Alessandra Fais | CV

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SUMMARY

I am a Ph.D. student in the Department of Information Engineering, University of Pisa. In 2016, I received my Bachelor's Degree in Computer Science at the University of Pisa. In 2019, I received my Master's Degree in Computer Science and Networking (*summa cum laude*) from the Department of Computer Science of the University of Pisa jointly with the Scuola Superiore Sant'Anna. During my Master Degree's thesis, I started approaching the data stream processing research area.
My main research interests are related to data stream processing applications in the networking domain, high-performance network processing on multi-core end-host machines, data plane acceleration in Software Defined Networks, SmartNICs, parallel computing and high-performance computing.

EXPERIENCE

Teaching - Course "Basi di JavaScript" 2021 **Portoferraio, Italy**
Project IFTS "I.T.E.M. in Elba" - C.E.S.C.O.T. Formazione srl e C.A.F.T. srl *Nov. 2021 - Dec. 2021*
Topics: JavaScript programming language, event-driven programming paradigm, web development using JavaScript, HTML5 and CSS3, the jQuery library.

Attendee PRACE Autumn School on GPU Programming with CUDA **Innsbruck, Austria**
PRACE and University of Innsbruck *Oct. 2021 - Oct. 2021*
The Autumn School taught the necessary programming paradigms to write correct and efficient code for GPUs and to port existing code to use GPU acceleration. Many hands-on exercises were included in the program, so that the learned concepts could be applied immediately. The full program and description is available at `https://events.prace-ri.eu/event/1154/`.

Attendee DII Summer School on 5G technologies and research challenges **Pisa, Italy**
Università di Pisa - Department of Information Engineering (DII) *Jul. 2021 - Aug. 2021*
The Summer School "5G: Enabling Technologies, Opportunities and Research Challenges Ahead" provided lessons, from the industry and academic community, about the enabling technologies and methodologies in 5G networks and applications. The full program and description is available at `https://www.dii.unipi.it/5g-enabling-technologies-opportunities-and-research-challenges-ahead`.

Teaching - Course "Linguaggi di Programmazione" 2021 **Pontedera, Italy**
Project IFTS "Digital Media Designer" - Istituto Modartech *Jun. 2021 - Jul. 2021*
Topics: JavaScript programming language, event-driven programming paradigm, web development using JavaScript, HTML5 and CSS3.

Teaching - University Course "Wireless Networks" - A.Y. 2020/2021 **Pisa, Italy**
Teaching Support for the Laboratory Part ("Virtualization Lab") *Feb. 2021 - Jun. 2021*
Topics: SDN, NFV, MEC, Cloud and Edge computing, SOA architectures, virtualization approaches (hypervisors, VMs, containers), RedHat OpenStack, VirtualBox, Docker, Kubernetes).
- Material presented during the course: `https://github.com/alefais/virtualization-lab-unipi`

Teaching - University Course "Wireless Networks" - A.Y. 2019/2020 **Pisa, Italy**
Teaching Support for the Laboratory Part ("Virtualization Lab") *Feb. 2020 - Jun. 2020*

Topics: virtualization approaches (hypervisors, VMs, containers), VirtualBox, Docker, SDN, NFV, RedHat OpenStack.

PUBLICATIONS

Journal Papers

[J1] **A. Fais**, G. Lettieri, G. Procissi, S. Giordano, F. Oppedisano. **Data Stream Processing for Packet-Level Analytics.** 2021, MDPI Sensors, Vol. 21, Issue 5, Pages 1735. DOI: 10.3390/s21051735.
[J2] G. Mencagli, M. Torquati, A. Cardaci, **A. Fais**, L. Rinaldi, M. Danelutto. **WindFlow: High-Speed Continuous Stream Processing with Parallel Building Blocks.** 2021, IEEE Transactions on Parallel and Distributed Systems (TPDS), Vol. 32, Issue 11, Pages 2748-2763. DOI: 10.1109/TPDS.2021.3073970.
[J3] N. Bonelli, F. Del Vigna, **A. Fais**, G. Lettieri, G. Procissi. **Programming Socket-Independent Network Functions with Nethuns.** 2022, ACM SIGCOMM Computer Communication Review (CCR), (under review, submitted Aug. 2021, revised version re-submitted Jan. 2022)

