Relazione Scientifico Annuale sull’attività svolta nell’ambito dell’assegno di ricerca

Nominativo dell’assegnista di ricerca: __________Christian Quadri________________________

Titolo dell’assegno di ricerca: Mobile Edge Computing and emerging network services

Specificare se si tratta di assegno di ricerca di tipo A o di tipo B: __________A________________

Docente referente: __________Gian Paolo Rossi______________________________

Durata del contratto da __________01/08/2018_______ a __________31/07/2020_________

Periodo di riferimento della relazione da __________01/08/2019_______ a __________31/07/2020_______

Obiettivi della ricerca:
The research aims at designing and evaluating novel network services by leveraging both network virtualization and softwareization paradigms which are driving the today’s transformation of the mobile network towards 5G and beyond.

- Study of emergent network solutions and technologies: the next generation of mobile network leverages new technologies and paradigms, such as Fog Computing/Mobile Edge Computing (MEC), Software Defined Networking (SDN), Network Function Virtualization (NFV) and Network Slicing. My research in this field aims to provide solutions for the dynamic orchestration of the resources pursuing two goals: (i) optimal placement of virtualized resources in order to increase the Quality of Experience (QoE) and respecting the Service Level Agreement (SLA), and (ii) optimal utilization of the physical resources (CPU, Memory, I/O, and Bandwidth)

- Design and evaluation of vertical services in a sliced network, to analyze costs/benefits, Quality of Service (QoS) and Quality of Experience (QoE) by means of network emulator/simulator and testbed.

Risultati della ricerca:
Study of emergent network solutions and technologies
- We developed and evaluated an optimization model for Virtual Network Function (VNF) placement in a multi-slice scenario. We have performed an extensive analysis on the VNF placement algorithm showing that the multi-slice version outperforms the single slice one in terms of QoS parameters. The results of this research are published in [1].
- We are performing a preliminary study on the provisioning and managing of virtualized resources to support MEC services shared by multiple mobile users, e.g. video conference, online gaming, etc. which require stringent latency requirements. We are defining the offline optimization model to obtain an upper-bound of the QoE offered to the users. As a next step in this research, we will develop an online algorithm to manage the initial placement and the life-cycle of the shared services taking into account the users mobility and the network load.

Design and evaluation of vertical services in a sliced network
- This activity initiated during my internship at IMDEA Networks in Madrid where we studied the feasibility of a MEC assisted platooning control. The result of this research is a simulator for
platooning that enabled us to show, through extensive simulations, that the MEC assisted platooning control is a viable, safe, effective and more scalable alternative to the traditional distributed V2V approach. The results of this research are reported in [2]

- The research is now extending the MEC controller to multiple platoons which are coordinated by a controller deployed in the MEC. The preliminary results show that it is possible to coordinate multiple platoons by guaranteeing the stability of single platoons. Besides, the proposed controller is flexible and scales in terms of RAN utilization.

Attività svolte:

- Teacher Assistant:
  - Reti di Calcolatori (bachelor course) 2019/2020
  - Reti wireless e Mobili (master course) 2019/2020
- Co-supervision of master thesis (on-going):
  - Francesca Bassi 921900- “Migration of virtual network function in uno scenario di mobile EDGE computing.”
- Co-supervision of bachelor thesis:
  - Ledia Prifti 893507- “Implementazione di scenari di Mobile Edge Computing con tecniche SDN”
  - Andrea Minotti 828420 – “Analisi del protocollo di comunicazione IEEE 802.11p a supporto della mobilità di plottoni di veicoli”
  - Matteo Carlo Giavarini 896141– “Studio e analisi delle prestazioni del protocollo 802.11p per la guida autonoma di platoon di veicoli”
- Co-supervision of bachelor thesis (on-going):
  - Leonardo Menti 908947 – “Progettazione e sviluppo dell’orchestratore dell’architettura ETSI MEC nel simulatore Omnet++”
  - Valerio Cislagli 909682 – “Sviluppo di un multi-platoon manager in ambiente di edge computing”
- TCP member of the 8th International Workshop on Complex Networks and their Applications (Complex Networks 2019)
- Reviewer for IEEE Transaction on Wireless Communications
- Reviewer for Elsevier Pervasive and Mobile Computing
- Reviewer for the MDPI Electronics
- Reviewer for the MDPI Symmetry
- Reviewer for the MDPI Applied Science

Prodotti della ricerca conseguiti:

Journals

Submitted
2. C. Quadri, V. Mancuso, M. Ajmone Marsan, G. P. Rossi, “Platooning on the edge”, submitted to 23rd ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWiM 2020) – This paper is the result of the research internship at IMDEA Networks - Madrid
Descrizione dell'attività di ricerca svolta all'estero (eventuale; specificare: periodo, luogo, affiliazione):

Periodo: 1\textsuperscript{st} September – 4\textsuperscript{th} October 2019
Luogo: Avda. del Mar Mediterraneo, 22 - 28918 Leganes (Madrid) Spain
Affiliazione: IMDEA Networks
Research: - Joint research on Mobile Edge Computing focused on the optimization of resources allocation at the edge of the mobile network

La presente relazione, non contiene dati sensibili e dati giudiziari di cui all'art. 4, comma 1, lettere d) ed e) del D.Lgs. 30.6.2003 n. 196.
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Firmato (In Stampatello) CHRISTIAN QUADRI

Data 07/07/2020

Il Responsabile Scientifico [Signature]

L' Assegnista di Ricerca [Signature]