Chapter 10
Importance of Cloud Computing in 5G Radio Access Networks

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ABSTRACT

The fifth generation of wireless networks (5G) will kick off with evolved mobile broadband services as promised by several mobile-related associations, researchers, and operators. Compared to 4G, 5G aims to provide greater data rates with lower latency and higher coverage to numerous users who stream ubiquitous multimedia services. 5G benefits the innovation of internet of things (IoT) as well. To this end, several modifications in the network architecture are required. This chapter is discussing the role of cloud computing centers in 5G networks, and how such integration could be implemented as found in the literature. The benefits of cloud/5G integration will be explained as well. In addition, some challenges related to the integration will be demonstrated.

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INTRODUCTION

The fifth generation of mobile communication systems (5G) will kick off with evolved mobile broadband services as anticipated by several mobile-related associations, researchers and operators. For example, with faster connectivity, it is possible to develop a new radio access network (RAN) for user equipments (UEs). A Cloud-RAN or Centralized-RAN (C-RAN) can be developed leveraging Cloud Computing and 5G networking to provide a new centralized and powerful RAN to resolve capacity and coverage issues in a more effective way. More on Cloud Computing technology and the C-RAN approach will be introduced in the following sections.

CLOUD COMPUTING

Cloud Computing refers to the transfer of on-demand computing services - everything from software programs to hardware-like machines - and storage capacity over a network media based on a pay-per-use model to a large variety of end-users (IBM, Microsoft Azure and Prajapati, Sharma, & Badgujar, 2018). The Cloud concept is called so as it obscures from users the infrastructure details of the underlying hardware. Also, "Cloud" indicates a distance between the service provider and the end-user as it is the case in the shadow resulted by the sky clouds, and provided over long distances. There are several definitions that were put for Cloud Computing by Information Technology (IT) experts in the field (Geelan, 2010). The definition of Cloud Computing as stated by the National Institute of Standards and Technology (NIST) considers it as a model that enables ubiquitous, on-demand and convenient network access to a congregation of configurable and shared computing resources (e.g., networks, servers, storage, applications, and services) as shown in Fig. 1. These resources can be rapidly provisioned and released with minimal management effort or service provider interaction (NIST).

Cloud Computing aims to authorize the use of user's data, software and computation resources over a network with adequate prices, depending on the usage time. At the same time, Cloud end-users relieved from the inconvenience of IT firmware establishments and hardware installations (Prajapati et al., 2018). Through only a web browser on top of a PC/laptop or a mobile app, end users could access Cloud services running on servers in remote locations efficiently and effectively. Cloud Computing provides enterprises with faster and well-managed applications that require less maintenance compared to non-Cloud applications. Furthermore, Cloud services could be readjusted multiples of times to cope with fluctuating and unexpected business needs more quickly. Like the electricity grid, the sharing of Cloud Computing resources over the internet is based on consistent scale economies proportional to the utility. The foundation of Cloud Computing is the broader concept of converged infrastructure and shared services (Hurwitz, Bloor, Kaufman, & Halper, 2010).

Although Cloud and Virtualization are entirely different, Cloud Computing adopts the virtualization technology to enable the optimum utilization for available computing resources. The Cloud uses a monitoring software (i.e., hypervisor) to allow multiple instances with different operating systems to run concurrently on the same machine with total isolation from each other (VMware). With virtualization, each running instance is assigned to the appropriate physical hardware resources as required, enabling different clients to access them in a cost-effective manner.