Heterogeneous Networks: An Evolution Path to 5G for Smart Nation

Sun Sumei(sunsm@i2r.a-star.edu.sg)

26 February 2015
Evolving ICM Landscape

Exponential network data traffic growth

Widespread use of mobile consumer device and services

Digitisation of information and media content

CAPEX/OPEX reduction for sustainable ICT
“Smart” Everywhere

- Smart home
- Smart grid
- Intelligent transportation
- Smart city
- Smart nation
“Smart” Everywhere

- Smart home
- Smart grid
- Intelligent transportation
- Smart city
- Smart nation

M2M and Sensor Networks → High capacity Heterogeneous Networks → Data Analytics → ACTION
5G Network:

Energy- and Spectrum-Efficient Connectivity for

Everyone
Everything
Everywhere
All the Time
Characteristics of 5G: Service Requirement

- Hyper-connectivity
- Hyper-density communication
- Hyper-precision positioning
- High-speed mobility
- Hyper-responsiveness
- High energy efficiency

Institute for Infocomm Research (I²R)
Characteristics of 5G: Heterogeneity

- Multiple Networks
- Multiple Bands
- Multiple QoS
- Multiple Tiers
- Multiple Contexts
- Multiple Radio Accesses
HetNet: Intelligent Integration of Multi-RAT, Multi-Layer, Multi-Network, Over Multiple Spectrums

- Small cell + WiFi
- Small cell (3.5GHz)
- M-MIMO (mmwave)
- WiFi
- M-MIMO (mmwave)
- Core Network

Institute for Infocomm Research (I2R)
Our Areas of Focus
Context-Aware, Fast-Adapting, Spectrum and Energy-Efficient HetNet

- Multi-tier cellular
- WiFi

- Infrastructure sharing
- DSA/OSA/LAA
- MTC integration

Seamless Inter- & Intra-Network Roaming

- C-RAN/L-DAS
- Large MIMO
- Seamless Fronthaul-RAN

Energy-, Cost-, & Spectrum-Efficient Resource Sharing

- Context derivation
- Context-aware resource & network management
- Distributed storage & edge computing

High-Capacity Transmission System & Network

- Context-Aware HetNet Management for QoS & QoE
Software Defined Radio Access Network (SDRAN)

- Control unit (CU)
- Baseband unit (BBU)
- Small cell
- Small cell + WiFi
- WiFi
- M-MIMO
- Core Network
- C-Plane
- U-Plane
- DA
A Lab Test Bed

- Integration of optical front-haul and with **11ac** wireless transmission system
- **8 Antennas at Access Point**
  - Active Antenna System
- Unified architecture for MTC integration
- demo
Thank you!

Online:
www.i2r.a-star.edu.sg
www.facebook.com/i2r.research
Recent Publications (1)


Recent Publications (2)

Recent Publications (3)

38. J. Joung, C. K. Ho, and S. Sun, “Power amplifier switching/selection (PAS) for energy efficient MIMO systems”, submitted to Globecom 2014
42. K. Adachi, S. Sun, and C. K. Ho, “Power minimization of cooperative relay transmission with relay’s private information,” IEEE VTC 2011 Fall
43. K. Adachi, S. Sun, and J. Joung, “Cooperative relay transmission with relay’s private information,” IEEE VTC 2011 Spring
44. K. Adachi and S. Sun, “Inter-Sector cooperative relaying for network power minimization,” IEEE VTC 2012 Spring
45. C. K. Ho, P. H. Tan, and S. Sun, “Relaying for energy-efficient scheduling with deadline,”, IEEE ICC 2010
47. C. K. Ho, P. H. Tan, and S. Sun,, “Relaying with deadline constraint: energy minimization with full channel state information,” IEEE VTC 2012 Spring