

Omran Ayoub

Ph.D. Information Technology

Milan, Italy

+39 327 035 1982

✉ omran.a.ayoub@gmail.com

 [omranayoub](#)

<http://ayoub.faculty.polimi.it>



Personal Data

Date of birth	11 September 1989
Place of birth	Lebanon
Nationality	Lebanese
Country of Residence	Italy
Type of Permit of Stay	'Permesso di Soggiorno Lavoro Subordinato'
Address	Via Madre Anna Eugenia Picco, 8, Milano 20132, MI, Italy
Work Address	Politecnico di Milano, Department of Electronics, Information and Bioengineering, Via Ponzio 34/5, Milano 20133, MI, Italy

Current Position

Research Fellow (Post-doctoral)

Nov. 2018–Present	Politecnico di Milano, Milan, Italy , <i>Department of Electronics, Information and Bioengineering.</i>
Main Activities	Research in the field of Communication Networks; Participating in research projects (national and international); Teaching; Tutoring PhD and MSc students
Research Interests	Optimization and Design of Communication Networks; Machine Learning for Failure Management in Microwave Networks; Network Function Virtualization (NFV); Artificial Intelligence applied in Networking; Disaster Resiliency; Privacy in Networking
Advisor	Prof. Massimo Tornatore

Education

PhD Degree

Nov. 2015–Oct. 2018	Information Technology - Telecommunication Section , Politecnico di Milano, Milan, Italy.
Main Activities	Research in the field of Communication Networks; Participating in research projects (national and international); Teaching; Tutoring MSc students
Thesis Title	<i>Resource Management and Planning in Cloud-Enabled Optical Metro-Area Networks</i>
Advisors	Prof. Massimo Tornatore and Prof. Francesco Musumeci

MSc Degree

- Sep. 2012–
Sep. 2015 **Telecommunications Engineering (96/110) [courses taken in both English and Italian languages]**, *Politecnico di Milano*, Milan, Italy.
- Thesis Title *Energy-Efficient Caching and Content Distribution of Video-on-Demand in Fixed Mobile Convergent Networks*
- Advisor Prof. Massimo Tornatore

BSc Degree

- Sep. 2007– Jul.
2011 **Computer Communications Engineering (Honors List. GPA: 3.38/4.00) [courses taken in English language]**, *American University of Science and Technology*, Beirut, Lebanon.
- Graduation Project *Multi-Lingual Braille System Output Device with Audio Enhancement (Best 'Engineering Expo' Graduation Project)*
- Advisor Eng. Michel Owayjen

Secondary School/Baccalaureate Certificate

- 2006–2007 **Baccalaureate Certificate of Secondary Education**, *Ashbal Al-Sahel High School*, Beirut, Lebanon.
- 2005–2006 **American High School Attendance Certificate - Exchange Student**, *University High School*, Spokane Valley, Washington, United States of America.

Research Experience

International and National Research Projects

- 2019 - present **Tecniche di Ottimizzazione Innovative per il Design e la Gestione di Reti Radio e Ottiche**, *Main role: Processing of big data in microwave networks and implementation of Machine Learning algorithms for failure identification.*
- 2017 - 2020 **Metro-HAUL**, *METRO High Bandwidth, 5G Application-aware optical network, with edge storage, CompUte and low Latency, EU H2020 Research and Innovation Action, Main role: Implement algorithms for the optimization of metro-aggregation networks.*
- 2016 - 2020 **RECODIS**, *Resilient communication services protecting end-user applications from disaster-based failures, EU Cost Action n. 15127, Main role: Implementation of novel algorithms for the protection of services against natural- and weather-based failures.*
- 2016 - 2018 **New Optical Horizon**, *Collaborative Project funded by Regione Lombardia, Main role: Optimization and performance evaluation of next generation optical networks.*
- 2015 - 2016 **COMBO**, *COnvergence of fixed and Mobile BrOadband access/aggregation networks, EU FP7 Integrated Project.*

Visiting PhD Student

- Mar. 2018– Jul.
2018 **Centre Tecnologic de Telecomunicacions de Catalunya (CTTC)**, *Barcelona, Spain.*
- Topic *Dynamic Provisioning of Service Function Chains in Optical Metro-Area Networks*
- Advisor Eng. Ramon Casellas

Visiting PhD Student (2 days/week)

Oct. 2017–
Feb. 2018

SM Optics, Vimercate, Italy.

