



BAREFOOT ACADEMY

BA-101

Introduction to Data Plane Development with Tofino™ and Capilano™ SDE

Course Prospectus

BA-101 is an intensive 4-day course that provides a robust introduction to data plane programming in P4, Tofino™ device architecture and Capilano™ Software Development Environment (SDE), including Barefoot APIs and development workflows.

Course Goals

Upon the completion of the course, the students will have gained the following skills:

1. P4_14 Language fluency, allowing them to program in P4_14 as well as being able to read and understand P4 code written by others
2. Understanding of basic data plane development approaches and ability to design fully-functional data plane programs
3. Understanding of the architecture of the Tofino™ programmable pipeline and its main resources as it pertains to efficient data plane program development. This includes the ability to make informed choices about various P4_14 coding styles and practices
4. Understanding of the main fixed function Tofino components, such as MACs, SerDes, and Packet Replication Engine (PRE) and related APIs necessary for both data and control plane development
5. Detailed understanding of Capilano™ SDE components, APIs and tools as well as practical skills in using them for data and control plane development

The course includes both lectures and extensive hands-on labs, conducted in the virtual simulation environment.

Target Audience

This course is most suitable for designers and architects, tasked with design and development of data plane and control plane programs for modern networking equipment.

Pre-requisites

- General understanding of network and telecommunications architecture and protocols
- Knowledge of C language, especially as it relates to embedded and NOS development
- Basic understanding of Python

Sample Day Schedule

All 4 days of training follow this general schedule:

07:45AM – 08:00AM: Arrival, Registration and Breakfast

08:00AM – 11:00AM: Lecture

11:00AM – 12:30PM: Lab

12:30PM – 01:30PM: Lunch (Labs can be continued)

01:30PM – 04:00PM: Lecture

04:00PM – 06:00PM: Lab (Afternoon snack at 4pm)

Curriculum

The following topics will be covered during the course. Theoretical material will be reinforced through the labs. Notice that the material is interleaved and therefore the list below does not represent the actual schedule.

- Introduction to P4 Language
 - Programmable pipeline model
 - Basic Language constructs
 - Automatic API generation
 - P4 development tools
- Introduction to Tofino™
 - Tofino device architecture
 - P4 programming on Tofino
 - Tofino-specific pipeline components and P4 extensions
 - Tofino-specific optimizations and P4 programming approaches
 - P4 debugging on Tofino
 - Fixed function components and their interfaces
- Introduction to Capilano™ SDE
 - SDE components, development and deployment workflows
 - Program-Dependent (PD) APIs
 - Barefoot APIs
 - Port, SerDes, Multicast, Packet DMA, Mirroring
 - SDE initialization and High-Availability approaches
 - Port Management and Link troubleshooting
- The Art of Data Plane Development
 - Unicast Forwarding
 - Multicast and Broadcast

- Learning and Aging
- Statistics
- ACLs
- Link aggregation
- Metering and QoS
- Interfacing with the control plane
- Tunneling and header manipulation

Important Notes

BA-101 is an introductory course, designed to cover a variety of material, therefore allowing the students to jumpstart their development. For in-depth exploration of the selected topics, please ask about our upcoming “Level 2” classes and video training modules.

In-depth coverage of the “switch” package (switch.p4, switchAPI and switchSAI) is a subject of a separate course. However, taking BA-101 will allow students to easily read, understand, and modify switch.p4 and related APIs. Excerpts from switch.p4 will be discussed and used as examples throughout the course.

Barefoot Capilano™ SDE is a software product, developed independently from the software, available via p4.org. Some components of the SDE were contributed by Barefoot to p4.org, but the goals of the projects, the main tools, and the workflows are different. p4.org software is a community-supported project with many resources freely available. This class covers SDE and not p4.org software.

The current production version of P4 compiler for Tofino accepts programs written in P4_14 with Barefoot-specific extensions and generates Program-Dependent (PD) APIs for them. Therefore, the class focuses on P4_14 language and PD APIs and not P4_16 language. The class labs also allow the users to use the newer compiler (bf-p4c) to compile P4_14 code.

Logistics

Public classes are conducted at Barefoot Networks’ training facility at 4750 Patrick Henry Drive, Santa Clara, CA, 95054. Registration can be completed online ahead of time. Registration fee includes quality printed materials, breakfast, lunch and afternoon snack for all days.

All students are expected to bring a laptop for the labs. No special software is required.

Contact

For more information, please contact academy@barefootnetworks.com.