

5G-enabled Emergency Networks

Kingston
University
London

EPSRC
Engineering and Physical Sciences
Research Council

WMN
Research
Group
Kingston University London

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About UK EPSRC



£2.5bn
RESEARCH PORTFOLIO



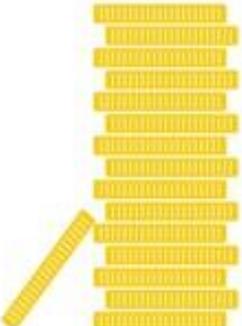
45%
OF RESEARCH
PORTFOLIO IS
COLLABORATIVE



£1.69bn
OF OUR PORTFOLIO
IS RELEVANT TO THE
GOVERNMENT
INDUSTRIAL STRATEGY



42%
OF PORTFOLIO
IS MULTIDISCIPLINARY



£800m
ANNUAL BUDGET

Key strategic areas

- **Ensuring the ICT Theme is at the heart of UK efforts to contribute to a world leading capability in key strategic areas**
- ***Big Data Analytics*** - where the contribution of ICT researchers is integral to the development of capability and capacity
- ***Future Intelligent Technologies*** – including robotics and autonomous systems, where the smart element of these is critical to their effectiveness
- ***The Internet of Things*** - which builds on strength across a range of ICT research areas
- ***Human-like Computing*** - offering the prospect of computation which is akin to that of humans, where learning and making sense of information about the world around us can match our human performance
- ***Safe and Secure ICT*** – ensuring the reliable and responsible development of ICT, including cyber-security

A few words about GCRF

The Global Challenges Research Fund (GCRF) announced by the UK Government to support cutting-edge research that addresses the challenges faced by developing countries through:

- Support cutting edge, challenge-led, research which addresses the problems faced by developing countries
- Address global challenges through disciplinary and interdisciplinary research
- Strengthen capability for research and innovation directly to international development, within the UK and developing countries
- Enable agile responses to emergencies and opportunities

A few words about GCRF

- GCRF is administered through delivery partners including the Research Councils and national academies.
- GCRF was launched in 2016 and has a budgeted investment of £1.5 billion between 2016 and 2021 on collaborative research and innovation through UK universities and research organisations, delivered by the Research Councils, the UK Academies, funding bodies and UK Space Agency.

Strengthening pathways to impact within developing countries

- Building research capacity and collaborations with academics in developing countries
- Building partnerships and collaborative links with NGOs/charities/civil society in developing countries
- Developing further collaborative opportunities to strengthen international links (including Newton, DfID, Commonwealth etc)



GCRF ethos of “doing things with people and not simply for or to them”

Distributed Autonomous and Resilient Emergency Management System (DARE) - Factsheet

- 3 UK Universities: University of Surrey, Kingston University London, University of Glasgow
- University of Malaya, Malaysia – Top technical University there
- There is also advisory board consisted of O2, BT, Huawei, UbiTech
- 3 years Project, May 2017 - April 2020
- Operational Budget ~ £2 million



University
of Glasgow



UNIVERSITY
OF MALAYA



DARE - Introduction to Research Problem

- Submitted to “Tackling global development challenges through engineering and digital technology research” call
- Global terrorist activity, earthquakes, tsunamis have made the anticipation, preparation and response to such manmade or natural events very critical.
- It is of paramount importance to research into an appropriate emergency management system (EMS) that is capable of handling such catastrophes.
- The current communication platforms for EMS are susceptible to being incapacitated or destroyed by the disaster or the network congestion that arise as a result of such disaster. In the light of this, the aim of the project is to conduct advanced research into a new Distributed Autonomous and Resilient EMS

