Davide Sanvito

Curriculum Vitae

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About me

- PhD candidate in Information Technology
- Research interest in computer networks and systems
- Strong hands-on experience: low-level programming languages, networking domain languages, scripting languages, emulated network testbeds
- Mathematical background: operation research, linear programming
- Basic understanding of Machine Learning
- Contributions to open source projects

Professional experience
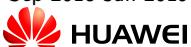
Oct 2019-present

Research Scientist, *NEC Laboratories Europe GmbH*, Heidelberg (Germany).
- Intelligent Software Systems (ISS) group

Sep 2018-Jan 2019

Assistant Research Engineer, *Huawei Technologies Co. Ltd., France Research Center, Mathematical and Algorithmic Science Lab*, Boulogne-Billancourt (France).
- Network Layer Team
- Research topic: SD-WAN Traffic Engineering
    - Design of a robust routing optimization model (operation research, linear programming) implemented in COIN-OR/LEMON (C++) for a Software-Defined Wide Area Network
    - Performance evaluation under realistic and synthetic traffic scenarios
    - Design and implementation of automated test suites (Python, Bash scripting, MATLAB)

Jan 2018-June 2018

PhD Student Intern, *NEC Laboratories Europe GmbH*, Heidelberg (Germany).
- Systems and Machine Learning (SysML) group
- Research topic: In-Network Computing with SDN programmable data plane
    - Analysis and profiling of Neural Networks computation on Intel CPU (Intel Caffe)
    - Design and implementation of automated test suites to collect hardware performance counters (Linux Perf, Python, Bash scripting)
    - Definition of techniques and methods to split the computation of a Neural Network using heterogeneous processors (CPU and Network Flow Processor)
    - Implementation of a Neural Network executor on a Netronome NFP SmartNIC based on P4 and architecture-specific MicroC

Jan 2015-Apr 2016

Research Associate, *CNIT – Consorzio Nazionale Interuniversitario per le Telecomunicazioni*, UdR Politecnico di Milano, Milano (Italy).

○ Extension of open source SDN software (CPqD ofsoftswitch13 in C and Ryu controller in Python) to support stateful SDN programming abstractions and applications (OpenState and BEBA projects)
○ Design and implementation of a failure detection and recovery scheme based on OpenState
○ Experimental validation with automated testbeds (Mininet, Python)

Projects and open source contributions

ONF ONOS, `https://onosproject.org/`.

ONOS (Open Network Operating System) is a production-ready open source SDN network operating system built for service provider networks, hosted by the Linux Foundation, designed for scalability, high performance and high availability, in Java. I contributed with an Intent Monitor and Reroute service which enables an off-platform plug&play routing logic for intent-based ONOS applications. The code has been included in ONOS 1.13 in the master branch.

CPqD ofsoftswitch13, `https://github.com/CPqD/ofsoftswitch13`.

Open source OpenFlow 1.3 user-space software switch implementation, in C. In the context of OpenState and BEBA projects, I was part of the team contributing with the stateful packet processing implementation. The code has been integrated in the project repository as an experimental branch.

OpenState, `http://www.openstate-sdn.org`.

Open source project for the development of an OpenFlow extension that adds support for stateful packet processing, to reduce the need for switches to rely on external controllers. I was part of the team focusing on the design and implementation of an OpenState softswitch and controller based on CPqD ofsoftswitch13 (C) and OSRG Ryu (Python).

BEBA (BEhavioural BAsed forwarding), `http://www.beba-project.eu/`.

European H2020 project on SDN data plane. BEBA's ultimate goal is the implementation of future-proof network devices capable to be repurposed with middlebox-type functions well beyond static packet forwarding, with focus on monitoring and network security applications. I was part of the team focusing on the software prototyping and on the design and implementation of stateful SDN applications.

Education

May 2016-Mar 2020

PhD Student in Information Technology, *Politecnico di Milano*, Milano (Italy).

○ Advanced Network Technologies LABoratory (ANTLab) research group (prof. Antonio Capone)
○ Research topic: Traffic Engineering in Software-Defined Networking with programmable dataplanes
  – Design of robust routing optimization models (operation research, linear programming) implemented in Gurobi (Python) exploring the tradeoff between dynamic and stable routing
  – Design and implementation of stateful SDN applications (OpenState) related to network load balancing, network failure resiliency and traffic classification offloading
  – Experimental validation with emulated SDN networks (Mininet, OpenFlow, P4, Ryu, ONOS, Java)
○ Contribution to open source projects (see *Projects and contributions*)
  – CPqD ofsoftswitch13 and OSRG Ryu: added support for in-switch stateful packet processing
  – ONF ONOS: added new Intent-Based Networking monitoring service
○ Research projects (see *Projects and contributions*):
  – OpenState
  – BEBA (BEhavioural BAsed forwarding)
○ Teaching assistantship in *Engineering of Computing Systems* Bachelor of Science
  – Fundamentals of Internet and communication networks - 097246 - 50 hours
  – The Internet and communication networks (2nd module - Internetworking with TCP/IP) - 086203 - 10 hours
○ Teaching for *Progetto SHELL - Cluster Smart Living Technologies* master (Sep 2016)
  – Protocols for data collection and transmission - MA1.4 - 36 hours