Topic *Provisioning of Virtual Network Functions with Intel's DPDK (Data Plane Development Kit)*

Advisor Eng. Giorgio Parladori

Attended Conferences

2014-present ICC 2020 (Virtual Conference - Dublin, Ireland), ONDM 2020 (Virtual Conference - Castelldefels, Spain), IMCET 2018 (Beirut, Lebanon), ICTON 2018 (Bucharest, Romania), ONDM 2016 (Cartagena, Spain), IEEE Greencom 2015 (Online), NOC 2014 (Milan, Italy)

Technical Skills

Programming C, C++, Python for Machine Learning and Data Science (Keras, TensorFlow, Numpy, Pandas, scikit-learn), Matlab

Simulation Tools Net2plan, Cisco Packet Tracer and experience with event-based driven simulators

Operational Research CPLEX/AMPL

Virtualization Environments DPDK and Docker Containers

OS Windows, Linux (user)

Applications Microsoft Office Package and Latex

Teaching and Tutoring Experience

Teaching

Course name **'Fondamenti di Internet e Reti' (Fundamentals of Internet and Networks)** [54 hrs, undergraduate course on basics of communication networks and Internet]

University Politecnico di Milano, Milan, Italy

Academic Year 2018/2019, 2019/2020

Teaching Language Italian

Course name **'Communication Network Design'** [10 hrs, graduate course focusing on the application of theoretical communication network design concepts]

University Politecnico di Milano, Milan, Italy

Academic Year 2018/2019, 2019/2020, 2020/2021

Teaching Language English

Tutoring Activity

2017-present I've been responsible for co-tutoring and coordinating the research activity of more than 15 master students in Politecnico di Milano under the supervision of Prof. Massimo Tornatore. Currently I'm responsible for co-tutoring and coordinating the research activity of 9 master students and 2 PhD students.

List of Publications

International Journals

- J11- **Omran Ayoub**, Amaro de Sousa, Silvia Mendieta, Francesco Musumeci, Massimo Tornatore *Online Virtual Machine Evacuation for Disaster Resilience in Inter Data Center Networks*, IEEE Transactions on Network and Service Management, January, 2021
- J10- Leila Askari, **Omran Ayoub**, Francesco Musumeci, Massimo Tornatore *On Dynamic Service Chaining in Filterless Optical Metro-Aggregation Networks*, IEEE Access, December, 2020
- J9- Francesco Musumeci, Luca Magni, **Omran Ayoub**, Roberto Rubino, Massimiliano Capacchione, Gabriele Rigamonti, Michele Milano, Claudio Passera, Massimo Tornatore *Supervised and Semi-Supervised Learning for Failure Identification in Microwave Networks*, IEEE Transactions on Network and Service Management, November, 2020
- J8- Memedhe Ibrahim, **Omran Ayoub**, Francesco Musumeci, Oleg Karandin, Andrea Castoldi, Rosanna Pastorelli, Massimo Tornatore *QoT-Aware Optical Amplifier Placement in Filterless Metro Networks*, IEEE Communication Letters, November, 2020
- J7- **Omran Ayoub**, Davide Andreoletti, Francesco Musumeci, Massimo Tornatore, Achille Pattavina, *Optimal Cache Deployment for Video-On-Demand in Optical Metro Edge Nodes under Limited Storage Capacity*, Applied Sciences, March, 2020
- J6- Memedhe Ibrahim, **Omran Ayoub**, Francesco Musumeci, Oleg Karandin, Andrea Castoldi, Rosanna Pastorelli, Massimo Tornatore *Minimum-Cost Optical Amplifier Placement in Metro Networks*, Journal of Lightwave Technology, April, 2020
- J5- *Davide Andreoletti*, **Omran Ayoub**, Cristina Rottondi, *Silvia Giordano*, Giacomo Verticale, Massimo Tornatore, *A Privacy-Preserving Protocol for Network-Neutral Caching in ISP Networks*, IEEE Access, October, 2019
- J4- Francesco Musumeci, **Omran Ayoub**, Monica Magoni, Massimo Tornatore, *Latency-Aware CU Placement/Handover in Dynamic WDM Access-Aggregation Networks*, Journal of Optical Communications and Networking, April, 2019
- J3- **Omran Ayoub**, Francesco Musumeci, Massimo Tornatore, Achille Pattavina, *Energy-Efficient Video-on-Demand Content Caching and Distribution in Metro-Area Networks*, IEEE Transactions on Green Communications and Networking, December, 2018
- J2- **Omran Ayoub**, Francesco Musumeci, Massimo Tornatore, Achille Pattavina, *Efficient Routing and Bandwidth Assignment for Inter-Data-Center Live Virtual-Machine Migrations*, Journal of Optical Communications and Networking 9 (3), B12-B21, January, 2017
- J1- Michel Owayjan, Taimour Wehbe, Elie Bou Daher, **Omran Ayoub**, *The Design and Development of a Multi-Lingual Braille System Output Device with Audio Enhancement*, Journal of Software Engineering and Applications, 2013, 6, 289-295, March, 2013

