Summer school

Designing and Assembling Smart Cyber-Physical Systems

Dealing with nowadays complex systems is very difficult. Cyber-Physical Systems (CPSs) are even more critical as they need to cope with software (in some sense something people are used to) with hardware (typically geographically distributed, among different domains). Future systems will always be a combination of physical and cyber parts, and thus it is mandatory to know how to deal will them and, in particular, consider IoT devices as full-fledged resources to play with, as we usually do with computing, storage and networking.

The summer school will introduce the participants to deal with such systems where there is no distinction among the different parts: computing, storage, networking and Internet of Things (IoT) all contribute to setting up the modern processing environments and for this reason it is mandatory to keep them simultaneously under control. In particular, the school intends to offer a comprehensive approach to design, implement and use CPSs, i.e., computing systems with a strong interaction between the physical environment (equipped with sensors and actuators) and the cyber part (the Fog and Cloud in a wide sense). Sensors, boards, edge devices, computing, storage, networking resources are seen as elements of a whole picture where everything can be virtualized and composed to create the infrastructure on top of which services and applications can be deployed. Infrastructure continuum represents our environment, where we can move from edge computing (by exploiting remote resources) to the Cloud, going through Fog resources to set up the entire framework for services deployment.

This summer school proposes a new approach to the design and programming of CPSs by considering them as complex “systems of systems'' that need a specific methodology for their design and management. Better to say, all current systems are seen as CPS by nature and for this reason the interaction among the physical and the cyber parts has to be managed since the very first phases of their design. The IoT dimension is part of the overall infrastructure and IoT resources have to be considered since the very beginning, and kept at the same level of consideration of other more traditional resources such as computing, storage and networking. The school will teach how to design a network architecture with all the virtualized resources in place, how to optimise their interaction and keep everything under the full control of the system manager.

The school will drive students, researchers, practitioners, professionals to learn theory behind CPS and concretely work with CPSs putting into practice what they have learned with concrete examples and hands-on experiments. Furthermore, we contribute to improve the quality of education being the lectures also supported by the text book “Assembling Smart Cyber-Physical Systems: heterogeneous, diffuse and green technological infrastructures for cities and industries”[1] authored by Z. Benomar, F. Longo, G. Merlino and A. Puliafito and a software repository with modules, components and app. This will simplify the learning process and support remote and continuous learning.

[1] Each participant to the school will receive a copy of this text book

The Summer School will take place from Monday 14th to Friday 18th of July 2025

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
8:30 – 8:50	*Registration*				
8:50 – 9:00	*Opening*	*Opening*	*Opening*	*Opening*	*Opening*
9:00 – 10:30	Introducing the Internet of Things	Edge-cloud continuum and beyond	Network virtualization	Heterogeneous computing	Decentralizing authorization and delegation
10:30 – 11:00	*break*	*break*	*break*	*break*	*break*
11:00 – 12:30	Edge, Fog, and Cloud computing principles	Implementing the I/O cloud	Laying a Web over Things by exposing IoT	The SLICES research Infrastructure	The deviceless paradigm (IoT hosted function as a service)
12:30 – 14:00	*Lunch*	*Lunch*	*Lunch*	*Lunch*	*Lunch*
14:00 – 15:30	Serverless computing	Introducing Stack4Things	Behavior-enabled IoT	The Cloud/Edge blueprint	Exploiting federated learning
15:30 – 16:00	*break*	*break*	*break*	*break*	*break*
18:00 – 20:00	*Guided tour of the Ortigia island*	*Boat excursion and bath*	*Visit to the Greek theatre*		
20:00 – 22:00	*Welcome cocktail with Sunset*	*Pizza and music*	*Social dinner at Grand Hotel Ortigia*	*Dinner*	

Early registration (before June 15, 2025): 500 €

Late registration: 650 €

The website of the school is: *https://portale2.unime.it/sosmartcps*

All the logistic issues are managed by:

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The school is organized by:

Prof. Antonio Puliafito is a full professor of computer engineering at the University of Messina, Italy. His interests include distributed systems, networking, IoT and Cloud computing. He participated in several European projects such as Reservoir, Vision, CloudWave, Beacon and SLICES. He has contributed to the development of the Stack4Things middleware. He is the founder of SmartMe.io, a startup focused on hw and sw solutions to design and manage Cyber Physical Systems. He is author and co-author of more than 500 scientific papers.

