A Flexible 5G RAN architecture with dynamic baseband split distribution and configurable optical transport

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EXTENDED ABSTRACT

In a Cloud Radio Access Network (C-RAN) architecture, different baseband processing functions (BPFs) splits options are available on the interface between the central unit (CU) and the radio units (RUs) [1]. A lower layer split, e.g., low-physical (PHY), can support advanced radio coordination techniques, for example Joint Reception (JR) Coordinated MultiPoint (JR-CoMP) [2]. However, the interface between low-PHY and the rest of the BPF chain (i.e., referred to as enhanced Common Public Radio Interface – eCPRI [3]) requires a high-capacity transport. With a higher layer split, e.g., between the Packet Data Convergence Protocol (PDCP) and the Radio Link Control layer (RLC), the transport capacity required on the interface between RLC and PDCP (i.e., referred to as F1 [1][4]) is lower than for eCPRI. However, with this split it is difficult to implement advanced radio coordination functions. The choice of BPF split and consequently the transport capacity requirements are determined by the RUs' radio coordination needs [1][5].

Another crucial aspect to consider is the physical location of the BPFs. The closer BPFs are to RUs, the lower is the number of eCPRI flows to be accommodated by the transport network. On the other hand, tight radio coordination schemes require joint processing of eCPRI flows from all the RUs involved (i.e., high level of BPFs aggregation). A C-RAN architecture is not able to capture this trade-off. All the BPFs reside in the CU (regardless of the actual radio coordination needs), resulting in high transport resource requirements, regardless of the actual radio network needs.

This talk presents a new RAN concept referred to as *Flexible RAN* (*F-RAN*). In F-RAN, BPFs are strategically distributed within the RAN in order to optimize the trade-off between radio performance maximization and transport capacity requirement minimization. In the use case examined in this talk, tight radio coordination management schemes are used to manage radio interference. The F-RAN concept is applied to a radio network using a Dense Wavelength Division Multiplexing (DWDM) centric transport [6]. Two variants of F-RAN are proposed, i.e., *Partially Centralized F-RAN* (*PCF-RAN*), and *Fully Distributed F-RAN* (*FDF-RAN*). The performance evaluation of both PCF-RAN and FDF-RAN confirm that by applying the F-RAN concept it is possible to achieve a better utilization of transport resources compared to conventional C-RAN.

Keywords: 5G transport, Cloud Radio Access Network (C-RAN), Baseband functional split, Flexible RAN.

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