SDN enabled mm-Wave RANs for Next Generation Fixed Mobile Convergence

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Future Networks

Software-Defined Networks

“SDN is possibly the biggest shift in telecoms in 30 years... The network is finally the computer.”


Cloud Services & Big Data

“In a few years, we can expect the communications industry to look and feel similar to the IT industry.”


Mobile Broadband

“Mobile data traffic will increase 18-fold between 2011 and 2016. There will be over 10 Billion mobile-connected devices in 2016.”


Source: ADVA
Summary of key 5G Requirements

- 100 times higher number of connected devices
- 10 to 100 times higher user data rates
- 5 times reduced End-to-End latency
- 10 times longer battery life
- 1000 times higher mobile data volume per area

Source: METIS
New Fixed Mobile Convergence

New SDN enabled mm RAN

SCC: SDN Central Controller
mm-Wave Radio

- mm-wave frequencies could be used to augment the currently saturated 700 MHz to 2.6 GHz radio spectrum bands for wireless communications
- mm-wave carrier frequencies allow for larger bandwidth allocations, which translate directly to higher data transfer rates

However, challenges at these frequencies still exist, primarily related to attenuation through wall penetration and atmospheric absorption

Intention is to support small cells with up to 200m radius

Source: Ericsson
Radio over Fibre (RoF) can be the most promising solution to backhaul such ultra-high capacity (i.e. in the range of Tbps) cells.

Several issues with mm-Wave RoF (e.g. components non-linearity, SNR, etc.) still need to be resolved.

SCC can be used to control the whole network including site antennas PHY.

New SDN RAN

- Channel equalisation data is collected throughout the operation of the network
- A database of de-convolution impulse responses (IRs) is devised that combats channel conditions for discrete locations
- The system detects if there is no improvement in the error correction and steps back, ensuring that the de-convolution has always a positive contribution
- This database is updated in regular time intervals at the eNB hotel (for the RRHs), as well as the individual ONU/eNBs

• System level OPNET simulation of LTE over OFDMA has demonstrated the importance of appropriate packet mapping between optical and wireless QoS queues

• The SCC in the new FMC network needs to be aware of this process and perform mapping taking into consideration several access segments


Technology readiness

• The underlying key technologies have already been studied individually and in most cases demonstrated

• Therefore, the new developments are based on proven concepts in order to provide extended designs that match the proposed requirements

• Operators across Europe are keen and committed to move directly to an open demonstration so that they can show the SDN FMC concept to its main stakeholders
The expected roadmap

• Where can the proposed FMC concepts fit?

Source: Huwei
In summary

SDN enabled mm-Wave 5G RAN….

• ... will provide gigabit per second mobile connectivity to end users (Horizon 2020 target)

• ...presents the network operators with suitable technologies that can effectively complement the toolkit of access methods they will utilize to best address the backhaul needs of the various classes of cell sites that exists in their network
In summary

• ... will enable effective “open access” network allowing providers to manage and lease the infrastructure to service providers through un-bundling creating a new business model

• ... will reduce the total cost of ownership as well as CAPEX/OPEX enabled by the consolidation of COs and software defined nodes

• ... will have a significant impact on European ICT market growth due to high perceived service quality