Dr. Filippo Berto

Software Engineer

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Current Position

Filippo Berto is a Software Engineer at "Counseil Européen pour la Recherche Nucléaire" (CERN), Switzerland. His research interests are in the areas of **edge-cloud computing**, **distributed systems**, and **cyber security**. In particular, he works in the area of **security assurance**, **5G networks** and **edge-cloud computing**, focusing on **certification techniques** for computing infrastructures, networks and distributed services. In CERN, he focuses on the realization of Large Language Model applications for code development automation and operation, and on the implementation of edge-computing infrastructures for high reliability virtualized PLC applications.

Work Experience

Counseil Européen pour la Recherche Nucléaire (CERN) **Meyrin, Switzerland**

Software Engineer, under the supervision of Fernando Valera Rodriguez Oct 2025 – Present

- Development of techniques, tooling and services based on Large Language Models for the automation of development and testing of PLC code based on SIEMENS' CTRL/CTRL++ code.
- Implementation of a high-reliability edge-computing infrastructure for the deployment of SIEMENS' virtualized PLC systems
- Profiling of virtualized PLCs capabilities on time-sensitive applications
- Implementation of edge-cloud-ready services for the integration of PLC applications

SEcure Service-oriented Architectures Research Lab (SESAR Lab) - Università degli Studi di Milano Milan, Italy

Postdoctoral Researcher, under the supervision of Prof. Marco Anisetti Nov 2023 – Sep 2025

- Two-year research grant financed by the MUSA project (PNRR, Mission 4, Component 2, Investment 1.5).
- Lead the design and implementation of a **multi-tenant cloud research platform**, enabling **distributed computing**, **federated learning**, and **Big Data analysis** for **multiple research groups** [3].
- Developed assurance methodologies for **real-time verification** of non-functional properties in **edge-cloud continuum**, extending a **5G core network** [6].
- Integrated **machine learning** techniques in edge-cloud continuum environments, guaranteeing **fairness** and **integrity** properties [1], [4].
- QoS-aware scheduling and **cloud deployment** methodology, integrating applications with services for achieving higher level **guarantees** [9].
- Engineered the complete migration of the **research group's data center** from a VM-based architecture to a scalable, **on-premises Kubernetes cluster**, enhancing **service availability and multi-tenancy**.
- Proposed a methodology for detecting web cache deception vulnerabilities in content distribution networks [7].
- **Mentored** students, 11 Bachelor's and 4 Master's, during their thesis, working on **research activities** inherent to the group's projects.

Security & Privacy Research Group (SPRITZ) - Università degli Studi di Padova **Padua, Italy**

Predoctoral Researcher, under the supervision of Prof. Mauro Conti Apr 2020 – Oct 2020

- Six months research grant financed by the "Securing Smart Building Devices" project of the HIT Research Centre.
- Developed a cache-poisoning resistant **Content Distribution Network** system using Named Data Networking based on **real-time contents classification** and **popularity prediction**.
- Experimentally verified its effectiveness in a **network topology** simulating the major Internet switches in Germany.

Skills, Languages, Interests

- **Languages**: Italian (Native speaker), English (Proficient speaker - B2 Certificate).
- **Programming**: Rust, Python, Go, Haskell, C, C++, JavaScript, Typescript, Java, Scala, LaTeX.
- **Data Analytics and ML**: Numpy, Pandas, Polars, Plotly, Torch, Sklearn, Spark.

- **Cybersecurity**: Certification, Security Assurance, Network analysis, Static Analysis, Web exploitation, Security Assessment.
- **Web Development**: Axum, Tonic, React, Node.js, FastAPI, GRPC, GraphQL.
- **Tools**: Linux, Git, Docker, DevOps, Kubernetes, Nix, Jupyter Notebook, OpenAPI, Protobuf, ZeroMQ, Cloud Providers (AWS, GCP).
- **Teaching**: Computer networks, Programming languages, Application monitoring, Cloud computing infrastructures, Code versioning systems.
- **Interests**: Video games, Music and video production, Cybersecurity Competitions, Reading books, Embedded development, NixOS package maintainer, Flight simulators.

