



OBSERVATIONS by participants at the Workshop.

Jacqueline Redmond (CENSIS UK)

The first session emphasized the need for collaboration between industry, academia, and government (triple helix approach) to drive 6G innovation that addresses societal needs and has solid business cases. The work of initiatives like the EPSRC Future Telecoms Hubs, CENSIS, and Scotland 5G Centre was highlighted, built on a foundation of cross-sector collaboration.

The panellists agreed that no single technology would be the sole solution, but rather the integration of existing and emerging wireless technologies, along with wired and wireless networks, into an integrated "network of networks" is key for delivering a sustainable and impactful 6G infrastructure. Strategic decision-making aligned with commercial realities, rather than arbitrary goals, was also stressed as crucial.

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Matthew Baker (NOKIA, UK)

In my view, the workshop provided a useful view of perspectives from industry (both vendors and operators), regulators and academia. Of course, as consensus builds over the coming months and years, we can expect that some narrowing-down of the scope of 6G will take place, as commercial realities act as a filter on the various technologies and architectures currently being discussed. Although this was not strongly evident at the workshop, some such aspects are already emerging in more industry-dominated fora: for example, it seems rather unlikely now that sub-THz, sub-ms latency, or non-OFDM-based waveforms will play a role in the launch of 6G. Had there been more time in the standards panel session, I would have been tempted to make some remarks around “what 6G will not be”! By next time we meet, I have no doubt that this will be more visible.

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Muriel Medard (MIT, US)

The workshop was a unique forum in which a dialog among colleagues from across the world blended engineering, policy, commercial and scientific considerations. Such opportunities are extremely rare, yet necessary for thoughtful cooperation and coordination of efforts. Standards and technology interact in a peculiar way, where the former reflects the latter, but the latter is guided, even constrained, by the former. Examining this complex and often fraught interdependence, and what its future form might be, was a clear intellectual outcome of the workshop.

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Abhaya Sumanasena, (UK Spectrum Policy Forum, UK) and Ashutosh Dutta (Johns Hopkins University, US)

Our mandate is to consider the spectrum requirements of 6G and consider some of the future policies and frameworks that could support the needs of this next generation.

Abhaya started the session reminding that spectrum should be independent from the technology, so refarming is possible. New bands would help deploying a generation of Technologies and enable access to new bands i.e. mmWave in 5G. 6G make use of the higher bands including mmWave, and THz and LiFi. Low & mid bands will also remain essential for wide area coverage. The evolution and growth of shared spectrum strategies more important than in the past. Transmission doesn't stop at the border so international collaboration, harmonisation.

David Willis from Ofcom mentioned about sharing frameworks Ofcom is working on. He said that our systems should be more interference tolerant to pack more users in the same area.

David Lister provided an MNO view and mentioned 2 key points 1) we need harmonized standards and harmonized spectrum. 2) we need to be successful in 5G to have successful 6G. He made the case to lower annual licence fees to direct more investments to 5G. Government could also make planning permission easier to deploy and make policies to succeed in 5G.

Ed Tiedemann provided industry view by stating the challenge in sharing spectrum is to make it work in difficult situations. He introduced a concept of dynamically sharing the radio units and spectrum based on the operator demand. It's difficult to share with military since we don't know the wave forms and when and where they use it. We can't ask them to clear spectrum either. In the implementation of sharing is complex and takes longer, the use cases will move on. From time to implement point of view the order is licence exempt, exclusive access and database approach.

Prof Monisha Ghosh provided an academic view by saying mobility makes sharing more difficult. She said we need to see sharing is inherent in 6G from day one irrespective of the use case.

Mark Waddle from BBC chatted MNOs if they need more spectrum. He also presented the use case of covering a large event in London using the shared spectrum band, much cheaper than traditional commercial events.

Prof Bob Stuart introduced the capabilities of Strathclyde n77 test bed. One of the challenges for smaller players in this band was the unavailability of devices. He showcased the n77 radios they made.