Book Chapters

- B1- M. Tornatore, P. Babarczy, **O. Ayoub**, S. Ferdousi, R. Lourenco, J. Zerwas, A. Blenk, M. Klügel, W. Kellerer, *Alert-Based Network Reconfiguration and Data Evacuation*, Book: Guide to Disaster-Resilient Communication Networks (2020), pages: 353-377. Editor: Springer, Cham.

International Conference Proceedings

- C20- **Omran Ayoub**, Leila Askari, Andrea Bovio, Francesco Musumeci, Massimo Tornatore, *Virtual Network Mapping vs Embedding with Link Protection in Filterless Optical Networks*, IEEE Global Communications Conference (Globecom), Taipei, Taiwan, December, 2020
- C19- *Davide Androletti*, **Omran Ayoub**, *Silvia Giordano*, Massimo Tornatore, Giacomo Verticale, *Privacy-Preserving Multi-Operator Contact Tracing for Early Detection of Covid19 Contagions*, IEEE Globecom 2020 Special Workshop on Communications and Networking Technologies for Responding to COVID-19, Taipei, Taiwan, December, 2020
- C18- Sachin Sharma, Avishek Nag, Luís Cordeiro, **Omran Ayoub**, Massimo Tornatore, Maziar Nekovee, *Towards Explainable Artificial Intelligence for Network Function Virtualization*, The 16th International Conference on emerging Networking Experiments and Technologies (CoNEXT), Barcelona, Spain, December, 2020
- C17- Leila Askari, Payam Majidzadeh, **Omran Ayoub**, Massimo Tornatore, *Exploiting DPDK in Containerized Environment with Unsupported Hardware*, IEEE Conference on Network Function Virtualization and Software Defined Networks (IEEE NFV-SDN), Virtual Conference, November, 2020
- C16- Oleg Karandin, **Omran Ayoub**, Francesco Musumeci, Massimo Tornatore, *A Techno-Economic Comparison of Filterless and Wavelength-Switched Optical Metro Networks*, International Conference on Transparent Optical Networks (ICTON), Bari, Italy, July, 2020
- C15- Leila Askari, Francesco Musumeci, Lorenzo Salerno, **Omran Ayoub**, Massimo Tornatore, *Dynamic DU/CU Placement for 3-layer C-RANs in Optical Metro-Access Networks*, International Conference on Transparent Optical Networks (ICTON), Bari, Italy, July, 2020
- C14- **Omran Ayoub**, Faryal Fatima, Andrea Bovio, Francesco Musumeci, Massimo Tornatore, *Traffic-Adaptive Re-Configuration of Programmable Filterless Optical Networks*, IEEE International Conference on Communications (ICC), Dublin, Ireland, June, 2020.
- C13- **Omran Ayoub**, Andrea Bovio, Francesco Musuemci, Massimo Tornatore, *Survivable Virtual Network Mapping in Filterless Optical Networks*, International Conference on Optical Network Design and Modeling (ONDM), Castelldefels, Spain, May, 2020
- C12- A. Horota, R. Costa, S. Rahman, **Omran Ayoub**, G. Figueiredo, M. Tornatore, B. Mukherjee, *Deferred Protection of Deadline-Driven Requests in Inter-Datacenter Elastic Optical Networks*, International Conference on Optical Network Design and Modeling (ONDM), Castelldefels, Spain, May, 2020
- C11- **Omran Ayoub**, Memedhe Ibrahimi, Francesco Musuemci, Andrea Castoldi, Rosanna Pastorelli, Massimo Tornatore, *Routing and Spectrum Assignment with Amplifier Placement in Elastic Metro-Aggregation Networks*, 45th European Conference on Optical Communications, Dublin, Ireland, September, 2019

