

Blueswitch: Enabling Provably Consistent Configuration of Network Switches

Multi-Service Networks Workshop

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Jong Hun Han

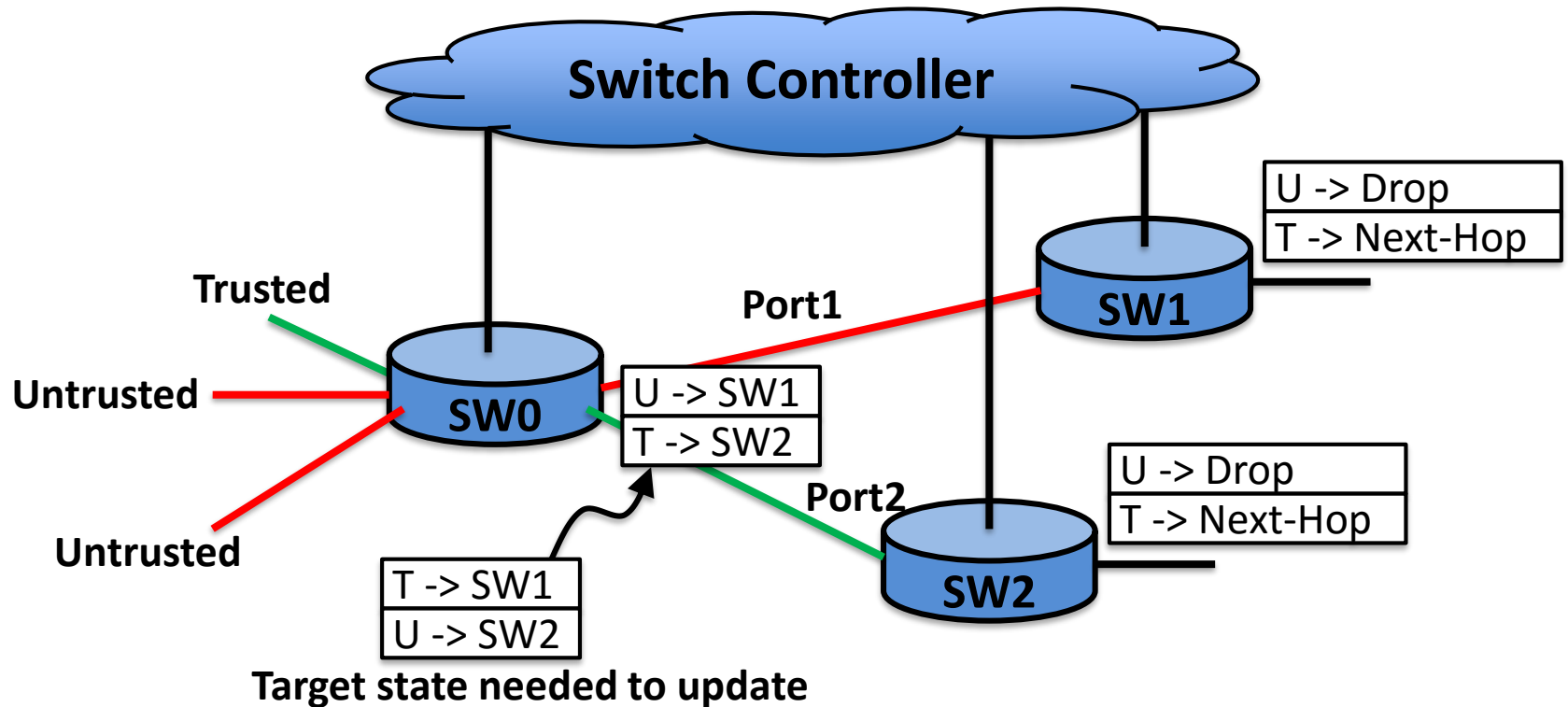
Jong Hun Han, Prashanth Mundkur, Charalampos Rotsos, Gianni Antichi, Nirav Dave, Andrew W. Moore, Peter G. Neumann, Blueswitch: Enabling Provably Consistent Configuration of Network Switches, ANCS 2015

Introduction

- *Configuration changes can be a source of instability in networks, leading to broken connectivity, forwarding loops, etc*
- *Most research works for consistent updates in SDN focus on solutions for centralized network-configuration controllers*
- *A controller cannot guarantee consistent rule updates in switches*
- *A switch installs rules sent from a controller, affecting data-plane configuration*
- *Blueswitch - A prototype OF switch with double-TCAM on NetFPGA-SUME platform for atomic rule updates*
- *Demonstrate packet-consistent configuration in rule remove and insertion*

