

# Mobile Cloud Networking: Mobile Network, Compute, and Storage as One Service On-Demand

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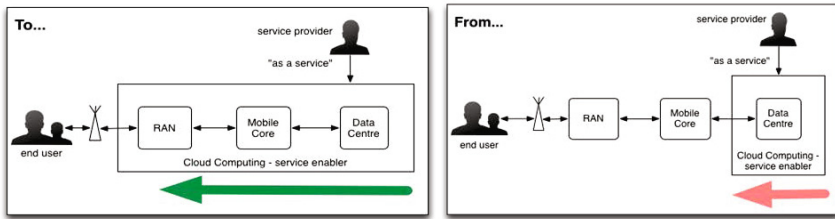
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**Abstract.** The Future Communication Architecture for Mobile Cloud Services: Mobile Cloud Networking (MCN)<sup>1</sup> is a EU FP7 Large-scale Integrating Project (IP) funded by the European Commission. MCN project was launched in November 2012 for the period of 36 month. In total top-tier 19 partners from industry and academia commit to jointly establish the vision of Mobile Cloud Networking, to develop a fully cloud-based mobile communication and application platform.

## 1 Introduction

Today's Cloud Computing is confined to data centres and one of the weakest points of the established Cloud Computing value proposition is that it does not support the seamless integration of cloud computing services in the mobile ecosystem. Another observation is that infrastructure sharing, enabled by virtualisation and seen as one of the most fundamental enablers of Cloud Computing, does exist in the Mobile Telco industry ever since the emergence of the Mobile Virtual Network Operator (MVNO). However, the principles of Cloud Computing are neither used nor supported by Mobile Networks and this regardless of the fact that many of today's network components are intrinsically cloud-ready and could be hosted on top of a Cloud Computing platform. These facts create a unique opportunity for the European Telco industry to provide a novel, distinct, and atomic (i.e., all services as one bundle) Mobile Cloud Networking

<sup>1</sup> <http://www.mobile-cloud-networking.eu>



**Fig. 1.** Vision and Scope of Mobile Cloud Networking

service, that is: Mobile Network plus Decentralised Computing plus Smart Storage offered as One Service On-Demand, Elastic and Pay-As-You-Go. The MCN project will investigate, implement and evaluate a fully cloud-based mobile communication and application platform for Mobile Cloud Networking services.

## 2 Main Objectives

The top-most objectives of the MCN project are to: a) extend the concept of Cloud Computing beyond data centres towards the mobile End-User, b) to design an 3GPP Log Term Evolution (LTE) compliant Mobile Cloud Networking Architecture that exploits and supports Cloud Computing, c) to enable a novel business actor, the MCN Provider, and d) to deliver and exploit the concept of an End-to-End MCN for Novel Applications and Services. The MCN architecture will define and implement an architecture that meets real-time performance requirements of Mobile Network functions on top of a high-performance Cloud computing framework. It will further support efficient and elastic use and sharing of both, radio access and mobile core network resources between operators. Mobile network functionalities, such as baseband unit processing, mobility management and QoS control, will run on the enhanced mobile cloud platform leveraging commodity hardware. This requires extensions towards higher decentralisation of Mobile Network functions and enhancing those functionalities to enable elastically scaling up and down according to the load. In addition, the end-to-end control and management will orchestrate infrastructure and services across several technological domains: wireless, mobile core and data centres, providing an entirely novel mobile cloud application platform and thus novel revenue streams for telco operators. This platform will bridge Cloud Computing and the Mobile Network domains by integrated solutions such as end-to-end SLAs, monitoring, AAA, Rating, Charging, and Billing. Besides the technological aspects, MCN will identify and evaluate overarching novel business models that support the exploitation of the Mobile Cloud Networking in various multi-stakeholder scenarios. The MCN architecture will be evaluated in realistic scenarios and with a set of concrete use-cases, based on applications such as MCN-enabled Digital Signage. The evaluation will be done from diverse viewpoints, exploiting the well-balanced and representative consortium, including leading industry from the Telecommunication as well as the Cloud Computing segments.

### 3 Technical Approach

The technological approach is structured in several segments; Cloud Computing Infrastructural Foundation, Wireless Cloud, Mobile Core Cloud, and Mobile Platform Services. The project baseline is a representative portfolio of mobile cloud services, application scenarios, and business models. These serve as fundamental input for the design and evaluation of the MCN architecture. The necessary foundational, Cloud Computing infrastructural resources and services required to create, enable and deliver fully virtualised end-to-end MCN services are based on the popular OpenStack framework and respective extensions to be developed. On top of this framework mobile network extensions are foreseen, namely to enable the concept of Wireless Cloud and Mobile Core Network Cloud. This will address in particular a novel mobile network cloud concept in support of on-demand and dynamic deployment of wireless access and mobile core network services in a Cloud Computing environment. The project will also design and develop a mobile platform for end-to-end mobile-aware service deployment including SLA management, AAA, Content Distribution Services, Rating, Charing, and Billing. The ultimate objective is to specify, implement, evaluate, and standardize a complete Mobile Cloud Networking and Service platform.

### 4 Key Issues

The key research and innovation issues that the MCN project is expected to tackle are the following: a) how to virtualise the Radio Access Networks (RAN), b) how to design a cross-domain Infrastructure-as-a-Service (IaaS) control plane, c) how to upgrade virtualisation and Cloud Computing middleware to support highly demanding, real-time network applications and services, d) how to design, deploy, and operate 3GPP LTE software components to attain and fully benefit from Cloud Computing attributes, e) how to ensure a good QoE with advanced content and service migration mechanisms for mobile cloud users, and f) how to support multiple cross-domain aspects that must service a multitude of business actors and stakeholders.

### 5 Expected Impact

MCN innovations will enable European Mobile Telco providers to enter the Cloud Computing domain with a strategic advantage, which is the ownership of the mobile network. The enabler for this is an MCN architecture that seamlessly integrates the domains, cloud computing, mobile networks, and respective support services for application development and commercialization.

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