2020	**PhD, Information Technologies**, *Politecnico di Milano*, Italy, cum laude.
	Thesis: *Traffic management in networks with programmable data planes*
	Advisor: Prof. Antonio Capone
2014	**MS, Telecommunications Engineering**, *Politecnico di Milano*, Italy, 110/110 cum laude.
	Thesis: *Software-Defined Networking Applications Based on OpenState*
	Advisor: Prof. Antonio Capone
2012	**BS, Telecommunications Engineering**, *Politecnico di Milano*, Italy, 108/110.
2009	**Scientific School Diploma**, *Liceo Scientifico G.B. Vico*, Cologno Monzese (MI), Italy, 97/100.

Online Courses

| 2016 | **Machine Learning**, *Stanford University (prof. Andrew Ng)*, Coursera QVVUBBR2X4WZ. |

Publications

D. Sanvito, A. Marchini, I. Filippini, and A. Capone. **CEDRO: an in-switch elephant flows rescheduling scheme for data-centers**. In *IEEE NetSoft 2020*, June 2020.

D. Sanvito, I. Filippini, A. Capone, S. Paris, and J. Leguay. **Clustered Robust Routing for Traffic Engineering in Software-Defined Networks**. In *Computer Communications*, volume 144, pages 175–187. Elsevier, 2019.

A. Tomaszewski, M. Pióro, D. Sanvito, I. Filippini, and A. Capone. **On Optimization of Semi-stable Routing in Multicommodity Flow Networks**. In *EURO/ENOG INOC 2019*, June 2019.

S. Pontarelli, R. Bifulco, M. Bonola, C. Cascone, M. Spaziani, V. Bruschi, D. Sanvito, G. Siracusano, A. Capone, M. Honda, F. Huici, and G. Bianchi. **FlowBlaze: Stateful Packet Processing in Hardware**. In *USENIX NSDI 2019*, February 2019.

D. Sanvito, G. Siracusano, and R. Bifulco. **Can the Network be the AI Accelerator?** In *ACM SIGCOMM NetCompute 2018 Workshop*, August 2018.

D. Sanvito, D. Moro, M. Gulli, I. Filippini, A. Capone, and A. Campanella. **ONOS Intent Monitor and Reroute service: enabling plug&play routing logic**. In *IEEE NetSoft 2018*, June 2018.

D. Sanvito, I. Filippini, A. Capone, S. Paris, and J. Leguay. **Adaptive Robust Traffic Engineering in Software Defined Networks**. In *IFIP Networking 2018*, May 2018.

N. Bonelli, G. Procissi, D. Sanvito, and R. Bifulco. **The Acceleration of OfSoftSwitch**. In *IEEE NFV-SDN 2017*, November 2017.

D. Sanvito, D. Moro, and A. Capone. **Towards Traffic Classification Offloading to Stateful SDN Data Planes**. In *IEEE NetSoft NEAF-IO 2017 Workshop*, July 2017.

C. Cascone, D. Sanvito, L. Pollini, A. Capone, and B. Sansò. **Fast Failure Detection and Recovery in SDN with Stateful Data Plane**. In *IJNM Special Issue: Softwarization of networks, clouds, and internet of things*, volume 27, page e1957. Wiley Online Library, March 2017.

A. E.C. Redondi, D. Sanvito, and M. Cesana. **Passive Classification of Wi-Fi Enabled Devices**. In *ACM MSWiM 2016*, November 2016.

C. Cascone, L. Pollini, D. Sanvito, A. Capone, and B. Sansò. **SPIDER: Fault Resilient SDN Pipeline with Recovery Delay Guarantees**. In *IEEE NetSoft 2016*, June 2016.

C. Cascone, L. Pollini, D. Sanvito, and A. Capone. **Traffic Management Applications for Stateful SDN Data Plane**. In *IEEE EWSDN 2015*, September 2015.

Technical skills

| Programming languages | Python, C, C++, Java, MATLAB |
| Networking technologies | TCP/IP, switching, routing, SDN, ONOS, P4, OpenFlow, Ryu, Mininet, Netronome SmartNIC |

Mathematical tools	Operation Research, Linear Programming, Gurobi, COIN-OR, Lemon, AMPL

Languages

Italian	Native
English	Professional proficiency - (2012) - ETS TOEIC - Listening and Reading Test: 910/990 - C2

Interests and activities

Music	Studying classical piano at Civica Scuola di Musica "G. Donizetti" - Sesto San Giovanni (Mi) obtaining *Licenza di Teoria, Solfeggio e Dettato musicale* (2009) and *Esame di Compimento Inferiore di pianoforte* (2010) from Istituto Superiore di Studi Musicali "F. Vittadini" - Pavia.
Social	Volunteer activity as cinema projectionist at CineTeatro Don Bosco - Carugate (Mi). Development of tools to automate the tasks of the projectionists (`http://bit.ly/ctdb-tools`).