Projects

"MUSA - Multilayered Urban Sustainability Action"
Università degli Studi di Milano (PNRR, Missione 4, componente 2, investimento 1.5) Jan 2022 – Dec 2025
- Developed **edge-cloud continuum** solutions integrated into **5G networks** and **MUSA's Cloud Computing platform**.
- Designed **monitoring and assurance methodologies** for edge-cloud applications to improve MUSA's security posture.
- Implemented **QoS-aware deployment solution** for MUSA's hybrid-cloud distributed applications.

Catalyst "Incident Co-Pilot"
Università degli Studi di Milano Jan 2024 – Jun 2024
- Designed an **LLM fine-tuning** pipeline for analysis and solution of Telco network errors.
- Collaborated on the development of an **LLM agent** for assisting Telco operators in incident remediation.

Catalyst "Intent Driven Autonomous Network phase 3"
Università degli Studi di Milano Jan 2023 – Jun 2023
- Focused on the integration of **intent-driven** solutions for the automation of **Telco network management**

"MIND FoodS Hub"
Università degli Studi di Milano (POR FESR 2014-2000) Nov 2020 – Mar 2022
- Developed **edge-cloud continuum** solutions for automatic analysis of agricultural **IoT data**.

"One Health Action Hub": University Task Force for the resilience of territorial ecosystems
Università degli Studi di Milano (PSR 2021 - GSA - Linea 6, "Piano sostegno alla ricerca") Jan 2022 – Jan 2021
- Implemented **Big Data pipelines** to collect and analyze the project's data, integrating assurance techniques.

"Sovereign Edge-Hub"
Università degli Studi di Milano (PSR 2021/2022 – GSA – Linea 6) Jan 2021 – Dec 2022
- Developed a **Big Data Engine** based on open-source projects and focused on the **privacy-preserving** management of personal data.

"H2020 CONCORDIA" - Cyber security cOmpeteNCe fOr Research anD InnovAtion
Università degli Studi di Milano (European Union's Horizon 2020 Research and Innovation program) Jan 2020 – Nov 2022
- Extended the 5G network specification for allowing **transparent monitoring**.
- Defined an assurance framework for **5G networks**, providing real-time **QoS and security** verification.

"Data Governance and Data Protection"
Università degli Studi di Milano (SERICS - PE00000014 - NRRP MUR program - NextGenerationEU) Nov 2022 – Jan 2024
- Developed a **Big Data Engine** for research on privacy-preserving solutions in cloud-ready environments.

VSIX, the Internet Exchange Point (IXP) operated by the University of Padua
Università degli Studi di Padova Oct 2019 – Oct 2020
- Collected real-time traffic for **content popularity classification and prediction**.
- Integrated the prediction model in a **Content Distribution Network** solution based on **Named Data Networking**.

Education

Università degli Studi di Milano **Milan, Italy**
Ph.D. in Computer Science Nov 2020 – Oct 2023

- **Honors**: Cum laude.
- **Courses**: Security threats, trends challenges and gaps, Governance, risk and compliance in distributed architectures, Modeling, analysis and optimization of networks, Security certification: from traditional software and cloud system to ML-based services.
- **Thesis**: "Assurance-aware 5G Edge-Cloud Architectures for Intensive data analytics", under the supervision of Prof. Marco Anisetti and Prof. Claudio A. Ardagna [5].
- Efficient **QoS-aware deployment** methodology for distributed services in edge-cloud continuum [12].
- Collaborative and lightweight **assurance methodologies** for advanced **non-functional properties** in **distributed services** [11], [15].
- Assurance techniques based on **transparent monitoring** of **edge-cloud computing** environments and modern infrastructures.
- Development of a **Big Data platform** for collection and analysis of agricultural data using an **automated robotic platform** and **IoT devices** [14].
- **5G core network function** and MEC specification extension and implementation for advanced property verification.
- Implemented monitoring techniques in **5G network functions** for advanced **non-functional verification**, validated on a real test bed network.
- Automatic integration of **assurance techniques** for **Big Data analysis pipelines** in **edge-cloud** environments [10], [13].

