

# Mirko Mariotti

HPC & Distributed Systems Engineer — FPGA Computing Architect

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## Professional Summary

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Senior HPC and distributed systems engineer with 20+ years of experience in scientific computing infrastructures, cloud platforms and high-performance architectures.

Expert in Linux systems, networking, HPC clusters and distributed storage, with research activity in FPGA-based computing architectures.

Strong interest in unconventional systems and emerging technologies, including experimental operating systems, novel programming languages and alternative computing architectures.

Author of multiple peer-reviewed publications and creator of the BondMachine open-source reconfigurable computing architecture.

## Skills

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Core technical expertise across HPC infrastructure, distributed systems, Linux platforms, embedded systems and reconfigurable computing.

<b>Programming</b> <ul style="list-style-type: none"><li>• C, Go, Rust</li><li>• Python</li></ul>	<b>Systems</b> <ul style="list-style-type: none"><li>• Linux development</li><li>• Linux kernel development</li><li>• Linux administration</li></ul>	<b>HPC / Distributed Computing</b> <ul style="list-style-type: none"><li>• HPC clusters</li><li>• MPI</li><li>• GRID computing</li><li>• distributed storage</li></ul>	<b>Cloud / Infrastructure</b> <ul style="list-style-type: none"><li>• OpenStack</li><li>• Kubernetes</li><li>• Docker</li><li>• Ceph</li></ul>	<b>Hardware / Acceleration</b> <ul style="list-style-type: none"><li>• FPGA (RTL, HLS)</li><li>• GPU computing</li></ul>	<b>Networking</b> <ul style="list-style-type: none"><li>• network architecture</li><li>• routing / switching</li><li>• network programming</li></ul>
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## Department of Physics and Geology - University of Perugia, INFN Perugia

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### System and Network engineer

*2002 - present*

My main responsibility is managing the departmental computer network, both from a networking perspective (switching equipment, routers, firewalls) and a systems perspective. In particular, the managed systems include Linux clusters in educational laboratories, data acquisition systems, and Terminal Server systems. I collaborated with the National Institute of Nuclear Physics - Perugia Section, where I engaged in High-Performance Computing (HPC) and GRID computing activities (from 2003 to 2009). As the technical coordinator of the team of system administrators responsible for managing the hybrid farm encompassing computation, networking, storage, and security aspects, I also administered the related INFN-GRID site. During this period, I oversaw the testing of new technologies to be integrated into the cluster or potentially developed. Additionally, I have been involved in Cloud computing activities (from 2014 to the present) through the management of virtualization infrastructures (OpenStack), distributed file systems (Ceph), containers (Docker) and orchestration (Kubernetes). Over the years, I have undertaken various projects, among which the most notable ones include:

- UniNuvola, a prototype K8s-based cloud infrastructure to provide cloud services to the university community.
- PIM (PhysGeo Infrastructure Manager) is a centralized system for managing all aspects of departmental Authentication, Authorization, and Accounting. It is based on various technologies, including LDAP, Kerberos, and Postgres. Additionally, it features a web engine called Convergence, developed in Python.
- The first prototype of INFN-GRID farm with nodes in a private network. The project became an official part of the INFN-GRID initiative.

## Other work experiences

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### Freelance

*2000-2011*

Involvement, as a consultant, in numerous projects, among which it's worth noting:

- Development, on behalf of the Province of Perugia, of a low-cost firewall prototype for high schools in the province based on Linux and installed in 40 schools.
- Collaboration with the Department of Civil and Environmental Engineering on: "Configuration of Linux clusters for high-performance computing (HPC), debugging, and porting of parallel code (MPI), and grid application for meteorological studies."
- Collaboration with Mediocredito dell'Umbria S.p.A., a local bank

# Selected Research and Development Projects

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## BondMachine

*2015 - present*

Conception and realization of the BondMachine (<https://www.bondmachine.it>) project, a new type of architecture for computers with reconfigurable processors. Over the years, the project has produced several Master's theses, workshop presentations, and participated in MakerFaire Rome 2016. In 2018, the project took part in the InnovateFPGA contest by Terasic and Intel, achieving second place in the EMEA region. It qualified for the grand finale held at the Intel Campus in San Jose, California, USA, and also won the Iron Award (4th place) worldwide out of over 400 competing projects. At the end of 2018, the project was featured in a television episode of "Speciale Universita" on the local channel TEF. The project has been presented at various international events, including Golab 2018, at ICTP, the prestigious Abdus Salam International Center for Theoretical Physics (2019,2022) and several INFN (National Institute for Nuclear Physics) workshops on computing.