Conference and Workshop Papers

[C1] **A. Fais**, G. Procissi, S. Giordano, F. Oppedisano. **Data Stream Processing in Software Defined Networks: Perspectives and Challenges.** IEEE CAMAD 2020. Pisa, Italy (Virtual Conference), September 14-16, 2020. DOI: 10.1109/CAMAD50429.2020.9209303.
[C2] **A. Fais**, S. Giordano, G. Procissi. **On the Design of Fast and Scalable Network Applications Through Data Stream Processing.** IEEE NFV-SDN 2020. Madrid, Spain (Virtual Conference), November 9-12, 2020. DOI: 10.1109/NFV-SDN50289.2020.9289855.
[C3] **A. Fais**, G. Lettieri, G. Procissi, S. Giordano. **Towards Scalable and Expressive Stream Packet Processing.** IEEE GLOBECOM 2021. Madrid, Spain (Hybrid: In-Person and Virtual Conference), December 7-11, 2021. (to appear in proceedings)

EDUCATION

Università di Pisa — **Pisa, Italy**
Ph.D. in Information Engineering — *Nov. 2019 - Present*

- Supervisors: Prof. Stefano Giordano, Prof. Gregorio Procissi
- Research: My research mainly focuses on the usage of the Data Stream Processing computational model to accelerate network applications performing near real-time processing of streams of packets on multicores. The idea is to achieve high performance while providing to the programmers high-level abstractions that hide the complexity related to both network programming and parallelism.
- PhD Courses:
  - English for Research Publication and Presentation Purposes, C1 and C1+ levels (Prof. Joanne Spataro, UniPi Language Center, Italy)
  - On Cyber-Physical Social Systems (CPSSs): challenges and new research directions (Prof. Antonella Longo - UniSalento, Italy)
  - Credibility assessment in social media with a focus on social bot detection (Dr. Stefano Cresci - IIT CNR Pisa, Italy)
  - 5G and V2X communications (Dr. Dario Sabella - Intel Deutschland GmbH, Germany)
  - Computing in Communication Networks for 5G and the Tactile Internet (Prof. Dr. Frank H. P. Fitzek - TU Dresden CeTI, Germany)
  - 5G, Beyond 5G and 6G: the next frontier (Dr. Emilio Calvanese Strinati - CEA-LETI Grenoble, France)
  - High-Performance Computing: architectures and systems (Dr. Vassilis Papaefstathiou - ICS-FORTH Heraklion, Crete, Greece)
  - Arm Architectures for High-Performance Real-Time (Dr. Matteo Andreozzi - Arm, UK)

Università di Pisa and Scuola Superiore Sant'Anna **Pisa, Italy**
Master's Degree in Computer Science and Networking *Sep. 2016 - Oct. 2019*

- Mark: 110/110 *cum laude*
- Master's Thesis Title: Benchmarking Data Stream Processing Frameworks on Multicores
- Supervisor: Dr. Gabriele Mencagli
- Abstract: The work shows a comparison in terms of performance (bandwidth and latency) between traditional Data Stream Processing (DaSP) systems and WindFlow (`https://paragroup.github.io/WindFlow/`), an efficient C++17 streaming library based on FastFlow's building blocks (`http://calvados.di.unipi.it/fastflow`). The goal is to quantify the benefit that may be achieved by using the C++ solution w.r.t. modern Java-based ones.
  A benchmark of four real-world DaSP applications have been designed and implementations are provided using Apache Storm, Apache Flink and WindFlow. Experiments show a significant throughput improvement and latency reduction by using the C++ solution w.r.t. the state-of-the-art frameworks on single multi-core machines. The results obtained are encouraging for future works which aim at designing innovative DaSP frameworks based on C++ and providing high-level abstractions like Storm and Flink, that may be able to overcome modern Java-based Stream Processing Engines on distributed scenarios too.
- Master's Thesis Text: `https://etd.adm.unipi.it/t/etd-09162019-220730/`
- Produced Software:
  `https://github.com/alefais/storm-applications`
  `https://github.com/alefais/flink-applications`
  `https://github.com/alefais/windflow-applications`
- Master Programme: Relevant courses cover parallelization methodologies, parallel programming models, architectures of high-performance computing systems, management and configuration of IP networks, Software Defined Networks, analysis of packet switching architectures, SOA, cloud computing, microservices, virtualization techniques.

