

FPGA based 10G Performance Tester for HW OpenFlow Switch

Yutaka Yasuda, Kyoto Sangyo University

Takefumi Miyoshi, e-trees.Japan Inc.

draft version, for proposal

Why (data plane) Performance Test needs for HW OpenFlow switch?

- There are some “Conformance Test” activities
 - RYU Certification / ONF PlugFest
 - How about “Performance Test” ?
 - Lack of it, you (operator) may fall into the pitfall.
 - “It works, but too slow”
 - Functionality is okay, but the performance is so slow in some specific cases...

Difficulties of expecting the behavior of the OF HW switch

- Forwarding by Hardware (ASIC) or Software (CPU)
 - 1000 times difference in latency. (μ sec vs msec)
 - It is not always documented. (basically, no reason to confess it for vendors)
- No easy & straight way to know it.
 - Use professional testers such as Ixia or Spirent? So super expensive....
- **Imagine**, what happen when you update your firmware, NOS or OF App.....
 - It might be depend on the version of them.

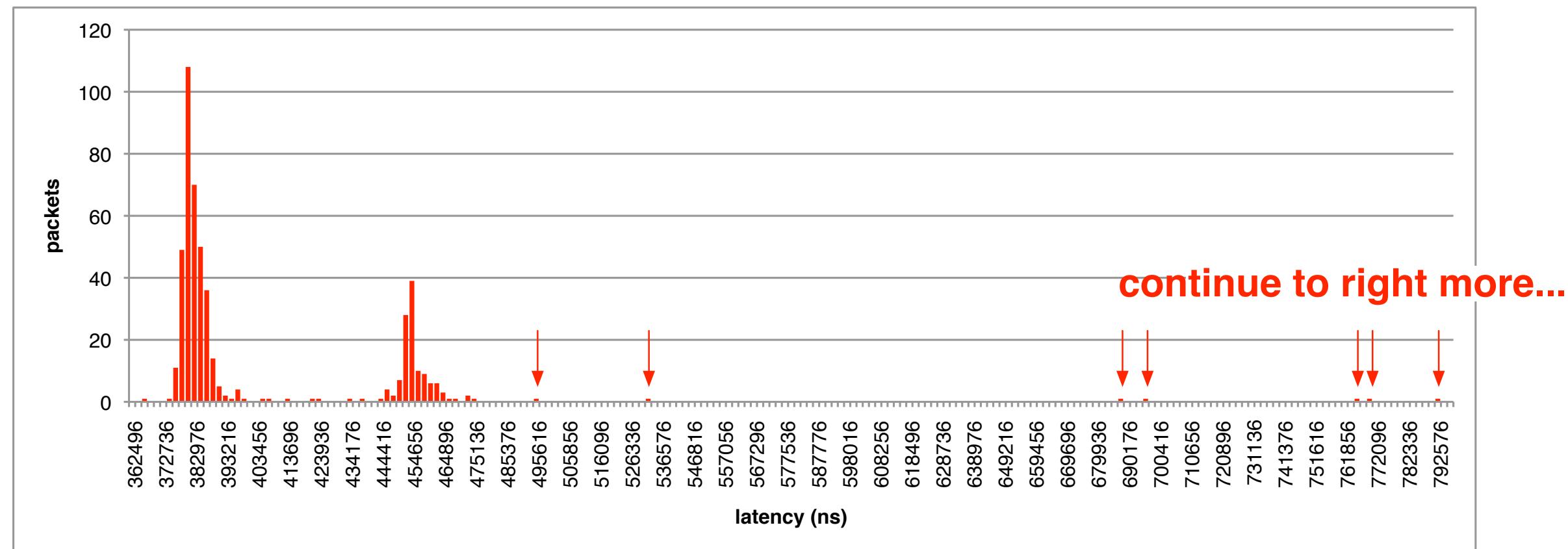
Actual switch behavior example, processing cases in HW and SW

- If you set IP SRC match **and** IP DST Mod. simultaneously, forwarding in **terribly** slow (see next slide)
- IP SRC match **or** IP DST Mod. at once, forwarding in quick
- IP SRC match **and** IP ToS Mod. simultaneously, forwarding in quick
- The specific combination makes objectionable result, but who knows it?