Università degli Studi di Padova **Padua, Italy**
Master's Degree in Computer Science (LM-18) Oct 2017 – Apr 2020

- **Grade**: 105/110
- **Courses**: Algorithms & Computability, Innovation Economy, Functional Languages, Formal Programming Languages, Global Computing Languages, Data Mining, Machine Learning, Artificial Intelligence, Cognitive Services, Computer & Network Security, Static Analysis.
- **Thesis**: "Content Popularity in Named Data Networking: Prediction Models And Security Applications", under the supervision of Prof. Mauro Conti
  - Development a cache-poisoning resistant policy for Named Data Networking based on **collaborative distributed monitoring** and **prediction of content popularity** across the network.
- Development of of **memory-exhaustion DoS attack** against Named Data Networking routers and integration of a more resistant alternative **probabilistic data structure** [16].
- Developed a **static analyzer** in **Rust** featuring abstract and concrete interpretation of the "While" language.

Università degli Studi di Padova **Padua, Italy**
Bachelor's Degree in Computer Science (L-31) Oct 2014 – Sep 2017

- **Courses**: Computer Networks, Operating Systems, Mathematical Analysis, Computer Programming, Algebra, Logic, Databases, Algorithms & Data Structures, Statistics, Formal Languages, Operations Research, Software engineering, Mobile Programming, Bioinformatics.
- **Thesis**: "Development of a video streaming platform for remote assistance via wearable devices"
  - Analysis of current standards for **video streaming** and **chat solutions**.
  - Implemented a broker-based message-queue system for **high throughput chat messaging** and **video streaming**.
- **Led a team of seven people** during a year long **software engineering project**, building a **AI personal assistant** using **AWS services**.

Honors and Awards

Best Innovation & Future Techco award **Copenhagen, Denmark**
Issued by *TM Forum* Jul 2023

- The Catalyst project, "Intent Driven Autonomous Network phase 3", in recognition of its pioneering contributions to the field of **Intent Driven Autonomous Networks**.

Affiliations

CINI - Consorzio Interuniversitario Nazionale per l'Informatica **Italy**
Member and of the "Data Science" and "Cybersecurity" national laboratories Apr 2018 – Present

- Part of the **organizing committee** of ITADATA, the **international conference** of the "Data Science" lab, and the associated national **data science competition**, ITADATA Hack.
- Participated to national events and competitions of the cybersecurity national lab.

mhackeroni (national inter-university cybersecurity team) **Italy**
Member Apr 2018 – Present

- Participated in several **international cybersecurity competitions**, including **DEFCON**, **HITCON**, **ENOWARS**, **MidnightSun CTF**, **Google CTF**, **Facebook CTF**, **Hack-a-Sat**, **CSAW CTF**, **VolgaCTF**, **Plaid CTF**.

NoPwnIntended (University of Padua's cybersecurity team) **Padua, Italy**
Member Apr 2018 – Present

- Participated in several **international cybersecurity competitions**.
- Led the university team to the **national selection competition** of CyberChallenge.

Research and Publications

[1] M. Anisetti, C. A. Ardagna, F. Berto, and A. D. Bruna, "ML Assurance in 6G-Enabled Edge-Cloud Continuum Workflows," in *2025 IEEE Wireless Communications and Networking Conference (WCNC)*, Mar. 2025, pp. 1–6. doi: 10.1109/WCNC61545.2025.10978637.

[2] C. A. Ardagna, E. Damiani, and F. Berto, "Script Language Security," *Encyclopedia of Cryptography, Security and Privacy*. Springer, Cham, pp. 2177–2179, 2025. doi: 10.1007/978-3-030-71522-9_657.

[3] M. Anisetti *et al.*, "MUSA: A Platform for Data-Intensive Services in Edge-Cloud Continuum," in *Advanced Information Networking and Applications*, L. Barolli, Ed., Cham: Springer Nature Switzerland, Apr. 2024, pp. 327–337. doi: 10.1007/978-3-031-57931-8_32.