Università di Pisa **Pisa, Italy**
Bachelor's Degree in Computer Science *Sep. 2011 - Mar. 2016*

- Mark: 105/110
- Bachelor's Thesis Title: Programming techniques for FPGA devices
- Supervisor: Prof. Marco Danelutto
- Abstract: The thesis is a dissertation about FPGA programming methodologies (Hardware Description Languages, Chisel and OpenCL), with an overview of current technological trends.
- Bachelor Programme: Relevant courses cover theory of programming languages, architectures of calculators and networks, network management and IP network monitoring, traffic monitoring and elements of operational research, cryptography, software engineering.

Istituto di Istruzione Superiore "G. A. Pischedda" Bosa **Bosa, Italy**
High School Education - Liceo Scientifico *Sep. 2006 - Jul. 2011*

- Mark: 100/100

MAIN ACADEMIC AND RESEARCH PROJECTS

A more complete list is available on my GitHub profile.

Contributions to Research Projects

Nethuns *Nov. 2020 - Present*

A C software library which provides a unified API for fast and portable network programming on multi-core end-host machines. Nethuns allows network programmers to access and manage low-level network operations over different underlying network sockets and operating systems. Network applications based on Nethuns only need to be re-compiled to run over a different socket/OS. The supported underlying capturing solutions are `libpcap`, `AF_PACKET`, `Netmap` and `AF_XDP`.

- Link to the project: `https://github.com/larthia/nethuns`

WindFlow *Jul. 2019 - Present*

A C++ software library for parallel data stream processing targeting heterogeneous shared-memory architectures equipped with multi-core CPUs and NVIDIA GPUs. The library provides traditional stream processing operators like map, flatmap, filter, fold/reduce as well as sliding-window operators designed with complex parallel processing modes.

- Link to the project: `https://github.com/ParaGroup/WindFlow`

Academic Projects

Parallel and Distributed Systems (paradigms and models) project *Sep. 2018 - Nov. 2018*

C++ and FastFlow implementation of the parallel scan Blelloch algorithm with a master-worker architecture schema and tests.

- Link to the code: `https://github.com/alefais/spm-18`

Networks and Technologies for Telecommunications project - FPGA part *Jul. 2018 – Jul. 2018*

Verilog implementation of Adders, Subtractors and Multipliers and tests on both the Quartus University Program Waveform Simulator and on the DE2-115 series FPGA board.

- Link to the code: `https://github.com/alefais/rtt-18-fpga`

Packet Switching and Processing Architectures project *Mar. 2018 – May 2018*

C++ monitoring application that captures traffic with Libpcap and identifies and analyses different flows.

- Link to the code: `https://github.com/alefais/aed-18`

Network Management project *Jul. 2014 – Aug. 2014*

Lua script (chisel) that monitors system events with Sysdig to measure the performance of an application and the amount of resources required.

- Link to the code: `https://github.com/alefais/net-man`

Computer Networks project *May 2014 – Jun. 2014*

Java implementation of a distributed chat system.

- Link to the code: `https://github.com/alefais/rcl-14`

OTHER ACTIVITIES

Università di Pisa and Scuola Superiore Sant'Anna **Pisa, Italy**

Master's Degree in Computer Science and Networking *Oct. 2016 - Oct. 2018*

Master Students' Representative.

SCHOLARSHIPS, GRANTS, AWARDS

IEEE NFV-SDN '20 // Virtual Conference — **Leganes - Madrid, Spain**
Intel Award "Student Participation Grant" — *Nov. 2020*

NetResults S.r.l. — **Pisa, Italy**
Ph.D. scholarship within the Information Engineering Ph.D. Programme — *Nov. 2019*

Istituto di Istruzione Superiore "G. A. Pischedda" Bosa and Rotary Club Bosa — **Bosa, Italy**
Rotary Award for top performing students during their last year of high school — *Jul. 2011*

SKILLS

Programming Languages:
- C, C++11, Java
- basic knowledge of Bash scripting, GNU Make and CMake, Verilog, Python, C#, F#, OCaml, Scala

Parallel Programming Frameworks:
- FastFlow, WindFlow, Apache Storm, Apache Flink

Network Programming Tools:
- Libpcap, AF_XDP, XDP, eBPF
- basic knowledge of Netmap, P4, ONOS, OpenFlow, Mininet

Tools:
- Docker
- basic knowledge of OpenStack

Libraries:
- GDAL, GeoTools, Alglib (Descriptive Statistics package)

Version Control and IDEs:
- git, JetBrains suite, Visual Studio Code

Productivity:
- LaTeX, Office suite
- basic knowledge of gnuplot, R

LANGUAGES

- Italian: mother tongue
- English: C1+ level (C1+ CEFR certification)

Last updated on January 11, 2022.