DARE - Technical Context

- One of the highly challenging technical requirements of EMS is resilience in networking.
- The resilience of a network can be expressed with the quality of resilience (QoR) metrics which are typically the service availability and the time to recover from failure, i.e., the recovery time objective.
- On the other hand, Quality of service (QoS) addresses other metrics such as network latency, throughput, energy efficiency, reliability and packet loss rate.
- An effective EMS must guarantee QoR without compromising on QoS
- an effective EMS must incorporate an autonomous i.e. self-governed, self-healing disaster/network failure detection mechanism to reduce the cost of control signalling traffic associated with the traditional disaster/network failure detection mechanisms which require frequent network probes and network alarms
- This autonomy will also decrease the time to recovery by utilising predictive algorithms and operating the flow of signalling traffic locally

DARE - Academic Impact

- Researchers in communication engineering, computing and networking disciplines will enormously benefit from the results of this project, as the research involves cutting edge design of distributed, autonomous and resilient EMS for emergency scenarios.
- An entirely novel cross-platform hierarchical radio access protocol is introduced, potentially opening a new field of research. With impact onto the computing and networking communities, a novel ad-hoc and WSN routing approach with KPI (key performance indicator) considerations using EMS phase aware data prioritisation is pioneering.
- Finally, the high-level and interdisciplinary environment of research that would be created here will provide an excellent training ground for researchers to become future leaders in this ever-changing field.

DARE - National Importance

- The Civil Contingencies Secretariat (CCS) within the Cabinet Office has developed a cross-sector Critical Infrastructure Resilience Programme (CIRP), with the aim of improving the resilience of critical infrastructure and essential services to severe disruption from natural hazards.
- The success of the project is thus critical to CCS and similar organisations, such as Centre for the Protection of National Infrastructure (CPNI) and Government Communications Headquarters (GCHQ), since it enables a networking architecture with high resilience in the face of various disasters.
- The delivery of DARE to exploit the interactions between platforms, cross-layer context-aware routing and future networks approaches is a major leap forward on the innovative paradigm and will enable an entirely new EMS that gives rise to a plethora of interesting applications and new business opportunities. The link to Surrey's 5GIC, Kingston's Emergency testbed and their industry partners will further amplify the impact of DARE.

DARE - Objectives

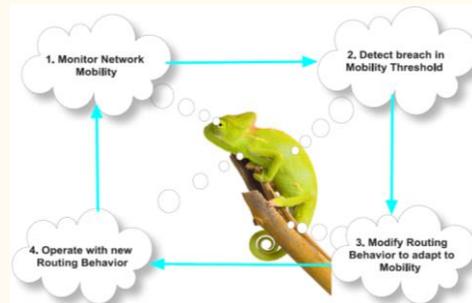
- Investigate the technical requirements of a ubiquitous critical communication platform for all phases of EMS. Develop a novel EMS based on the identified requirements.
- Develop a highly resilient EMS measured by Quality of Resilience (QoR) metrics. Define a novel and WSN routing architecture, for robust, efficient and effective critical communications.
- Develop distributed autonomous solutions for a novel EMS. This entails incorporating self-organisation and self-governing functionalities, i.e., self-configuration, self-optimisation and self-healing, into the EMS.
- Verify the distributed, resilient and autonomous designs through simulations and real