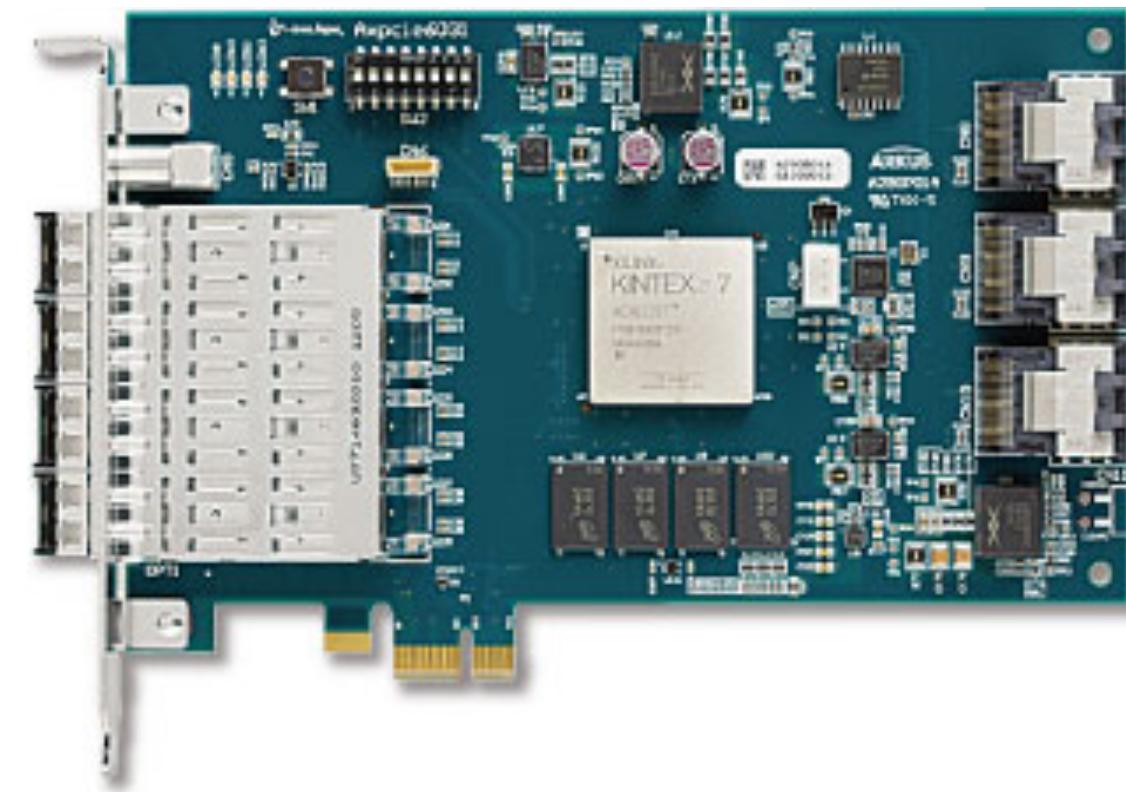
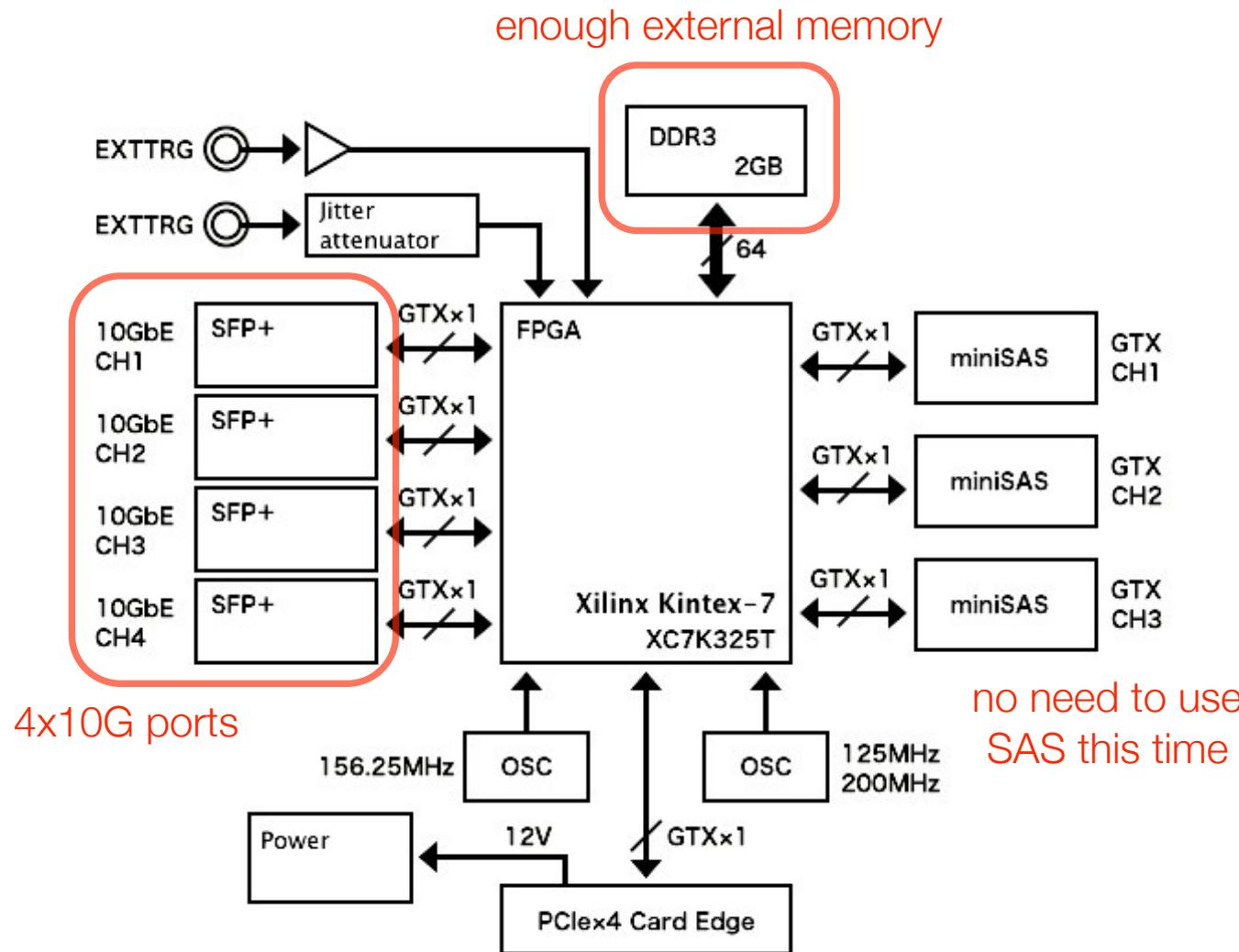
	IP SRC Match	IP DST Mod	ToS Mod	latency
#1	✓	✓		slow
#2		✓		quick
#3	✓			quick
#4	✓		✓	quick