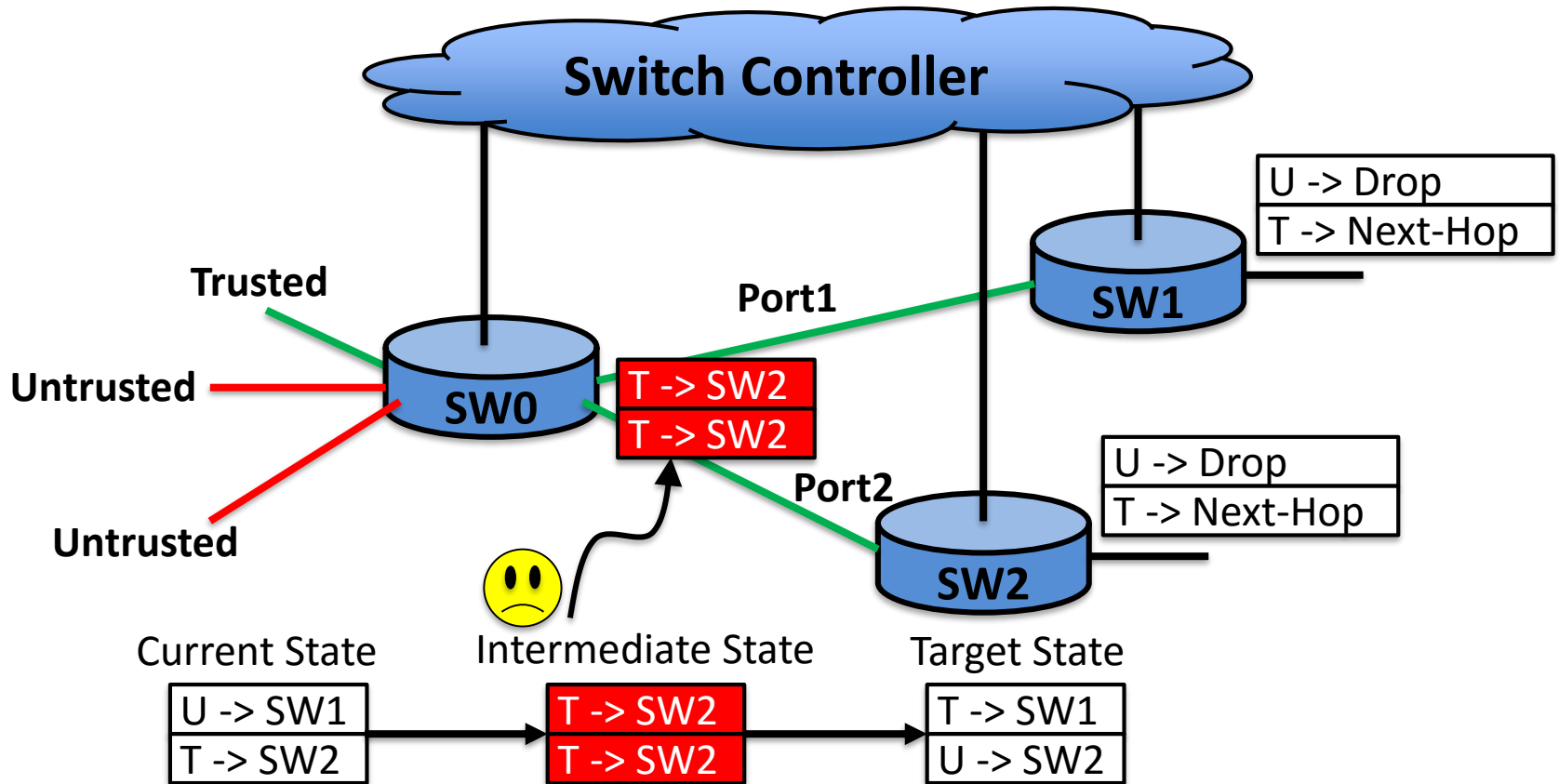
Motivation

- Consistent policy update affects security in SDN.



