CV Domenico De Guglielmo

EXPERTISE

Senior Software Engineer, Ph.D, with 5+ years of industrial experience. My skills range from the design and testing of secure wireless protocols (see J1-J6) to cloud architectures and IoT embedded systems design. I have significant experience in setting up CI/CD environments and in application development. In the past years I wrote research and patent proposals. I have been a work-package coordinator of the EU-funded H2020 SIFIS-HOME research project and I am currently contributing to the AsCoT-SCE PRIN project.

EXPERIENCE

Senior Postdoctoral Researcher

IIT CNR, Pisa, Italy
May 2022 - Present
During the last years I participated and contributed to two research projects in the IoT and Smart Home fields, namely SIFIS-HOME and ASCOT.

SIFIS-HOME:

- I was the leader of Work Package 6 (Smart Home Pilot Use Case) in the SIFIS-HOME H2020 project, a EU funded project (October 2020 - October 2023). Our goal was to test and evaluate the performance of the SIFIS-HOME framework (a distributed and secure IoT platform that we developed during the project) in a physical testbed involving heterogeneous *wireless* devices such as actuators, sensors and gateways.
- *SIFIS-HOME testbed design and implementation:* I was the responsible for the design, implementation and testing of the SIFIS-HOME testbed. The SIFIS-HOME testbed is composed of a number of wireless devices ranging from powerful ones (Banana PI R3 WiFi boards) to resource constrained ones (Shelly ESP8266/ESP32-based WiFi actuators). The Banana PI R3 boards are the devices where the main SIFIS-HOME software components run. The R3 boards are are all connected with each other using a WiFi multi-hop mesh network and, also, create a dedicated WiFi network to which the resource constrained WiFi devices connect to. WiFi-Bluetooth Low Energy gateways have been used to allow Bluetooth Low Energy devices to access the network.
- *SIFIS-HOME DHT design and implementation:* I am the author of the SIFIS-HOME DHT, i.e. the software component that enables communication among the different SIFIS-HOME services using a pub/sub pattern. The DHT is the component that allows the SIFIS-HOME platform to be resilient and distributed. In detail, the DHT allows nodes and components to join and leave the network at any time. Also, it allows services running on different nodes to discover each other and communicate in a secure way (messages are encrypted and only authorized nodes can join the DHT).
- *Home Assistant DHT Integration:* I developed an Home Assistant integration for the DHT I developed for the SIFIS-HOME project. Such integration allows Home Assistant, a famous IoT platform for the smart home, to receive and send messages to the DHT and the SIFIS-HOME devices. By using such integration it is possible to control the devices connected to the SIFIS-HOME testbed using the Home Assistant UI, rule engine as well as mobile application no matter to which gateway they are connected to, creating a fully distributed network.

- *Firmware for WiFi devices*: Firmware implementation for a number of ESP8266-based WiFi devices (Shelly1, 1PM, 2.5, EM, Dimmer, RGBW).
- *ESP32 Bluetooth Low Energy Gateway*: firmware implementation of an ESP32-based Bluetooth Low Energy Gateway (BLE). The ESP32 gateway analyzes BLE beacons sent by Bluetooth Low Energy sensors and sends relevant information to the SIFIS-HOME DHT. It also allows to control BLE actuators such as thermostatic radiator valves (TRV).
- *Deliverables*: Preparation of SIFIS-HOME technical deliverables (WP1, WP5, WP6).

ASCOT:

- *OpenWrt firmware image for Banana PI R3 IoT devices*: I developed a number of tools that allow producing an OpenWrt image containing all the ASCOT software components for the Banana PI R3 board.
- *OpenWrt firmware updater for Banana PI R3 IoT devices*: I developed a software component that allows to update the Openwrt image used by the Banana PI R3 boards used in the project in a secure way. The updater is robust to network and power failures.

