Intel® Connectivity Academy Online

Course Prospectus

Intel Connectivity Academy is proud to announce ICA-Online – a collection of multiple one-day online course modules that cover a range of topics from introduction to basic concepts of data plane programmability all the way to advanced P4 programming techniques.

These hands-on course modules allow you to receive world-class instructor-led training at your own pace and in the convenience of your own home or office. The course modules can be taken either individually or as conveniently organized bundles. The latter will help to ensure that you have taken the necessary pre-requisite course modules and pick up the right set of modules to achieve your own educational goals.

Course Goals

The overall goals for all the courses are to provide robust, hands-on introduction to the relevant subject at the appropriate level of detail and difficulty that will allow the students to start or continue their development process. The courses are designed to complement, rather than replace the official documentation.

The relevant concepts are introduced and explained first and followed by carefully designed examples. The material is further reinforced through the specifically designed labs of various difficulty. To ensure the successful completion of labs, a preconfigured virtual machine and a dedicated online support channel is provided.

What is included?

Course Module tuition includes:

1. A ticket to the online, interactive instructor-led lecture. Most lectures last for up to 3 hours with one or two short breaks
2. Lecture materials and lab guides in PDF format with lifetime updates
3. Two or five consecutive days of lab time on a preconfigured, cloud-based virtual machine (except for the preparatory-level modules)
4. Dedicated online support for the labs

Course Catalog

Course Module Nomenclature

All online course modules use the 4-digit numbering (ICA-***CLTM***) that is organized as follows:

C – The first digit of the course number indicates that this is an online course

- 0 – Reserved for in-person training
- 1 – Online course module
- 2..9 – Recommended course bundles, where the first digit indicates the number of course modules in the bundle
- LVL – this is a special prefix, reserved for full courses

L – The second digit indicates course module level:

- 0 – Preparatory
- 1 – Level 1
- 2 – Level 2

T – The third digit indicates a course module theme (subject)

- 0 – Subject introduction
- 1 – Mandatory pre-requisite course
- 2 – Data Plane Programming in P4
- 3 – Intel® P4 Studio SDE, Drivers and APIs
- 4 – ASIC Architecture

M – The fourth digit indicates a specific module within a given theme

For the bundles, the last two digits (***T*** and ***M***) are combined to form the bundle number

Examples:

ICA-1121: "P4 programming: Multicast and L2 Switching"

1 – Online Course Module
1 – Level 1
2 – Data Plane Programming in P4
1 – Module number (Multicast and L2 Switching)

ICA-3101: "Quick introduction to $P4_{16}$/TNA, Intel® P4 Studio SDE and Intel® Tofino™

3 – Short (3-Course) Bundle
1 – Level 1
01 – Bundle number. The specific content of each bundle is described below.

ICA-LVL1: Full Level-1 Course

Course Module List (subject to further revisions)

Please, see individual course module prospectuses for the detailed description of each of the module.

Preparatory-level Course Modules (planned)

- ICA-1001: Introduction to Data Plane Programmability

Level 1 Course Modules (ICA-LVL1)

- ICA-1111: Introduction to P4 and Intel® P4 Studio workflow. The very first program
- ICA-1112: Advanced parsing and checksums in P4. L3 Switching and Access Control Lists
- ICA-1113: Counters, meters and registers. Non-standard IPv4 processing
- ICA-1121: Multicast, LAG and ECMP
- ICA-1122: Mirroring, Resubmit and Recirculation
- ICA-1123: Simple L2 Data Plane Project
- ICA-1131: Introduction to Intel® P4 Studio. Building and using Intel® P4 Studio
- ICA-1132: Intel® Switch Runtime Interface and Packet Test Framework
- ICA-1141: Introduction to Intel® Tofino™ and Tofino2 ASIC Architecture
- ICA-1142: Optimizing for and Debugging P4 Programs on Intel® Tofino™

Level 2 Course Modules (ICA-LVL2) (planned)

- ICA-1221: Stateful Processing in Intel® Tofino™
- ICA-1222: Intel® Tofino™ Packet Generators
- ICA-1223: Non-Linear Computations on Intel® Tofino™
- ICA-1231: Packet DMA
- ICA-1232: Intel® Switch Runtime protocol
- ICA-1241: Intel® Tofino™ specific P4 optimizations and program fitting

Course Bundles

Course bundles are recommended groups of course modules that provide comprehensive training targeting the needs of different audiences. They also come with a nice discount making the price of a bundle lower than the price of the equivalent number of individual courses.