In detail, how slow?

- 2-3 usec in HW, but 3.7-4.7 ms in SW (1000 times slow)
- “Long tail” distribution you will face... (more serious than the average)

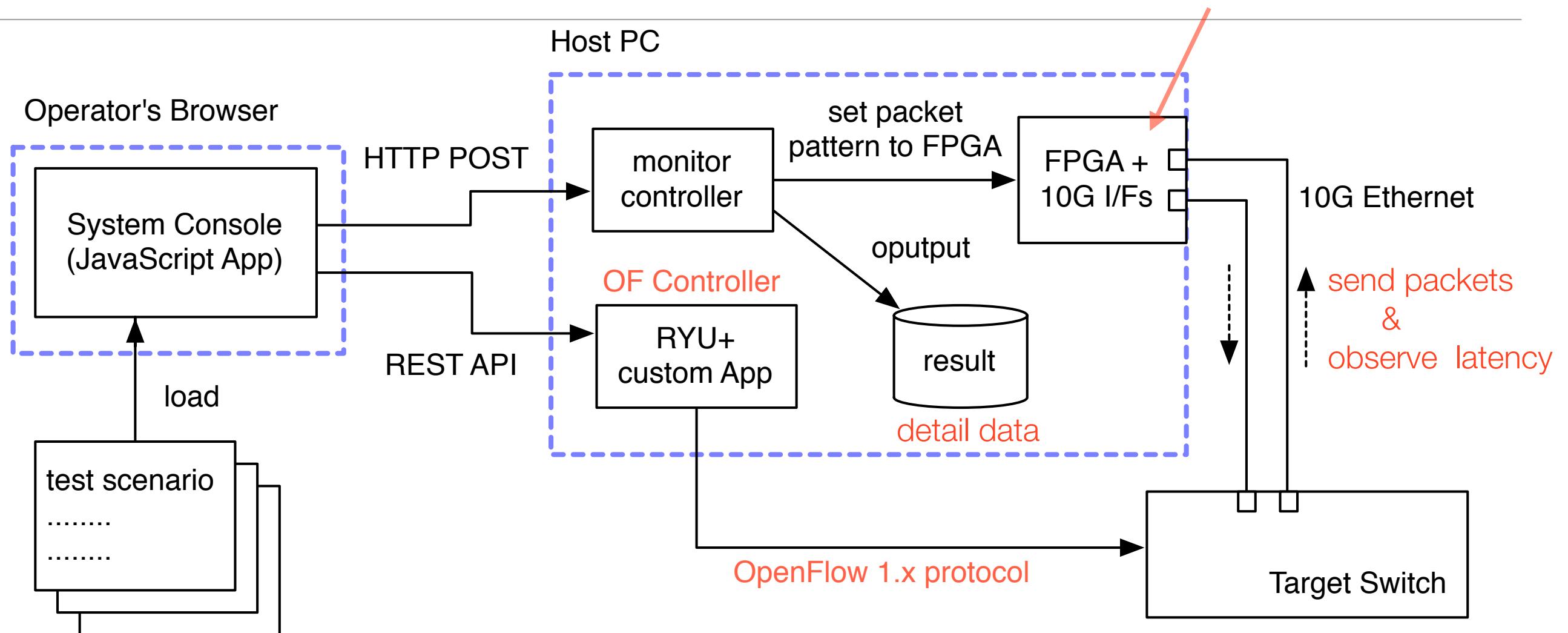


Our project : FPGA based performance tester



Xilinx Kintex-7, 125MHz
10G (SFP+) x4
Hardware TCP/UDP implement
PCIe gen2 x1 (just for control)