Senior IoT Engineer

MIND, Modena, Italy
February 2016 - April 2022
Mind is an innovative multi-gateway solution for the smart home that provides smart lighting, temperature, irrigation and multimedia devices control using advanced computer-vision and machine learning algorithms. I was responsible for the following activities:

House Edge platform: Design and implementation of the wireless mesh architecture used to connect Mind smart-home devices (802.11 IBSS and Babel routing protocol). Design and implementation of the middleware used for application messages exchange and to allow services to move between mesh nodes without losing their state (C++, Sqlite, MQTT, Google Protocol Buffers). Design and implementation of Mind device updater: it allows updating the applications running on our devices (Docker containers) as well as the device OS with minimum downtime and being tolerant to power failures (Docker, Python, AWS S3, AWS ECR, U-Boot). I was responsible for creating a custom Linux image (Debootstrap) for our devices (Nvidia Jetson TX2 SOM + custom carrier board) containing the kernel, device drivers and system scripts.

Cloud platform: Design and implementation of the cloud architecture of Mind, a highly available and scalable architecture composed of a number of different services such as MQTT brokers, web services, relational and time-series databases and VPN servers. Our cloud services are hosted on AWS and use many AWS services such as AWS EC2, AWS VPC, AWS S3, AWS Lambda and AWS Route 53 . All our services run on Docker containers. To properly orchestrate them we use Kubernetes. We use the ELK stack for log management.

DevOps: Design and implementation of the platform that allows us to continuously build, package, test and deploy our software packages, i.e. more than 50 software components ranging from x86 and arm64v8 applications to custom Linux OS images and firmwares for microcontrollers. Main technologies: Teamcity, AWS EC2, Docker, Kubernetes, Git.

Applications and firmware development: Firmware development (C++, PlatformIO) for our WiFi actuators (ESP8266 platform). Also, I wrote a number of C++ applications (C++, CMake, Git, Docker) that allow controlling third party devices (i.e. BLE and Zigbee radiator valves, smart doorbells, temperature and humidity sensors) from Mind. Finally, I wrote a Vue.js application for system configuration (i.e. add/remove devices, set temperature targets, etc).

Senior IoT Consultant

ELEMIZE TECHNOLOGIES, Roma, Italy (Remote)
May 2019 - October 2019

Design and implementation of the platform for managing Elemize IoT devices. The platform allows monitoring the state of all the deployed devices, updating the applications they run and the OS of the devices. Main technologies: AWS S3, AWS ECR, AWS Lambda, AWS DynamoDB, NanoPi device, U-boot, Vue.js.

Postdoctoral Researcher

UNIVERSITY OF PISA, Pisa, Italy
January 2015 - January 2016
I worked with Prof. Giuseppe Anastasi on topics such as Wireless Sensor Networks, Internet of Things, Network Security and Smart cities.

Research assistant

ITALIAN NATIONAL RESEARCH COUNCIL (CNR), Pisa, Italy
April 2015 - May 2015
Experimental evaluation of IEEE 802.15.4e Time Slotted Channel Hopping (TSCH) MAC Behavior Mode for IoT applications.

Research assistant

ITALIAN NATIONAL RESEARCH COUNCIL (CNR), Pisa, Italy
April 2013 - May 2013
Design and implementation of an IEEE 802.15.4-based environmental monitoring system.

EDUCATION

Doctor of Philosophy (Ph.D) in Computer Science, Systems and Telecommunications

UNIVERSITY OF PISA-FLORENCE (Pegaso project), Pisa, Italy
January 2012 - December 2014
Advisor: Prof. Giuseppe Anastasi Thesis: *Wireless Sensor Networks (WSNs) for Critical Applications: analysis and enhancements*

My research activity was in the field of Wireless Sensor Networks and Internet of Things. My work consisted in evaluating the performance of low power wireless protocols by means of analytical models, simulations and experiments on real testbeds. I had the opportunity to gain an advanced knowledge of the IEEE 802.15.4 MAC protocols and IEEE 802.15.4e amendment. Also, I proposed solutions to reduce the network formation time of WSNs as well as increase their resistance to selective jamming attacks. My work resulted in a number of international publications. Finally, I had the opportunity to present my work in a number of international conferences and to support a number of students during their Master thesis period. Also, I have been a teaching assistant for the Computer Networks course at the University of Pisa for 4 years.