[4] S. Maghool, P. Ceravolo, and F. Berto, "A Novel Assurance Procedure for Fair Data Augmentation in Machine Learning," in *Proc. of AIEB 2024: Workshop on Implementing AI Ethics through a Behavioural Lens*, Santiago de Compostela, Spain: CEUR-WS, Apr. 2024, pp. 25–36. [Online]. Available: https://hdl.handle.net/2434/1159100

[5] F. Berto, "Assurance-aware 5G Edge-Cloud Architectures for Intensive Data Analytics," Milan, 2024. Accessed: Apr. 25, 2024. [Online]. Available: https://hdl.handle.net/2434/1021895

[6] F. Berto, C. A. Ardagna, M. Banzi, and M. Anisetti, "Assurance in Advanced 5G Edge Continuum," *IEEE Access*, vol. 12, pp. 178659–178671, 2024, doi: 10.1109/ACCESS.2024.3503437.

[7] F. Berto, F. Minetti, C. Ardagna, and M. Anisetti, "A Methodology for Web Cache Deception Vulnerability Discovery," in *Proceedings of the 14th International Conference on Cloud Computing and Services Science - CLOSER*, SciTePress, 2024, pp. 231–238. doi: 10.5220/0012692000003711.

[8] C. A. Ardagna, E. Damiani, and F. Berto, "Script Language Security," *Encyclopedia of Cryptography, Security and Privacy*. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 1–3, Sep. 2023. doi: 10.1007/978-3-642-27739-9_657-2.

[9] M. Anisetti, F. Berto, and R. Bondaruc, "QoS-Aware Deployment of Service Compositions in 5G-Empowered Edge-Cloud Continuum," in *2023 IEEE 16th International Conference on Cloud Computing (CLOUD)*, IEEE, Jul. 2023, pp. 471–478. doi: 10.1109/CLOUD60044.2023.00063.

[10] M. Anisetti, C. A. Ardagna, and F. Berto, "An assurance process for Big Data trustworthiness," *Future Generation Computer Systems*, vol. 146, pp. 34–46, 2023, doi: 10.1016/j.future.2023.04.003.

[11] M. Anisetti, C. A. Ardagna, F. Berto, and E. Damiani, "A Security Certification Scheme for Information-Centric Networks," *IEEE Transactions on Network and Service Management*, vol. 19, no. 3, pp. 2397–2408, Sep. 2022, doi: 10.1109/TNSM.2022.3165144.

[12] M. Anisetti, F. Berto, and M. Banzi, “Orchestration of data-intensive pipeline in 5G-enabled Edge Continuum,” in *2022 IEEE World Congress on Services (SERVICES)*, Jul. 2022, pp. 2–10. doi: 10.1109/SERVICES55459.2022.00025.

[13] M. Anisetti, N. Bena, F. Berto, and G. Jeon, “A DevSecOps-based Assurance Process for Big Data Analytics,” in *2022 IEEE International Conference on Web Services (ICWS)*, Barcelona, Spain: IEEE, Jul. 2022, pp. 1–10. doi: 10.1109/ICWS55610.2022.00017.

[14] F. Berto *et al.*, “A 5G-IoT enabled Big Data infrastructure for data-driven agronomy,” in *2022 IEEE Globecom Workshops (GC Wkshps)*, IEEE, 2022, pp. 588–594. doi: 10.1109/GCWkshps56602.2022.10008727.

[15] M. Anisetti, C. A. Ardagna, F. Berto, and E. Damiani, “Security Certification Scheme for Content-centric Networks,” in *2021 IEEE International Conference on Services Computing (SCC)*, IEEE, Sep. 2021, pp. 203–212. doi: 10.1109/SCC53864.2021.00033.

[16] F. Berto, L. Calderoni, M. Conti, and E. Losiouk, “Spatial bloom filter in named data networking: a memory efficient solution,” in *Proceedings of the 35th Annual ACM Symposium on Applied Computing*, Brno Czech Republic: Association for Computing Machinery, Mar. 2020, pp. 274–277. doi: 10.1145/3341105.3374074.

11/01/2026, Milan, Italy