Demo: A Mobility Aware Cooperative Scheme for MAC Reconfiguration in Cognitive Wireless Networks

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Categories and Subject Descriptors: C.2.1 [Network Architecture and Design]: Wireless Communication

Keywords: MAC, Adaptation, Cooperation

With increasing wireless communication applications, assigning dedicated spectral resource to each application is becoming impractical. Cognitive radios are emerging as a possible solution for enabling coexistence among networks and higher spectrum utilization by opportunistically using spectral holes through dynamic spectrum access schemes [1]. Since the spectral environment for a node can be highly dynamic and unstable due to mobility and spectrum sharing with other networks, medium access schemes must be flexible and adaptable in order to provide a stable and high Quality of Service (QoS).

Classically, protocols are implemented in a monolithic fashion which restricts reconfigurability required in a dynamic spectrum access paradigm and mobile environment. One common approach for reconfiguration is by appropriately setting the parameters of a particular protocol such as the selection of the modulation and coding schemes in LTE [2]. MultiMAC [3] switches among a few pre-defined standalone protocols based on QoS requirements. Although these approaches aim at providing flexibility, the design choice is limited to the subset of the tunable parameter values and pre-selected options. In our demonstration, we will use a toolchain for runtime protocol realization (TRUMP) [4] which is built based on Decomposable MAC Framework [5]. It enables flexible adaptation of MAC behaviour on-the-fly resulting from spectral and network dynamics, mobility and varying QoS application demands. Reconfiguration at individual nodes may lead to possibly incoherent MAC schemes in a neighbourhood. Therefore, we have designed and implemented a cooperative mechanism where coexistence of different MAC solutions is allowed in the same network without disruption in communication links. Furthermore, the cooperative scheme allows the neighbouring nodes to adapt their MAC behaviour in order to maximize the performance characteristics. This is achieved through a controlling mechanism which monitors the MAC behaviour of its neighbours and disseminates this information.

Demo This demonstration will provide an opportunity to the audience to interactively change the protocol configuration at individual nodes, spectral conditions and/or the network topology and correspondingly observe the resulting performance characteristics. The demonstration will show how our cooperative scheme enables MAC reconfiguration in a network neighbourhood. The demo will also show that our cooperative scheme allows nodes to reconfigure their MAC behaviour with a low controlling overhead while being able to communicate seamlessly even when a node joins or leaves the network. We have implemented our solution on WARP [6], a SDR platform with Virtex Pro II FPGA. In this demonstration, four WARP boards will be connected to a PC as shown in Figure 1. An interactive Graphical User Interface (GUI) displays live MAC behaviour and performance statistics. Different topologies can be formed by adjusting the positions of the WARP nodes on the GUI. The transmit power of the nodes will be changed accordingly to model the topology and node mobility. An interferer will be introduced to the network to model a dynamic spectral environment. The demonstration requires two channels at 2.4 GHz band to be dedicated for the usage since the interferer will be jamming the channels randomly.

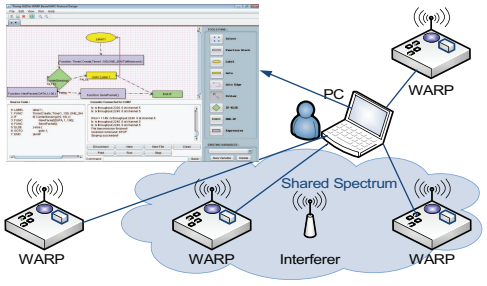

Figure 1: Demonstration scenario.

MobiSys'12, June 25–29, 2012, Low Wood Bay, Lake District, UK.
ACM 978-1-4503-1301-8/12/06.

Acknowledgment

We would like to thank partial financial support from RWTH Aachen University, DFG through UMIC research centre (Nucleus project) and EU through 2PARMA project.

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