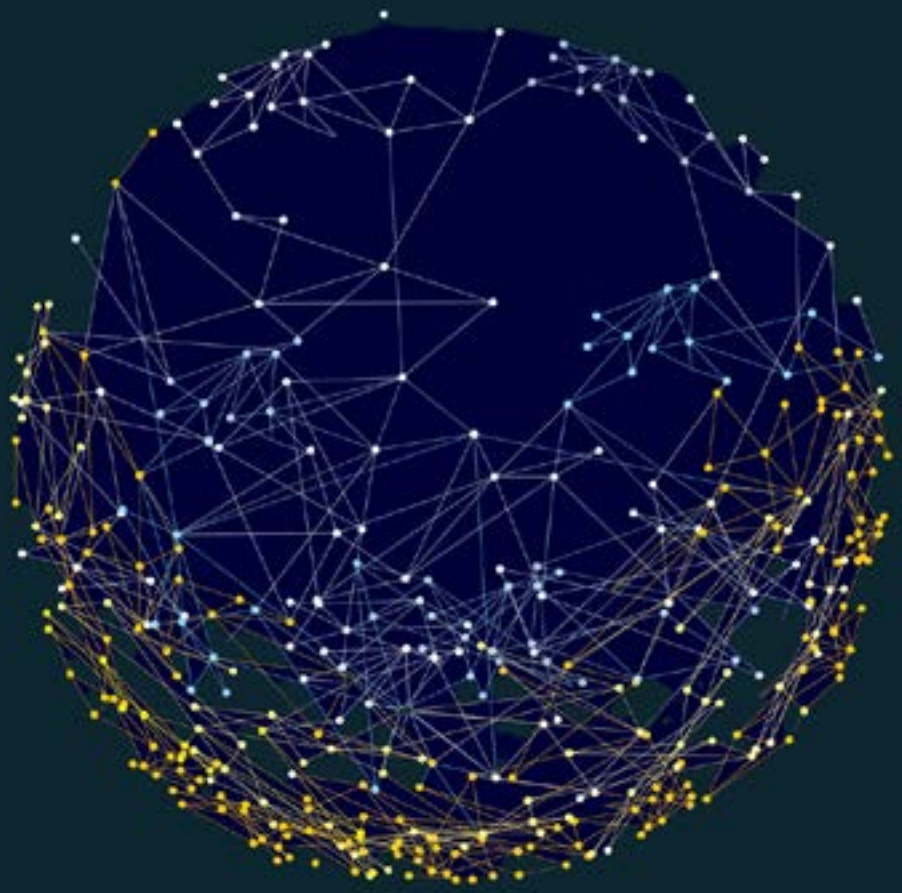
CHEDDAR

Annual Report

CHEDDAR 2024/25



Who We Are

Introducing CHEDDAR

Communications Hub for Empowering Distributed clouD computing Applications and Research

CHEDDAR is a UK-based research consortium that initially comprised six leading universities and has now expanded to include 21, all focused on advancing next-generation communications technologies.

The Communications Hub for Empowering Distributed Cloud Computing Applications and Research (CHEDDAR) is funded by the Engineering and Physical Sciences Research Council (EPSRC), part of UK Research and Innovation (UKRI), through the Technology Missions Fund (TMF). Alongside hubs such as TITAN and HASC, CHEDDAR serves as a strategic platform for innovation in communication systems. The hub aims to strengthen collaboration across academia, industry, and the wider global community.

The CHEDDAR Hub is being led by Imperial College London, and its core partner universities include the Universities of Cranfield, Durham, Glasgow, Leeds, and York.

