactile Internet testbed



remote surgery/ Teleheath

Connected ambulance/remote US



Connected culture/
5G music event

Emergency services/ Connected drone



King's Centre for Telecommunications Research: www.kcl.ac.uk/research/ctr

Internet of Skills: 5G Case Study of Internet of Skills: Slicing the Human Senses

Connected culture https://www.kcl.ac.uk/cultural/projects/connected-culture

6GFutures: www.6gfutures.uk

Contact email: <u>Toktam.Mahmoodi@kcl.ac.uk</u>

3. Lancaster University

Lancaster University





- Lancaster University has expertise providing full stack Monitoring and Evaluation to projects of scale.
- Collaborated with providing independent evaluation to 5GRIT and MANY; Phase 1 and 2 5GTT projects.
- Developed a holistic monitoring framework to best capture and evaluate the performance and impact of novel technologies on the end user.





Monitoring Framework





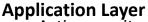
Physical Layer

Passive monitoring of wireless network performance parameters reported by wireless network devices. Received Signal Indicator/Power/Quality, Signal to Noise Ratio, Modulation Scheme, Coding Scheme



Network Layer

Active monitoring using an Intel NUC/ Android application of universal network parameters. *Throughput, Latency and Jitter*





Active monitoring of resource intensive user level applications, such as video streaming using a NUC. Resolution, Buffer Time, Stall Count and Resolution Shifts

Monitoring Dashboard





Realtime KPIs – Statistics at a glance with alerting functionality.

Historical Data – Holistic, full stack trend spotting, exportable for in-depth data analysis.

Invaluable data when collaborating with CSPs in diagnosing the difference between environmental, backhaul/CSP and user level issues.

Prof. Nicholas Race, Colin McLaughlin & Eleanor Davies {n.race, c.i.mclaughlin, eleanor.davies}@lancaster.ac.uk

4. Queen's University Belfast



Scalable, Quantum-Safe, Hierarchical Identity-Based Encryption



Dr. Ayesha Khalid

Lecturer, CSIT (a.khalid@qub.ac.uk)

Gavin McWilliams

Multidisciplinary Programmes Director,

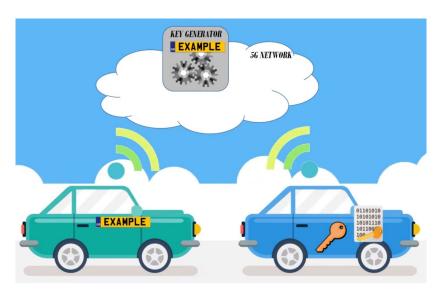
ECIT, QUB (g.mcwilliams@qub.ac.uk)



Identity Based Encryption (IBE)

Certificateless PKC that takes an existing identifier as the subject's public key

- Significant effort is spent by the traditional CA
 - Managing and distributing certificates
 - Enrolling end-users
- Efficient as Public key database not needed!
 - Device's unique identity is the public key (email / employee number / number plate)
- IBE uses a Key Management Server (KMS)
 - Private key generation is a one time activity
 - Computationally intensive operation
 - Single point of failure



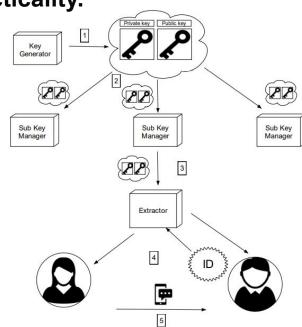
If the green car wants to send a message to blue car, it needs only needs the blue cars registration number to guarantee its message's authenticity.



Quantum Safe Hierarchical IBE (HIBE)

QUB CSIT and the NCSC jointly developed and performed a security analysis of the new HIBE¹ and brought it into the realm of practicality.

- HIBE uses a tree structure for key address space.
 - Creates finer grained access control in an organisation
 - limits damage in case of compromise of a Key Management Server
 - Reduces workload of key generator
- Quantum Safe IBE
 - Built on-top of a lattice-based cryptosystem first suggested by Ducas, Lyubashevsky & Prest (DLP) in 2014
 - Lattice based PKC scheme called Kyber is taken up recently by NIST PQC for standardisation





Enhanced 5G Security Architecture

QUB CSIT with Thales UK wishes to develop a professional grade reference implementation of HIBE to facilitate a wide range of 5G applications.