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John Cioffi (Stanford U, US)

Summary of the 6G Standards Forum event.

The panel and audience generally discussed that the long standards process from innovation to significant deployment reflects a standards-process strength that has resulted in wide interoperable use. A theme that some driver applications may be not initially be foreseen, and indeed some requirements (latency) may be over specified while others not fully anticipated, but the process is still good. There were viewpoints on densification, efficiency, sustainability for 6G. The densification has pluses but also costs. Most panellists noted that investment often seeks a better return on investment that is understood before next wireless generations emerge successfully.

New areas like terrestrial-satellite combinations in 6G were anticipated. All agreed that standards collaboration, even among fierce competitors, helps build better networks and lead to greater benefit for all. There were concerns expressed about geopolitically induced separation, but most agreed that while politicians may have peaked interest, the process remains productive and collaborative globally. Audience comments emphasized special-needs persons' address and possible standards modularity improvement so that small entities could also bring their innovations to standards.

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Magnus Frodigh (CTRO Ericsson Sweden)

The 6G summit in Glasgow marked an important discussion for further collaboration in the 6G area. Significant investment are taking place across the globe in the field of future communication platforms. The benefits of working together across countries and regions are obvious. At the conference several research proposals was discussed and we will see many applications being written as a result out of the workshop. With the support of the research financing bodies this will make an important contribution.

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Halim Yanikomeroglu (Carleton U, Canada)

Last week's Inter-Academy Workshop was a phenomenal event. My LinkedIn posting on the topic has received ~11,500 views and 310 likes, demonstrating the appreciation of the community at large as well: :-)

<https://www.linkedin.com/feed/update/urn:li:activity:7211484999340953600/>

Thank you for the great hospitality as well...

I am IEEE Communications Society's Advisor to ICC 2026 Glasgow. I am already looking forward to the mentioned next edition of the Inter-Academy Workshop series.

: "The Workshop brought together leaders and influencers from a wide range of stakeholders (industry, academia, standardization bodies, and granting agencies) from around the world with diverse and enriching viewpoints. The Workshop was intense and delightful -- it was a great success!"

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Pekka Rantala (Business Finland)

I perceive the Glasgow workshop as a very fruitful opportunity to meet some of the key thought-leaders from research and industry. I had interesting talks with them.

I have visited a few international seminars and conferences before, but I have not come across a similar type of cross-sectoral and intensive seminar. In my opinion this Glasgow seminar was a continuation of the previous one which was held in Stockholm 6/2023. But the scope and the audience were much larger now which is favourable.

Business Finland and Research Council of Finland are interested in international collaboration. We do have appropriate funding instrument/schemes available. From my point of view the easiest way to foster international collaboration is to follow the largest funding available, and in practice the usual picks would be NSF or Horizon Europe/SNS JU acting as a "leading agency".

From Business Finland perspective maybe the hardest part in putting collaboration into practice in 6G is to engage private companies onboard.

And finally, I'd like to participate in the Glasgow 2026 seminar as well together with some Finnish researchers.

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Monisha Ghosh (U Notre Dame, US)

The Inter-Academy International Workshop on "Future Communications and 6G" brought together leaders from industry, academia and government for two days of in-depth and thoughtful discussions on the technology and policy needs of future communication networks. The panel discussions deliberated on all aspects of future networks: use-cases, technology, business models, spectrum and secure synchronization. I look forward to continued engagements with the community on these topics.

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Rahim Tafazolli (Surrey U, UK)

Future Communications and 6G Inter-Academy Workshop was excellent experience for me from many aspects. It was well organised with fantastic international speakers and experts. The discussions were frank and to the point.

I am looking forward to be involved in future re-run of the workshop.