Visiting Ph.D student

SWEDISH INSTITUTE OF COMPUTER SCIENCE (SICS), Stockholm, Sweden
Analysis and experimental evaluation of IEEE 802.15.4e TSCH CSMA-CA Algorithm, Advisor: Prof. Thiemo Voigt.

Master of Science (M.S.) in Computer Engineering

UNIVERSITY OF PISA, Pisa, Italy
Concentration: Networking and Multimedia
October 2009 - October 2011
Level of Distinction: *110/110 Cum Laude*
Attended *Percorso di Eccellenza* (excellence curriculum)

Bachelor of Science (B.S.) in Computer Engineering

UNIVERSITY OF PISA, Pisa, Italy
October 2006 - July 2009
Level of Distinction: *110/110 Cum Laude*

PUBLICATIONS

Google Scholar: H-Index=12, i10-Index=13

JOURNALS

J1 D. De Guglielmo, F. Restuccia, G. Anastasi, M. Conti, S.K. Das, "Accurate and Efficient Modeling of 802.15.4 Unslotted CSMA/CA through Event Chains Computation", IEEE Transactions on Mobile Computing (TMC), 2016. (SJR: Q1)

J2 D. De Guglielmo, Beshr al Nahas, S. Duquennoy, T. Voigt, G. Anastasi, "Analysis and Experimental Evaluation of IEEE 802.15.4e TSCH CSMA-CA Algorithm", IEEE Transactions on Vehicular Technology (TVT), 2016. (SJR: Q1)

J3 M. Tiloca, D. De Guglielmo, G. Dini, G. Anastasi, S. K. Das, "DISH: DIstributed SHuffling against Selective Jamming Attack in IEEE 802.15.4e TSCH Networks", ACM Transactions on Sensor Networks (ToSN), Vol. 15, N. 1, February 2019. (SJR: Q1)

J4 M. Tiloca, D. De Guglielmo, G. Dini, G. Anastasi, S.K. Das, "JAMMY: a Distributed and Dynamic Solution against Selective Jamming Attack in TDMA WSNs", IEEE Transactions on Dependable and Secure Computing (TDSC), 2015. (SJR: Q1)

J5 S. Brienza , M. Roveri, D. De Guglielmo, G. Anastasi, "A Learning-based Algorithm for Optimal MAC Parameters Setting in IEEE 802.15.4 Wireless Sensor Networks", ACM Transaction on Autonomous and Adaptive Systems (TAAS), Vol. 10, N. 4, January 2016. (SJR: Q1)

J6 D. De Guglielmo, S. Brienza, G. Anastasi, "IEEE 802.15.4e: A Survey", Computer Communications, Vol. 88, pages 1–24, August 2016. (SJR: Q1)

CONFERENCES

C1 D. De Guglielmo, S. Brienza, G. Anastasi, "A Model-based Beacon Scheduling algorithm for IEEE 802.15.4e TSCH networks", 2016, Proceedings of IEEE International Symposium on a World of Wireless, Mobile, and Multimedia Networks (WoWMoM 2016).

C2 D. De Guglielmo, A. Seghetti, G. Anastasi, M. Conti, "A Performance Analysis of the Network Formation Process in IEEE 802.15.4e TSCH Wireless Sensor/Actuator Networks", Proceedings of IEEE International Symposium on Computers and Communications (ISCC 2014), Madeira, Portugal, June 23-26, 2014.

C3 S. Brienza , D. De Guglielmo, C. Alippi, G. Anastasi, M. Roveri, "A Learning-based Algorithm for Optimal MAC Parameters Setting in IEEE 802.15.4 Wireless Sensor Networks", Proceedings of ACM International Symposium on Performance Evaluation of Wireless Ad Hoc, Sensor, and Ubiquitous Networks (PE-WASUN 2013), Barcelona, Spain, November 3-7, 2013.