- **ICA-3101**: Quick Introduction to $P4_{16}$/TNA, Intel® P4 Studio SDE and Intel® Tofino™ ASIC
  This is an excellent, well-rounded course for engineers and architects, who want to sample everything without delving into too many details
  - ICA-1111, ICA-1131, ICA-1141

- **ICA-3102**: Comprehensive Introduction to P4$_{16}$/TNA
  This is a full set of pre-requisite modules that prepare a data plane designer to take more specialized P4 course modules.
  - ICA-1111, ICA-1112, ICA-1113
- **ICA-5101**: (*ICA Level 1A*) Comprehensive introduction to P4$_{16}$/TNA, Intel® P4 Studio SDE and Intel® Tofino™ ASIC
  This is an excellent set of course modules that fully prepares a student for learning more advanced data plane programming concepts, while providing a broader view of the control plane interfaces and the ASIC architecture, It is a great choice for those who can't decide between ICA-3101 and ICA-3102, since it combines both in a convenient package.
  - ICA-1111, ICA-1112, ICA-1113, ICA-1131, ICA-1141
- **ICA-5102:** (*ICA Level 1B*) Become a P4 master
  This course bundle is intended for serious data and control plane designers who completed ICA-5101(Level 1A), but would like to learn how to write more complex programs using such capabilities and multicast, traffic distribution over LAG or ECMP, mirroring, resubmit and more as well as start developing production-grade code using Intel® Switch Runtime Interface.
  - ICA-1121, ICA-1122, ICA-1123, ICA-1132, ICA-1142
- **ICA-LVL1**: Intel® Connectivity Academy Level 1 Diploma
  This course bundle covers everything an engineer needs to become a competent, well-rounded data and control plane developer. This course satisfies the training requirement of the *Intel® Connectivity Research Program* and thus is recommended for all academic and research organizations.
  - All ICA-11xx modules

You can always create your own course bundles and even combine course modules from different levels. Please, consult Intel® Connectivity Academy staff to ensure that you have all the pre-requisites, especially if you plan to take advanced courses.

Pre-requisites

- General understanding of network and telecommunications architecture and protocols. For non-engineers we highly recommend taking ICA-1001 first
- Knowledge of C and C++ languages
- Knowledge of Python language
- Experience in data or control plane design is extremely helpful
- Good and reliable Internet access for both online lectures and VM access is a must

Schedule

All individual course modules consist of a 3-hour online lecture with one or two short breaks. We recommend spending at least the next several hours doing the assigned labs. Class dates and times will be announced ahead of time and are subject to the specific demand.

How to Apply

The up-to-date training calendar with the registration links can be found on Intel Connectivity Academy Support Portal. Currently this portal is separate from Intel.com and requires a separate account.

If you represent a commercial customer:

- If you do have an account on the Resource and Design Center:
  - Fill in this form to request an Intel Connectivity Academy account
- If you do not have an account on the Resource and Design Center:
  - Please contact your Intel Sales Representative or reach out to barefootsales@intel.com to request one

If you represent an academic or a research institution:

- If you do have an account on the Resource and Design Center:
  - You should already have an account. If you forgot your password, you can always request password reset
- If you do not have an account on the Resource and Design Center:
  - Please visit the Intel® Connectivity Research Program page for more information on how to apply.
  - If your institution is not a member of Intel® Connectivity Research Program, membership is free, you get access to a lot of information and will join a thriving community of fellow researchers all over the world.

If you represent a governmental organization, reach out to barefootsales@intel.com

Logistics

An event-specific link to ticket purchase site will be provided on Intel® Connectivity Academy Calendar page accessible in the Resource and Design Center.

To attend an online presentation, you will need to create a **free Zoom account, associated with your work email address**. Upon the registration, you will receive a link to the online event. You will also receive an invitation to establish a Slack account for lab support, also **associated with your work email address**.

A high-speed internet connection is required to attend the online presentation. Call-in numbers for higher voice quality might be provided, depending on the region. Please, connect to the online meeting 15 minutes before the start to work out all potential connection problems.

All necessary materials, including the presentation PDFs and lab exercises will be available through the Resource and Design Center a day before the start of the class. We highly recommend that you print the presentation PDFs and use them to take notes. Alternatively, these presentations can be loaded on a tablet, where the notes can be taken with an electronic pen.

The information about the lab Virtual Machines will be provided at the end of the lecture. VMs will be kept running for the next two or five days, depending on the ticket type. This time can be extended through a separate arrangement.

Important Notes

Intel® P4 Studio SDE is a software product, developed independently from the software, available via p4.org. Some components of the SDE were contributed by Intel to p4.org, others rely on the code from p4.org, but the goals of the projects, the tools, and the workflows are different. P4.org software is a community-supported project with many resources freely available. This class covers Intel® P4 Studio SDE and not p4.org software. Specifically, not covered are the Behavioral Model (BMv2), v1model and PSA $P4_{16}$ architectures and neither is P4Runtime protocol.

$P4_{16}$ compiler for Intel® Tofino™ and Intel® Switch Runtime Interface APIs are in active development as is the course module material. While Intel® Connectivity Academy team strives to introduce Intel customers to the leading-edge software, bugs, errors and omissions may occur. The later versions of these course modules might significantly differ from the early ones.

The course module material covers both Tofino and Tofino2 devices. Relevant enhancements and differences are emphasized and discussed whenever applicable.

The availability of each course module is announced separately. Please, visit Intel® Connectivity Academy website for more information.

The online presentations may be recorded and may be published, in whole or in part, in various media, including print, audio and video formats without further notice. If you do not want to participate, you may choose to either keep your audio and video connections muted or turned off or leave the call. By choosing to remain, you are consenting to the recording of the session.

Contact

For more information, please contact connectivity.academy@intel.com.