- Long-term security guarantees
 - resistance to attacks from quantum computers
- Improved operational efficiency
 - Certificateless operation
 - Fast communications set-up
- System scalability
 - Hierarchy of sub KMS used
- Fine grained access control
 - Hierarchy of sub KMS avoids single point of failure



Scalable, quantum safe, HIBE systems could facilitate 5G applications like remote healthcare, smart metering, connected vehicles and e-government.

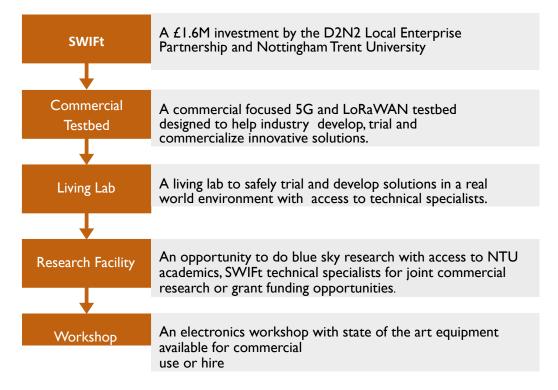
5. Smart Wireless Innovation Facility (SWIFt)



SWIFt - Smart Wireless Innovation Facility Accelerating Wireless Innovation August 2022



WHAT IS SWIFT?



A BRAND-NEW STATE OF THE ART 5G AND IOT ENABLED
SMART LAB AND TESTBED LOCATED IN NOTTINGHAM

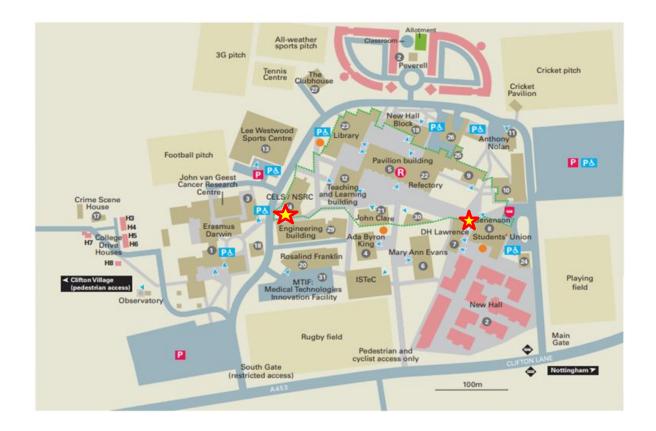


THE TESTBED

- The SWIFt testbed offers access to a state-of-the art private 5G network internally and externally on a Non-Stand Alone (NSA) and Stand Alone (SA) basis.
 - NSA features:
 - 5G NR on Band 78
 - LTE anchor point on band 7
 - NB-IoT Service
 - Nokia NDAC 4G/5G core
 - SA Features:
 - 5G NR on Band 78 3.6-3.8GHz for indoor
 - 5G NR on Band 77 3.8-4.2 for outdoor
 - ORAN architecture (CD and DU deployment)
 - Druid 5G Core
- The SWIFt testbed includes low-power wide-area network (LPWAN) capabilities. More specifically, the network protocol that was provisioned is LoRaWAN, which is designed to connect wirelessly resource-constrained devices to the internet over very long distances at very low power.



Clifton Campus 5G Outdoor Network



SWIFt - Smart Wireless Innovation Facility **Accelerating Wireless Innovation**

THANK YOU

STUART FENTON

MANAGING

DIRECTOR

STUART.FENTON@NTU.AC.UK

6. The Original Content Company

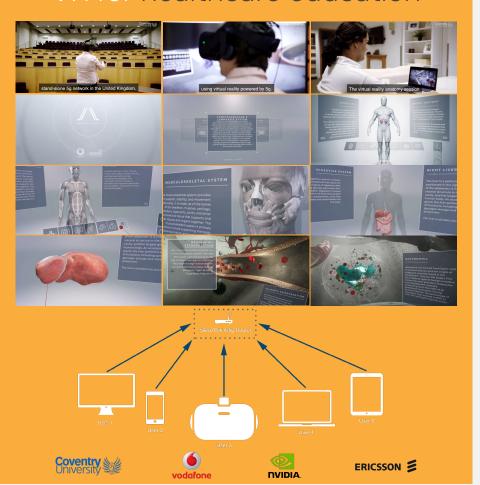
the original content company



Content creation for Metaversities



VR for healthcare education



VR Anatomical Learning

A cloud and device-agnostic solution for healthcare education.