Our Mission

Powering the Future of Communications

The future of communications is unfolding across a vast spectrum, from tiny edge devices to massive cloud infrastructures.
As we look ahead to the expected arrival of 6G standards around 2030, the focus is shifting from simply connecting people and devices to enabling truly interconnected intelligence. To make this leap, we must build communications systems that are not just fast and powerful, but also safe, secure, trustworthy, and sustainable.
That's where CHEDDAR comes in. We're investigating how next-generation communications systems can support cutting-edge computing and how cloud and AI technologies can, in turn, supercharge communications. Drawing on the UK's world-class expertise and creative thinking, the Hub is tackling emerging challenges in computation and critical infrastructure, always with a clear focus on the needs of real-world users across sectors.
In partnership with two other national hubs, CHEDDAR is helping shape a collaborative research ecosystem that nurtures talent, fosters radical new ideas, and drives progress in 6G technologies: the very foundation of tomorrow's intelligent networks.

The CHEDDAR Hub is led by Imperial College London, with core partners including Cranfield, Durham, Glasgow, Leeds, and York: together forming a powerhouse of innovation for the connected world ahead.

Foundations for Innovation

Introduction to Our Research Pillars

Emergent Systems

As networks become increasingly complex, our research prioritizes embedding human values at the core of 6G design. We aim to create technologies that uphold trust, security, privacy, resilience, and equity, ensuring that future networks are designed for the diverse needs of society.

Our work emphasises transparency and interpretability, ensuring that advanced systems remain understandable and accountable. By centering human needs, we support equitable access to next-generation digital infrastructure and empower communities through inclusive innovation.

Sustainable Systems

Sustainability is vital to the future of technology and next-generation telecoms are no exception. We take a green-by-design approach, optimising devices, algorithms, and data flows to reduce environmental impact. Our goal is to develop energy-efficient telecoms technologies that enable responsible,

Human Centric Systems

As network complexity grows, our research focuses on embedding human values into 6G technology design. We aim to ensure that future networks uphold trust, security, privacy, resilience, and equity, addressing societal needs directly.

We emphasise transparency and interpretability to make advanced technologies understandable and accessible. This approach ensures that innovations serve diverse communities and support equitable digital transformation.

Research Highlights

The past year has marked a period of significant progress across CHEDDAR's research pillars, delivering critical advances in secure, intelligent, and adaptive communications infrastructure. Our work continues to shape the foundation for 6G technologies through cutting-edge developments in AI-native networks, sensing, security, and digital twins. Highlights from2024/25 include:

- AI-driven Open RAN digital twin framework (TRL 6).
- mmWave sensing with metasurface antennas for health monitoring and Industry 5.0.
- RIS-enhanced radar for smart homes and non-invasive health monitoring.
- AI-native RAN with dynamic co-scheduling of AI/RAN workloads (first in UK).
- Benchmarking dataset for GenAI on the Edge published (GitHub).
- Secure cryptosystem combining QKD and classical encryption for telemedicine.
- Formal verification tools for IoT networks developed and published.
- New threat model for RISANT-6G networks.
- Real-time multi-target tracking system (TRL 4–5).
- xApp pipeline from user requirements to automated orchestration.

Key Milestones and Outputs

CHEDDAR Hub has made significant progress across research, collaboration, and innovation. Key developments include the establishment of an Advisory Board and the expansion of the network to 10 new universities. The Hub has fostered strong partnerships, securing over £8 million in additional funding and engaging with nine user and public sector partners.

A range of activities have supported skills development and knowledge exchange including tailored EDI training, early career researcher leadership, and multiple cross-hub events. With 66 academic publications in Q3 alone, alongside new prototypes, patents, and a registered spinout, CHEDDAR is already demonstrating a strong pipeline of outputs and impact.

CHEDDAR key milestones	
Expanded to include 10 new universities.	EDI training tailored to communications research delivered.
Events delivered: 2 Winter Festivals and 3 cross-hub meet ups (as of Q3).	3 early career researchers leading projects.
9 user partner/public sector collaborations.	Over £2 million in further funding raised.
Scoping Projects call: Launched April 2025.	Synergy Platforms & Internships/Secondments: Scheduled May 2025.
6 academic publications in Q3 (up from 34 in Q2).	3 patents filed (awaiting FTH setup).
New outputs: 6 prototypes and 6 new techniques/processes.	New outputs: 6 prototypes and 6 new techniques/processes.
1 spinout company registered.	72 people trained; 15 partnerships brokered; 4 secondments; 4 policy engagements.

