P4 Workshop
Welcome

Nate Foster
Cornell University
"Our whole networking industry stands to benefit from a language like P4 that unambiguously specifies forwarding behavior, with dividends paid in software developer productivity, hardware interoperability, and furthering of open systems and customer choice."

— Tom Edsall, Cisco
State of P4

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Industry Momentum

- Diverse collection of P4-enabled targets
- Growing number of P4-based products
- Real-world deployments
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- Research papers at top conferences
- New courses at leading universities
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**Open Source Community**
- Vibrant technical working groups
- Powerful set of P4 tools
Agenda

Overview
• Recent progress
• Future roadmap

Working Group Updates
• Language Design
• Architectures
• APIs
• Applications

Presentation Track
• 11 accepted talks + 1 keynote
• 20 minutes each

Demo Track
• 14 accepted demos
• 1 minute lightning talks + live demos (at other end of building)
P4 Perspective (ca. 2014)
Diverse Targets

- FPGAs + Smart NICs
- Programmable ASICs
- Fixed-Function ASICs
- Software Switches
Diverse Targets

Portable Switch Architecture

- FPGAs + Smart NICs
- Programmable ASICs
- Fixed-Function ASICs
- Software Switches
Complex Control-Planes
Complex Control-Planes

NEW

P4 Runtime

L2
L3
ACL
Rich Applications

[Diagram showing components and connections related to Rich Applications]
Rich Applications

In-Band Network Telemetry

NEW

P4

L2
L3
ACL
Language Design Working Group
Language Design Working Group

**Last year:** Released P4$_{16}$ v1.0.0
- A major update to the language:
  - Target-architecture separation
  - Static types
  - Higher-level programming constructs
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**This year:** Releasing P4\textsubscript{16} v1.1.0
- Backwards-compatible changes to improve usability
- Top-level functions
- Optional and named parameters
- Type definitions
- Enum representations
- Parser value sets
- Saturating arithmetic
- Structured annotations
Ergonomic Improvements

Top-Level Functions

```c
bit<32> max(in bit<32> left, in bit<32> right) {
    if (left > right)
        return left;
    return right;
}
```

Named Parameters

```c
extern void f(in bit<32> x, out bit<16> y);
bit<32> xa = 0;
bit<16> ya = 1;
f(xa, ya); //by position
f(x = xa, y = ya); //by name
f(y = ya, x = xa); //by name
```

Enum Representations

```c
enum bit<8> E {
    e1 = 0,
    e2 = 1,
    e3 = 2
}
```
Roadmap

Modularity
• Construct complex programs by out of simpler pieces of P4 code
• Design tools for separately compiling and linking programs
• Develop constructs for controlling names, imports, exports, etc.

Semantics
• Precisely define the packet-processing behavior of every program
• Build reference implementations that can be used for testing and validation
• Use semantics to guide design of future language extensions
LDWG Co-Chairs

Gordon Brebner
Xilinx

Mihai Budiu
VMware
P4 Distinguished Service Award

Citation: For dedicated service to the P4 community as co-chair of the Language Design Working Group.

As one of the stewards of the P4 language, Gordon has provided essential leadership and guidance through the early years of the development of the language. He has been a tireless advocate for the elegant and yet pragmatic design that can be seen in many of the language's features. At Xilinx, Gordon also led development of a P4-enabled target, building on his decades of expertise implementing efficient packet-processing engines using FPGAs.

Gordon Brebner
Xilinx
Education Working Group

**Charter:** The purpose of this working group is to promote the education of P4 programmers. Its main tasks will include the hosting and curating of shared community resources; the development of instructional materials; and the organization of educational events.

**Co-Chairs**

Robert Soule  
Lugano

Noa Zilberman  
Cambridge

P4 EU Workshop @ ICNP '18
P4 Tutorial @ SIGCOMM '18
Get Involved

Become a member of P4.org
• No fee + simple membership agreement
• Code and data under Apache2 License

Participate in working groups
• Activities are open to all members
• Anyone with a good idea can help shape the future of P4

Contribute to Open-Source Software
• Compiler (p4c)
• Software switch (bmv2)
• Control-plane APIs (P4Runtime)
• Tutorials
• Documentation
• Standard applications (PSA, INT)
• New applications
Thank You

Program Committee
- Andy Fingerhut, Cisco (chair)
- Mina Arashloo, Princeton
- Sujata Banerjee, VMware
- Tom Rodeheffer, Google
- Cole Schlesinger, Barefoot
- Anirudh Sivaraman, NYU
- Noa Zilberman, Cambridge

Conference Organization
- Sedef Ozcana, P4.org
- Rachel Everman, Barefoot
- Prem Jonnalagadda, Barefoot

P4.org Board
- Jennifer Rexford, Princeton
- Amin Vadhat, Google
- Nick McKeown, Stanford

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