5G enables the AR/VR/MR digital asset to be more complex and interactive compared to 4G.

Potential to change the way we interact with technology within the training environment.

5G low latency and edge compute enable high quality graphics without a local computer.

Enables users from different locations to collaborate together in the virtual learning environment.

VR-learners can complete training three times faster than in classroom.

World's first VR Experience over a 5G standalone network World's first commercial offering globally to use NVIDIA CloudXR

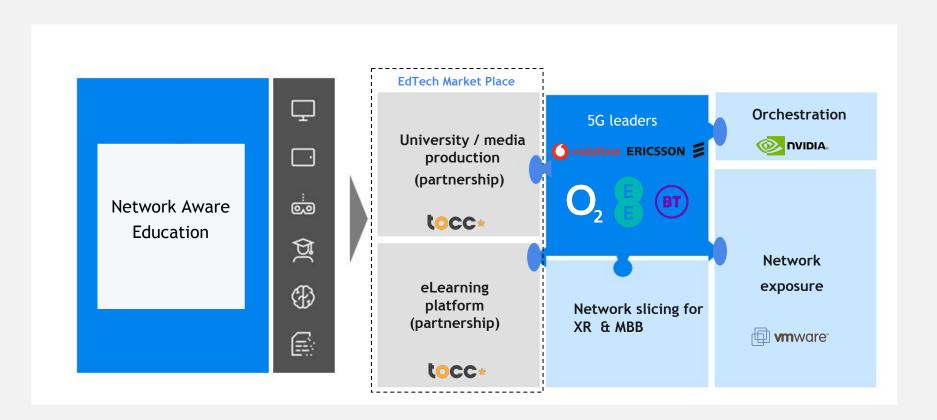








Looking for collaborators to build the next **Meta**vercities for 5G ready content



XR in Education - Market Growth 2020-2030





Global XR Market Value 2030



UK XR Market Value 2020



UK XR Market Value 2030

XR Content Creation













Open RAN Principles (2022), need to be embedded from the beginning in the creation of network architectures, interfaces and technologies



Please direct any questions to matt@tocc.work +44 (0) 7980 869 865

7. University of Glasgow



FONRC - Open Networks Research

Prof Muhammad Ali Imran

Director - Communication, Sensing and Imaging Research Group Head - Autonomous Systems and Connectivity Research Division

Dean - Glasgow College UESTC

Muhammad.Imran@glasgow.ac.uk





TRL 9 TRL 8

TRL 7



Funded Grants

The Scotland **5G** Centre

Co-Founder

Capacity Limits

Fundamental

SON frameworks

Energy Efficiency

Tests and Trials System

Optimisation

Applied

Commercialisatio

System/Subsyster
Development

System Test, Launch & Operations

Technology Development

WORLD CHANGING GLASGOW

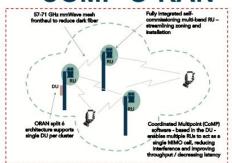
GOOD UNIVERSITY **GUIDE**

SCOTTISH UNIVERSITY OF THE YEAR



Open Network Related Research within CSI

COMP-O-RAN



- UoG drives the algorithm development and simulation in COMP-O-RAN project
- UoG has research experience in the modeling, design, and simulation of CoMP systems
- UoG has expertise in RAN intelligent algorithms design and implementation on software-defined radio
- UoG is an academic contributor to the O-RAN Alliance.

