Flexicell – Next Generation Cloud Radio Access Networks

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The convergence of fixed transport networks, based on high-speed optical infrastructures and broadband spectrally efficient wireless components has been identified as a key enabler of future access networks. The next generation of wireless systems (5G) should fulfil several goals, among which: provision of true broadband wireless access and enhanced system capacity, when compared with current third (3G) and fourth (4G) generation networks. A traditional cellular network is built with many stand-alone base stations (BSs), each one covering a cell and processing and transmitting its own signal to and from the mobile terminals. The issues regarding the growing complexity of BSs, the need for cooling, the increasing number of BSs for improved coverage and the difficulties in the acquisition of sites has led to some rethinking of the cellular concept, whose main trends are currently converging to Cloud Radio Access Network (C-RAN). C-RAN has been defined in several different ways, but essentially designates a network architecture where several distributed Remote Radio Heads (RRHs) with reduced complexity are linked to a central or Base Band Unit (BBU) at which joint radio signal processing is performed. The connection between the RRHs and the BBU is established through a high capacity network link, named fronthaul, typically supported by an optical infrastructure. In the scope of the Flexicell project, a collaborative research of IT-Aveiro/UA and Altice Labs, a complete C RAN testbed for next generation mobile networks was developed and successfully demonstrated with a 25 km length fronthaul. The most important aspects of the Flexicell project are:

· Utilization of Passive Optical Networks (PONs) as the physical infrastructure for the fronthaul, in coexistence with triple-play services (voice, video, and data), avoiding dedicated and expensive links and simplifying the deployment of small cells for improved coverage and spectral efficiency. Figure 1 shows this infrastructure sharing.

· Compression of the fronthaul traffic data between the BBU and the RRH to increase almost 50% of fronthaul traffic capacity in PON systems with negligible performance degradation.

· Upgradability to future PON technologies (e.g. NG-PON2) that will support larger fronthaul bandwidths for next generation mobile networks with wider channels and bit rates.

· Adoption of software defined radio approaches from the BBU to the RRH, leading to an access infrastructure that is agnostic and upgradable to future network standards.

· Baseband processing and core network virtualization for more flexible deployment, management and upgradability, as well as better energy and resource efficiency.

· Interoperability of the developed mobile network infrastructure with commercial mobile terminals, for demonstrating end user applications (e.g. mobile internet access, voice and video calls) and evaluate overall system performance.

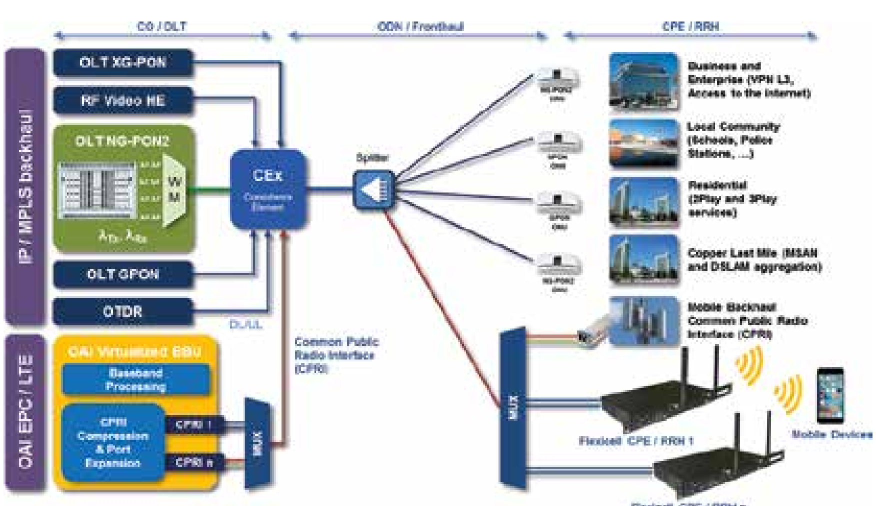

FIGURE 1
Deployment scenario of the Flexicell project in the scope of Radio Access Network converged with a Passive Optical Network infrastructure.