Contact Details

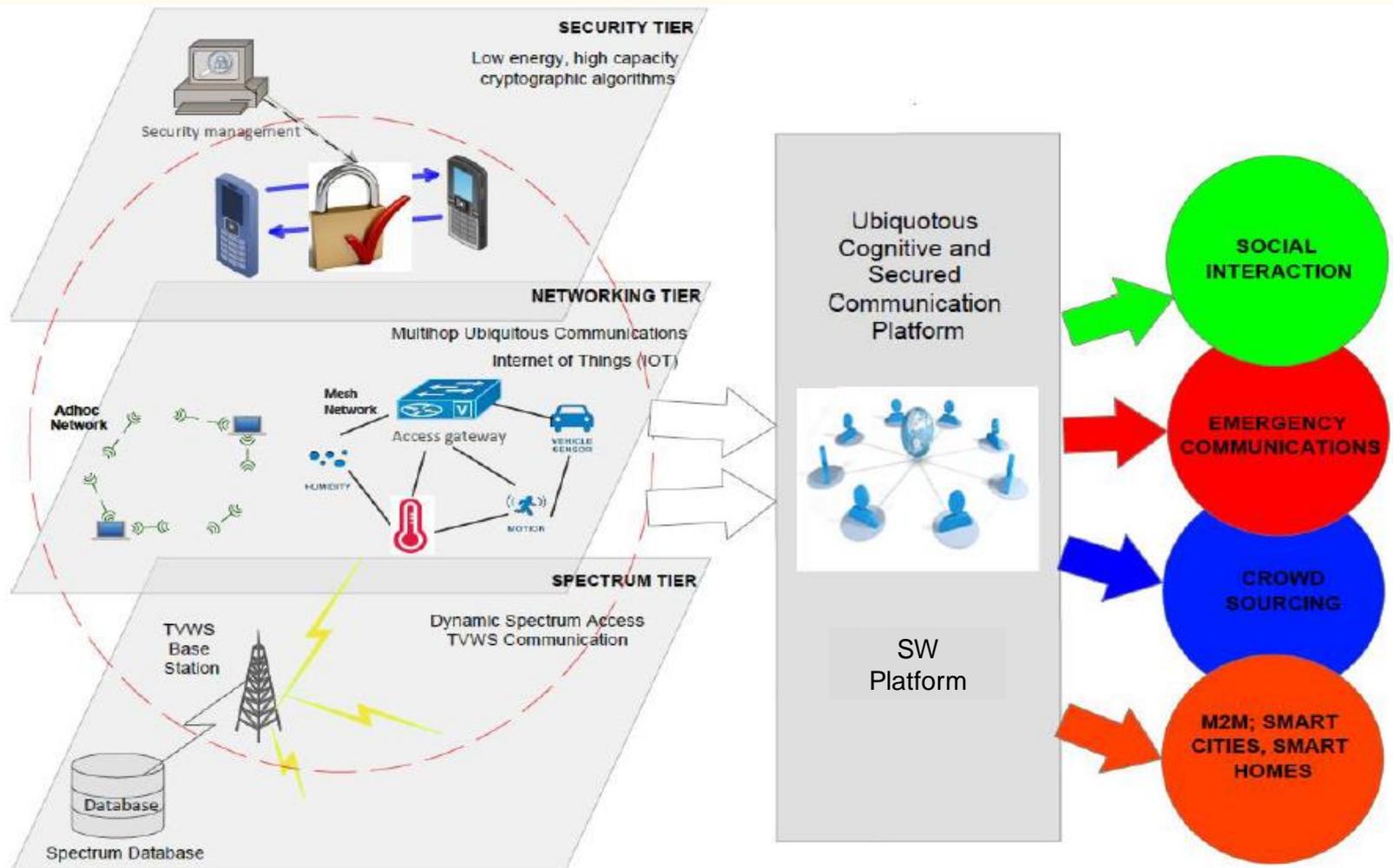
- **University of Surrey - Prof. Rahim Tafazolli (r.tafazolli@surrey.ac.uk)**
- **University of Glasgow - Prof. Muhammad Imran**
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- **Kingston University London - Prof. Christos Politis (c.politis@kingston.ac.uk)**
- **University of Malaya - Prof. Kaharudin Dimyati (kaharudin@um.edu.my)**

Kingston: So far, so good!