COMP-O-RAN Basic Architecture







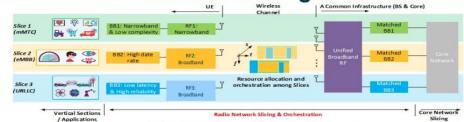




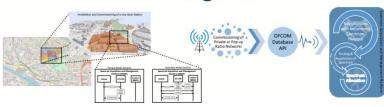
System Integration



Network Slicing

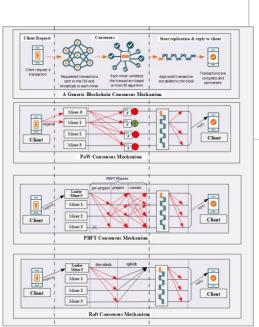


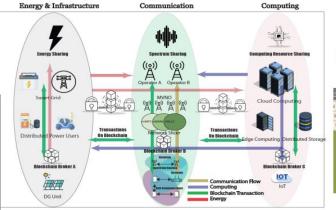
Dynamic Spectrum Management

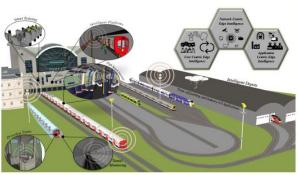


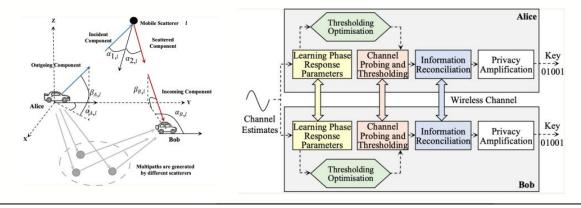


Security and Privacy Preservation











CSI – Emerging Research Areas







Advanced sensors and devices

Blockchain wireless networks



IDENTITY PROFILE



Network Resilience



5G Testbed Scalable Use Case Platform



Intelligent Reflective Surfaces (IRS)



Converged and Self organising **Networks**



Measurement Capabilities





Antennas Research and Design

Al Driven Design





Signal Processing for future waveforms



CONTROLLED AR/VR

Wireless for Healthcare



Free-space optics & wireless backhaul



NON-FACIAL VIDEO ANALYTICS



Working together, in a strong community, with shared goals, we can make the unimaginable possible and deliver world class research with lasting impact.



5G Centre

Welcome to collaborate with Glasgow!















































Glasgowlife

Glasgow

















federated

Radisys

wireless









#UofGWorldChangers @UofGlasgow

8. University of Sheffield



Software Defined Radio for B5G and 6G Networks (SDR6G)

Professor Timothy O'Farrell

Email: T.OFarrell@sheffield.ac.uk

Department of Electronic & Electrical Engineering,
University of Sheffield,
UK





The University Of Sheffield.





Key Facts

- We are a radio systems research group (11 academics, >60 researchers)
- We research antennas, RF circuits, direct digital acquisition, PHY layer signal processing, and medium access control protocols.
- This work is aimed primarily at Software-Defined-Radio solutions for mobile networks and extends to WiFi.
- We complement this Physical layer research with expertise in the computer modelling and KPI evaluation of:
 - Energy Efficient RANs;
 - Small cell RANs; and
 - Open RAN







Facilities

- We have a 5G Physical layer testbeds covering the FR1 and FR2 bands
- We have 2 instrumented anechoic chambers
- We host the UKRI National Millimetrewave Facility (www.sheffield.ac.uk/mm-wave/).
- We are biding for an UKRI Strategic Equipment Grant to fund a unique SDR6G Test Facility covering 24GHz to 220GHz.







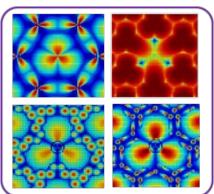


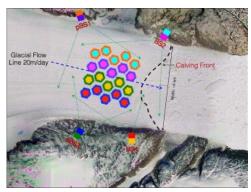




Research and Contributions

- Green Radio (EPSRC/mVCE, EP/G064105/1, 2009-12)
- Networks of Sensors (NERC, NE/I007148/1, 2011-15)
- Seamless and Adaptive Wireless Access for Efficient Future Networks (EPSRC, EP/L026147/1, 2015-18)
- Frequency Agile Radio (EPSRC, EP/M013723/1, 2015-19)
- CommNet2 (EPSRC, EP/N007824/1, 2015-19)
- Direct Digitisation for Frequency Agile Millimetre Wave Massive MIMO (EPSRC, EP/S008101/1, 2019-23)
- Future Millimetre Wave RF Transceiver Architectures for Communications Systems (UKRI FLF, 2021-25)
- Next Generation Information Networks (DSTL, 2022-2025)
- UK5G Climate and Environment Working Group
- DCMS College of Experts
- mVCE, WWRF, CW









