User-centric networking and the cellular wireless bandwidth crunch

U-NET Panel Session

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Currently, as users “mobilize” all of their communication activities, cellular operators are facing a severe mobile data traffic explosion.

- Cellular infrastructure lags behind the users’ demand
  - Increase in the number of data users (smartphones, tablets, etc.)
  - Increasing demand for bandwidth-hungry applications (multimedia)
Current Trends

- Carriers have responded by *acquiring spectrum* and *tiered pricing* to control traffic growth
- Major vendors have focused on tried and trusted approaches and shied away from “radical” innovations
- Innovators are frustrated by this situation

> “Not even the inventor of the cellphone, Martin Cooper, is convinced that the wireless industry faces a serious challenge that cannot be overcome with technology”, NY Times

- My take: These trends may force a paradigm shift in both the technology and business model of the cellular industry

Is User-centric networking an answer to this crisis?

- Perhaps! Along with smart antennas, small cells, cognitive radio, WiFi offloading ...
- Most of the capacity gains of cellular networks has been achieved by shrinking cells and thus reusing spectrum (1600X vs. less than 25X from physical layer!)
- Who will host the small cells?: You (or your landlord!) in residential areas, commercial real estate owners elsewhere
- Opportunity for user-centric networking in a licensed band environment
- Users provide sites for small cells (and pay for utilities and wireline backhaul), carriers pay users with $ or cheaper services, address “not in my backyard” problem, and get a low-cost increase in capacity in line with user’s ability to pay for these services
- This trend will increase if spectrum is truly under strain and carriers move to millimeter waves, where line of sight connections are needed.
Is User-centric networking an answer to this crisis?

- In a small cell world, users at “good” locations are kings!

- The technology that would form the basis of user-centric networking would be:
  - “Open” femtocells allowing for the support of traffic from passers by
  - Vehicular and other fast moving users can only be supported using fast handoff – this requires over the air (OTA) signaling through the base station: femtocells with OTA relay capability or femto-relays
  - **Tight integration of fast signaling, security, interference management, and low latency backhaul networks offered by 4G networks coupled with the user’s contribution to small cell infrastructure can provide a significant increase in low cost capacity**

Fast Handover in Cellular Networks with Femtocells, by Ayaskant Rath et al., ICC 2012