Mobile Comms – Design Steps 1

Kings College
Centre for Telecommunications Research,
Department of Informatics, King's College London
London, United Kingdom
{*name.surname*}@kcl.ac.uk

Abstract
In this paper, we summarize some of our latest research in wireless communications and system design. The typical years innovation cycles between generations, the "G"s, worked well in the past but are unfortunately not adequate for the future. Based on some past trends [1,2], the aim of this paper is to develop a technology, innovation and business roadmap for the mobile ecosystem. Notably, required technology disruptions to the cellular infrastructure are discussed as well as much-needed changes in the overall innovation landscape suggested, which would enable a massive shift from selling the cost of connectivity to co-creating value in ubiquitous connectivity [3,4]. With the exposed insights, 5G is likely to be the last "G" of cellular.

I. Introduction

The mobile industry has had solid growth over the past decades. It has evolved from a niche technology [5,6,7], embodied by an analogue first generation (1G) voice system, to a fully fletched Internet on the move, embodied by an end-to-end digital 4G system. With so many generations of mobile now deployed globally, the technology is starting to become commodity and is naturally experiencing market pressure underpinned by shrinking margins and higher deployment costs [8,9].

It is hence adequate to ask about the future of wireless. We would like to understand which technology disruptions are required to enable mobile not only to survive [10,11,12] but to thrive in an increasingly competitive technology and business landscape.

Understanding that technology disruption is tightly coupled to innovation, we examine which changes in the innovation landscape are required [13] to enable such technology transformation. This in turn will also change finances, business models and value chains in mobile [14,1].

II. Mobile Trends

Years of mobile development, deployment and usage allows us to draw the following trends [15,3].

The key performance indicators (KPIs) of cellular have evolved in a rather consistent way from generation to generation [16,17]. The most important ones are rate, number of devices and delay/latency. Illustrated in [18], each of these have increased or decreased by 1-2 orders of magnitude. Notably, the rates evolved [19,20].

5G and the evolutions thereafter are unlikely to follow a different trend. Notably, for the next generation this means that rates will be as articulated in [21] and [22].

Indeed, the extremely high number of devices (and optimised power consumption) allows 5G to enable the emerging Internet of Things (IoT) which requires billions of end-points to be connected. Given the global coverage (with mobility and roaming support), 5G is hence consolidating as a serious candidate to enable the IoT.

Furthermore, the very low latencies (along with low outages), enables critical applications to be serviced.

V. Concluding Remarks

We have discussed some fundamental design approaches which will be further expanded in subsequent papers. Based on these trends, we will suggest some disruptive technology changes.

All this have very important impacts onto the business models of cellular, which have not been discussed here and which are left as future work. However, it is worth outlining already that the value chains will transform slowly where we see telco operators transit from B2C business models to B2B business models.

Bibliography

[1] G Fettweis, H Boche, E. Steinbach, et al. "The Tactile Internet," ITU-T Technology Watch Report, August 2014; http://bit.ly/1BvAhlr.

[2] M Dohler, G Fettweis, "The Tactile Internet – IoT, 5G and Cloud on Steroids," Telefonica Guest Blog Post, 30 October 2014, >200k views; http://bit.ly/1BpOG3H.

[3] G Fettweis, "The Tactile Internet: Applications and Challenges," IEEE Vehicular Technology Magazine, vol.9, no.1, March 2014; http://bit.ly/1wXjwks.

[4] A. Aijaz, Mischa Dohler, A.H. Aghvami, V. Friderikos, M. Frodigh, "Realizing The Tactile Internet: Haptic Communications over Next Generation 5G Cellular Networks," IEEE Wireless Communications (Magazine), in press.

[5] T Watteyne, K Pister, D Barthel, M Dohler, I Auge-Blum, "Implementation of gradient routing in wireless sensor networks," Global Telecommunications Conference, 2009. GLOBECOM 2009. IEEE, 1-6, 2009.

[6] K Zheng, Y Wang, W Wang, M Dohler, J Wang, "Energy-efficient wireless in-home: the need for interference-controlled femtocells," IEEE Wireless Communications 18 (6), 2011.

[7] L Giupponi, A Galindo-Serrano, P Blasco, M Dohler, "Docitive networks: an emerging paradigm for dynamic spectrum management [dynamic spectrum management]," IEEE Wireless Communications 17 (4), 2010.

[8] M Dohler, A Gkelias, AH Aghvami, "Capacity of distributed PHY-layer sensor networks," IEEE Transactions on Vehicular Technology 55 (2), 622-639, 2006.

[9] O Galinina, A Pyattaev, S Andreev, M Dohler, Y Koucheryavy, "5G multi-RAT LTE-WiFi ultra-dense small cells: Performance dynamics, architecture, and trends," IEEE Journal on Selected Areas in Communications 33 (6), 1224-1240, 2015.

[10] A Galindo-Serrano, L Giupponi, M Dohler, "Cognition and docition in OFDMA-based femtocell networks," Global telecommunications conference (GLOBECOM 2010), 2010 IEEE, 1-6, 2010.

[11] M Dohler, DD Meddour, SM Senouci, A Saadani, "Cooperation in 4G-hype or ripe?," IEEE Technology and Society Magazine 27 (1), 13-17, 2008.

[12] N Accettura, MR Palattella, G Boggia, LA Grieco, M Dohler, "Decentralized traffic aware scheduling for multi-hop low power lossy networks in the internet of things,"

[13] World of Wireless, Mobile and Multimedia Networks (WoWMoM), 2013 IEEE 14th, 2013.

[14] J Lu, F Valois, M Dohler, MY Wu, "Optimized data aggregation in wsns using adaptive ARMA,"

[15] Sensor Technologies and Applications (SENSORCOMM), 2010 Fourth International, 2010.

[16] T Walteyne, A Bachir, M Dohler, D Barthe, I Auge-Blum, "1-hopmac: An energy-efficient mac protocol for avoiding 1-hop neighborhood knowledge," Sensor and Ad Hoc Communications and Networks, 2006. SECON'06, 2006.

[17] M Dohler, H Aghvami, "On the approximation of MIMO capacity," IEEE

Transactions on Wireless Communications 4 (1), 30-34, 2005.

[18] M Porretta, P Nepa, G Manara, F Giannetti, M Dohler, B Allen, et al "A novel single base station location technique for microcellular wireless networks: description and validation by a deterministic propagation model," IEEE Transactions on Vehicular Technology 53 (5), 1502-1514, 2004.

[19] A Osseiran, JF Monserrat, P Marsch, "5G mobile and wireless communications technology," Cambridge University Press, 2016.

[20] L Sarakis, T Zahariadis, HC Leligou, M Dohler, "A framework for service provisioning in virtual sensor networks," EURASIP Journal on Wireless Communications and Networking 2012 (1), 135, 2012.

[21] T Watteyne, I Augé-Blum, M Dohler, S Ubéda, D Barthel, "Centroid virtual coordinates–A novel near-shortest path routing paradigm," Computer Networks 53 (10), 1697-1711, 2009.

[22] M Dohler, "Wireless sensor networks: the biggest cross-community design exercise to-date," Recent Patents on Computer Science 1 (1), 9-25, 2008