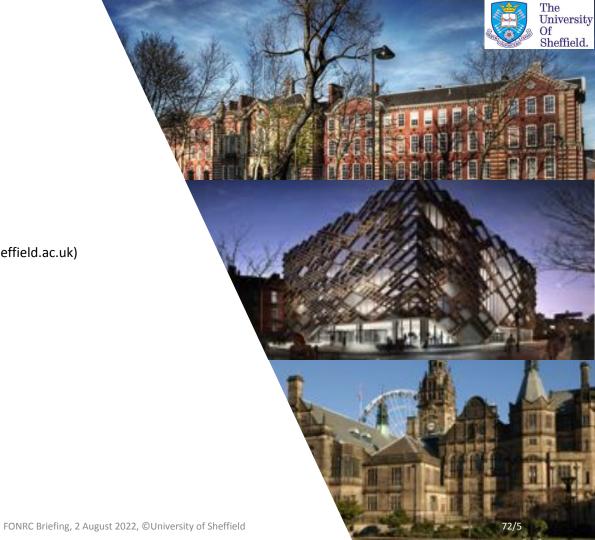




Thank you

Contact

Prof Timothy O'Farrell (t.ofarrell@sheffield.ac.uk)





9. University of Surrey, 6GIC

The Flex-5G Project

"Flexible, Efficient and High-Performance 5G Open RAN"

- Flexible: Different deployment architectures (network-in-a-box private,
 cellular private & small cell, dynamic and wide-ranging frequencies)
- High performance: Massive MIMO
- Efficient: High capacity softwarised baseband; SDR. Energy efficient
- Intelligent: RIC and novel OSS, with digital twin

Flex-5G Team























New ideas towards 6G: Building on Flex 5G project

5G OPEN RAN:

- Power efficient coverage extension with (e.g, novel DAS)
- SDR technology from below 6 GHz frequency to over 100 GHz frequency

6G OPEN Network:

New open network architecture for 3D Network (Space & Terrestrial)

- Semantic Communication and Sensing RAN
- Semantic Communication and Sensing Core

10. University of York





Facilities

- Network testbed and tools for modelling key features of challenging environments
- Robotic, UAV, and IoT testing environments at University of York's new £35M Institute for Safe Autonomy
- *iTwins-Techno-social* lab developing privacy protecting ML telecoms and improving its public acceptance
- 5G private network SDR testbed implemented for 5G MANY project
- Low altitude SDR testbed (Helikites), payload design expertise and experimentation

Specific Expertise

- Physical layer design, signal processing, including RAN disagreggation and MIMO antenna arrays
- RAN system architecture design, including unlicensed and dynamic spectrum access
- Machine Learning applied to telecommunications
- Knowledge of SDR and implementation of RAN based on open source components, including SRS
- Incorporation of communications into challenging environments, including vehicular deployments

Our core team

Professor Alister Burn

Professor David Grace

Dr. Hamed Ahmadi

Dr. Yi Chu

5G Mobile Access North Yorkshire



Interdisciplinary 5G Testbed and Trials project providing 5G connectivity to uncovered areas of North Yorkshire.

- We designed and developed rapidly deployable terrestrial and aerial 5G networks for providing coverage for temporary events and disaster relief tasks.
- Supported two main use cases mountain rescue and outdoor large social events.
- SDR and open-source SRS software allow the mobile network to adapt to future 3GPP releases
- Self-sustainable systems using batteries and solar power which allow flexible locations for deployment without relying on infrastructure
- Successfully tested with flexible Internet backhaul options, including fibre, Starlink, point-to-point, wireless.



FRANC project "5G DU-Volution", led by ADVA UK

The project is developing a Distributed Unit (DU) platform for the Open RAN network

- We are exploiting our expertise in system-level simulation and in Distributed
 Massive MIMO to evaluate:
 - Trade-off of fronthaul load with network performance, and influence of fronthaul compression schemes
 - Overall system capacity, coverage probability for an Open RAN network
 - How design and location of DUs in the network might optimise capacity
- We will evaluate how the Open RAN architecture can enhance network cooperation and greatly increase capacity density, and the role the DU can play in this
- We will advise the consortium on future development towards 6G, and disseminate its work in academic venues



End of event: Closing Remarks