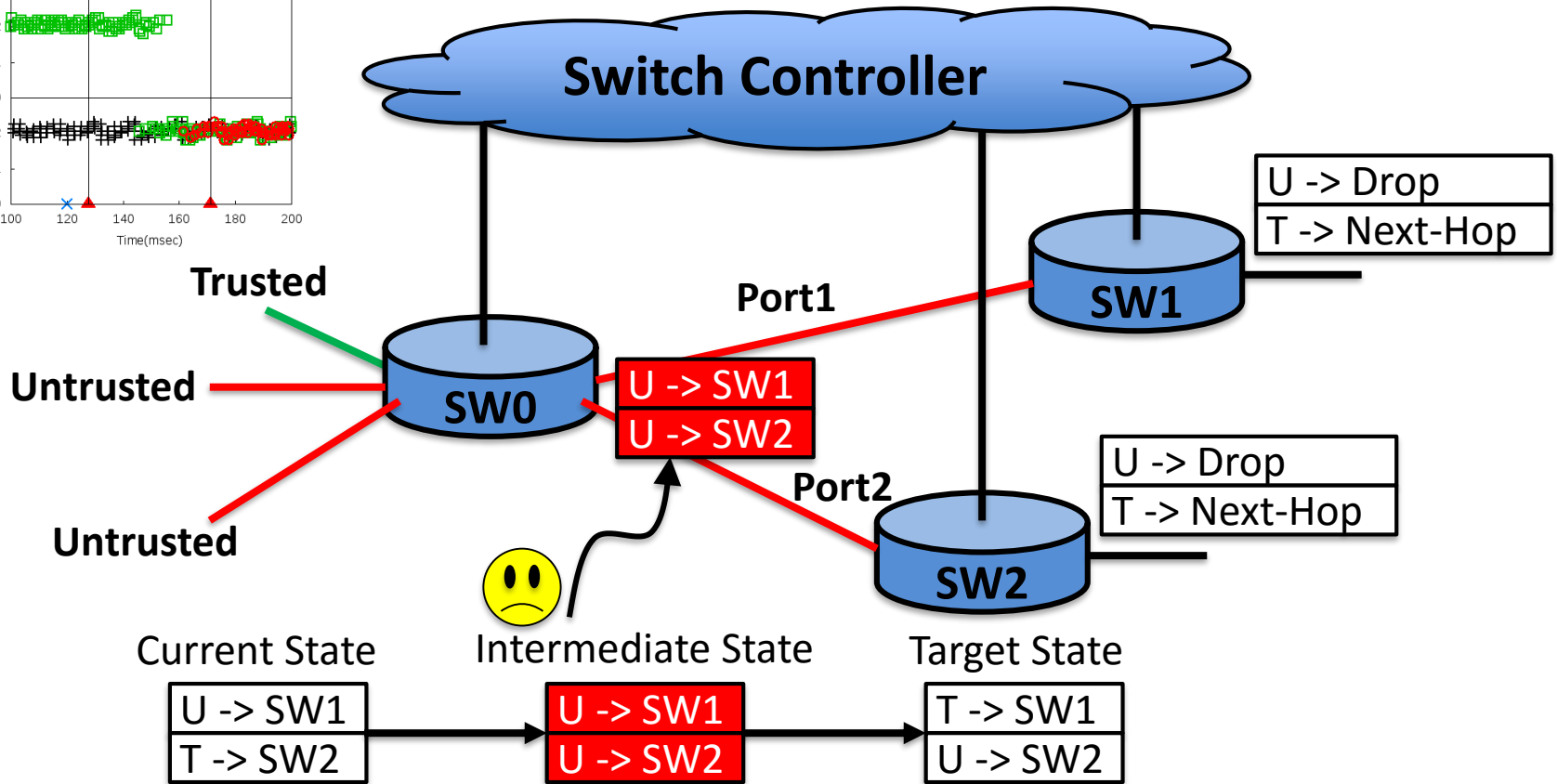
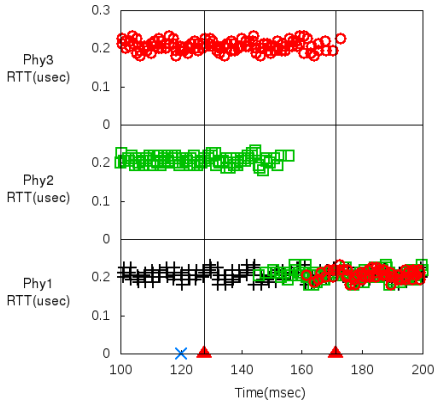
Motivation

- *Non-Atomic Rule Update I – Update per Rule*
- *Only one rule can be updated in every access*