- C10- *Davide Andreoletti, Omran Ayoub, Silvia Giordano, Giacomo Verticale, Massimo Tornatore, Privacy-Preserving Caching in ISP Networks, IEEE International Conference on High Performance Switching and Routing, Xian, China, April, 2019*
- C9- **Omran Ayoub**, Obed Huamani, Francesco Musumeci, Massimo Tornatore, *Efficient On-line Virtual Machines Migrations for Alert-Based Disaster Resilience, 15th International Conference on the Design of Reliable Communications and Networking, Coimbra, Portugal, March, 2019*
- C8- **Omran Ayoub**, Francesco Musumeci, *Davide Andreoletti, Marco Mussini, Massimo Tornatore, Achille Pattavina, Optimal Cache Deployment for Video-on-Demand Delivery in Optical Metro-Area Networks, IEEE Global Communications Conference, Abu Dhabi, United Arab Emirates, December, 2018*
- C7- **Omran Ayoub**, Francesco Musumeci, Christian Addeo, Marco Mussini, Massimo Tornatore, *Caching Placement Strategies for Dynamic Content Delivery in Metro Area Networks, 2018 IEEE International Multidisciplinary Conference on Engineering Technology, Beirut, Lebanon, November, 2018*
- C6- **Omran Ayoub**, Shady Shehata, Francesco Musumeci, Massimo Tornatore, *Filterless and Semi-Filterless Solutions in a Metro-HAUL Network Architecture, 20th International Conference on Transparent Optical Networks (ICTON), Bucharest, Romania, July, 2018*
- C5- Mohamed Shehata, **Omran Ayoub**, Francesco Musumeci, Massimo Tornatore, *Survivable BBU Placement for C-RAN Over Optical Aggregation Networks, 20th International Conference on Transparent Optical Networks (ICTON), Bucharest, Romania, July, 2018*
- C4- **Omran Ayoub**, Francesco Musumeci, Massimo Tornatore, Achille Pattavina, *Techno-Economic Evaluation of CDN Deployments in Metropolitan Area Networks, International Conference on Networking and Network Applications, July, 2017*
- C3- **Omran Ayoub**, Stefano Bregni, Najme Monajemi, Francesco Musumeci, Massimo Tornatore, *Strategies for Effective Converged Control of LTE and Wi-Fi Networks, 8th Latin-American Conference on Communications, Medellin, Colombia, November, 2016*
- C2- **Omran Ayoub**, Luca Pace, Francesco Musumeci, Achille Pattavina, *Dynamic Routing and Bandwidth Assignments for Live Virtual Machines Migrations, 20th International Conference on Optical Networks Design and Modeling, Cartagena, Spain, May, 2016*
- C1- Marco Savi, **Omran Ayoub**, Francesco Musumeci, Zhe Li, Giacomo Verticale, Massimo Tornatore, *Energy-Efficient Caching for Video-on-Demand in Fixed-Mobile Convergent Networks, IEEE Online Conference on Green Communications, November, 2015*

Certificates

- 2011 **Cisco Certified Network Associate Certificate (Cisco CCNA).**

Academic Scholarships and Awards

- 2011 **First Place Winner of 7th Annual Engineering and Computer Science Project Expo, American University of Science and Technology, Beirut, Lebanon.**
- 2011 **Best Graduation Project Award, American University of Science and Technology, Beirut, Lebanon.**

- 2015 **Research Doctorate Generic Scholarship**, *Department of Electronics, Information and Bioengineering*, Politecnico di Milano, Milan, Italy.
- 2017 **Best Paper Award**, *Paper entitled Techno-Economic Evaluation of CDN Deployments in Metropolitan Area Networks* at 2017 Networking and Network Applications Conference.

Invited Talks

- 1- **Optical Metro-Area Networks for 5G Communications: Research Lines**, *Keynote Speaker at the 4th AUST Symposium on Innovations in Computer and Communications Engineering*, Beirut, Lebanon, April, 2019.
- 2- **Efficient Inter-Data Center Online Virtual Machines Migration**, *IEEE Lebanon Branch, American University of Science and Technology*, Beirut, Lebanon, January, 2018.
- 3- **Energy-Efficient Caching and Content Distribution**, *Wroclaw University of Technology, Wroclaw, Poland*, May, 2016.

Languages

Arabic	Native
English	Fluent
Italian	Fluent