

June 17-18, 2019, Università degli Studi di Firenze, Italy

The ns-3 Consortium is organizing ns-3 training at its June 2019 annual meeting in Florence, Italy, prior to the Workshop on ns-3. While extensive documentation is available on the public website¹ of the project, this two-day training session offers users the opportunity to learn from several of the maintainers of ns-3 about the scope and capabilities of the tools, how to run simulations, and how to write new code for ns-3.

Instructors

Sessions will be taught by several of ns-3's open source maintainers. The following are planning to lead sessions:

- **Zoraze Ali.** Zoraze, a research assistant at CTTC (Centre Tecnològic de Telecomunicacions de Catalunya) in Barcelona, received his MSc degree in Radio Communication from Blekinge Institute of Technology, Karlskrona Sweden. He is active in ns-3 LTE module with a current specialty in public safety-oriented LTE extensions.
- **Sebastien Deronne.** Sebastien has been the Wi-Fi maintainer in ns-3 since 2015, and works professionally as Wireless Expert at Televic Conference. Sebastien has been active with ns-3 for nine years.
- **Tom Henderson.** Tom is an ns-3 project founder and lead maintainer of the open source project, and has been active with ns-2 and ns-3 for twenty years, most recently through the University of Washington.
- **Tommaso Pecorella.** Tommaso, a professor at the University of Florence, has long participated in ns-3 development and maintenance, with particular interest in IPv6 and the internet module in general, and in models for wireless personal area network (WPAN).

Topics

The two days of training will be organized around the basic simulator on Monday and more advanced topics and extensions on Tuesday. We will reserve a portion each day for interactive Q&A and guidance from the instructors, allowing deeper treatment of topics of particular interest. The first day of training, a hands-on overview to ns-3, is significantly revised based on material developed for a recent graduate-level course at University of Washington, and not yet available as part of the online published tutorial. The first portion of Monday training will focus on **using ns-3**, while the second half will focus on **extending ns-3** for your own work. Tuesday training will cover specific technologies (Wi-Fi, LTE, IPv6 and 6LowPAN, TCP), again using new worked examples.

Monday June 17	Tuesday June 18
<ul style="list-style-type: none">• Using ns-3: Fundamental objects such as simulation time, events, and random numbers, and the ns-3 object system (type IDs, attributes, trace sources, config subsystem). Node, NetDevice, Channel, MobilityModel, PropagationModel, Packet, and Application classes. ns-3 configuration and ns-3 data output (tracing). Visualization and statistics. Monte Carlo techniques for simulation runtime selection. Scripting for parametric studies.• Extending ns-3: Topics will be explored using a simple-wireless simulation module. Design patterns used in ns-3. Controlling random variables. Creating new modules. ns-3 test framework. Documentation practices and code contributions.	<ul style="list-style-type: none">• Studying TCP performance in ns-3, including contemporary topics (DCTCP, RACK, BBR) and related models (ECN, QUIC, AQM).• A survey of the Wi-Fi models in ns-3, including model architecture for both MAC and PHY layers, network configurations for some typical use cases, and an overview of mobility and propagation models• The ns-3 LTE module, including model architecture, propagation models, LTE Radio Protocol Stack and EPC model, and Device-to-Device (D2D) models.• ns-3 and IoT models, including 6LoWPAN/LR-WPAN and LoRaWAN.

¹ <http://www.nsnam.org>

Prerequisites

Basic proficiency in C++ programming and in working at the Unix command-line is considered a prerequisite for working with ns-3. A basic understanding of computer networking protocols and technology such as TCP/IP, and wireless and wired models (e.g. Ethernet, Wi-Fi, and LTE) is also assumed. Python or bash programming skills may also be helpful but are not required.

Schedule

Training will run from 09h00-18h00 on Monday and Tuesday (a combination of 90 and 120 minute sessions), with a morning and afternoon coffee/tea break and a lunch break. ns-3 training covers the first two days of a week-long event schedule, and attendees are welcome to attend other events later in the week. On Wednesday, the 11th annual Workshop on ns-3, in cooperation with the ACM, will be held; this single-track workshop will feature original research papers regarding the design and performance of ns-3 software. Thursday is reserved for the annual meeting of the [ns-3 Consortium](#) and for development activities (coding sprints). On Friday, a new [Workshop on Next-Generation Wireless with ns-3](#) will be held, to discuss and coordinate progress on implementing next-generation IEEE (802.11ax, 802.11ay) and 3GPP (NR, mmWave).

Materials

The training will be conducted with a mix of Linux and OS X (depending on speaker preference).

A bootable Live-CD for an Intel x86 architecture, with ns-3 and related software pre-installed, will be provided. This can be run inside a virtual machine or native on x86-compatible laptops. However, attendees are encouraged to download and build ns-3 on their machine of choice prior to the workshop, and to review the online tutorial.

All other materials will be provided via the Internet. Guest WiFi access will be available to attendees.

Registration

Registration must be made with a credit card at: <https://washington.irisregistration.com/Form/NS-3>. Registration must be paid in full prior to attending the first session. To allow for proper planning, all attendees are requested to register by one week prior to the event, or to contact the organizers if within the one-week window.

All proceeds, after meeting costs are covered, will be deposited to the NS-3 Consortium gift account at the University of Washington, to support the open source project activities.

Local Information

WNS3 and the associated events will take place at [Università degli Studi di Firenze, Italy](#). Local information, including links to accommodations and information about getting to the meeting site, is available at this [local information page](#). Contact the meeting general chair, Prof. Tommaso Pecorella, with any logistical questions or concerns.

Meals

Coffee/tea service (morning and afternoon) and a lunch will be provided to attendees.