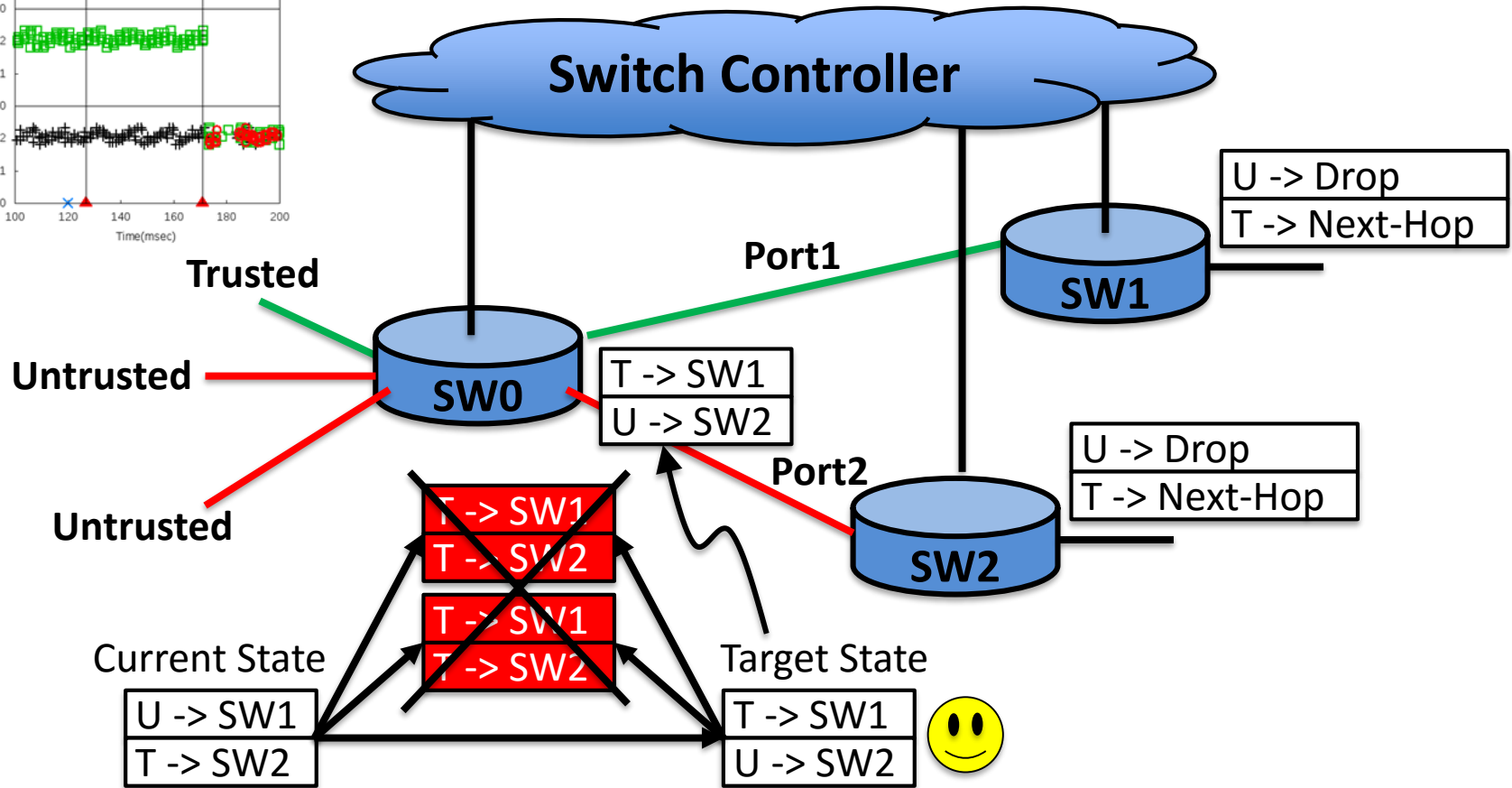
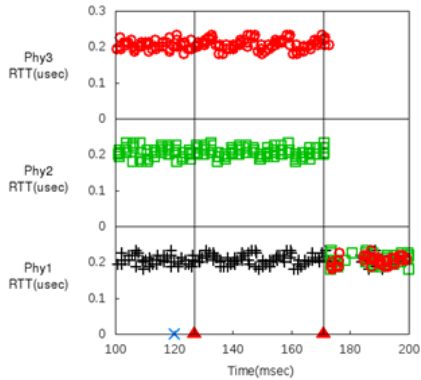
Motivation

