

Future Directions in Wireless Networks

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The research leading to these results has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 258301 (CREW project).



Evolution of wireless communications





- More spectrum (e.g., mmwave, licensed + unlicensed, ...)
- More antennas
- New technologies



- New spectrum licensing regimes
- Cell densification
- Resource sharing
- Slicing and virtualisation





Networks of the future will be characterized by *heterogeneity*:



of spectrum use

of resource ownership models



of radio access technologies









Future wireless networks will rely on sharing and virtualisation

... and this requires the ability to slice and trade resources





Increased efficiency and lower costs through:

- Incentives for the deployment of localised (small cell, primarily) infrastructure by medium-sized and small operators
- The ability to provide service over infra-structure that employs heterogeneous technologies, and has different properties and ownership
- Improved service in currently under-served areas
- The ability to offer virtual wireless networks with different associated quality of experience, at different price points



Virtualisation





Virtualisation = the illusion of exclusive access to physical resources that are, in fact, shared

A virtual wireless access network feels to the user like a traditional network operated by a single entity but is in fact orchestrated out of a diverse pool of resources with different ownership models

A set of physical resources can host several virtual networks



Blurring the lines between OTT and MNO













OTT = over-the-top service provider MNO = mobile network operator





- How to select physical resources to meet the needs of the virtual operator?
- How to dynamically manage these virtual networks and the sharing of resources?
- How to ensure security and privacy?
- How will economic and public policy models evolve to support this new paradigm?

(...)





- Heterogeneity brings efficiency and complexity
- Experimental investigation more important than ever... yet no single research group can cover the broad range of radio access technologies and usage conditions of interest
- > Need to lower barriers to entry for experimenters
- > Need to test under field conditions, with repeatability



Federation, common control frameworks



- What CREW accomplished: a federation of testbeds that enables experimentation in a variety of spectrum bands (LTE, ISM, TV, radar, ...) with a variety of radio access technologies
- To enable sharing, need to develop a programmable network substrate and intelligent control
- Wireless and optical network domains affect each other: need for a common control framework
- Ultimate goal is integration of diverse technologies, spectrum use, modes of ownership in shared experimental facilities that can be used for field tests





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