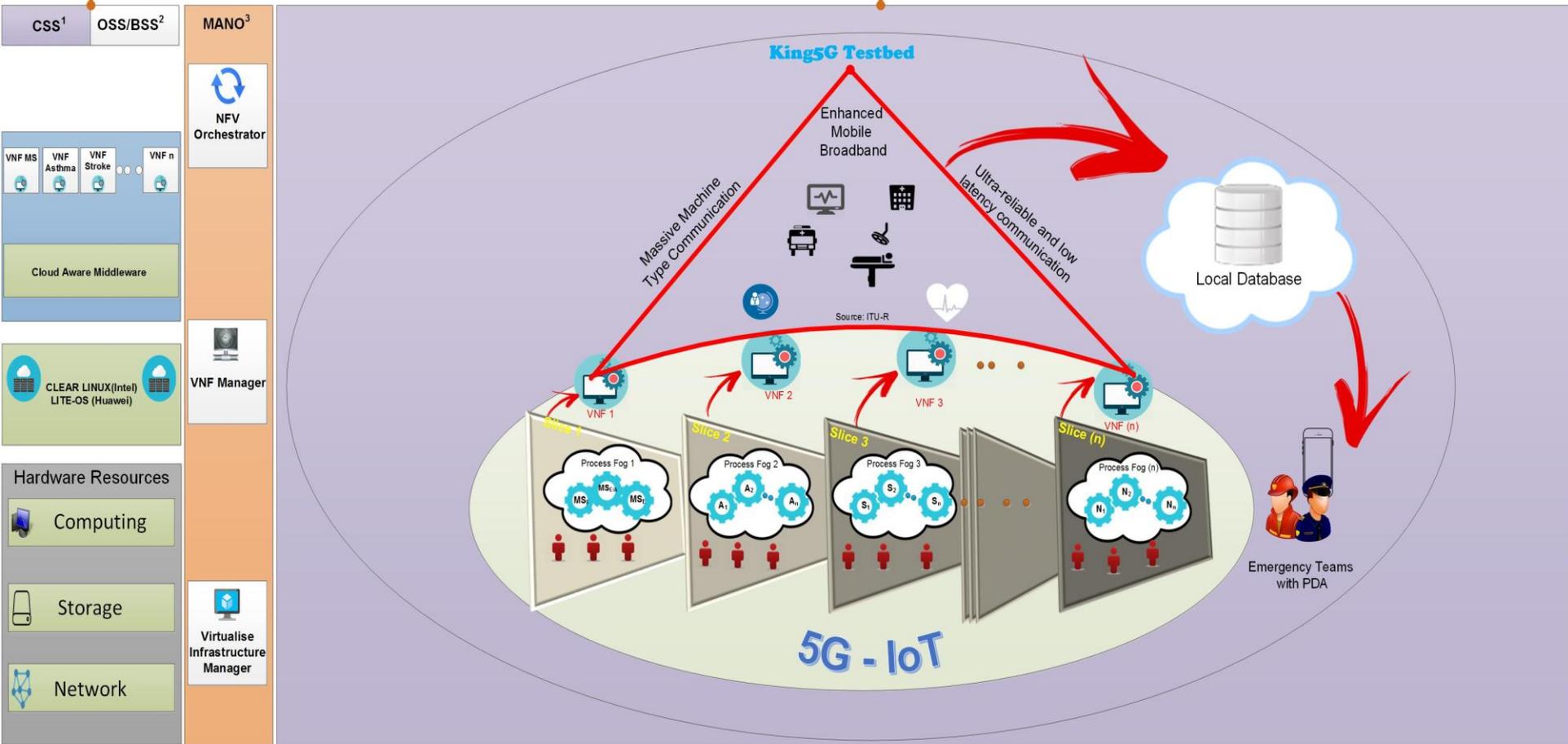
- 3 IETF drafts (CMLv2, CML and CAM)
- Real-life distributed modular Testbed ([King5G](#))
- 4 EU-funded projects (PEACE, PROACTIVE, SALUS, RESCUE)
- 2 UK TSB-funded projects (UBINET, VOCALITY)
- 1 UK EPSRC-funded project (DARE)
- 1 technology start-up
- 6 PhD degrees awarded
- 1 App for emergencies (Google Market)



King5G Testbed



King5G Testbed – future



¹ Clinical Support Systems
² Operation/Business Support System

³ Management &

Thank You!

Any Questions?