

Proposition de sujet de thèse - 2016

Title: Resources control and management in Mobile Edge Environment

Supervisor

Professor Toufik AHMED,

Phone +33 (0) 6.61.11.30.71

Email: tad@labri.fr

Web: <http://www.labri.fr/perso/tad>

Laboratory (UMR):

UMR 5800 – LABRI (Laboratoire Bordelais de Recherche en Informatique) – Université Bordeaux.
351 cours de la Libération – 33405 – Talence. France.

Introduction

In today mobile network such as 3GPP network architecture, the introduction of new network functionalities could take a long time from the standardizing process to the implementation and deployment stages. This long process can dissuade network operators to innovate and to invest in new services. In this architecture, the use of specialized networking components and specific hardware-platform suffer from limited flexibility in scaling/upgrading and openness, indeed, each new service should comply with the standard and the existing interfaces. Mobile Edge Environment [1] is a concept which relays on proposing to end-user, and mobile application developers a set of context-related services aiming to enhance the mobile broadband experience while being transparent to the 3GPP specification and the existing interfaces. In this context, specific solutions have to be designed to support important functions such as Cloud-RAN with resources management, control, mobility and reliability to mention few of them. The aim of this thesis is to study how Mobile Edge Environment and cloud-based environment as a new paradigm can enable innovative application and enhance the user quality of experience.

In order to achieve these objectives, there is a need to tackle different components in the mobile network infrastructure that can be applied to 4G and 5G context:

- Network Functions Virtualization (NFV) [8]: resulting in some network functions such as Radio Access Network (RAN), quality of services, firewall, multicasting, caching to be implemented in software as virtualized network functions (VNF). Operator can construct and manage its network dynamically and enable network functions to be instantiated, connected, or chained, to achieve the overall network functionality or service. Operator can also open the mobile edge environment to third-party partners to exploit some data and vital value of the mobile network to propose innovative applications. The main challenge facing the operator is to ensure that NFV should not degrade the overall services performance while providing flexibility, elasticity and short innovation cycle.
- Programmable and Software-Defined Networking (SDN) [2][3][4][5]: abstracting and externalizing some control plane functionalities within the network functions to logically-centralized controllers running a collection of applications for local and/or end-to-end optimized network operation. The SDN should be resilient and should not affect network availability while it should have the necessary fault tolerance mechanisms to ensure that it is operating according to the expected behavior.
- Unified Resource Management, enabling a coordinated management of the overall network resources across the entire domain and to ensure the expected performance and the required

Proposition de sujet de thèse - 2016

resilience. This unified resource management should ensure that operational and management functions are not overly complex.

Thesis objective

The objective of this thesis is to propose a coherent architectural framework that enables rapid and cost effective deployment of new and existing network functions on the mobile edge. We aim at propose new algorithms that take advantage of the big data available at the edge in order to provide the user with a better and improved quality of experience. We intended to evaluate through an emulation approach (or a mixed one: simulation + experimental) the proposed solutions in order to assess related key performance.

Research Challenges

Through this thesis we aim to explore in-depth different concept (VNF, SDN, and resources management). Some specific focus can be done on:

- Virtualization of mobile edge /core network function. Specifically, which are the function to position at the network edge in order to improve the user experience, cut down the network operator costs and enable rapid deployment of new services.
- When the proposed virtualized network functions need to be instantiated. Initial contribution may be related to analyzing collected data at the Edge to predict and contextualize the provided services (Optimised CDN delivery, IOT, Location Tracking, RAN-aware Content Optimization, Service Performance Optimization....)
- Ensuring optimized service performance and resilience in the introduced architecture.

Référence

- [1] Mobile edge Computing Introductory Technical White Paper https://portal.etsi.org/Portals/0/TBpages/MEC/Docs/Mobile-edge_Computing_-_Introductory_Technical_White_Paper_V1%2018-09-14.pdf
- [2] VISSICCHIO, Stefano, VANBEVER, Laurent, et BONAVENTURE, Olivier. Opportunities and research challenges of hybrid software defined networks. ACM SIGCOMM Computer Communication Review, 2014, vol. 44, no 2, p. 70-75.
- [3] HANMUGALINGAM, Sivasothy et BERTIN, Philippe. Programmable Mobile Core Network. In : Computers and Communication (ISCC), 2014 IEEE Symposium on. IEEE, 2014. p. 1-7.
- [4] E. Egi, A. Greenhalgh, M. Handley, M. Hoerd, F. Huici, and L. Mathy, "Towards High Performance Virtual Routers on Commodity Hardware", in Proc. ACM CoNEXT 2008, Madrid, Spain, December 2008.
- [5] N. Egi, A. Greenhalgh, M. Handley, M. Hoerd, F. Huici, L. Mathy, P. Papadimitriou, "A platform for high performance and flexible virtual routers on commodity hardware", ACM SIGCOMM Computer Communication Review archive, vol.40, no.1, pp.127-128, January 201
- [6] Enabling Innovation in the Internet Architecture through Flexible Flow-Processing Extensions. Information available at: <http://www.change-project.eu>
- [7] A. Greenhalgh, M. Handley, M. Hoerd, F. Huici, L. Mathy and P. Papadimitriou, "Flow Processing and the Rise of Commodity Network Hardware", ACM SIGCOMM Computer Communication Review, Volume 39, Number 2, April 2009
- [8] Implementing SDN and NFV with Intel Architecture, available at: <http://www.intel.com/content/dam/www/public/us/en/documents/white-papers/sdn-part-2-secured.pdf>
- [9] H. Ali-Ahmad, C. Cicconetti, A. de la Oliva, V. Mancuso, M. Reddy Sama, P. Seite, S. Shanmugalingam, S. "An SDN-Based Network Architecture for Extremely Dense Wireless Networks," Future Networks and Services (SDN4FNS), 2013 IEEE SDN for , vol., no., pp.1,7, 11-13 Nov. 2013.