Case Studies and Impacts

Summary of Case Studies and Impacts	
1.	GenAI benchmark datasets adopted by the research community.
2.	mmWave sensing explored for robotics control and NLoS positioning.
3.	Demonstrated secure and synchronized remote robotics control for dental surgery using O-RAN.
4.	Microgrid demo using solar panels, EVs, and 6G-enabled VR.
5.	Industry demos led to expressions of interest for licensing (Q3).
6.	CHEDDAR Annual Report

Extending the Network

CHEDDAR's New Research Collaborations and Partnerships

As part of its commitment to advancing innovation in next generation telecommunications, the CHEDDAR Hub supports a portfolio of subprojects led by universities across the UK.
In addition to the directly funded CHEDDAR research projects, these targeted initiatives enhance the Hub's national reach and amplify the impact of its research in distributed cloud computing, secure connectivity, and advanced network infrastructures. Together, these projects are central to CHEDDAR's vision of translating cutting-edge research into real-world applications.

Lead Institutions for CHEDDAR Subprojects 2024
The following universities serve as lead institutions for CHEDDAR subprojects:

- University of Surrey,
- Keele University,
- Lancaster University
- Glasgow Caledonian University

The institutions below are actively engaged in CHEDDAR subprojects

- Birmingham City University
- University of Exeter
- University of Warwick
- Northumbria University
- Queen Mary University of London
- Coventry University

New Partners via CHEDDAR Partnership Fund (Sandpit Proposal, 2025)

Through the CHEDDAR New Partnership Fund and associated sandpit initiative, the Hub has expanded to include the Collaborating Universities (Non-Core CHEDDAR Partners)following eight new universities and institutions:

- University of Oxford
- Brunel University London
- King's College London
- Loughborough University
- University of West London
- Digital Catapult
- University of Essex
- University of Hull.

Where Research Meets Collaboration

Strategic Relationships: Research Pipeline

Telecoms research is dependant on bringing through our great talent. CHEDDAR has a strategic relationship with DIveIn to allow PhD students access to our National research ecosystem.

The DiveIn Programme is a Centre for Doctoral Training designed to support new PhD students in building research skills, developing interdisciplinary expertise, and expanding professional networks across academic and innovation. Through tailored training modules, students engage in sessions on research design, interdisciplinary collaboration, and innovation impact. A cohort-based approach and mentoring provide valuable guidance and help foster a strong sense of community.

Professor Qammer H. Abbasi is a Principal Investigator on CHEDDAR and also serves as deputy director of the DiveIn Centre for Doctoral Training (CDT) at the University of Glasgow. The DiveIn CDT focuses on developing the next generation of interdisciplinary researchers in areas such as intelligent sensing, wireless communications, and distributed systems, while CHEDDAR advances research on secure, seamless, and sustainable next-generation networks. Supported by EPSRC funding, these complementary initiatives address critical challenges in future communications and computing infrastructures, and Professor Abbasi's leadership helps bridge academic training with cutting-edge applied research. Notably, 10 students will be joining CHEDDAR in September 2025, further strengthening this pipeline of talent and innovation.

International Activities

MWC Barcelona 2025

The CHEDDAR Hub had a prominent presence at the Mobile World Congress 2025 in Barcelona, showcasing pioneering work in 6G innovations, integrated sensing and communication, and human-centric digital systems. Activities included live exhibition demos, an interdisciplinary panel discussion on ethical tech futures, and strategic networking with industry leaders, policymakers, and global research collaborators.

Takeaways:

- Demonstrated CHEDDAR Hub's leadership in next-gen telecom research, particularly in the areas of inclusivity and societal relevance of technology.
- Enhanced visibility of UK research at a global forum, leading to new international collaboration prospects.
- Attendee feedback informed plans for more interactive public-facing content and inclusive engagement models in future outreach.
- Participation directly contributed to shaping communication strategies for explaining complex tech to diverse audiences, aligning with science diplomacy and responsible innovation goals.

