Chapter 8
Managing 5G Converged Core With Access Traffic Steering, Switching, and Splitting: From Hybrid Access to Converged Core

Toktam Mahmoodi
King’s College London, UK

Stephen H. Johnson
British Telecommunications plc, UK

Massimo Condoluci
King’s College London, UK

Vicknesan Ayadurai
Ericsson Research, Sweden

Maria A. Cuevas
British Telecommunications plc, UK

Mischa Dohler
King’s College London, UK

ABSTRACT

This chapter discusses the ongoing work around hybrid access and network convergence, with particular emphasis on recent works on ATSSS in 3GPP. Three main aspects are analyzed: policy enforcement, integration with 5G QoS framework, interaction with underlying multi-path transport protocol. The chapter also provides some preliminary testbed results showing the benefits of ATSSS in the management of multiple accesses analyzing some primary performance indicators such as achievable data rates, link utilization for aggregated traffic, and session setup latency. The chapter also provides some results by considering two examples of realization of ATSSS policies to avoid inefficiency in link utilization and to allow the fulfillment of data rate requirements.

DOI: 10.4018/978-1-5225-7570-2.ch008
INTRODUCTION

The increasing availability of heterogeneous accesses offers an opportunity for exploitation in order to boost network capacity and present new business opportunities as for instance discussed by Raj et al. (2010). The exploitation of fixed and mobile broadband (FBB and MBB, respectively) introduces several benefits, among those: (i) boosting end-user performance; (ii) load balancing; (iii) network optimization; (iv) “always best connected”; (v) session continuity when leaving coverage of one access (i.e., failover).

The exploitation of multiple accesses can be accomplished via different approaches. A first option is to exploit the aggregation of multiple available links towards one destination to boost the data rate of a session. Available links can be managed at the end-points (i.e., the end-device and the remote server) thanks to utilization of transport protocols such as multipath TCP (MPTCP), which is in charge for advertising the availability of multiple links and managing traffic aggregation. In this case, the end-points are unaware of the status of the two networks, and the FBB and MBB links are unaware of the aggregation that is performed. Therefore, this limits the opportunities for network operators to optimize the traffic within their networks.

In order to exploit in a more effective way the availability of multiple links, another approach is the so-called fixed-mobile convergence (FMC), where a service provider is aware of the availability of the different links and exploits this capability directly in a coordinated way. FMC enables the possibility to deliver any service, anywhere and via any access technology. Given the fact that, historically, FBB and MBB networks have been built separately and operated independently, FMC can be realized by exploiting a hybrid access gateway (HAG) considering the terminology used by the Broadband Forum (BBF) in BBF TR-348. The HAG is an aggregation point for the traffic from/to the Border Network Gateway (BNG) and the Packet Gateway (PGW) of the fixed and mobile networks, respectively, as seen in Figure 1(a). In this case, an operator managing the two networks is aware of the multiple accesses and, thus, can properly manage the traffic across them. In addition to improved user performance, the HAG allows to: (i) improve reliability, as traffic can be switched to another access if the performance degrades due to either congestion or mobility issues; (ii) enable seamless experience, as a service can now be accessed via either FBB or MBB. The latter aspects might also enable rapid service deployment by providing services such as high-speed broadband usually delivered via, e.g., fixed access through mobile networks in regions where fixed access is difficult and costly (or vice versa). More details on the improvements introduced through the exploitation of the HAG are given by Samdanis et al. (2017).

Nevertheless, some limitations are due to the fact that the BNG/PGW nodes as well as the HAG have a limited visibility of the network (e.g., layer 1/2 and mobility status is not available) and this limits the possibilities for the overall optimization of the end-to-end paths. Recently, the 3rd Generation Partnership Project (3GPP) has been working towards the concept of having a converged core network on the road to the standardization of the 5G system architecture, which can be found in 3GPP TS 23.501. This solution, shown in Figure 1(b), allows network operators to manage multiple accesses in a coordinated way by considering information related to service (e.g., QoS), network (e.g., statistical performance) and user (e.g., subscription type). To take full advantage of this feature, 3GPP TR 23.793 introduces the access traffic steering, switching and splitting (ATSSS) capabilities within the 5G CN in order to optimize and effectively drive the behavior of the network. The goal is twofold: (i) defining ATSSS policies to map specific services to the access(es) that better support their QoS requirements (i.e., steering) and this is of particular importance to effectively deliver services with strict QoS constraints such as ultra-reliable low latency communications (URLLC); (ii) guaranteeing reliability for ongoing sessions
Related Content

Spectrum Sensing in Cognitive Radio Networks
[www.igi-global.com/chapter/spectrum-sensing-cognitive-radio-networks/67012?camid=4v1a](www.igi-global.com/chapter/spectrum-sensing-cognitive-radio-networks/67012?camid=4v1a)

Physics of Multi-Antenna Communication Systems
[www.igi-global.com/chapter/physics-multi-antenna-communication-systems/8460?camid=4v1a](www.igi-global.com/chapter/physics-multi-antenna-communication-systems/8460?camid=4v1a)

Energy Efficient Image Compression and Transmission in WSN
[www.igi-global.com/chapter/energy-efficient-image-compression-and-transmission-in-wsn/148591?camid=4v1a](www.igi-global.com/chapter/energy-efficient-image-compression-and-transmission-in-wsn/148591?camid=4v1a)

Cultural Adaption of Hypermedia: A Contemporary State of the Art of Industrial Practice and Improvements by Multi-Trees
[www.igi-global.com/article/cultural-adaption-of-hypermedia/94553?camid=4v1a](www.igi-global.com/article/cultural-adaption-of-hypermedia/94553?camid=4v1a)