POLITECNICO DI MILANO

PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 39th cycle

Research Area n. 4 - Telecommunications

PARTENARIATO PNRR Research Field: HARDWARE ACCELERATION OF OPEN RAN FOR DIGITAL TWIN APPLICATIONS

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0
In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	From current research trends new generations of the cellular network will have greater and greater environment sensing capabilities. Techniques and algorithms for joint sensing and communications are being developed in ad-hoc solutions which are not standard compliant. On the other hand, Radio Access Networks (RAN) are also evolving towards more modular and customizable paradigms culminating in the idea of Open RAN, a completely interoperable enabler of new technologies for RAN. From the fusion of these two worlds emerging technologies like Digital Twins promise new and exciting applications. Bridging the gap between them, however, is a challenging task. It requires the execution of complex processing for sensing the environment within extremely tight time budgets to ensure low network latency.Thus, the goal of this research is to develop new enablers for these applications which are capable of meeting and exceeding such harsh requirements by developing FPGA images which enable sensing applications while exposing them through O-RAN interfaces. The challenges and prospects of using O-RAN for real-time operations will be explored, along with defining potential integration solutions for sensing applications. Finally, experimental verification with state-of-the-art hardware for the developed FPGA code will be

	performed.
Methods and techniques that will be developed and used to carry out the research	The research methodology shall include: 1) Study of the existing literature on O-RAN and joint sensing and communication solutions. 2) Study of the existing software tools for the development of FPGA images. 3) Integration of O-RAN interfaces and sensing applications at the hardware level through FPGA. 4) Performance evaluation of the developed solution and comparison with existing ones available in the literature.
Educational objectives	1) Acquire an expertise in technologies for next generation of wireless cellular networks as well as FPGA programming. 2) Acquire advanced skills in integrating physical and network layers to enhance wireless communication system performance and reduce power consumption. 3) Disseminate research results (oral presentations/written publications). 4) Learn how to identify research problems and to conduct research in a highly focused fashion. 5) Develop team working skills through the collaboration with the research groups on both theoretical and practical topics. 6) Develop highly sought after skills for life-long learning and professional development
Job opportunities	For the ambitious and disruptive objectives of the research, the experience and skills maturated in the highly sought after field of FPGA programming as well as for the reputation of the involved research groups; it is expected that after completion of the PhD program the candidate will be ready for being part of any research team in public and private institutions and centers, universities, and industry.
Composition of the research group	0 Full Professors 4 Associated Professors 2 Assistant Professors 0 PhD Students
Name of the research directors	Prof. Maurizio Magarini

Contacts
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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
List of Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research: Università di Bologna, Università degli Studi di Napoli ?Federico II?, Politecnico di Torino, Consiglio Nazionale delle Ricerche, Fondazione Ugo Bordoni, Athonet, Vodafone.   EDUCATIONAL ACTIVITIES (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student. TEACHING ASSISTANTSHIP: (availability of funding in recognition of supporting teaching activities by the PhD student) There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations. COMPUTER AVAILABILITY: individual use DESK AVAILABILITY: individual use The funding for the scholarship comes from the project RESTART (PNRR) This research project is in the framework of RESTART PARTENARIATO ESTESO RESEARCH AND INNOVATION ON FUTURE TELECOMUNICATION SYSTEMS AND NETWORKS TO MAKE ITALY MORE SMART CUP D43C22003080001 Decreto di Concessione D.D. 1549 del 11/10/2022

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