Cranfield 6G Academic Visits (Bangkok, Thailand)

Prof. Weisi Guo recently on at end of Oct and early November 2024 visited Bangkok Universities to discuss future UK and Thailand 6G collaborations in metaverse. He gave a talk alongside other academics from Thailand and India.

International Activities & Visits

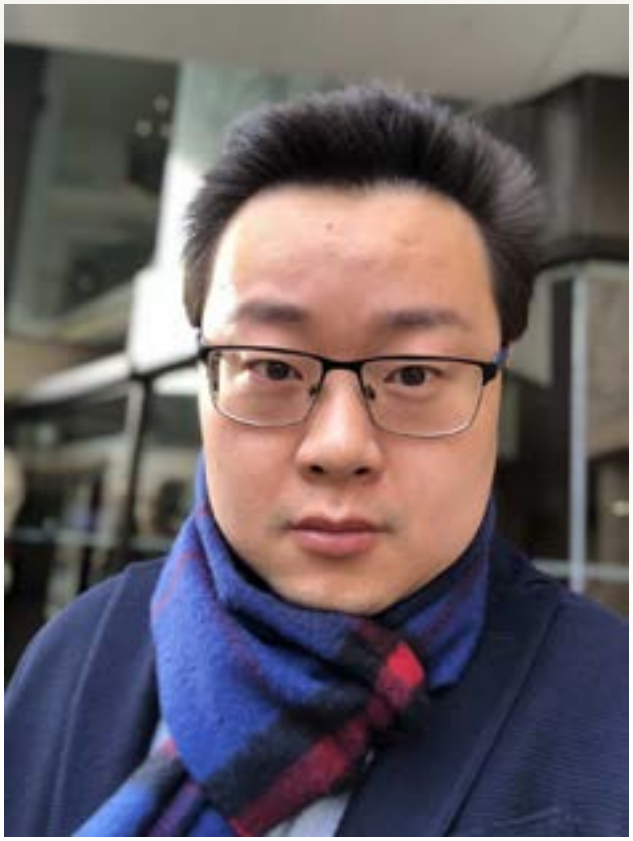
He also presented his research at the IEEE International Smarty City Conference where he networked with other networking researchers from TU Dresden, Newcastle University, and Chulalongkorn University.

Takeaways

- Strengthened international academic ties
- Explored potential partnerships for pilot projects in Southeast Asia. These focus on 2 areas important to Thailand: (1) Cultural Heritage, which they want to create a 6G enabled meta-verse for young people in digital age not to forget their heritage, and (2) Agricultural Drones enabled by rural connectivity.

Cranfield 6G and Timing Academics Visit (Bristol)

Prof. Weisi Guo recently on 22 Oct 2024 visited Bristol University's Smart Internet Lab to discuss 6G collaboration opportunities around Large Language Models that can orchestrate services with Dr Yulei Wu. He was accompanied by Dr Ivan Petrunin to discuss with Prof. Dimitra Simeonidou on how 6G Joiner and the National Timing Centre's Innovation Node at Cranfield can collaborate.



Takeaways

We are exploring how the National Timing Centre node at Cranfield can be connected with JOINER to enable traceable and synchronised actions across all JOINER infrastructure. Cranfield maybe interested in a strategic infrastructure bid in future.

Awards and Recognition

Celebrating Excellence: Awards and Accolades

- IET Fellow – Qammer H. Abbasi (2024): Recognition for sustained research leadership in telecommunications.
- IET Achievement Medal – Muhammad Ali Imran (2025): Honoured nationally for contributions to wireless communications, elevating CHEDDAR's profile.
- Distinguished Paper Award (ACM CCS) – Bozhidar Stevanoski et al. (2024): For "QueryCheetah," a breakthrough on privacy attacks in query-based systems.
- Top 2 Projects of the Decade – RAEng TSP (2025): Dr. Syed A. R. Zaidi's sensor networks and UAVs work, a CHEDDAR offshoot, was selected by the Royal Academy of Engineering and deployed in Jordan.
- 1st Prize – KubeCon & CloudNativeCon Hackathon (2024): CHEDDAR-inspired open-source work co-sponsored by OpenUK and the UN.

