Beginner Track Agenda (morning session)

- **8:00 - 8:30am**
  - *Registration and Breakfast*

- **8:30 - 9:00am**
  - Technical Set-up for Hands-on Lab
  - In order to complete the Developer Day exercises, we will distribute a virtual machine with all required software installed.

- **9:00 - 9:10am**
  - Welcome and Introductions
    - Speaker: Nate Foster (Cornell University)

- **9:10 - 10:30am (80 min)**
  - Tutorial overview: Introduction to Data Plane Programming
  - Session 1: Language Basics

    - This session will provide a hand-on introduction to P4. Students will start by   implementing a "Hello World"-style application to gain an understanding of P4 concepts. The lesson will progressively introduce core language features, such as header/metadata types, packet parsers, and controls. By the end of this session, students will be able to implement a basic IP router.

- **10:30 - 11:00am**
  - *Break*

- **11:00 - 12:30 (90 min)**
  - Session 2: P4 Runtime

    - In this session students will learn about software tools that are essential to developing P4 applications. Instructors will show how to invoke the the P4 compiler, run the debugger, and start a P4 software switch. This session will also introduce the control-plane interfaces via P4 Runtime, a protocol-independent API auto-generated from the definition of a packet processing pipeline written in P4.

- **12:30 - 1:30pm**
  - *Lunch*

Beginner Track Agenda (afternoon session)

- **1:30 - 1:50pm**
    - P4 Showcase: "Coherence and Consensus in P4"
        - *Speaker*: Dejan Vucinic, Western Digital Corporation

            Abstract: Programmable data plane introduces a new era of rapid innovation and transformation of data storage at scale. What used to require servers and software can now be done in switches--four orders of magnitude faster! At Western Digital Research we are exploring embedded uses of P4 switches and their impact on the Big Data ecosystem. We will showcase our Consensus protocol implementation in P4, enabling wearout-tolerant non-volatile main memory scaleout, as well as OmniXtend, a new open-standard coherence protocol enabling independent scaling of purpose-built compute, memory and storage using off-the-shelf P4 switches.

- **1:50 - 2:10pm**
    - P4 Showcase: "High Performance User Plane Function (UPF) for 4G/5G Networks with P4"
        - *Speaker*: Michel Gemieux, Kaloom

            Abstract: Presenting Kaloom Cloud Edge Fabric™, an optimized solution for edge data centers running 4G and 5G applications. Providing an embedded Hyperscale 5G UPF capable of sustaining terabits of data, traffic throughput with extremely low latency.

- **2:10-3:10 (60 min)**
    - Session 3: Monitoring and Debugging
        - This session will focus on a set of labs related to network monitoring and debugging. In this session, students will gain a deeper understanding of P4 language concepts, including custom headers and intrinsic metadata. In the first exercise, students will implement Explicit Congestion Notification (ECN) to set a congestion bit in a packet header when the queue depth exceeds a threshold. In the second exercise, MRI, students will implement a simplified version of In-Band Network Telemetry to track the path that packets travel through the network.

- **3:10 - 3:40pm**
    - *Break*

- **3:40 - 4:40pm (60 min)**
    - Session 4: Advanced Data Structures
        - In the final session, we will cover advanced data structures. Students will implement two data-plane applications. In the first, source routing, end-hosts specify paths through the network by using a stack of labels in the packet header. The switch must "pop" each label and forward out the appropriate interface. In the second, students will implement a network calculator. Packets containing arithmetic expressions are sent to a switch.

The switch will evaluate the expressions, and return the results back to the sender.

- **4:40 - 5:00pm**
  - P4 Showcase: "Leveraging P4 for Automated Switch Validation"
    - *Speaker*: Konstantin Weitz, Google

      Abstract: Network switches are complex devices that are currently being validated with hand crafted tests. As we move to a world with more heterogeneous switches and more stringent availability requirements, this manual approach to testing does not work anymore. In this talk, we'll show how we can automatically generate tests for our switches (thus reducing the manual test effort and increasing our test coverage) using the formal semantics of our switches developed in the P4 language, and techniques like SAT solving and fuzz testing.

- **5:00 - 5:20pm**
  - P4 Showcase: "P4 and Programmable Dataplane Use-cases in Enterprises, Telcos and MSDCs"
    - *Speaker*: Chang Kim, Barefoot Networks

      Abstract: There are hundreds, if not thousands, of professional P4 developers working in various companies. In this talk I'll try to share roughly what kinds of products they're developing and for what types of markets.

- **5:20 - 5:30pm**
  - Wrap up

- **5:30-6:30**
  - *Reception*