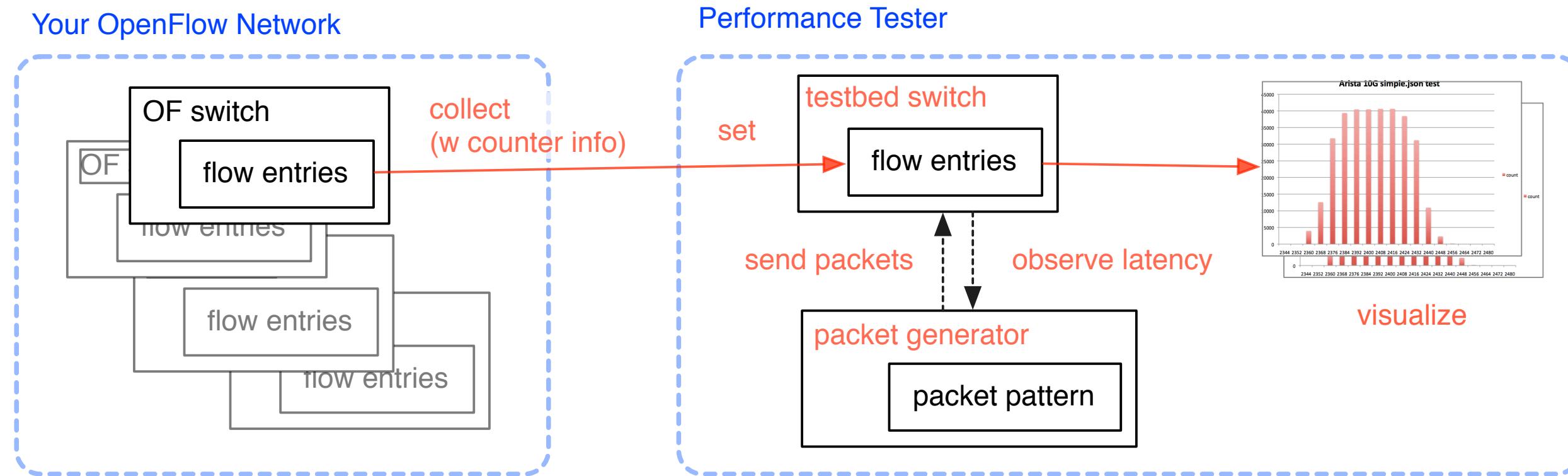
System Structure



includes :
packet generate pattern
+ flow entries configuration

Use Case #1

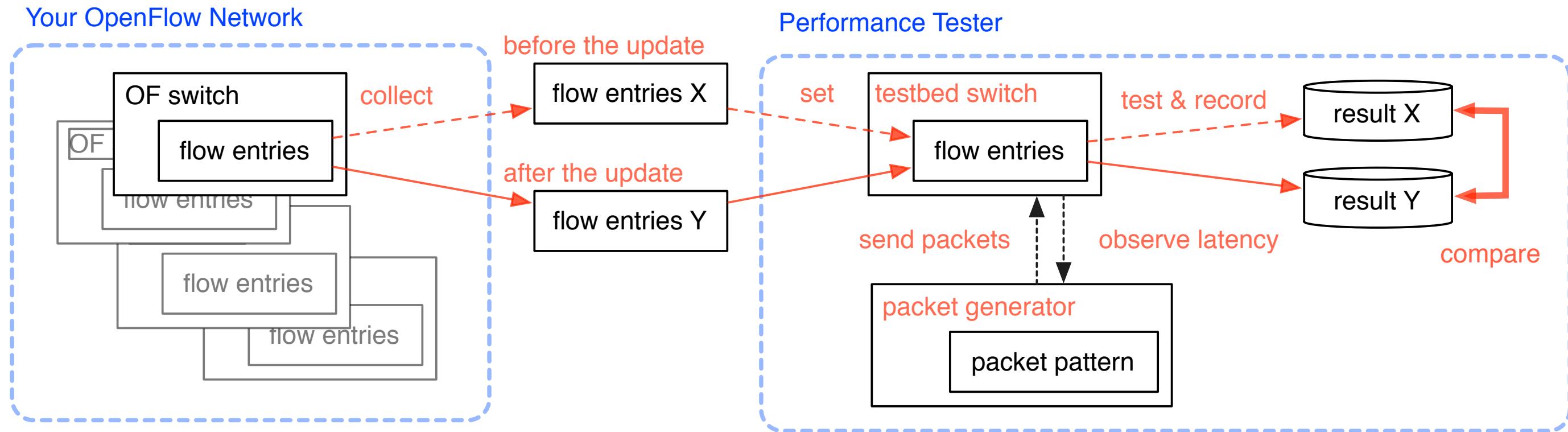
Hunt the “killer entry” - unexpected slow processing order you may have



- OF Apps set the flow entries as their needs, but they **don't care** about the performance.
- If you see the performance degradation, you need to check no “**killer entry**” exists.