International Policy Influence & Engagement

Shaping Global Policy and Partnerships

- ARROW Innovation Support (UK): CHEDDAR researchers advised a UK Shared Prosperity Fund project on regional innovation in energy and communications.
- Panel Contribution: Europe's Defence and Security R&D: CHEDDAR contributed expert insights on secure digital technologies at the Science Business policy forum in Brussels (Oct 2024), expanding the hub's policy engagement footprint across Europe.

Shaping Policy, Standards and Commercial Impact

Key Policy, Standards, and Commercialisation Highlights

- Policy papers on “Healthcare in a 6G World” and “Energy in the era of 6G”.
- 3 white papers (carbon neutrality, digital twins, 6G security and privacy).
- ETSI standards contributions on ISAC and telecom security (in partnership with Interdigital).
- IEEE Digital Twins of the Earth working group.
- Early involvement with AI-RAN Alliance, ORAN Alliance, LFEdge, OpenSTX.
- One spinout registered and involved in AI Acceleration Programme (Leeds + Scottish Enterprise).
- Contact made with potential licensing partners for xApp tools (Q3).
- Demonstrations at MWC 2025 and Connected Futures.
- Commercial integration of AI-enabled RAN platforms.
- Engagement with ABB Corporate Research Centre, Marshall Aerospace, VeLinkX startup.

Training and Skills

- 70+ researchers trained via IEEE Summer Schools and internal sessions.
- RA/PDRA training on ORAN, xApps, and RIS implementation.
- Training of undergrads/MSc students on AI/ML in telecoms.
- Courses developed on IoT, privacy engineering, and SDR/GNURadio.
- Hands-on immersive IoT education book published:

Our lead PIs define and inspire who we are.

We are a passionate, multidisciplinary team advancing distributed cloud computing. Meet the researchers, innovators, and industry leaders driving our projects, shaping solutions, and powering CHEDDAR Hub's mission.