- *Non-Atomic Rule Update I – Update per Rule*



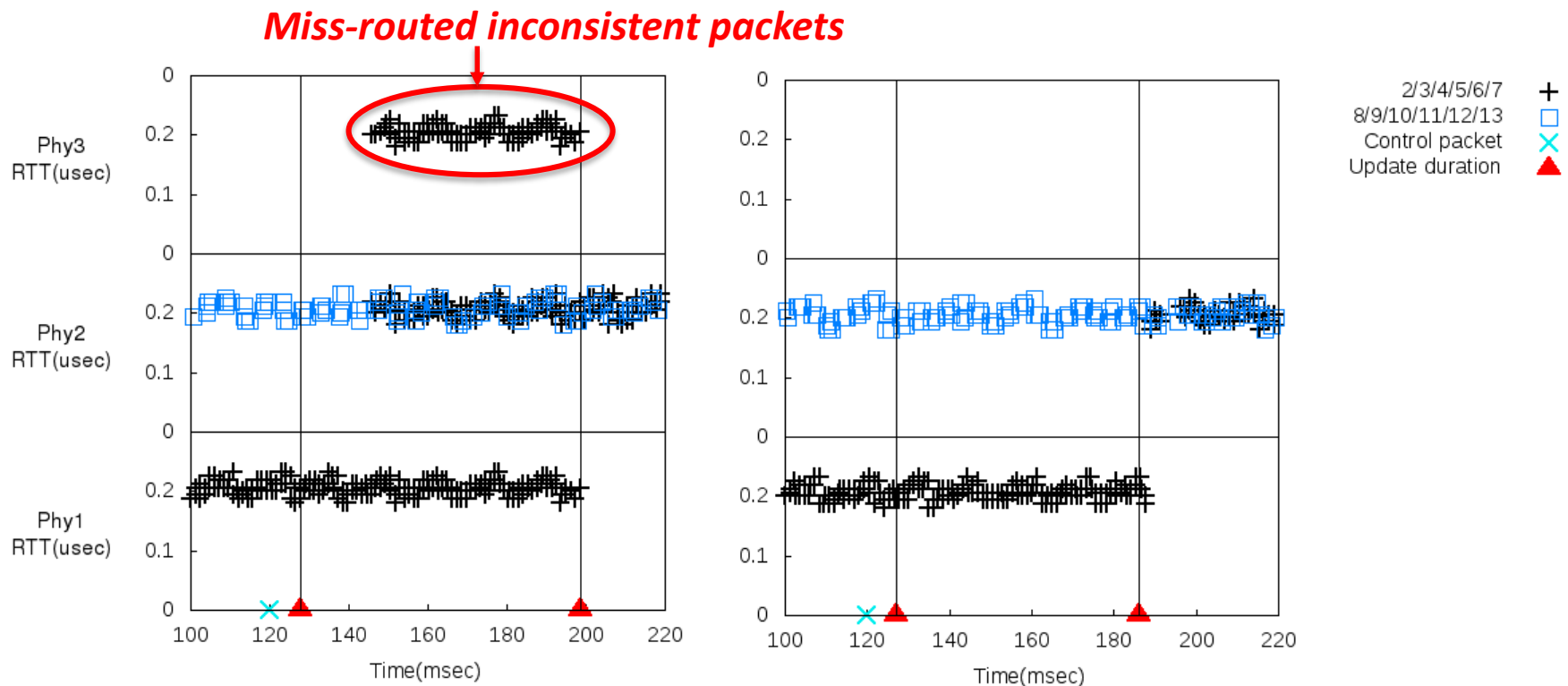
Motivation

- Atomic Update – Update All Rules with double-table



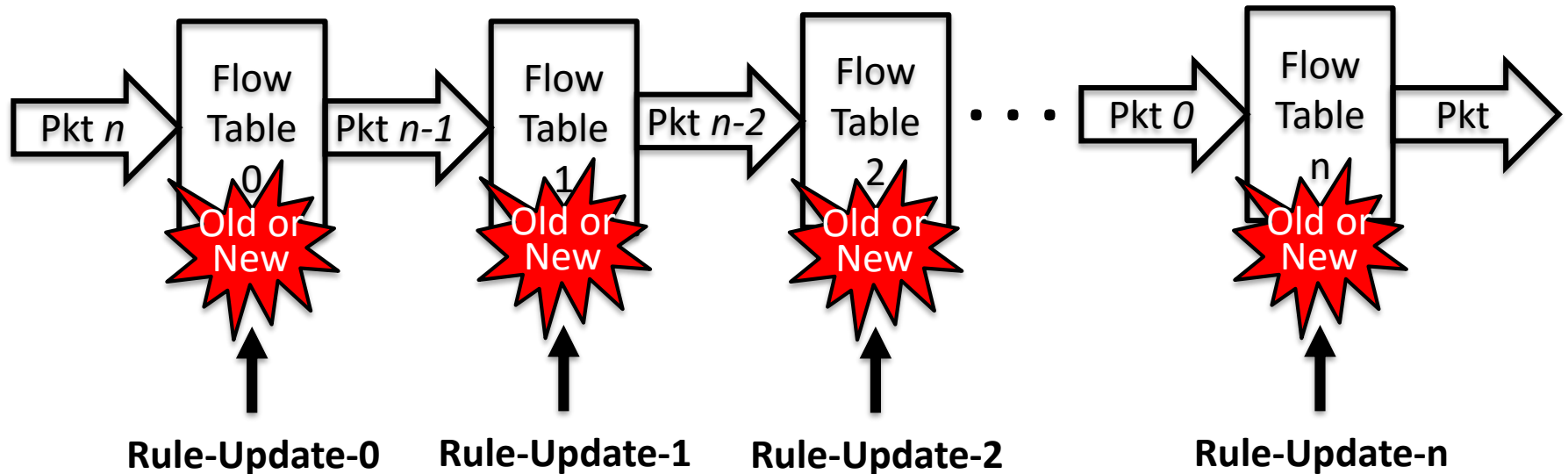
Comparison of Rule Updates

- *Comparison of rule remove and insertion results of inconsistent and consistent flow tables*
- *Miss-routed packets appearing can cause security problems*



