Technical standards provide the instructions to create and operate the devices and networks which we use to access the Internet.

An important way of accessing the Internet in the home, the workplace and public spaces, like cafes and airports, is through using Wi-Fi. Wi-Fi is often freely available and generally is not subject to the capacity allowances.

As more and more people access and use the Internet through portable devices like smartphones, laptops and tablets, for everything from sending a simple text to watching a sporting event, it is vital that technical standards evolve to cater for effective and reliable local wireless Internet communication.

Yet technical standards making for Wi-Fi is highly complex and conducted away from ‘every day life’, often in private international organisations. Because of this, its technical challenges and commercial timescales can mean that the broader public interest and public policy dimensions of what it delivers are under-emphasised.

Our policy brief aims to address this matter.

It emerges from part of a UK academic research project on technical standards making for the Internet conducted at the Universities of Exeter, Salford and Warwick between 2015 and 2018.

The work, conducted by Dr Imir Rashid and Professor Seamus Simpson, focuses on recent developments in technical standards making for the future of Wi-Fi communication.

It aims to help us understand better how technical standards making can create the conditions for better Wi-Fi communication and use.

Yet it also shows how significant technical and operational challenges need to be overcome to deliver the kind of seamless, high-speed wireless Internet access that people demand in the 21st century.

In particular, securing harmonious co-existence between different technical standards in the Wi-Fi space is not just a technical and commercial challenge but is also an important public interest concern and an aspect of efficient radio spectrum management for regulators.
Local Area Network (LAN) wireless communication has become an increasingly important component of the communication landscape. As people wish to use their laptops, smart phones and tablets to gain access to the Internet in increasing numbers, the valuable and limited nature of airwave capacity becomes clear. As a consequence, how to develop and manage this capacity is a key communication policy issue.

Unlicensed spectrum is a part of the airwaves which allows users to enter and utilise the available capacity without the acquisition of a formal licence to operate. The 2.4 and 5 GHz bands have developed into a vital space for accessing the Internet on this basis. Wi-Fi services operating in these bands have become synonymous with accessing the Internet locally.

Wi-Fi access is for the most part seen as ‘open’ and free for users in private domestic and public spaces alike.

An important feature of mobile smart phone usage is to switch to Wi-Fi services from licensed operators services when the opportunity arises. This process, known as ‘offloading’, can represent a cost saving to users with limited capacity licensed operator packages. For licensed mobile broadband operators too, the unlicensed bands have proved increasingly attractive to use in a bandwidth hungry - yet capacity constrained - operational environment.

These developments, as might be expected, have placed increased strain on unlicensed capacity. In particular, in crowded unlicensed spectrum bands, how can Wi-Fi and licensed mobile broadband operators co-exist with each other harmoniously and fairly?

The pursuit of co-existence has become an increasingly important matter with commercial and public interest underpinnings.

The unlicensed spectrum environment is particularly interesting in that maintaining order and functional efficacy within it has largely been undertaken through the development of technical standards in private international organisational contexts, according to which equipment using the space needed to conform.

Wi-Fi technical standards, which can be regarded as having incumbent status, are developed in the Institute for Electrical and Electronic Engineers (IEEE). The 802.11 family of standards have, successively, provided the technical mainstay for what we recognise as Wi-Fi Internet access.

Licensed mobile broadband operators have developed the Long Term Evolution (LTE) standards family to underpin the functioning of equipment using licensed bands. A key organisational venue for LTE development is the Third Generation Partnership (3GPP). Increasing interest in unlicensed spectrum has led to efforts to create new standards to exploit more effectively licensed mobile broadband use of unlicensed spectrum.

Parallel work on Wi-Fi and LTE standards making for unlicensed spectrum use in theory can provide an effective private regulation-through-technical-standards solution for more intensive use of unlicensed spectrum. Yet, in practice such developments have instead created a clash and threatened co-existence between the two systems in the unlicensed space.

A key question is thus: to what extent can private technical standards making resolve the co-existence problem in unlicensed spectrum?
RESEARCH FINDINGS

- Mobile broadband (LTE) and Wi-Fi (802.11) standards have fundamentally different technical features which determine the way in which devices operating according to them access channel spaces.

- In non-technical terms, Wi-Fi devices are more sensitive to - and polite in - the presence of other devices wishing to communicate in the space, not least LTE-based devices.

- This means that when operating in proximity to LTE-based devices, there is a danger that Wi-Fi devices will not gain fair access to communicate.

- The LTE-LAA (Licence Assisted Access) standard included LBT but used a less sensitive Energy Detection (ED) system than 802.11 standards (which employ a two stage ED and Preamble Detection (PD) system).

- Efforts to resolve the technical impasse showed different technical test evidence to support opposing perspectives. These amounted to re-statement of positions rather than movement towards a common ground.

- However, the European standards making context provided an opportunity for common ground to be identified and forward movement on co-existence to be achieved.


- The essence of the co-existence challenge has been to find agreement between Wi-Fi and LTE technical standards making bodies on the technical parameters of each standard that will avoid interference and give acceptable access.

- Put in more technical terms, private international technical standards development has been unable to resolve the key issue of energy detection levels and mechanisms for accessing transmission channels in unlicensed spectrum to avoid collisions between signals.

- For example, the LTE-U (Unlicensed) protocol did not include the ‘Listen Before Talk’ algorithm inherent in 802.11 standards aimed at avoiding collisions.

- In the ETSI Broadband Random Access Network committee, a three component compromise package emerged:
  
  - It was agreed to maintain the use of ED and PD in the revised ETSI standard.
  - It was agreed that the latest version of the IEEE 802 standard (802.11ax) would be covered by the European standard even though the former had not been completed at that point.
  - It was also agreed that a series of co-existence test exercises would be undertaken aimed at moving towards agreement on acceptable co-existence between LTE and 802.11 standards.
RECOMMENDATIONS

- Ensuring high quality communication in local area network unlicensed spectrum environments is a key communications policy concern. Increasing demand on finite spectrum resources requires a careful consideration of technical, commercial and consumer public welfare matters.

- Private technical standards making provides the essential basis for improving the quality of communications available to users and maintaining order in the unlicensed space.

- However, the recent contestation between Wi-Fi and licensed mobile broadband interests shows how the need to comply with legislative and regulatory backstop requirements can help to overcome blockages and expedite the pursuit of compromise.

- Achieving the latter is very much in the interest of equipment vendors, service providers and, most importantly, consumers.

- Going forward, regulatory bodies at the national level should pay closer attention to the evolution of private technical standards making processes as tools of regulation in wireless communications environments.

FURTHER READING

To read about our research on this topic in more detail please see the following:


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