Cooperative Radio Communications
for Green and Smart Environments

FROM HETNETS TO CLOUD RADIO ACCESS NETWORKS

8th IC1004 Training School

April 21-23, 2015

University of Luxembourg

Local organizer: Symeon Chatzinotas

Technical organizers: Lucio Ferreira (IST/INOV-INESC) and Silvia Ruiz (UPC)

MOTIVATION

Cloud computing technology has emerged as a promising solution for providing high energy efficiency together with gigabit data rates across software defined wireless communication networks, in which the virtualization of communication hardware and software elements place stress on communication networks and protocols.

Future Networks architectures are evolving to become to ever more flexible, developing towards the Cloud RAN concept, based on technologies such as distributed antenna systems, and evolving beyond it towards what can be called “ultra-flexible RANs”. C-RAN means a centralized processing, collaborative radio, real-time cloud computing and clean RAN systems. C-RAN brings to RAN the advantages of the cloud: resource-sharing, elasticity, on demand and pay-as-you-go.

Cloud RAN concept is expanded to include also EPC (Evolved Packet Core) functionalities, in what could be called Network Virtualisation, which refers to the capability of partitioning and/or pooling underlying physical resources or logical elements in a network, usually associated with the concepts of software-defined networking (SDN) and cloud services.

There are significant technical issues that still need to be addressed for successful rollout and operation of C-RAN and Virtual Networks. This training school brings together academic and industrial researchers to explain from the basis to the technical challenges and recent results related with C-RAN.

General Outline

Challenges of today’s RAN
Green and Cooperative HetNets
SON in HetNets

Architecture of C-RAN
BTS splitting in BBU and RRH
Technical challenges of C-RAN
Optical Transport Networks
Optical Fronthaul between BBUs and RRHs
Virtual Networks
Virtualisation in RAN, Core&Transport
Recent Advances and Testbeds
Cooperative Transmission/Reception and Dynamic Radio Resource Allocation
SDR and Joint Signal Processing

Training School Grants

A fixed grant of 300 € will be granted to 20 training school attendees

The selection will be based on a first coming first served base and on the following priorities:

1. PhD students from COST Country Institutions (one grant per Country)
2. While grants available, ESRs from COST Country Institutions
3. While grants available, other applicants

Speakers

Symeon Chatzinotas (Univ. Luxembourg), Luis Correia (IST/INOV-INESC), Lars Dittman (Technical University of Denmark), Lucio Ferreira (IST/INOV-INESC), Yoram Haddad (Jerusalem College of Technology), Anna Pizzinat (Orange), Dario Sabella (Telecom Italia), Eryk Schiller (University of Bern)

Detailed Draft Schedule:

First Day: Tuesday April 21, 2015

0. Welcome (9:00-9:15)
   Lucio Ferreira(IST/INOV-INESC, COSTIC1004) and Symeon Chatzinotas (Univ. Luxembourg, COST IC1004)
1. Introduction and challenges of Today's RAN (9:15-10:30)
   Lucio Ferreira (IST/INOV-INESC, COST IC1004)
   a. High power consumption due to large number of BS
   b. Multi-standard maintenance
   c. Fast increase in mobile internet traffic
   d. Non efficient use of resources (low BS utilization rate)
2. Operator's point of view (10:45-12:30)
   Dario Sabella (Telecom Italia)

3. SDN in Virtual Networks (14:00-17:00)
   Yoram Haddad (Jerusalem College of Technology, COST IC1004)
   a. Intro to SDN
   b. Wireless SDN
   c. Software-Defined Wireless Transport Networks to Deploy a Flexible Mobile Backhaul
   d. Open issues in (Wireless) SDN

Second Day: Wednesday April 22, 2015

4. Architecture of C-RAN (9:00-12:30)
   Lars Dittman (Technical University of Denmark)
   a. Centralized processing, cooperative radio, cloud and green infrastructure RAN.
   b. Splitting of BTS in BBU (Baseband Unit) and RRH (Remote Radio Head)
   c. Full/Partial centralization
   d. Advantages of C-RAN
   e. Technical challenges of C-RAN
5. Optical Transport Networks and Fronthaul (14:00-15:30)
   Anna Pizzinat (Orange)
   a. Bandwidth, latency and jitter requirement
   b. System reliability and cost
   c. Data compression techniques
   d. Optical Fronthaul between BBUs and RRHs
   e. Wireless Fronthaul

Third Day: Thursday April 23, 2015

6. Virtual Networks (9:00-12:30)
   Eryk Schiller (University of Bern)
   a. BS virtualization
   b. Shared resource pool
   c. Virtualization in RAN, Core&Transport
7. Virtualisation of Radio Resources (14:00-15:30)
   Luis Correia (IST/INOV-INESC)
   a. Architecture
   b. Virtual Resources
   c. Performance Metrics
   d. Algorithms for Virtual Resource Management
   e. Some Performance Results.
8. Cooperative Signal Processing Techniques for Multicell C-RAN(15:45-16:50))
   Symeon Chatzinotas (Univ. Luxembourg, COST IC1004)
   a. Multicast/Multigroup Precoding
   b. Symbol level Precoding
   c. Traffic-aware Resource Allocation
9. Closing (16:50-17:00)

Daily coffee breaks at 10:30-10:45 and 15:30-15:45