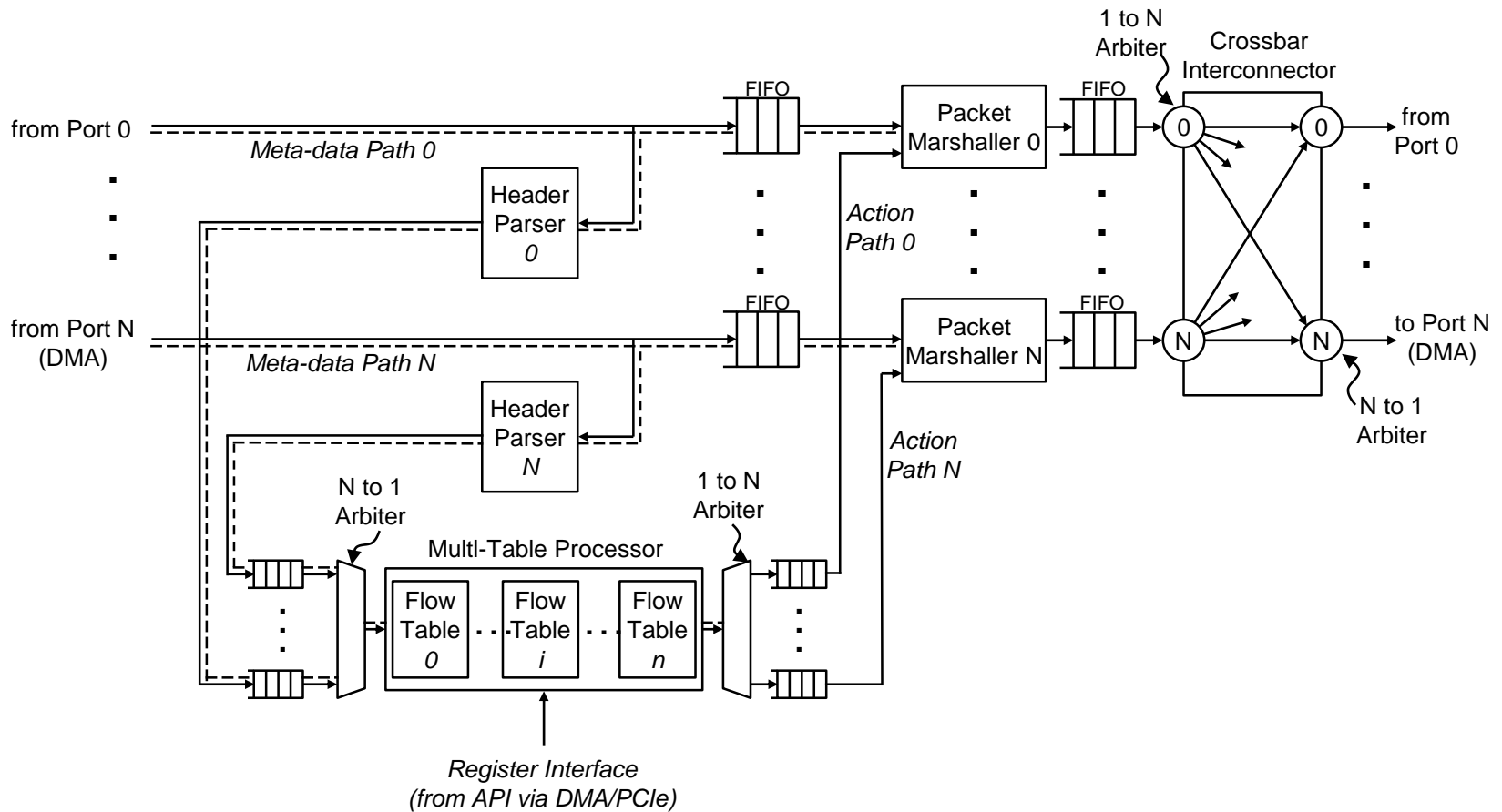
Multi-Table OF Switch Structure

- *Multi-table structure adopted from Openflow switch specification 1.1*
- *Non-Atomicity Multi-Table Structures are vulnerable in consistent rule update*