Prof. Stefano Silvestri is a researcher at the Institute for High-Performance Computing and Networking of the National Research Council of Italy (CNR-ICAR). He also serves as an adjunct professor, teaching courses in computer science, information processing systems, and computer networks at Luigi Vanvitelli University of Campania, University of Naples "Federico II", and Giustino Fortunato University. His primary research interests include Artificial Intelligence, Machine/Deep Learning, Smart Health, Smart Cities, Natural Language Processing, Cyber Security, and Big Data Analytics. He has participated in numerous national and international research projects.

Dr. Giuseppe Tricomi is a research fellow who earned his international Ph.D. at the University of Messina in 2021. Until February 2025, He was a researcher at the Institute of High-Performance Computing and Networking (ICAR) of the National Research Council of Italy (CNR). His current research interests include Cyber-Physical Systems(CPS), smart environments, Cloud-to-Edge continuum, and cooperative patterns to be applied to these technologies. He has co-authored 31 papers and has been involved in National and EU projects. He is a member of the team leading the design of Stack4Things, an OpenStack-based Sensing-and-Actuation-as-a-Service framework. He has co-authored 31 scientific papers in peer-reviewed journals and international conferences.

The school will take place at the Grand Hotel Ortigia, a historic residence of the late nineteenth century, completely renovated in 1995, that with its refinement without excesses has kept alive the charm of its origins, the architectural lines and the charm of its Art Nouveau style.

Ortigia Island: A Jewel of History and Beauty in the Heart of Sicily

Ortigia, also known as *Ortygia*, is a small island off the coast of Sicily, forming the historical center of the city of **Syracuse**. Despite its compact size, Ortigia is a treasure trove of history, mythology, and Mediterranean charm.

Historical Significance

Ortigia has been inhabited since ancient times, serving as the heart of **Greek Syracuse**, one of the most powerful cities of the ancient Mediterranean world. According to mythology, it is the place where the goddess **Artemis** turned the nymph **Arethusa** into a freshwater spring—*Fonte Aretusa*, still flowing today near the sea.

Throughout the centuries, Ortigia has been shaped by **Greeks, Romans, Byzantines, Arabs, Normans, and Spanish**, each leaving their architectural and cultural mark. The island's winding streets and baroque buildings reflect this rich tapestry.

Key historical sites include:

- **Temple of Apollo** – one of the oldest Doric temples in Sicily.
- **Cathedral of Syracuse (Duomo)** – built atop a Greek temple to Athena; it brilliantly blends pagan, Norman, and Baroque architecture.
- **Castello Maniace** – a 13th-century fortress offering panoramic sea views.

Aesthetic and Natural Beauty

Surrounded by turquoise waters and connected to the mainland by bridges, Ortigia enchants visitors with its **narrow cobbled streets, lively piazzas, elegant balconies, and romantic seafront promenades**. The island boasts a vibrant yet relaxed atmosphere, where golden-hued buildings reflect the warm Sicilian sun.

Charming cafes, artisan shops, and bustling local markets (like the famous **Ortigia Market**) add to its allure. At sunset, the light over the Ionian Sea casts a magical glow across the limestone buildings—it's a sight that captures the soul of Sicily.

The school is financed by ICAR CNR under the SoBigData PNRR project, prot. IR0000013 - Avviso n. 3264 del 28/12/2021

The school has the patrocinio of the University of Messina, and it is organized with the collaboration of the Smart cities & Communities Lab (CINI).

The school is sponsored by: STMicroelectronics, SmartMe.io.