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Ellen Zegura (Director CISE NSF, US)

I recently had the pleasure of representing NSF at the Inter-academy International Workshop on Future Communications and 6G hosted by the University Strathclyde in Glasgow, Scotland. This event was unique in my experience, bringing together senior researchers, funding agencies, telecom policy leaders, and industry across multiple like-minded countries. The stated objective, to promote "international cooperation on 6G, to ensure that future wireless systems are open, interoperable, scalable, and more importantly sustainable and universally accessible," mirrors the aspirations and values held by the US for future development of communication systems. I was delighted to see the elevation of sustainability and "connecting the unconnected" to be on par with other key considerations and as the topic of much robust discussion, along with traditional technical challenges.

I look forward to continuing the conversations and expanding the critical collaborations across our countries.

Junyi LI (VP Engineering and Qualcomm Fellow, Qualcomm USA)

It was great meeting many new and old friends and colleagues. The Workshop was a great success, bringing together great minds from academia, industry, and government. The content and format were unique in that the Workshop was supported by the leading academies in the world. I have learned a lot from the workshop. Look forward to the follow-on workshop in two years!

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Rahim Tafazolli (Surrey U, UK)

FROM Washup session

Summary of discussions on Future Communications and 6G

Why

- Environment sustainability
- Reducing the cost
- Societal Challenges
- More capacity
- Increase revenue

What

- Environment sustainability and reducing the cost: energy efficiency and Intelligent network control/operation and cost effective network functions/services upgrades
- Societal Challenges: Digital Divide, trustworthiness, Security, resilience and privacy
- More capacity: Massive MIMO, Spectrum Sharing, new spectrum
- Increase revenue: New use cases, ISAC, Cyber-physical convergence,...

How

- Network of Networks (Fixed, Mobile and Space nets) for ubiquitous coverage and energy efficiency based on extension of Open RAN principles to enable open virtualised Networking
- AI/ML (GenAI) for network control and automation
- AI computation and reliability specially with five 9s reliability
- AI as a service
- Data awareness (management and sharing)
- Network slicing and autoscaling
- IP centric access architecture with inherent local breakouts
- Distributed cloud Native enabled (access-edge-cloud), virtualisation
- Edge computing and security solutions
- RAN Intelligent Controller (RIC)
- Cognitive (intelligent) dynamic Spectrum sensing and sharing (licensed, shared and unlicensed)
- Wideband RU, DU, CU
- Reconfigurable Intelligent Surfaces (RIS): High energy efficient way of coverage extension outdoor-to-outdoor, outdoor-to-indoor, indoor-to-indoor

- Ultra Massive MIMO (UM-MIMO): Capacity, scalable MIMO system for energy efficiency and waveform specification
- New channel modelling for UM-MIMO
- ISAC channel models
- Quantum communications
- Quantum-safe communication networks
- Quantum sensing
- High quality time and reliable time distribution for resiliency
- Key technical specifications and solutions for cyber-physical convergence (interactivity) such Radio imaging and high accuracy location, time synchronisation accuracy and tolerable jitter
- Digital Twin

Methodology

International collaboration with aim of influencing future standards, IP generation with a combinational of information theory (fundamental limits), computer simulation and proof of concepts (experimental research and innovation).

Most of the above research challenges apply to both TN and NTN.

6G research should consider, in the first instance, evolution from 5G and should consider new solutions' implications on system (for example energy efficiency, QoS,..). Wherever possible implications on various industries, policies/regulation should be highlighted and considered in the research and innovation findings.

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Edward G. Tiedemann, Jr. (Sr VP Qualcomm, US)

Impressions of the Inter-Academy International Workshop on Future Communications and 6G