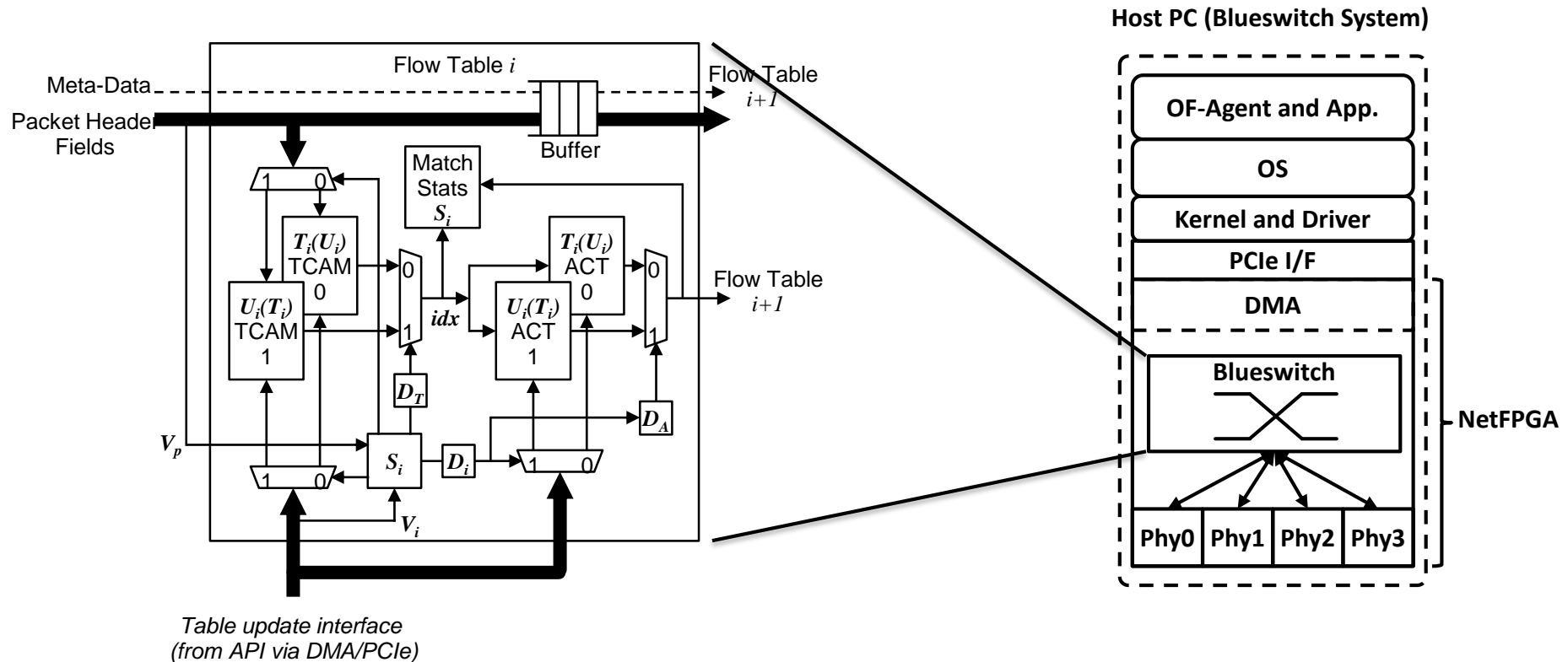
Blueswitch Architecture

■ *Blueswitch Data and Control Path Core Architecture*



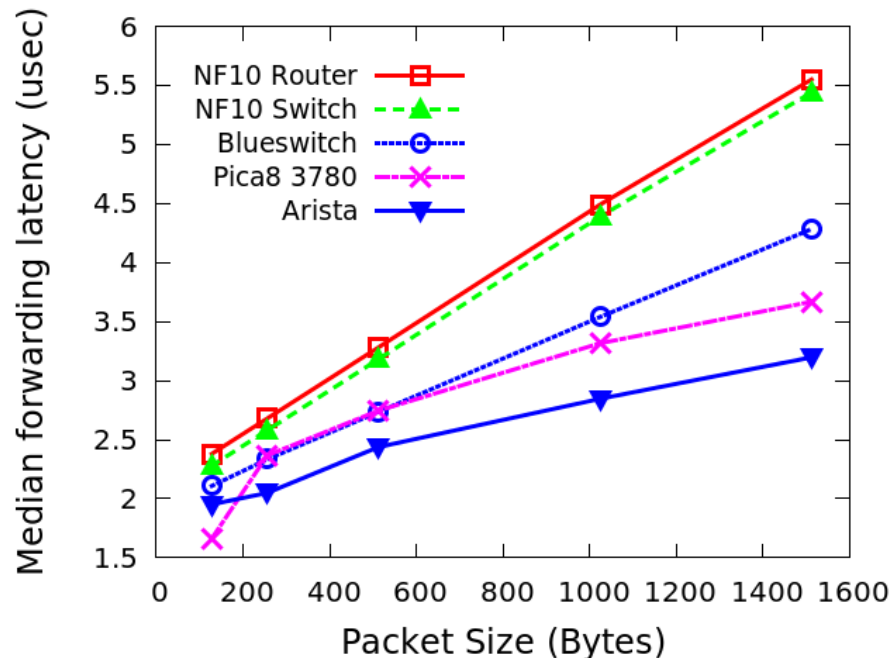
Blueswitch Architecture

- *Double-buffer TCAM flow table structure*
- *Blueswitch implementation on NetFPGA-SUME*



Performance Results

- *Latency of the switch measured RTT by OSNT packet generator and monitor*
- *Comparison between blueswitch, commodity switches and NF10 Router and Switch*



Future Works

- *Developing OF-Agent for communication with OF controller, running on top of the switch*
- *Extending more flow-table – OF switch specification 1.5 requires 14 fields and can support up to 45 fields*

Q & A

- *Blueswitch is available from NetFPGA-SUME-live github.*

The image displays a screenshot of a GitHub repository page for `NetFPGA / NetFPGA-SUME-live`, which is marked as `PRIVATE`. The repository has 38 Unwatch actions, 9 Stars, and 20 Forks. The current branch is `master`, and the selected path is `NetFPGA-SUME-live / contrib-projects / blueswitch /`. A commit by Jong Han is shown with the message "Add the header to the file." and the latest commit hash `f6b4e3a` on May 20. The file list includes:

- `hw`: Upload the blueswitch contrib project. (2 months ago)
- `sim`: Add the header to the file.
- `sw`: Update the test scripts for hw, sw.
- `test`: Add the header in the files.
- `Makefile`: Add Makefile for blueswitch implementation.

At the bottom of the screenshot, the footer reads: © 2016 GitHub, Inc. Terms Privacy Security Contact Help.

Overlaid on the bottom right of the screenshot is a photograph of the `NetFPGA-10G-SUME` hardware board. The board is a dark blue PCB with a large `VIRTEX-7` chip in the center. It features a green M.2 SSD, a `DIGILENT` logo, and the text `UNIVERSITY OF CAMBRIDGE` and `NetFPGA-10G-SUME` printed on it.

Experimental Setup

- *Experimental setup for consistency and inconsistency rule update tests.*
- *Blueswitch and OSNT packet generator on NetFPGA-SUME*