Use Case #2

Comparison “before & after” about the update of SW driver or NOS

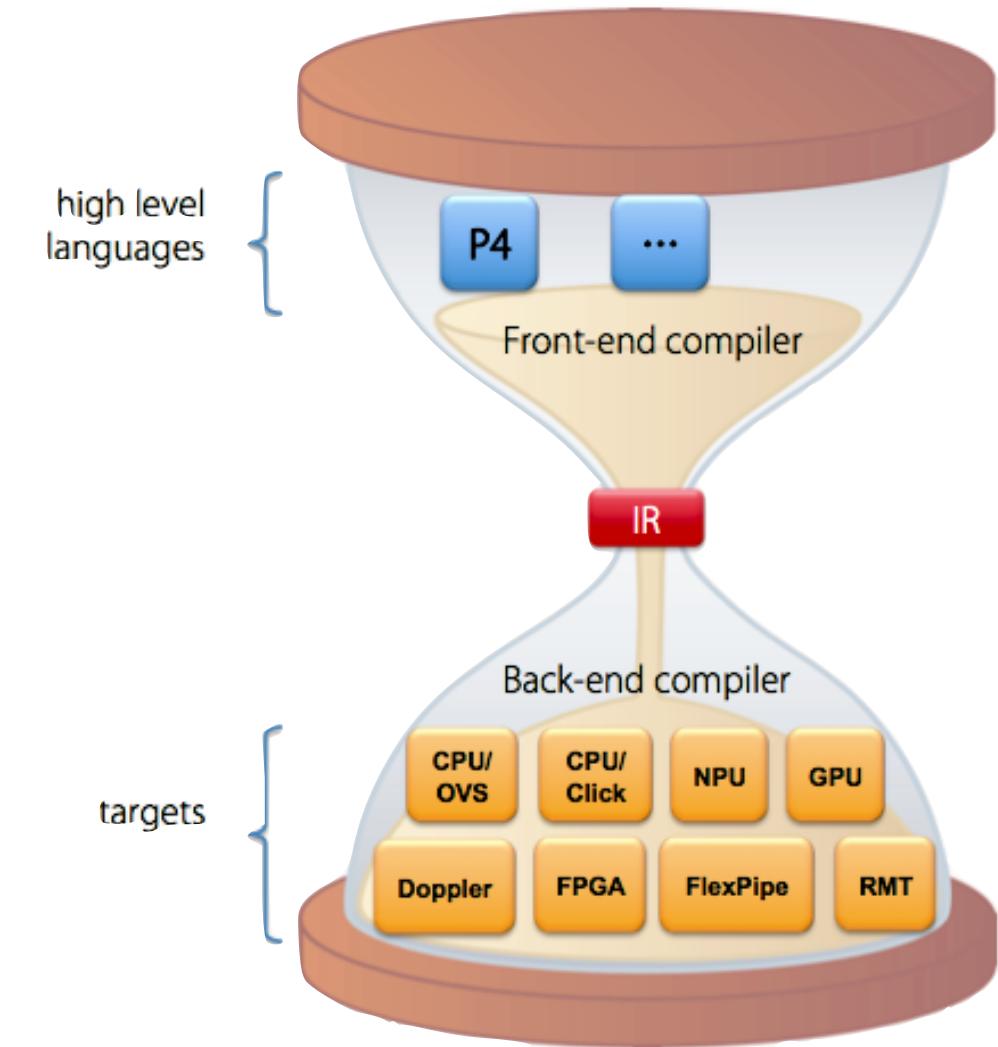


- Need to check the performance degradation **BEFORE** you apply the update to **REAL** network.
- For the future, need to see what happen if the flow entries and traffic will go **double**.

Use Case #3

Future Needs : OF-PI (or OpenFlow 2.0 or P4)

- All switches run their own software + hardware combination.
- Too hard to expect the performance.
- Need to check the performance by each site, by each configuration.
- Also need to optimize the P4 program.
(without it, how you can do that totally?)



source: "How to tell your plumbing what to do Protocol Independent Forwarding", Nick McKeown, 2014

Current status and the next steps

- Works in 8ns accuracy on 10G interface
- Available to supply for advanced user to test by themselves
- Now brushing up the software (Web UI, visualization, and etc.)
- Need your help!
 - Testing on the field, user networks in real operation
 - Correcting actual measurement results then share the knowledge
 - Hearing the feedback from field operators to enhance the usability