Project's github organization: <https://github.com/BondMachineHQ>.

## Other Projects

A list of all other projects is visible in the Projects section of my website (<https://www.mirkomariotti.it/projects>) or on my GitHub profile (<https://github.com/mmirko>).

## Publications

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Author or co-author of numerous publications in peer-reviewed international journals, including:

- Extending a moldable Computer Architecture to Accelerate DL Inference on FPGA, electronics special issue on "Advancements in Hardware-Efficient Machine Learning" - DOI: 10.3390/electronics14173518
- The BondMachine, a moldable computer architecture, Parallel Computing 109 - DOI: 10.1016/j.parco.2021.102873
- Development of pulse shape analysis for noise reduction in Si-based neutron detectors, Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 2018-09 — DOI: 10.1016/j.nima.2018.09.071 Part of ISSN: 0168-9002
- Strategies and systems towards grids and clouds integration: A DBMS-based solution, Future Generation Computer Systems 2017-03 DOI: 10.1016/j.future.2017.02.047
- GPU Linear algebra extensions for GNU-Octave, Proceedings of the 14th International Workshop on Advanced Computing and Analysis Techniques in Physics Research (ACAT 2011) 5-9 September 2011

The complete list of publications is available using the ORCID index: 0000-0001-8848-2523

## Participation and organization of Conferences, Workshops, and Schools

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Throughout my professional journey, I have had the opportunity to participate and contribute to the organization of various international schools and conferences. Among the most notable experiences are my participation in the NiPS Summer School in 2018, the organization of multiple editions of the "International PhD School on Open Science Cloud" from 2017 to 2024 and participation in the First International Workshop on Plan9 in 2006.

## Seminars and Talks

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A decade of experience in presenting technologies or projects in various national and international contexts. Here is a selection of the most significant experiences in this regard:

- Scientific committee member and lecturer at the "Introductory course to VHDL and HLS FPGA programming" - ICSC - National Research center on HPC, Big Data and Quantum Computing - Milan, Italy - 2025
- Invited Lecturer at "FPGA-based SoC and its Applications to Nuclear and Scientific Instrumentation" - ICTP Trieste - 2019 and 2022.
- Lecture on "Enabling Machine Learning on FPGA" delivered at the NiPS Summer School on "Architectures and Algorithms for Energy-Efficient IoT and HPC Applications" - September 6-9, 2019 - Perugia.
- Talk (Viewable at <https://youtu.be/5hjDzwSjAZU>) on aspects related to the Go programming language of the BondMachine project - Presented at Golab 2018 - October 22-23 - Florence.
- Talk and live session on the BondMachine project - Presented at Intel Campus San Jose (CA), USA, on August 15-16, 2018.
- Talk on "Harvesting dispersed computational resources with Openstack: a Cloud infrastructure for the Computational Science community" about the work on connecting various data centers using SDN techniques - Presented at the "International Symposium on Grids and Clouds 2018," March 13-23, 2018 - Taipei, Taiwan.

## Teaching - Lessons, Courses, and Theses

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A decade of experience in conducting courses on programming, systems administration, and FPGA at all levels, both for private companies and within academic and research institutions. As an example, I gave a series of lectures on FPGA programming for the doctoral school at the "XV Seminar on Software for Nuclear, Subnuclear, and Applied Physics," held from May 27 to June 1, 2018, at the Porto Conte Hotel in Alghero. Additionally, I taught the "General Computer Laboratory" course for four years as part of the Bachelor's program in Computer Science at the Faculty of Sciences, University of Perugia.

My teaching activities also includes coordinating various interns engaged in network management, system administration, user support, and application development. Furthermore, I've supervised and served as a co-advisor for over 10 theses, including both undergraduate and graduate-level projects.

## Awards and Recognitions

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Iron Award InnovateFPGA 2018 (awarded by Terasic and Intel)

*August 2018*

2 Certificates for Special Merit in Physics and Mathematics (awarded by G. Alessi Scientific High School)

*June 1994*

## Additional Information

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### Education

Bachelor's Degree in Physics — University of Perugia (2012)

Thesis: Design and Implementation of the Pointing and Tracking System for the Infrared Telescope "Maffei", currently operational in Antarctica.

### Languages

Italian (native), English (advanced), German (basic)