Prof. Julie A. McCann
CHEDDAR Principle Investigator
Imperial College

Prof. Weisi Guo
CHEDDAR Principle Investigator
Cranfield University

Dr. Poonam Yadav
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Prof. Muhammad Imran
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Dr. Syed Ali Raza Zaidi
CHEDDAR Principle Investigator
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Prof. Hongjian Sun
CHEDDAR Principle Investigator
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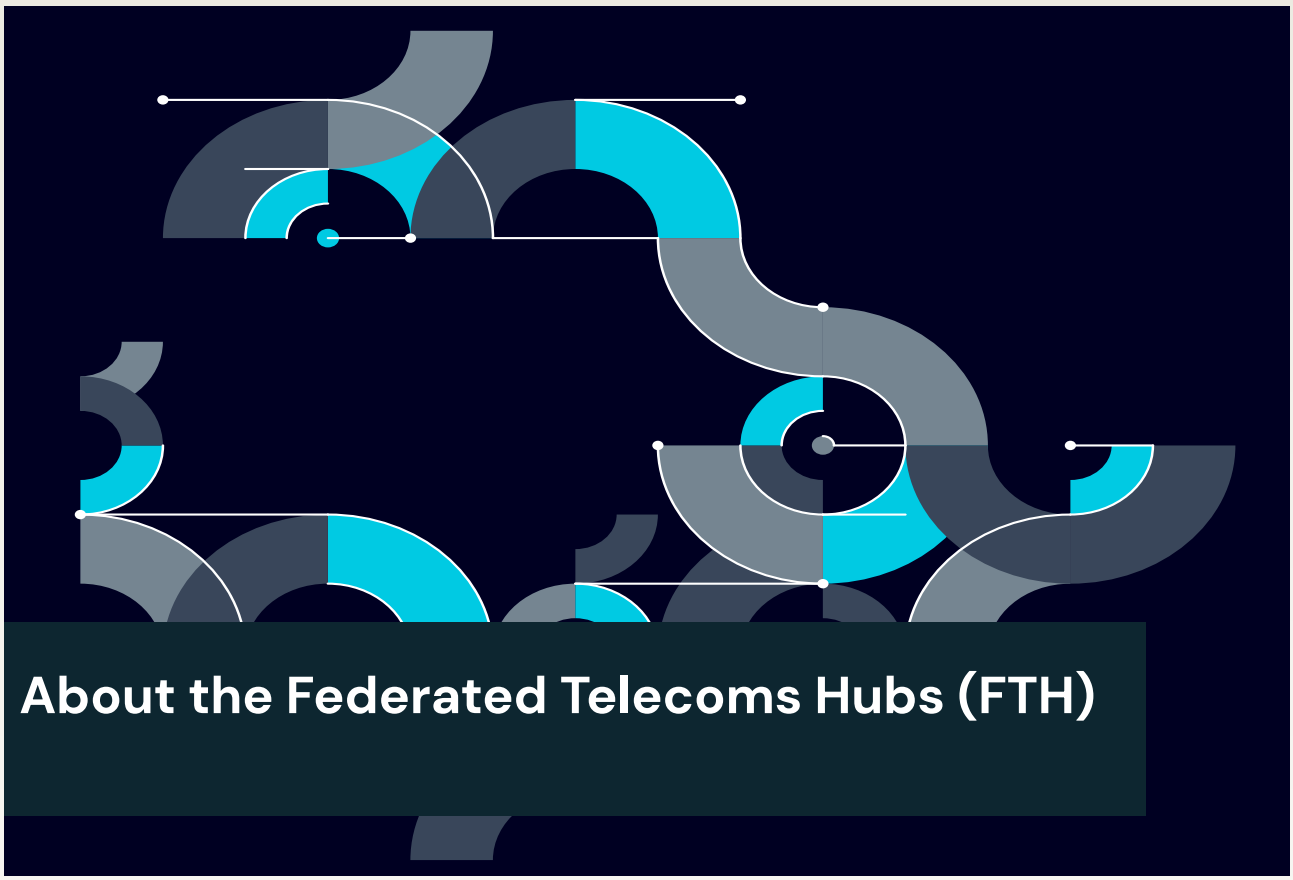

About the Federated Telecoms Hubs (FTH)

The Federated Telecoms Hubs (FTH) is a pioneering national initiative designed to transform the UK's telecoms research landscape.

Funded through the Department for Science, Innovation and Technology (DSIT) and EPSRC's £70 million Future Telecoms Mission Fund, FTH brings together four major research hubs: CHEDDAR, HASC, TITAN, and JOINER these are supported by over 25 leading UK universities.

FTH operates as a strategic federation, enabling each hub to focus on specialist research areas while working collaboratively to accelerate technological innovation and support the UK's transition to next-generation networks. The federation fosters an integrated approach to research and development, providing a shared platform for prototyping, testing, and real-world validation. This approach ensures rapid progress from laboratory research to deployable solutions.

A key element of FTH is the shared experimentation infrastructure led by JOINER, which connects national lab facilities to support cross-hub collaboration and co-design. Through a unified governance structure and dedicated missions, FTH coordinates efforts in critical areas such as cloud-distributed systems, network security, energy-efficient architectures, and advanced connectivity.

By actively engaging with industry and global standards bodies, FTH helps shape future telecoms standards and ensures that UK research has international impact. Beyond technical advancements, FTH also focuses on developing skills and fostering a culture of innovation, supporting the creation of patents, commercial spinouts, and practical applications that address societal needs.

Through this collaborative model, FTH is positioning the UK at the forefront of future telecoms, driving economic growth and ensuring resilient, secure, and sustainable communication networks for the years ahead.

CHEDDAR

The CHEDDAR Hub is being led by Imperial College London, and its core partner universities include the Universities of Cranfield, Durham, Glasgow, Leeds, and York.

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