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Beyond 5G: New thinking for truly ubiquitous ample-speed wireless communications

Abstract: Growth in demand for communication services has been unrelenting during the past decade, both in terms of the number of users simultaneously requiring service and the high data rate (so called broadband) nature of user applications. For example, during the same period that the Internet grew from a global penetration of 12% in 2003 to 38% in 2013, the number of mobile cellular telephone subscriptions skyrocketed from 22% to 93% of the world's population. Today's global communication network, providing reliable error-rare information transmission in a timely fashion, is a hugely commendable feat and the culmination of the work of governments, regulatory bodies, industry, academia and countless individuals over a period of more than 150 years. However, much of the work was unplanned and uncoordinated, and progress was piecemeal and often opportunistic and through trial and error. In particular, no one sat down 100 or 50 years ago and said, "Let us build a global Internet, and here's the plan." Furthermore, as evidenced by the evolutionary generations of cellular telephony from 1G in 1981 to 5G by 2020, innovative solutions are often short-sightedly targeted at current challenges rather than bold future aspirations. The short shelf life of 'innovative' designs should therefore hardly surprise. This talk envisions a future global communication network that caters to not just our eyes and ears but also our senses of touch and smell, connects people as well as functional things, provides continuous coverage and observation of the entire planet, focuses on ample rather than high speed, and makes sparing and sustainable use of resources. The realisation of this vision requires a host of new sensors and displays, but wireless connectivity capability must be ready for the global data transmission deluge that would ensue. Transmitters (from terrestrial systems to high-altitude platforms and space-orbiting satellites) and nodes that drive this future network will be intelligent link-aware devices capable of leveraging various signal processing strategies to optimally adapt to changing channel and network conditions. We discuss fundamental trade-offs amongst the three primary system resources of bandwidth, signal power and time and identify possible paths to a future-proof truly ubiquitous ample-speed global communication network. Solutions are discussed for densely populated conurbations and for coverage of regions around the North and South Poles that are invisible to geostationary satellites. Ideas and benefits are also presented for a global Earth monitoring constellation system (GEMCoS) that provides full and continuous sub-metre resolution imaging of the entire Earth (land and sea).

Biography: Ifiok Otung was appointed Professor of Satellite Communications at the University of South Wales (USW) in December 2011. He is the author of several textbooks, including the internationally acclaimed 664-page Communication Engineering Principles, ISBN 9780333775226, published in 2001 by Palgrave Macmillan, and the 520-page Digital Communications, ISBN 9781849196116 published in 2014 by the Institution of Engineering and Technology (IET) London. Ifiok heads the Mobile and Satellite Communications Research Group at USW and is Associate Editor of the IET Journal of Engineering. His research experience in the areas of Wireless and Satellite Communications includes supervision of 16 PhD and over 100 MSc projects as well as numerous Journal and Conference publications. Ifiok earned a PhD in Satellite Communications from the University

of Surrey in 1995.