C4 G. Anastasi, M. Antonelli, A. Bechini, S. Brienza, E. D'Andrea, D. De Guglielmo, P. Ducange, B.Lazzerini, F. Marcelloni, A. Segatori, "Urban and Social Sensing for Sustainable Mobility in Smart Cities", Proceedings of IFIP/IEEE International Conference on Sustainable Internet and ICT for Sustainability (SustainIT 2013), Palermo, Italy, October 29-31, 2013.

C5 M. Tiloca, D. De Guglielmo, G. Dini, G. Anastasi, "SAD-SJ: a Self-Adaptive Decentralized solution against Selective Jamming attack in Wireless Sensor Networks", Proceedings of IEEE International Conference on Emerging Technologies Factory Automation (ETFA 2013), Cagliari, Italy, September 10-13, 2013.

C6 D. De Guglielmo, G. Anastasi, M. Conti, "A Localized Slot Allocation Algorithm for Wireless Sensor Networks", Proceedings of IEEE/IFIP Annual Mediterranean Ad Hoc Networking Workshop (Med-Hoc-Net 2013), Ajaccio, France, June 24-26, 2013.

C7 S. Brienza, D. De Guglielmo, G. Anastasi, M. Conti, V. Neri, "Strategies for Optimal MAC Parameter Setting in IEEE 802.15.4 Wireless Sensor Networks: a Performance Comparison", Proceedings of IEEE International Symposium on Computers and Communications (ISCC 2013), Split, Croatia, July 7-10, 2013.

C8 D. De Guglielmo, G. Anastasi, "Wireless Sensor and Actuator Networks for Energy Efficiency in Buildings", Proceedings of IFIP/IEEE International Conference on Sustainable Internet and ICT for Sustainability (SustainIT 2012), Pisa, Italy, October 4-5, 2012.

BOOK CHAPTERS

B1 D. De Guglielmo, G. Anastasi, A Seghetti, "From IEEE 802.15.4 to IEEE 802.15.4e: A Step towards the Internet of Things", Chapter 10 in Advances onto the Internet of Things (S. Gaglio, G.Lo Re, Editors), Series on Advances in Intelligent Systems and Computing, N. 260, January 2014. Springer.

TUTORIALS

S1 G. Anastasi, S. Brienza, D. De Guglielmo, "Towards the Internet of Relevant Things", SAC 2016 31st ACM Symposium on Applied Computing Pisa, Italy April 4-8, 2016.

TEACHING EXPERIENCE

1. "Computer networks" class, Computer Engineering Program, University of Pisa (October 2015 - December 2015).
2. "Computer networks" class (Prof. Giuseppe Anastasi), Computer Engineering Program, University of Pisa (October 2014 - December 2014).
3. "Computer networks" class (Prof. Giuseppe Anastasi), Computer Engineering Program, University of Pisa (October 2013 - December 2013).
4. "Computer networks" class (Prof. Giuseppe Anastasi), Computer Engineering Program, University of Pisa (October 2012 - December 2012).
5. "Operating systems and computer networks" class (Prof. Giuseppe Anastasi), Executive Master in Internet technologies , University of Pisa (January 2012 - March 2012).
6. "Networked Embedded Systems (NES)" class, University of Pisa, 2014 - 2015.

SUPERVISED MS THESIS

1. D. Carmignani, "Security in IEEE 802.15.4e TSCH networks", University of Pisa, 2016.
2. A. La Marra, "MBS: a Model-Based beacon Scheduling algorithm for IEEE 802.15.4e TSCH networks", University of Pisa, 2015.
3. M.G. Antona, "A cooperative sensing system for monitoring air quality in urban scenarios", University of Pisa, 2013.
4. S. Brienza," Design and evaluation of an adaptive algorithm for optimal MAC parameter tuning in IEEE 802.15.4 WSNs", University of Pisa, 2012.

PROFESSIONAL SERVICE

1. *TPC Member:* IFIP Sustainit (2015)
2. *Reviewer:* ACM Transactions on Sensor Networks, IEEE Transactions on Industrial Informatics, Elsevier Pervasive and Mobile Computing Journal, Elsevier Computer Communications Journal, Springer Wireless Networks Journal, IEEE MASS, IEEE WoWMoM, IFIP Sustainit, IEEE LCN, Simutools