The Inter-Academy International Workshop on Future Communications and 6G brought together academia, industry, and governments. It consisted of a sequence of panels where the participants expressed their views and answered questions. A few key points follow: The telecommunications industry is moving forward to develop a 6G standard with technical work being kicked off by a workshop in March 2025 with the first version of the standard likely in 2029 or 2030. 5G is a very good system technically and is capable of addressing a wide range of usages. Fixed Wireless Access (FWA), using 5G to provide home Internet service, has been a big success in multiple countries. Private networks are also emerging as a new deployment model and are becoming successful in some countries. Public mobile networks continue to be plagued with coverage holes outside of metropolitan areas. Business and societal issues are causing issues in getting return on investments and spurring deployment of certain capabilities, such as URLLC. Thus, some operators who have not seen the return on 6G are questioning the timing or even the need for 6G. Others expressed that 6G is needed for energy efficiency, security, trust, as well as other technological improvements over the last decade. Early on, more emphasis needs to be placed on use cases, how money can be made from them, and the requirements of IoT users. There should be more focus on integration of various communications technologies, such as Wi-Fi, as has started in 5G with the satellite industry and Non-Terrestrial Networks (NTN). To enhance coverage, cells should become come more cost effective, where the site acquisition, permitting, and preparation costs are often far larger than the equipment costs. O-RAN based interfaces are expected to become even more important in 6G and may help by

providing a greater selection of Radio Units (Rus). 6G systems should be distributed and cloud native with open breakout the operational norm. Obtaining additional spectrum for 6G is very challenging as there is no significant amount of practically usable spectrum available (under 15.35 GHz and preferably much lower) that does not have incumbents. As a result, some sort of sharing mechanisms may be required. Finally, there should be an increased emphasis on R&D with steps taken to better couple industry and academia. Overall, the workshop was highly successful in having an open dialog on the future of 5G and 6G communications.

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Dereje Agonafer (U Texas Arlington, US)

Subject: Inter-Academy International Workshop on Future Communications & 6G
24/25 June 2024, Technology and Innovation Centre, Glasgow, Scotland, UK

Dear Professor Tariq Durrani and Dr. Mallik Tatipamula,

Firstly, as your role as Chair and Vice Chair of the workshop, I want to congratulate you on sponsoring an outstanding program featuring global leaders in Wireless Communication Systems. It was especially important to note that you used your renowned leadership from both industry, Dr. Mallik Tatipamula as CTO of Ericsson, and academia, Professor Tariq S Durrani OBE FRSE FEng FTWAS, Research Professor in the Department of Electronic and Electrical Engineering at University of Strathclyde, Glasgow Scotland UK., to attract very high caliber speakers. I was very impressed that the workshop started with addresses by international academy leaders including: Sir Jim McDonald, President, Royal Academy of Engineering, and Principal, University of Strathclyde; Sir John Ball, President, Royal Society of Edinburgh; Dr John Anderson, President, US National Academy of Engineering; Dr Catherine Karakatsanis; President, Canadian Academy of Engineering; Professor Indranil Manna, President, Indian National Academy of Engineering; Mr Marcus Wallenberg, President, Royal Swedish Academy of Engineering Sciences. The 10 sessions that constituted the workshop was really outstanding.

I was especially pleased I had the opportunity to participate in a panel entitled: "ENGINEERING ACADEMIC INFLUENCERS PANEL" where we discussed ongoing research activities and potential key technologies for the next decade, with a view to offering topics for collaboration by international teams. In particular, I addressed advanced Packaging as - *"Leveraging Advanced Packaging to both improve performance and reduce cost - disaggregating and aggregating an SOC so it can perform almost as good as SOC but much cheaper - components can be placed in closer proximity on advanced substrates (silicon, glass), and Chiplets can be reused varying technology nodes as needed – newer for logic and older for memory."* I concluded by stating that advanced packaging will play a significant role in future 6G systems.

I will be remiss if I don't discuss the first-class banquet Monday evening at Glasgow City Chambers, in the elegant Satinwood Suite of the City Chambers in the presence of Glasgow's Lord Provost Jacqueline McLaren. At the banquet, I very much enjoyed listening to Martin Hendry, banquet speaker, and especially his focus on Lord Kelvin, Scottish engineer, mathematician, and physicist, who amongst others was instrumental in the development of the second law of thermodynamics and the absolute temperature scale (named after him). These topics are the backbone of my thermodynamics class, and it was indeed a pleasure getting an in-depth historical perspective on the Scottish scientist.

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